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THE ROLES AND LIMITS OF THE GRAIN MARKET IN ASSURING HOUSEHOLD FOOD SECURITY IN NORTHEASTERN MALI: IMPLICATIONS FOR PUBLIC POLICY

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ABSTRACT

THE ROLES AND LIMITS OF THE GRAIN MARKET IN ASSURING FOOD SECURITY IN NORTHEASTERN MALI: IMPLICATIONS FOR PUBLIC POLICY

by

Philip Nathan Steffen

This dissertation addresses the challenge of striking a workable institutional balance between public and private-sector grain marketing activities in semi-arid, low-population Northeastern Mali which is responsive to household food security needs. It focuses on rural households, urban and rural grain markets, and grain traders as the key units of analysis.

The dissertation is structured in four parts. Part I comprises an introductory chapter. Chapter 2 reviews the regional setting of Northeastern Mali, the structural volatility of grain market supply and demand, and the government's food emergency programs and marketing policies.

Part II examines rural household food security in the Gao Region with the objective of providing an empirically based understanding of factors determining seasonal effective demand for cereals and seasonal exchange entitlements in 1988/89, a good production year. The conceptual framework of analysis in Chapter 3 embodies food security, food exchange entitlements, and the sequencing of household strategies for coping with food insecurity. Chapter 4 investigates household income and expenditure patterns by strata, including seasonal dependence on the market for cereals. Chapter 5 measures the success of household home production and income diversification strategies by strata and season in assuring average

daily cereal consumption levels, including econometric analysis of expenditure elasticities of demand for all foods and cereals and determinants of cereal calorie consumption.

Part III of the dissertation takes a critical look at the performance and dynamism of urban and rural grain markets in the Northeast as seasonal supply and demand coordinating mechanisms. Chapter 6 introduces a second conceptual framework based on the subsector approach to commodity market analysis and the structure-conduct-performance paradigm, transaction cost economics, thin markets and market failure. The role of the public sector in providing market services is assessed using concepts from public choice economics. Chapter 7 examines the structure, conduct and performance of the seven rural markets in the Gao Region. Chapter 8 examines the structure, conduct and performance of urban markets in the Northeast, in contrast to urban markets elsewhere in Mali.

In Part IV, Chapter 9 recommends market performance-oriented policy measures and household food security-oriented measures in the Northeast.

To Mona.

That says it all.

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AV

BCEAC

CEFOI

CESA

CFAF

CILSS

CMDT

CNAU

COC

DNA

DNAE

DNSI

DRA

DRAC

FAO

FEWS

LIST OF ACRONYMS

AV	*Association villagoise*, village association or cooperative, a statutory designation indicating eligibility for cereals marketing credit programs
BCEAO	*Banque centrale des états de l'afrique de l'ouest*, central bank of the West African Monetary Union of which Mali is a member
CEFODOC	*Centre d'information et de documentation*, information and documentation center of OPAM
CESA	*Commission nationale d'évaluation et de suivi de la stratégie alimentaire*, National Food Strategy Evaluation and Monitoring Commission, counterpart Malian agency for the MSU Food Security Project
CFAF	CFA Franc, unit of currency used by member countries of the West African Monetary Union, including Mali, convertible with the French Franc at 1 FF = 50 CFAF at the time of this research
CILSS	*Comité inter-états de lutte contre la sécheresse dans le Sahel*, Interstate Committee for Drought Control in the Sahel, organization of Sahelian states for coping with drought
CMDT	*Compagnie malienne de développement des textiles*, Malian ODR for the promotion of cotton
CNAUR	*Comité national d'actions d'urgence et de réhabilitation*, Malian agency concerned with emergency aid and rehabilitation activities; formerly known as *Comité national d'aide aux victimes de la sécheresse* (CNAVS), national aid commission for drought victims
COC	*Comité d'orientation et de coordination*, Malian government interagency oversight committee guiding grain market liberalization
DNA	*Direction nationale de l'agriculture*, national department of agriculture
DNAE	*Direction nationale des affaires économiques*, agency formerly charged with enforcement of grain price regulations
DNSI	*Direction nationale de la statistique et de l'informatique*, national department of statistics
DRA	*Direction régionale de l'agriculture*, regional department of agriculture, Mali
DRACOOP	*Direction régionale de l'action coopérative*, regional department of cooperatives
FAO	Food and Agricultural Organization of the United Nations
FEWS	Food and Early Warning System, USAID

FGR	*Féderation de groupements ruraux*, federation of rural groups, a statutory designation for agricultural "pre-cooperatives," usually in the Northeast
GIE	*Groupement d'intérêt économique*, a statutory designation for economic interest group of small-scale grain traders which allows pooling of capital as collateral for marketing credits
ICRISAT	International Crop Research Institute for the Semi-Arid Tropics
IFPRI	International Food Policy Research Institute
MATDB	*Ministère de l'administration territoriale et de développement à la base*, Ministry of Territorial Administration and Local Development
MF	Malian Franc, Mali's currency from 1962 until mid-1984. When Mali rejoined the West African Monetary Union, its currency became the CFA Franc, converted at the rate of 1 CFAF = 2 MF
MT	Metric Ton (1,000 kilograms)
MSU	Michigan State University
ODR	*Opération de développment rural*, geographically focused integrated rural development project(s) specializing in cereals and/or cash crops
OHV	*Opération haute vallée*, ODR promoting coarse grain production in the upper Niger River valley
ON	*Office du Niger*, large-scale ODR specializing in irrigrated rice production in the Niger River delta
OPAM	*Office des Produits Agricoles du Mali*, cereals marketing agency of Mali
OSCE	*Office statistique des communautés européennes*, statistical agency of the European Community, Mali
OSRP	*Office de Stabilisation et de Régulation des Prix*, price regulatory agency and cross-subsidy fund for key exports and consumer goods
PRMC	*Programme de Restructuration du Marché Céréalier*, multi-donor program guiding grain market liberalization
PVO	Private voluntary organization (also known as non-governmental organization, NGO)
RBB	Standard grade of 80 percent brokens Malian rice
RM25	Standard grade of 25 percent brokens Malian rice
RM40	Standard grade of 40 percent brokens Malian rice
SAP	*Système d'alerte précoce*, Early Warning System, Mali
SIM	*Système d'information sur le marché céréalier*, grain market information and analysis unit operated by OPAM

SNS	*Stock national de securité*, strategic grain reserve operated by OPAM
USAID	United States Agency for International Development

In addition, the following English terms will be used for Malian administrative jurisdictions:

Région	Region
Cercle	District
Arrondissement	Sub-district

Lastly, all values in CFA francs are based on 50 CFAF = 1 French franc.

Part I.

Chapter One. Introduction

Mali occupies a vast, sparsely populated, landlocked territory in the middle of West Africa. Agriculture and livestock, the major productive sectors, are highly vulnerable to harsh and capricious climatic conditions, especially rainfall patterns. Many households are chronically food insecure. Mali has one of the world's lowest per capita incomes, one of the lowest literacy rates and one of the shortest life expectancies. Physical, economic and institutional rigidities compromise efforts to promote growth. Government services are thinly stretched due to a scarcity of trained technicians and a persistently deficit fiscal base. Physical infrastructure is often deteriorating or unreliable due to insufficient maintenance. Prospects for sustained development must necessarily take a long-term viewpoint.

1.1. Background and Problem Statement

Towards the end of each year, following an assessment of the main cereals harvest, the Malian government publishes an official list of "grain-deficit zones" and "zones under surveillance." Eighteen of the country's 46 districts (*cercles*) are designated "chronically deficit" in grain production based on long-term trends, where local grain production falls short of the government's per capita consumption norms, or in terms of difficult market access (COC 1988, OPAM 1988, MATDB 1989). Designation as a "deficit zone" entitles these zones to special attention by the public sector and to direct market intervention, if warranted, including distribution of free food aid.

All of the "deficit zones" lie partly or completely north of the 14th Parallel. Thus, the entire Regions of Tombouctou and Gao are comprised of deficit zones, having five such zones each, for a total of 10 of 18 deficit zones.[1] Three zones in the neighboring Region of Mopti are also considered as chronically deficit.[2] Together, these deficit zones in the Northeast, stretching from Burkina Faso and Niger in the south to the central Sahara Desert in the north, make up three-quarters of the national territory but only about fifteen percent of the population. (See Figure 1.1 on page 3.)

The question of food security in the Northeast is particularly acute for Malian policy makers in view of recurrent and often devastating droughts which reduce both incomes and cereals supplies. The first, socialist government of Mali set the tone by fixing "fair" nation-wide uniform prices for cereals, the main consumption staple. This legacy was reflected in successive national plans calling for "equitable" cereals marketing policies, by which all consumers would be able to meet their cereals needs at "reasonable and approximately identical prices, regardless of distance from producing regions" (*Direction générale du plan et de la statistique*, 1974). Although official producer and consumer prices were dropped in

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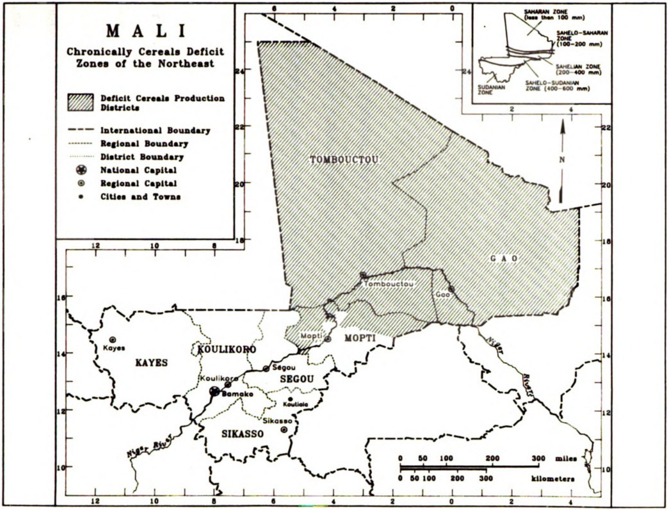
[1]These are the districts of Niafounke, Diré, Goundam, Tombouctou-Central and Gourma-Rharous in the Region of Tombouctou and the districts of Ansongo, Ménaka, Gao-Central, Bourem and Kidal in the Region of Gao. In late 1991 Kidal became a separate region, with the city of Kidal as its capital.

[2]These are the districts of Douentza, Ténenkou and Youvarou.

Figure 1.1. Chronically Cereals Deficit Zones of the Northeast

Figure 1.1. Chronically Cereals Deficit Zones of the Northeast



1987, adequately provisioned grain markets at affordable prices are still seen as a bellwether of the central government's concern for economic equity, racial harmony and national unity.

Designing appropriate policies for the deficit and hard-to-reach zones — recognizing the strengths of the market mechanism while compensating for its weaknesses — continues to preoccupy the government and its principal donors. At issue is the desirable mix and timing of alternative market and non-market arrangements for assuring stable cereals supplies and prices for producers, traders and consumers, coupled with appropriate safeguards for those who are temporarily or permanently priced out of the market.

1.2. Dissertation Objectives

This dissertation, therefore, addresses the challenge of striking a workable institutional balance between public and private-sector grain marketing activities in Northeastern Mali which is both allocatively accurate and equity-sensitive in responding to household food security needs.

Two related objectives guide this dissertation. The first is to analyze key elements of cereals supply and demand at household and trader levels, including an evaluation of cereals market performance, in order to assess the roles and limitations of the market in assuring household food security.

The second objective is to identify where the public sector can strengthen cereals market facilitating services to enhance market performance and take counter-cyclical measures against structural instabilities of the market.

This research takes as its null hypothesis that, given an enabling environment fostered by the public sector, the grain market will be able to assure household food security in the

13. (

deficit zones of Northeastern Mali in years following good-excellent grain production through routine management of supply and demand, during which the public sector provides essential market-facilitating services (and perhaps some non-market targeted programs), but does not compete with the market as a grain buyer and seller. That is, *day-to-day* grain supply and demand management for food security in the Northeast "defaults" to the market in good years. In poor production years when both grain availability and effective demand decline, macro-level supply and demand management will fall more upon the public sector which will have to take direct intervention measures, but fully informing traders and consumers of its plans and subcontracting with the private sector where feasible.

1.3. Conceptual Framework

The conceptual framework of analysis embodies food security and its counterparts of chronic and transitory food insecurity; various institutional aspects of public choice and transaction cost economics, especially analysis of the regulatory environment, as well as the impact of religious practices on the market; and analysis of the subsector approach for the study of the grain market, including the structure-conduct-performance paradigm, and the concepts of workable competition and contestable markets, imperfect information and uncertainty, thin markets and segmented markets. These concepts will be discussed in the appropriate chapter.

The essential core of this research addresses a specific problem (the design of market and non-market institutional arrangements for improving food security in the Northeast) for specific policy makers (the Government of Mali and collaborating donors, including USAID). Yet, this dissertation is broader than problem-solving research. This research may be classified as subject-matter research in that it is intended to shed new light on the range of workable public sector interventions in grain markets or on national food security policies generally, solving a set of problems for present and future decision makers.

The philosophical orientation guiding this research is pragmatism. Under pragmatism, prescriptions must pass the test of workability. For matters as sensitive as national marketing and food security policies, technical and economic prescriptions cannot be neatly separated from political realities. Central to the problem-solving approach is the issue of which clientele is to be served and at what cost. In weighing alternative institutional arrangements, policy makers will have to consider who benefits and who does not. This pragmatic subject matter research will attempt to understand and take into account the decision processes involved (and the role of power distributions among them) to transform prescriptions into workable solutions.

1.4. Research Approach and Implementation

Research for this dissertation was financed through the Food Security in Africa Cooperative Agreement between Michigan State University (MSU) and the Agency for International Development (AID) in Washington, D.C., with supplementary support from the USAID Mission in Mali. The purpose of the Cooperative Agreement is to assist African countries in formulating alternative institutions and management processes dealing with critical short- and medium-term food security problems and that are consistent with longer-term strategies for achieving more reliable, productive and dynamic food systems that will benefit both producers and consumers.

Since its inception in 1985, the Mali component of the Food Security Project has pursued several research objectives: 1) Analyze the effects of cereals marketing reforms on the willingness and capacity of coarse grains producers and traders to invest in improving the food system; 2) Analyze the factors affecting the payoff to farming systems research and its expansion to the Region of Mopti; 3) Provide technical assistance and applied research to the Malian Government and USAID/Mali to strengthen the empirical foundations of ongoing cereals market liberalization; and 4) Help establish a cereals market information system and analytical unit based within the grain marketing agency. A conscious attempt was made under each objective to collaborate directly with counterpart Malian institutions and train Malian nationals as researchers, both to improve the interactive quality of analysis and upgrade local institutional and professional capabilities.

1.4.1. Research Approach

This research takes its organizational direction from the increasingly acknowledged relationship between household food security, sufficient food (cereal) supplies and access to those supplies through effective demand, stemming from sufficient and diversified sources of income. Thus, rural agricultural and non-agricultural household economic behavior and their implications for the design of market and non-market instruments to improve food security constitute the analytical starting point for the dissertation.

It is hypothesized that household effective demand for cereals largely determines the marketing strategies of grain-trading firms and the operations of public grain agencies. Key concepts from household economics and food exchange entitlements will be examined in addition to the food security coping strategies of agricultural and non-agricultural households. Specific analysis will consider 1) household income in deficit zones; 2) household effective demand for grain, including adjustments in intra-annual and inter-annual household food security strategies and 3) household access to grain in deficit zones.

The dissertation will then analyze the vitality of the rural and urban wholesale grain marketing channels in the Northeast, concerning: 1) key elements of grain supply and demand and market integration; 2) factors affecting the evolution of supply and demand, including the new institutional coordinating arrangements brought about by liberalized grain marketing policies; and 3) implications for the performance of the grain marketing system as defined by key performance indicators.

Next, this research will analyze grain trader capabilities in meeting effective grain demand in Northeastern Mali. Specific attention will be focused on: 1) the assessment of grain marketing transactions costs, including information needs and sources, financial needs and sources and the direct impact of the regulatory environment on wholesaler conduct and performance; 2) storage practices; and 3) the impact of public-sector activities on grain markets, such as free food aid distribution and the buy/sell operations of the National Strategic Grain Reserve, and their implications for the design of market and non-market instruments to improve food security.

Lastly, this research considers various measures that the public sector can take to improve effective grain demand and assure supply availabilities (including to those without sufficient income to make their demand "effective" in the market), and the scenarios under which these measures become necessary, for both immediate and medium-term impact. Specifically, the dissertation will evaluate key elements of current proposals for the reorganization of the grain marketing agency, OPAM, and propose market and non-market institutional responses to improve the functioning of the grain marketing system.

1.4.2. Research Implementation

1.4.2.1. Site Selection for Primary Data Collection

Selection of research sites in the Northeast proceeded from the identification of principal supply arteries from grain-producing regions in southern Mali as well as first-hand observations made during a rapid reconnaissance of grain markets in the Mopti, Tombouctou and Gao Regions during July and August 1988 (Steffen and Koné).

Wholesale markets. The wholesale market in each regional capital was selected. In addition, two central assembly markets at the district level were selected for the Region of Gao, as follows:

Mopti (Region of Mopti)
Tombouctou (Region of Tombouctou)
Gao, Ansongo and Bourem (Region of Gao)

The cities of Mopti and Gao are both grain consumption centers as well as transit points for onward grain shipments. In contrast, Tombouctou is essentially a terminal consumption center. In addition, data collection in four southern wholesale grain markets (Bamako, Ségou, Koutiala and Sikasso), begun under the predecessor phase of this research, was continued in order to provide an overall national context and permit comparisons between the South and the Northeast.

Rural markets and rural households. The rural market research sites are located in the circles of Bourem, Gao-Central and Ansongo in the Region of Gao. They were selected according to the following criteria: 1) location within one of the 18 districts identified by the government as "chronically deficit"; 2) seasonal or year-round difficulty of access to these markets; 3) an approximately equal distribution of markets between sites along the Niger River and sites in the hinterland; and 4) division by principal occupations between farmer-fishermen and farmer-herders, a division which corresponds roughly to the main ethnic groups, the Songhaï, and the Tuareg and Bella, respectively.

The five rural market sites selected were:

Almoustarat (in the hinterland, Bourem District)
Temera (on the River, Bourem District)
Djebok (in the hinterland, Gao-Central District)
Bara (on the River, Ansongo District)
Tessit (in the hinterland, Ansongo District).[3]

A survey sample of about 25 households for each of these rural market sites was randomly selected from recent (1986) census records. The rural household component of this research is based on surveys of about 125 households, or 25 per rural market site.

1.4.2.2. Research Schedule

The surveys were designed to cover the seasonal dimensions of an entire agricultural marketing year, from November 1, 1988, to October 31, 1989. Delays in recruiting and training of enumerators caused this schedule to slip by one month. Enumerators were installed in their field sites by December 1, 1988, rather than November 1.

The following time-series recall questionnaires cover the one-year period November 1, 1988, to October 31, 1989: 1) wholesaler grain purchases; 2) wholesaler grain sales; 3) wholesaler gifts/transfers of grain; 4) household sources of income; and 5) household cereals consumption.

The remaining data collection was subsequently shortened from twelve to eleven months, covering the period December 1, 1988, to October 31, 1989, in the case of 6) weekly household expenditures recall questionnaires. The following time series questionnaires also cover eleven months: 7) rural market grain purchases by traders; and 8) rural market grain sales by traders.

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[3]In addition, Ansongo and Bourem were surveyed as rural assembly markets.

More than one dozen single-topic questionnaires were administered during the course of the field research to participating grain traders and rural households.

1.4.2.3. Unique Characteristics of the 1988/89 Grain Harvest

The 1988/89 harvest represented a rare convergence of an exceptionally good production year for Mali, which followed a near average, net surplus year (1987/88), succeeding two very good years (1985/86 and 1986/87).[4] This convergence has both positive and negative implications for studying grain markets in the Northeast.

On the negative side, rural grain markets are seasonally thin markets (where many grain transactions take place outside market channels and/or where the market is the residual source of grain supply) and therefore less active, due to plentiful local grain production and a good harvest of wild grains. Further, much of the market was handled by producers, assemblers and retailers of local cereals through the first part of the year, displacing part of the demand otherwise met by urban wholesalers who import cereals into the region.

On the positive side, the 1988/89 crop year likely reached the upward bound of the grain production possibility frontier in the Northeast (although still deficit), given existing technologies and institutions, and thus 1) household access to home-grown cereals and 2) household access to wild cereals.

Because of the strong positive correlation between favorable rainfall patterns and income derived from agriculture and herding, the 1988/89 crop year will also likely show the upward bound of household reliance on the market as a source of grain supplies (throughout the year for non-agricultural households and later in the year for deficit agricultural households). Moreover, household effective demand for grain is hypothesized to be firm due

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[4]Unless otherwise noted, split-year dates refer to the annual cereals production and marketing year, officially running from November 1 to October 31.

to: 1) negligible loss of income due to drought and 2) lower grain prices due to abundant supplies.

Finally, the absence of large regulatory stocks for sale at subsidized prices by OPAM and of massive food aid distributions was expected to remove two main sources of instability of expectations from grain wholesaler marketing strategies.

Selection of rural markets and households within a 180 kilometer radius from the regional capital, Gao — linked by paved highway to cereal markets in southern Mali — offers an unusual opportunity to observe the integration of national and local markets and market performance under a best-case cereal production scenario. Wholesaler survey data from Tombouctou, less accessible to markets in the South, will provide contrast with wholesaler survey data from Gao.

1.5. Structure of the Dissertation

This dissertation has identified 1) rural households, 2) urban and rural grain markets, and 3) grain marketing traders and firms as the key units of analysis.[5] Based on working hypotheses that rural grain markets in the deficit zones are demand-driven and that grain traders are constrained by household economic behavior, examination of rural households and their effective grain demand has been chosen as the starting point of analysis.

The dissertation is structured in four parts. **Part I** comprises this chapter and Chapter 2. Chapter 2 reviews the regional setting of Northeastern Mali and the structural volatility of grain market supply and demand on the basis of production possibilities, demographic factors,

[5]The main public sector grain marketing institutions, such as the cereals marketing agency (OPAM), and their operational impact on market performance will be assessed in Chapter 2 and Annex 2.1.

physical infrastructure and the government's food emergency preparedness programs and marketing policies for the Northeast.

Part II focuses on rural household food security in the Gao Region with the objective of providing an empirically based understanding of factors determining seasonal effective demand for cereals and seasonal exchange entitlements in a good production year. The conceptual framework of analysis, found in Chapter 3, embodies food security and its counterparts of chronic and transitory food insecurity. It will also examine the notion of food entitlement exchanges and recent critiques with regard to famine prevention and the sequencing of household strategies for coping with food insecurity.

Chapter 4 presents the rural households and market villages, including formal discussion of the sampling methodology and stratification of households, determination of seasons and weighting of household members as adult-equivalents. After a look at key demographic and economic indicators, Chapter 4 first investigates household income patterns by strata by measuring 1) the seasonal dependence on the market in comparison with the imputed value of home consumption of cereals and 2) the seasonal degree of income diversification and reliability of certain sources. Chapter 4 proceeds to measure household expenditure patterns by strata based on 1) budget shares allocated to cereals by season and 2) individual cereals within all cereals.

Chapter 5 builds on Chapter 4 by measuring the success of household home production and income diversification strategies by strata and season in assuring average daily cereal consumption levels, as evaluated against international calorie consumption norms and national/regional household consumption surveys, where consumption is measured by cereal and source of supply. Sensitivity analyses will evaluate the issue of forced post-harvest sales and consumption security and the numbers of sample households that are consumption secure based on alternative calorie requirements. Two sets of econometric models will estimate 1) expenditure elasticities of demand for all foods and cereals (by CFA francs and by calories) and 2) consumption of cereal calories based on income, income diversity, market access and demographic variables.

Part III of the dissertation takes a critical look at the performance of urban and rural grain markets in the Northeast as seasonal supply and demand coordinating mechanisms, drawing insights from market performance elsewhere in Mali. The objectives of this part are to assess the dynamism of rural and urban markets in the Northeast in meeting effective demand for cereals and the incentives and obstacles facing traders, especially urban wholesalers, and their impact on food security. Chapter 6 introduces a second conceptual framework based on the subsector approach to commodity market analysis and the structure-conduct-performance paradigm as well as elements of transactions cost economics and imperfect information and uncertainty. The role and responsibility of the public sector in providing market facilitating goods will be assessed using concepts from public choice economics.

Chapter 7 examines the structure, conduct and performance of the seven rural markets in the Gao Region, starting from the structural variables of numbers of participants and parallel channels, the information system and risk-sharing arrangements. Conduct is evaluated on the basis of planning, interstage cooperation and standard operating procedures of rural traders. Rural market performance will be evaluated using measures of spatial price integration between rural markets and between rural markets and Gao and regression analysis of rural market-urban wholesaler gross margins for sorghum and millet.

Turning to urban grain traders, Chapter 8 examines the structure, conduct and performance of urban markets in the Northeast in contrast to urban markets elsewhere in

Mali. The structure of urban markets will be described on the basis of entry conditions, differential access by traders to market information and measures of market concentration. Conduct considers elements of coordination: use of market information for price discovery, financial markets and credit mechanisms, storage practices and temporal price arbitrage, use of contractual relations among traders and conflict between traders and market regulatory agencies. The static efficiency of urban market performance is evaluated on the basis of spatial price integration, returns to storage and gross marketing margins between wholesalers and semi-wholesalers. Dynamic efficiency is assessed on the basis of progressive institutional arrangements, the growing demand for market information and the integration of public goods and markets.

Part IV concludes the dissertation. Chapter 9 will draw implications from Parts II and III for policy recommendations leading to improvements in an efficient, responsive and workable division of responsibilities and synchronization of grain marketing activities between the private and public sectors in the Northeast. Chapter 9 will also summarize salient features of the dissertation which are applicable as subject-matter knowledge linking the roles and limits of the cereals market to improvements in household food security in similar cereals production-deficit zones in Africa.

Chapter Two. The Setting

This chapter examines the regional setting of Northeastern Mali. Using secondary data, this chapter will describe and highlight cereals production, ecological, socioeconomic, and infrastructural characteristics which a) distinguish the "deficit zones" of the Northeast from the rest of the country and b) suggest that a particular food security policy is warranted for the Northeast, including clear implications for the cereals market.

This chapter first examines the structural volatility of cereals supply and demand by assessing cereals production possibilities based on natural endowments and cereals cropping patterns, overall cereals availabilities from production and trade, and the recourse to wild cereals.

Next, the chapter looks at demographic factors, the weak infrastructural base and the tragic consequences of the imbalance between the two during the drought periods of the past two decades.

Lastly, the chapter summarizes current marketing regulations, introduces the government's emergency preparedness programs and marketing policies for the Northeast, and explains the political constraints compelling the government to maintain a watchful eye on cereals market developments there. Annex 2.1 to this chapter reviews the gradual liberalization of cereals marketing policies in Mali as they effect the Northeast.

Together, the contiguous regions of Tombouctou and Gao[1] comprise about 940,000 km^2, lying between 15° N and 25° N latitude.[2] Both regions thrust deep into the Sahara Desert.

The most prominent geographic feature of the Northeast is the Niger River. Its long arc-shaped course bisects Mali, rising from the Fouta Djalon foothills far to the southwest, emptying into an immense inland delta before stretching up to the very edge of the Desert and then bending back to the sea. The Niger plays a vital role in the economic survival of the Northeast. Most of the population is concentrated in the River valley where most of the crops are grown. Not surprisingly, most of the cereals markets are found there as well.

2.1. Cereals Production in the Deficit Zones

Daytime temperatures are generally hot all year round.[3] Climate in the Northeast is thus chiefly defined by rainfall patterns. In turn, rainfall is the key to understanding the nature of cereals production there.

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[1]Due to the unavailability of certain data which are disaggregated below the regional level, the terms "Northeast," "deficit zones," and "deficit zones of the Northeast" will refer only to the regions of Tombouctou and Gao, unless otherwise noted, even though three nearby districts in the region of Mopti are also classified as deficit zones.

The Gao region was subdivided into two regions in late 1991, Gao and Kidal. All of the primary data collection for this dissertation occurred in the new, smaller Gao region, none in Kidal.

[2]This area is equivalent to California, Oregon and Nevada combined.

[3]Data for the international meteorological period, 1931 through 1960, show that the average monthly maximum temperatures for Tombouctou (capital of the Tombouctou region) ranged from 32° C (89.6° F) in January to 43° C (109.4° F) in May. Temperatures for Gao (capital of the Gao region) show a virtually identical range (*Ministère de la Coopération*, 1974, p. 42).

2.1.1. Natural Endowments

Global climatic patterns are due to the circulation of air masses in the atmosphere, modified by "local" conditions such as ocean currents, land mass and topography which may cause distinct regional variations. In West Africa, rainfall patterns are largely determined by the annual migration of the intertropical convergence zone (ITCZ), where moist south-westerly winds rising from the Atlantic Ocean collide with dry north-easterly winds blowing off the Sahara Desert, also known as the *harmattan* winds. As this convergence zone begins its seasonal northward ascent, it creates a line of atmospheric perturbations that generates rain. Hence, the southern part of Mali usually experiences a rainy season from May to October. As the ITCZ approaches the northern limit of its ascent over the southern Sahara in September-October, precipitation becomes increasingly erratic in spacing and timing or ceases altogether. Thereafter, the *harmattan* winds repel the monsoon winds, causing the ITCZ to begin its seasonal descent southward during which the northeastern part of Mali experiences a long dry season from approximately October to June (Albouy and Boulenger, FAO/UNESCO, Rasmusson, UNDP).

2.1.1.1. Rainfall and Natural Vegetation

The deficit zones of the Northeast are divided into two climatic regimes: a "hot subtropical desert" and the "semi-arid tropics."

2.1.1.1.1. Hot Subtropical Desert. The upper half of the regions of Tombouctou and Gao, roughly the area above 17-18° N, gets virtually no rain at all. In terms of climate, most of this area is defined as "hot subtropical desert". Sand and gravel (yermosols and lithosols) dominate the soils structure in these remote and barren stretches. Vegetation is classified as "desert shrub" where vegetation cover is sparse and transient, or "sand desert" where no vegetation exists. Only the lower limits of the desert may receive up to 100 mm of rainfall annually. Vegetation there, classified as "low subtropical," consists of widely scattered grass clumps.[4]

2.1.1.1.2. Semi-Arid Tropics. The rest of the Northeast — in fact, most of the rest of Mali — is considered "semi-arid tropical".[5] It corresponds to a band some 300 km wide lying between the 100 mm and 600 mm isohyets. The predominant natural vegetation is "thorn scrub savanna," where grass cover does not generally exceed one meter in height and acacias and commiphora represent the most common tree species. A smaller vegetation belt, classified as "reed marsh," corresponds to the Niger delta (FAO/UNESCO, p. 32).

It is the semi-arid tropical zone which holds potential for cereals production. Further dividing this zone in terms of rainfall is useful for discussing cropping patterns. Although there are no universally accepted standards for delimiting rainfall or vegetational zones *within* the West African semi-arid tropics,[6] the following classification, based on Nicholson (1983), is most suitable:

100-200 mm:	Sahelo-Saharan zone
200-400 mm:	Sahel zone
400-600 mm:	Sahelo-Sudanian zone[7]

[4]These classifications are based on Papadakis, as reported in FAO/UNESCO, *Carte mondiale des sols, 1:5,000,000: Volume VI. Afrique*. (UNESCO: Paris), 1976, pp. 20-23, 34-35.

[5]FAO/UNESCO. The rainfall regime for the extreme southern part of Mali below 13° N, classified as "hot tropical," lies outside the focus of this dissertation.

[6]For example, see the diversity of classifications in Albouy and Boulenger (1974), Bethke (1974), Bernus (1977), Copans (1975), Rasmusson (1987), Piché and Gregory (1977), UNDP (1975), and USAID (1985).

[7]As cited in Watts (1987, p. 173). This classification was also chosen to facilitate the stratification of survey households in Chapter 4.

Bordering the southern edge of the desert, the **Sahelo-Saharan zone** is made of a grass steppe of fixed dunes, usually the northern limit of camel pasture. The **Sahel zone** is a more heavily vegetated tree steppe. The **Sahelo-Sudanian zone** consists of shrub savanna with denser grasses representing the northern limit of most rainfed agriculture.[8] Thus, while rains fall relatively frequently between June and October in the southern Sahelo-Sudanian zone, the northern zones have a relatively shorter, more variable rainy season and a longer dry season lasting up to 9-10 months.[9]

The striking feature about Malian agriculture is the dominant influence of rainfall on production levels. Levine's study of 1960-80 production trends of the main agricultural crops (millet/sorghum, maize, rice, cotton and groundnuts) shows that rainfall is the only factor of production that is statistically significant for all crops. LeCaillon and Morrisson found similar results using data for 1960-82.

For the Northeast, which is critically dependent on one relatively short rainy season, rainfall volume is a necessary but insufficient condition for agriculture. The potential contribution of rainfall depends equally on frequency, intensity, duration, timing and location. The notion of "useful rain" implies a distribution of rainfall that permits sufficient moisture retention in the soil to develop the plant to maturity. Gallais defines a useful rain for the Sahel as a rainfall greater than 3 mm followed by a similar rain within one week (Bernus, 1977). Drought, therefore, implies the absence of useful rain.

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[8]The term "Sahel" is often loosely used to include the entire "semi-arid tropical" climatic band. The term also embraces the group of nine West African countries which jointly coordinate drought control activities.

[9]As will be discussed later in this chapter, the two principal economic activities in the Northeast correspond to rainfall patterns, nomadic pastoralism dominating in the drier north and mixed agriculture generally prevailing in the south.

Table 2.1 compares rainfall levels and variability between the Northeast (Tombouctou and Gao), the national capital (Bamako) and key cereals producing areas in southern Mali (Koutiala and Sikasso). The table shows that average annual rainfall in Tombouctou and Gao was substantially lower than that in the South. Moreover, annual rainfall in the Northeast shows higher variability in terms of the coefficient of variation (CV).[10] Data for the key rainfall months indicate rainfall distribution over time.[11] Again, rainfall is relatively more variable in the Northeast, making its shorter growing season vulnerable to capricious rainfall patterns.[12]

2.1.1.2. Soils

After rainfall and temperature, soils may represent the next most important influence on agricultural production (USDA, 1981). From the bend of the Niger River southward and eastward, soils are mainly typically luvic arenosols with low organic matter content and little nitrogen and phosphorous. Consequently these soils have poor natural fertility. Alluvial soils in valleys offer more possibilities for cultivation (FAO/UNESCO).

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[10]Inclusion of the drought of 1968-73 may bias average 1960-80 rainfall data in Table 2.1. downwards compared to other periods. A longer time series for Gao (1920-78) shows that city averaging 260.0 mm of rainfall from April through October (Boudet, p. 4). Similarly, rainfall data for April-October 1931-60 show Bamako receiving an average annual rainfall of 1075 mm, Gao receiving 271 mm and Tombouctou 200 mm (*Ministère de la Coopération*, p. 420).

[11]A better measure of variability would be time series data on daily rainfall, unfortunately unavailable for the 1960-80 data series. During the period 1931-60, Bamako had an average of 84 days of rainfall, while Tombouctou had 23 and Gao 28 (*Ministère de la Coopération*, p. 42).

[12]Rainfall for the chief cities in the districts in the deficit zones shows a similar pattern of variability, as shown in Chapter 3, Annex 3.1.

Table 2.1. Comparison of Rainfall Levels and Variability between Northeastern and Southern Mali: 1960-80

	Tombouctou	Gao	Bamako	Koutiala	Sikasso
Annual Average (April-October)					
Millimeters	164.9	206.6	963.9	927.2	1144.3
CV	0.25	0.27	0.16	0.18	0.15
Annual Average (May-October)					
Millimeters	163.2	203.3	935.3	900.9	1100.0
CV	0.26	0.28	0.16	0.19	0.15
June Average					
Millimeters	14.1	22.8	130.6	128.7	154.4
CV	0.93	0.97	0.39	0.36	0.26
July Average					
Millimeters	45.2	62.4	239.7	222.2	248.0
CV	0.68	0.45	0.22	0.27	0.31
August Average					
Millimeters	70.5	76.4	271.0	244.8	319.0
CV	0.51	0.42	0.32	0.37	0.25
September Average					
Millimeters	28.1	29.9	171.5	173.5	198.4
CV	0.49	0.77	0.34	0.38	0.26
October Average					
Millimeters	2.1	5.5	62.3	55.5	84.4
CV	2.05	2.05	0.82	0.97	0.80

Note: Bamako rainfall was measured at Sotuba. Source for calculations: Levine, 1983, Annex B.

Gleysols make up the dominant soil in the Niger delta basin and along certain stretches of the Niger River in the Tombouctou and Gao regions. These are sticky, clayey soils formed under the surface of water bogged soils, often rich in dissolved nutrients (FAO/UNESCO).

2.1.2. Cropping Patterns

Access to water defines three principal cropping patterns in the Northeast: rainfed agriculture, recession agriculture and irrigated agriculture. Each cropping pattern is calculated to maximize use of limited water resources. Although aggregate production levels are low, these seasonally staggered cropping patterns ensure that cereals can be harvested over 8-9 months in a normal year. Small holders are responsible for the bulk of food production in each cropping pattern.

2.1.2.1. Rainfed Agriculture

Millet (*mil duniaire*) and sorghum (*sorgho duniaire* or *sorgho d'hivernage*) are the principal rainfed crops grown. These crops are well-adapted to semi-arid conditions and can be counted on to provide a minimum yield in very bad years. Millet appears more drought resistant than sorghum, tolerating useful rainfall as low as 200 mm, although 400-700 mm is the optimal range. Millet reaches maturity within 90 days and as short as 55-65 days, depending on the variety. Sorghum requires about 110 days and, under optimal conditions, needs about 550 mm in rainfall. Hence, sorghum is more vulnerable to vagaries in rainfall (USDA, 1981; *Ministère de la Coopération*).

Both crops are planted near the onset of the rainy season in June/July with harvest in October/November. Under traditional rotational fallow cultivation, millet yields vary from 600 to 800 kg/ha in Mali, while recent yields in the Northeast are on the order of 250-500

kg. Sorghum yields are similar to those of millet (DRA, Tombouctou and Gao; Maïga and Rutten; *Ministère de la Coopération*).

Maize was little known in the Northeast before its introduction as food aid during the drought of 1972/73. Very little maize is grown under rainfed conditions (except in the lake zone in the southern part of Tombouctou) due to its demanding rainfall requirements, 600 mm for a 120-day growing period, and extreme sensitivity to variations in temperature and soil fertility. Few statistics are available for rainfed maize cultivation.

2.1.2.2. Water Recession Agriculture

Water recession agriculture refers to sequential planting along the river banks of the Niger as water levels recede during the dry season. It also refers to planting around the edges of low-lying depressions or seasonal ponds which form even in the desert. By drawing on moisture temporarily retained in the soil, recession agriculture compensates for low rainfall.

Millet cannot tolerate waterlogging, effectively ruling out water recession millet. In contrast, sorghum is adapted to a broader range of soil and water conditions, making water recession sorghum production possible. In river recession sorghum (*sorgho de décrue*), planting takes place as the river recedes in February/March. Plant growth is halted until the rains begin around July. If the rainy season has been good, river recession sorghum is harvested in September/October with yields in the 200-400 kg/ha range. If not, the crop is lost, even as livestock fodder due to plant toxicity.

Pond recession sorghum (*sorgho de mare*) is expanding rapidly and spontaneously among semi-sedentarized nomads who plant in September/October around temporary ponds which collect at the end of the rainy season. Harvest takes place in January/February. Even without fertilizers, maximum yields reach 1.0 to 1.5 tons/ha in the south and 600-700 kg/ha in the north (Maïga and Rutten), although more typical yields are about 350-400 kg/ha (DRA, Gao). Projects sponsored by private voluntary organizations (PVOs) are promoting the construction of water deviation controls and retention dikes to expand areas planted to recession sorghum.

Lastly, truck gardening (*culture de maraîchage*) has enjoyed something of a resurgence (Samaké and Touya). It competes with cereals in some water recession areas for home consumption and market. Chief crops include onions, tomatoes, potatoes and sweet potatoes, beans and cowpeas, while minor crops are cabbages, lettuce, beets, okra, carrots and manioc. Peanuts and tobacco are also cultivated in the Tombouctou region (DRA, Tombouctou and Gao).

2.1.2.3. Irrigated Agriculture

Irrigated agriculture is practiced along the Niger River and in the lake zone of Tombouctou. Irrigation can be classified by the control of flooding: no control or partial control and complete control.[13]

In lowland irrigated rice production, fields are flooded by rainfall and river flow with neither pumping nor drainage systems to control water levels. Even where earthen dikes have been constructed, limited drainage makes it impossible to maintain optimal water depth. Dikes are often submerged. Farmers practice submerged or floating rice cultivation (*riz de submersion* or *riz flottant*). Seedlings are transplanted in July/August and paddy harvested in December/January. With low fixed and variable production costs, a good harvest can bring

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[13]For a full classification of rice production technologies, see WARDA, "Classification of Types of Rice Cultivation in West Africa," mimeo, p. 20, as cited in USDA (1981), p. 96.

yields of 1.4 to 1.7 tons/ha. About two-thirds of the rice crop in the Northeast[14] comes from partial control irrigated production (DRA, Tombouctou and Gao).

In view of the considerable risks entailed in partial water control rice cultivation, the government, bilateral and multilateral donors and PVOs have embarked upon a series of investments in village-level irrigated perimeters with near complete water control. Fields of 10-20 hectares are levelled, pumps installed and farmers organized into producer cooperatives with extension service support. Two rice crops are possible, each yielding 3.5 to 4.0 tons/ha (D.R.A., Tombouctou and Gao). A main season crop (*riz saison*) is planted in July and harvested in December, and an off-season crop (*riz contre-saison*) is planted in January and harvested in June.

Residents of these village-irrigated perimeters are still adjusting to the stresses and strains of new organizational forms and work schedules. The intensive labor requirements of the double cropping calendar leave farmers little time for other activities. Other problems concern fragile management and organizational structures superimposed on traditional land tenure patterns, relatively high production and milling costs, delayed reimbursement of water service fees, late arriving inputs such as seeds, fertilizers and fuels, and prolonged breakdowns due to a lack of mechanics or spare parts. Continued external oversight and support seem essential at this stage of development (Maïga and Rutten; Samaké and Touya).

Wheat is grown nowhere in Mali except the Northeast deficit zones. Irrigated wheat production takes place in a government crop promotion zone at the top of the Niger delta in the Tombouctou region. A full water control wheat crop is planted in November and harvested in March, followed by an off-season millet and rice crop planted in June and

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[14]This is known as "local rice," or *koroboro* in Songraï and *riz local* in French.

harvested in November. Although irrigated wheat yields reach 2 tons/ha, wheat remains a minor crop. High production costs mean that wheat cannot be marketed at competitive prices.

2.1.2.4. A Comparison of Yields

Table 2.2. compares cereals yields in the Northeast with average yields for Mali in recent years. These yields must be interpreted with caution because some data are incomplete while others are highly aggregated. It is not always clear whether yields refer to area seeded or area harvested. Moreover, millet and sorghum (and sometimes millet, sorghum and fonio) are often reported jointly.

Three points emerge from Table 2.2. First, cereals yields in the Northeast tend to be less than national average yields. Second, yields can be higher in traditional zones than in agricultural project zones. Most importantly, yields in the Northeast vary considerably from year to year, an indication of their extreme dependence on rainfall or river flooding, itself a function of rainfall.

2.1.2.5. A Summary of Cereals Production and Availability in the Northeast

Despite the successful adaptation of cropping patterns to seasonal changes in water availability and poor soil conditions, aggregate cereals production in the Northeast falls far short of demand. The Northeast is considered chronically deficit — unable to meet cereals needs no matter what production conditions are like. Table 2.3 shows per capita cereals availability from production by region for the years between the census of December 1976 and that of April 1987, extended to 1989. The cereals deficit in the Northeast is starkly clear.

Table 2.2.

Tradition

Millet

Ga

Sorghum

Ga

Rice Pad

Ga

Modern

Millet-S

Ga

Rice Pad

Ga

Sources

Table 2.2. Comparison of Cereals Yields between the Northeast and the Rest of Mali

Traditional Sector	**1986/87**	**1987/88**	**1988/89**
Millet			
Tombouctou	400 kg	268 kg	.
Gao	.	.	450 kg
National Average	1,021 kg	939 kg	888 kg
Sorghum			
Tombouctou	870 kg	379 kg	.
Gao	682 kg	1,953 kg	295 kg
National Average	1,021 kg	939 kg	888 kg
Rice (Paddy)			
Tombouctou	2,747 kg	702 kg	.
Gao	455 kg	1,116 kg	1,544 kg
National Average	993 kg	1,538 kg	1,247 kg
Modern Sector	**1986/87**	**1987/88**	**1988/89**
Millet-Sorghum-Fonio			
Tombouctou	297 kg	876 kg	.
Gao	130 kg	271 kg	300 kg
National Average	745 kg	574 kg	.
Rice (Paddy)			
Tombouctou	2,972 kg	3,380 kg	.
Gao	496 kg	4,733 kg	3,500 kg
National Average	1,345 kg	1,381 kg	.

Sources: National averages and modern sector data from *Ministère du Plan/DNSI, Enquête Agricole de Conjoncture, campagne 1986/87, 1987/88*, and OSCE, *Statistiques de Base Agriculture Elevage*, 1988, 1989. Regional data for 1988/89 from DRA/Gao (undated mimeo) and OSCE, 1989.

2.13. Wild C

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According to Table 2.3, the deficit regions of Tombouctou and Gao have the lowest per capita cereals production of the seven national regions;[15] per capita production for Gao is only one-tenth of that for Ségou, the highest producer. In addition, per capita cereals availability from production is least stable in the Northeast; the coefficient of variation for Tombouctou is four times greater than that of Ségou. Lastly, cereals production expressed as a percent of either the former cereals consumption norm or the new consumption norm is lowest in the Northeast;[16] again, the percentage for Gao is less than one-tenth of that for Ségou.

2.1.3. Wild Cereals

Exclusively based on *cultivated* cereals, Table 2.3 understates aggregate cereals availabilities in the Northeast by ignoring the prevalence of *gathered* wild cereals and their non-negligible contribution to dietary patterns. These wild cereals are routinely consumed to "bridge" the hungry season between harvests. Limited supplies of wild cereals can be found in bad years, moreover, even if local cereals crops fail.

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[15]The District of Bamako, not shown in Table 2.3, is officially considered a deficit zone for which cereals production is not reported.

[16]The consumption norm is derived from the Malian Food Strategy (*Ministère de l'Agriculture*, 1982) while the consumption average is based on a 1988/89 nationwide household budget-consumption study (*Ministère du Plan/DNSI*, 1991a and 1991b). As of early 1991, the government and donors have informally adopted the more recent consumption study average as a norm (Yves Gueymard, personal communication, January 1991), a term which this dissertation will use.

These consumption norms, as well as dietary patterns, will be discussed in Chapter 5. Demand for cereals by socioeconomic group will also be examined in Part II in the context of household income, expenditure and consumption patterns.

Table 2.3. Per Capita Cereals Availability (kg) from Production in Mali by Region: 1976/77-1988/89

	Kayes	Kouli-koro	Sikasso	Ségou	Mopti	Tom-bouctou	Gao	National Average
1976/77	117.1	95.0	125.7	292.9	243.4	..	60.1	147.5
1977/78	133.0	181.8	233.6	301.8	165.4	..	66.8	169.1
1978/79	119.7	118.0	137.9	365.9	140.9	..	21.7	145.7
1979/80	142.4	100.3	125.9	268.3	96.8	40.5	22.5	122.8
1980/81	96.2	58.3	106.8	228.1	130.9	34.6	10.3	104.9
1981/82	130.1	135.3	103.9	336.5	127.2	18.9	20.0	138.0
1982/83	108.1	159.3	189.0	330.6	109.0	22.2	26.7	149.8
1983/84	36.4	135.7	290.6	296.0	169.5	148.7	15.6	165.7
1984/85	63.1	180.9	253.7	177.4	67.5	4.3	3.4	122.5
1985/86	90.1	227.4	281.1	316.7	133.3	60.0	18.2	177.6
1986/87	50.8	208.1	306.5	369.0	119.6	78.7	18.3	181.7
1987/88	161.1	175.7	245.5	223.8	195.9	35.9	55.0	168.1
1988/89	140.2	260.8	264.8	366.1	259.5	154.8	37.4	223.1
Average (kg)	106.8	156.7	205.0	297.9	150.7	59.9	28.9	155.1
Coefficient of Variation	0.341	0.350	0.355	0.193	0.354	0.836	0.660	0.191
Average as Percent of Consumption Norm:								
167.0 kg	64.0	93.8	122.8	178.4	90.2	35.8	17.3	92.9
212.4 kg	50.3	73.8	96.5	140.3	70.9	28.2	13.6	73.0

Data sources for calculations: Gross production data and net availability coefficients from OSCE (1989), DNSI series, and *Ministère du Plan, Enquête Agricole de Conjoncture: Résultats Définitifs (1986/87, 1987/88)*, and *Direction Régionale de l'Agriculture*/Tombouctou for wheat data (1988/89). Population data extrapolated from the April 1987 census, *Ministère du Plan/Bureau central de recensement* (1987).

Two hungry season wild cereals (*aliments de soudure*) are gathered most often, wild fonio (*fonio sauvage*, or *panicum laetum*) and sandburr grass, known as cram-cram (*cenchus biflorus*).

Wild fonio grows in clay soils in valleys or *wadis*, while cram-cram grows on sandy ground. Both cereals, actually the grains of perennial grasses, sometimes cover broad expanses of up to 20 hectares. Both are extremely drought-tolerant, cram-cram even more so than fonio, requiring as little as 100 mm of well-distributed rain. Fonio and cram-cram reach maturity in August/September, depending on localized rainfall conditions. Fonio disappears in December although cram-cram can usually be found up to the onset of the subsequent rainy season in June/July.

The stigma attached by sedentary farm households to gathering and consuming wild cereals has lessened since the drought of 1972/73. In poor rainfall years nomad and sedentary households participate alike. Gathering is a slow and tedious process of knocking panicles of grain into a special basket in a swinging motion or sweeping up grains that have fallen to the ground. One person can gather about 15 kg of fonio or 12 kg of cram-cram per day (Maïga and Rutten). Families with able-bodied gatherers and donkeys for transport can subsist on wild fonio for eight months under optimal conditions of rainfall and availability of water; in years of poor rainfall, supplies may last only from two weeks to two months (Davies and Thiam, 1987b). Fonio can be stored in granaries for two years.

Except for areas in the districts of Gourma-Rharous (Tombouctou) and Ménaka (Gao), where access is regulated by social code and property rights, wild fonio and cram-cram are part of the commons (Davies and Thiam, 1987b; Lindland). Yet, tensions arise over competing rights of access between gatherers and herders who want to pasture their animals and between Malian herders and herders from neighboring countries (Maïga and Rutten).

The reliance of nomads and poorer households on hungry season wild cereals cannot be understated. Wild cereals may constitute one of the staple cereals for most if not all of the r, not just during the hungry season (Davies and Thiam, 1987b; Lindland; Maïga and ten; Sundberg, 1988).

.4. Closing the Cereals Gap with Trade and Food Aid[17]

Discussion of the cereals deficit in the Northeast is incomplete without considering the sible gains from domestic trade based on regional comparative advantage.[18] The top part Table 2.4 shows the average national per capita availability of cereals from net production ecent years.[19] Comparison with regional per capita availabilities in Table 2.3 illustrates potential improvement in cereals availability for the Northeast if all domestic production e evenly distributed as a result of domestic trade. Only the drought year of 1984/85 ws a per capita availability considerably below the former consumption norm.

The bottom part of Table 2.4 shows the improvement in national per capita ilability of cereals once commercial and food aid imports are added to net domestic duction. Average per capita availability exceeds the former norm of cereals consumption ll years, even 1984/85, and never falls below 80 percent of the new, higher consumption m.

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[17]After Huddleston.

[18]A major obstacle to domestic inter-regional trade, according to long distance truckers, is lack of backhaul opportunities. Products for export from the Northeast are limited to tively low value straw mats, dates and dried fish. As for higher value exports, the former sphate extracting parastatal, SONAREM, relied on its own truck fleet for shipments south; t livestock for export are herded south, not trucked.

[19]Net production available for human consumption is gross production after deduction for l requirements, milling and various losses, based on the following coefficients: 0.85 for et, sorghum and fonio; 0.80 for maize; and 0.51 for rice paddy (CNAUR, as reported in :E, 1988).

Table 2.4.

Per Capita Cereals Availability (kg) in Mali from Production and from Production and Imports: 1983/84-1988/89

	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
Gross Cereals Production (000 MT)	1,507.1	1,111.7	1,669.9	1,736.8	1,637.5	2,194.9
Net Cereals Production (000 MT)	1,201.1	903.2	1,331.7	1,386.2	1,303.2	1,758.1
Population (000s)	7,244.8	7,367.8	7,493.0	7,620.2	7,749.8	7,881.5
Per Capita Availability	165.7	122.5	177.6	181.7	168.1	223.1
Percent of Consumption Norm:						
167.0 kg	99.2	73.4	106.4	108.8	100.7	133.6
212.4 kg	78.0	57.7	83.6	85.5	79.1	105.0
Food Aid (000 MT)	127.1	237.7	81.3	14.0	18.5	35.0
Commercial Imports (000 MT)	169.1	190.9	122.8	49.0	20.0	20.0
Total Cereals Imports (000 MT)	296.2	428.6	204.1	63.0	38.5	55.0
Per Capita Availability, including Imports (kg)	206.7	180.8	205.0	190.2	173.1	230.0
Percent of Consumption Norm:						
167.0 kg	123.8	108.2	122.7	113.9	103.7	137.7
212.4 kg	97.3	85.1	96.5	89.5	81.5	108.3

Sources: Gross and net production data from OSCE (1989), DNSI series; population data extrapolated from the April 1987 census, *Ministère du Plan/Bureau central de recensement* (1987).

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2.2. Demographic and Infrastructural Influences on the Market in the Northeast

Although the harsh climate and poor natural resources limit agriculture in the Northeast, the preceding section suggests that the cereals gap can be narrowed or even closed in some years as a result of trade and aid. With this assurance, it might appear that the market is perfectly capable of supplying cereals to the region, making a special policy toward the deficit zones unnecessary.

However, a compelling case can be made for a special policy on the grounds of poor accessibility due to an underdeveloped infrastructure base, exacerbated by unusual demographic factors.

2.2.1. Demographic Factors

2.2.1.1. An Overview of the Population

The Northeast is vast and the people few. Outside of the population concentrated in the Niger River valley and a few scattered settlements elsewhere, the Northeast is virtually devoid of people.

Table 2.5 shows unmistakable differences in demographic indicators between the Northeast and the South. First, population densities in Tombouctou and Gao are only one-sixth to one-seventh that of the country as a whole.

Second, the rates of change in population between the censuses of 1976 and 1987 show a diverging pattern of negative or low growth in the Northeast but high growth for Mali as a whole. Population growth for Mali without the Northeast is even higher. Demographic shifts within the Northeast itself cannot be immediately discerned, as some of the more urban districts gained population while others lost population.

Table 2.5. Demographic Indicators for the Northeast by Region and District: 1986 and 1987

	Population		Rate of Change: 1976-87 (Percent)	Population under 14 years (Percent)	Population Density per km²
	1976	1987			
Tombouctou	490,456	453,032	-0.8	28.9	1.0
Tombouctou	70,073	65,179	-0.7	34.6	0.2
Diré	82,706	79,507	-0.4	31.0	29.5
Goundam	108,730	113,119	0.4	30.5	1.3
Gourma-Rharous	96,011	87,049	-1.0	26.2	1.2
Niafunké	132,936	108,178	-2.0	23.6	9.7
Gao	370,903	383,734	0.3	31.0	0.8
Gao	117,486	148,886	2.3	39.4	4.4
Ansongo	85,622	76,896	-1.0	30.4	3.4
Bourem	90,703	73,134	-2.1	30.6	2.3
Kidal	25,454	34,813	3.0	28.6	0.1
Ménaka	51,638	50,005	-0.3	25.2	0.5
Mali					
With Northeast	6,394,918	7,620,225	1.7	37.7	5.8
Without Northeast	5,533,559	6,783,459	2.1	38.7	18.6

Sources: *Ministère du Plan, Recensement général de la population et de l'habitat du 1er au 14 avril 1987*, for 1976 and 1987 population data and *Ministère de l'Administration Territoriale et du Développement à la Base, Recensement administratif et fiscal du 2 mai 1986*, for population under 14 and population density. Population density for Gourma-Rharous is estimated.

Third, the regions of Tombouctou and Gao have the lowest portion of the population aged 1-13 years of age within Mali, 26.5 percent and 25.9 percent, respectively, compared with 39.6 percent in Bamako (MATDB, 1987). The somewhat older population base in the Northeast may reflect drought-related deaths of children, a subgroup experiencing a high incidence of disease and malnutrition during the 1970s and 1980s, or the out-migration of families of child-bearing ages.

2.2.1.2. Principal Economic Activities of the Population

Economic activities in the Northeast are still largely dominated by pastoralism and subsistence agriculture. These activities correspond to two main lifestyles, sedentary and non-sedentary, with some in between. To a large degree, the sedentary activities coincide geographically with higher rainfall zones or proximity to water. Hence, most of the population living in small villages or regional towns along the River or the shores of lakes and permanent ponds may be categorized as sedentary. The rest of the population living away from the River in the vast hinterland may be considered non-sedentary or nomadic whose access to water is more tenuous.

2.2.1.2.1. Sedentary Population. A whole range of occupations can be found in urban areas. A large part of the rural sedentary population practices seasonal or year-round subsistence agriculture according to the cropping patterns described in Section 2.1.2. Mixed agriculture-livestock is common.[20] Not all sedentary people farm, of course. Others are fishermen, boat makers, mechanics, transporters, merchants and petty traders, well-diggers, various sorts of craftsmen and artisans, laborers, religious instructors, millers and butchers, to list but some occupations.[21]

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[20]Anthropologists and demographers often put agriculture and herding on a continuum, identifying a number of gradations in between. Piché and Gregory construct a matrix of activity for the Northeast (agriculture, agriculture with herding, herding with agriculture, herding) by residence (sedentary, sedentary sometimes nomadic, nomadic sometimes sedentary, nomadic) (Piché and Gregory, p. 174).

[21]Chapter 4 will examine seasonal sources of income and efforts to diversify income at the household level.

Sedentary occupations and ethnicity generally overlap in the Northeast. A large majority of the indigenous sedentary population is Songhaï (speakers of Sonraï), with small minorities of Arabs, Bozo, Dogon, Peul, Somono, Sorko and Zerma.[22]

2.2.1.2.2. Non-Sedentary Population. Tuaregs and Bellas constitute the main non-sedentary ethnic groups,[23] followed by smaller numbers of Moors and Peuls. The strictly non-sedentary population is in decline as formerly non-sedentary Tuaregs and Bella, left destitute of their herds in recent droughts, have been forced to adapt sedentary lifestyles in permanent settlements. While a few nomads still engage in trans-Sahara trade, most nomads practice extensive herding characterized by small family-animal units and facility for immediate and rapid movement.

Migratory patterns are tightly regulated by seasonal rainfall and pasture conditions. During the hot dry season from March to June, herder families and their animals stay close to wells or drying ponds for water and grazing. During the rainy season from June/July to September/October, herders and livestock follow the rains northward in search of newly

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[22]An accurate breakdown of population by ethnic group is not possible as Government of Mali census reports do not publish data on ethnicity. See *Ministère de l'Administration Territoriale et du Développement à la Base* (1986) and *Ministère du Plan* (1976, 1987). Davies and Thiam (1987a, p. 21) report that 52 percent of the Gao region is comprised of Songhaï.

The UNDP estimated that the Malian population within the three-country (Mali, Niger and Burkina Faso) Liptako-Gourma Regional Authority in 1969/70 was 37 percent Songhaï and 63 percent Tuareg and Bella (*PNUD et l'Autorité de la Région du Liptako-Gourma. Aspects humains du développement*, (Montréal), 1976; as cited in Piché and Gregory, p. 173). While the Liptako-Gourma comprises nearly all of the Niger valley and part of the southern parts of the Tombouctou and Gao regions, it is difficult to make inferences to the rest of the Northeast, either geographically or over time, in view of the intervening 1972/73 drought which had a disproportionate demographic impact on the nomadic population (principally Tuaregs and Bellas). Any estimates of the current ethnic breakdown in the Northeast are thus approximate.

[23]Bellas are the former slaves or lower caste servants of Tuaregs. Culturally, Bellas are quite similar to Tuaregs with whom they often live in close economic association. Bellas speak the Tuareg language, Tomashek.

regenerated grassland. Families may split up during September/October to November/December as some members gather wild cereals and others tend the animals. During the cold season from November/December through February, families and herds return south to their home bases (Swift, 1973; Piché and Gregory).

Nomads seek to maintain diversity of animal species within the herd and flexibility in herd size based on ecologically rational use of water and grazing resources. Herd composition among cattle, camels, sheep and goats must balance the daily distance each animal can walk, the number of days each animal can go without water and the type of forage (grasses, trees or scrub brush) each animal requires in order to maintain equilibrium. Even the breeding cycles among different animals are regulated according to available pasture and the dietary needs for the nomads, such as the availability of fresh milk (Swift, 1973). Successful herding, maintaining animals in optimal relation to the carrying capacity of the land, requires an intimate awareness of microconditions of the environment (Johnson, in Piché and Gregory).

Nomads consider their animals foremost as their principal food reserve, and only secondarily as a source of exchange value. Just the same, nomads maintain contingency plans or coping strategies for drought and famine, including agriculture and/or symbiotic dependence on agricultural communities (Bonte, 1974; Johnson, in Caldwell, 1975; and Swift, 1973).

2.2.2. A Weak Infrastructural Base

In principle, the small population of less than one million facilitates provision of social services and other infrastructure. But once away from the population belt along the River, reaching all of the widely dispersed population in the Northeast is neither possible nor ıctical for Mali's limited administrative capabilities. As a result, distant non-sedentary ɔups wishing to avail themselves of public services must travel to those services.

Table 2.6 compares the availability of several types of social services and rastructure in the Northeast with their availability in Mali. It is immediately apparent that absolute number of facilities in the Northeast is smaller, the average area served by each ility is enormously greater and the average radius of the area served (or maximum distance a facility) several factors larger. Only the average number of school-aged children per mentary school is smaller in Tombouctou and Gao than in all of Mali (though still large in solute terms). Some outlying administrative centers, such as Kidal or Araouane, have no eals markets. Table 2.6 is illustrative but incomplete. Due to data limitations, it does not lude the other essential infrastructure for the cereals trade: a modern communications work and a reliable banking system.[24]

Public telephone facilities exist in the regional and circle capitals along the River. cal administrators at the district and sub-district levels rely on a solar-powered radio system official communications. Travellers are often requested to carry correspondence or ssages, but this method of communication remains slow and haphazard. On the other nd, passing nomads routinely exchange "the news" with each other, such that information culates long distances fairly quickly.

All-weather roads are indispensable during the rainy season but rare in both regions. terms of location and distances, the region of Gao is better endowed with good roads than mbouctou. The paving of the national highway between Mopti and Gao, completed in 86, put Gao within one day of the major cereals producing areas in the south. The

[24]A formal sector banking system is still in the formative stage in the Northeast. ancing and credit needs of traders are discussed in Chapter 8.

Table 2.6.
Comparison of Basic Infrastructure in the Northeast and the Rest of Mali: 1986

	Number	Average Population Served	Average Area Served	Average Radius of Area Served
Medical Dispensaries				
Tombouctou	38	12,113	13,318 km²	65.1 km
Gao	25	14,755	17,462 km²	74.6 km
Mali				
with Northeast	702	10,273	1,766 km²	23.7 km
without Northeast	639	9,988	537 km²	13.1 km
Elementary Schools				
Tombouctou	78	1,705	6,488 km²	45.4 km
Gao	79	1,445	5,526 km²	41.9 km
Mali				
with Northeast	1,434	1,893	865 km²	16.6 km
without Northeast	1,277	1,933	269 km²	9.2 km
Maternity Clinics				
Tombouctou	26	5,103	19,465 km²	78.7 km
Gao	18	5,981	24,253 km²	87.9 km
Mali				
with Northeast	676	2,869	1,834 km²	24.2 km
without Northeast	632	2,689	543 km²	13.1 km
Markets				
Tombouctou	34	13,538	14,885 km²	68.8 km
Gao	32	11,528	13,642 km²	65.9 km
Mali				
with Northeast	1,065	6,771	1,164 km²	19.3 km
without Northeast	999	6,389	344 km²	10.4 km
All-weather Roads (km)				
Tombouctou	50	9,206	10,122 km²	56.8 km
Gao	275	21	1,452 km²	22.5 km
Mali				
with Northeast	2,800	29	443 km²	11.9 km
without Northeast	2,475	29	120 km²	6.2 km

Note: Population served refers to total population in the case of medical dispensaries, markets and roads; children under 14 years in the case of elementary schools; and women aged 14-59 in the case of maternity clinics. Source: *Ministère de l'Administration Territoriale et du Développement à la Base, Recensement administratif et fiscal du 2 mai 1986.* Roads estimated.

Tombouctou region is at a particular disadvantage due to seasonal flooding in the upper Niger delta and lake zone which renders many localities inaccessible. Overland transportation to Tombouctou, arduous at best, all but stops during the rainy season. Other localities are completely isolated for three to five months at a time (Gagnon; Steffen and Koné).

Once again, the Niger River proves its worth as economic mainstay of the Northeast. More than just an agricultural resource, the River serves as a commercial and transport artery as well as communications link. River transport often represents the sole means for resupplying some zones. Large multiple-deck riverboats make numerous runs between Koulikoro and Gao during the River's crest from August to November, a voyage of 1,300 km.[25] Smaller *pirogues* (long wooden canoes) and *pinasses* (motorized *pirogues*) with shallow drafts are able to ply the River between June and January. Towns along the River, which would be otherwise inaccessible by road, are in touch with the outside for up to eight months per year.

2.2.3. Demographic and Infrastructural Imbalance: The Tragedy of the 1972/73 Drought

Serious droughts in Africa are more likely to occur in semi-arid areas where rains fall during one short season because the proportional deficiency in rainfall is greatest there (Topps; Caldwell, 1975). Fluctuations in climate can be extreme and abrupt (Nicholson, in Watts). A slight shift up or down in the northern advance of the intertropical convergence zone can make all the difference between starvation and plenty (Schove).

Droughts are no stranger to Northeastern Mali. Chronicles from Tombouctou and elsewhere in the Sahel recount the hardship of droughts occurring centuries ago, many

[25]These riverboats make nine stops in the Northeast (Aka, Niafunké, Tonka, Diré, Kabara (port of Tombouctou), Gourma-Rharous, Bamba, Bourem and Gao).

droughts persisting years on end.[26] In the Northeast, droughts can be anticipated, if not predicted.[27]

Failure of the rains in 1968 culminated in a drought lasting until the return of "regular" rainfall in 1974.[28] In 1972/73, the critical 100 mm rainfall isohyet defining the start of the "hot subtropical desert" was displaced hundreds of kilometers to the south of its mean location (Bernus, 1977). Virtually all of Northeastern Mali suffered the cumulative effect of desert-like conditions. The usual time-tested strategies for coping with localized drought were of little use in a generalized Sahel-wide drought such as this one (Swift, 1975). What happened in 1972/73 was the outcome of extreme ecological and demographic imbalance whose tragic effects were compounded by an underdeveloped infrastructure.

A myriad of factors contributed to the "severity...of the conflation of poor rainfall, ecology and land use" (Watts, 1987) about which analysts have written volumes: the causes of the climatological drought and ecological destruction in the Sahel, the adequacy of the relief effort and the effects of the drought on society. The purpose here is to summarize a few points whose relevance to cereals markets in the Northeast will become clearer in later chapters.

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[26]Cissoko, pp. 806-821, Franke and Cashin, p. 58, and Iliffe, pp. 36, 45, 157, 160, 252-254, for Mali; Bernus (1977), pp. 140-143 for Niger; Bonte, pp. 70-80, and Toupet, pp. 109, 111 for Mauritania; Caldwell, pp. 19-20, Grove, p. 58, Schove, pp. 41-46, and UNDP (1975), p. 14, for the Sahel.

[27]No conclusions can be drawn about secular trends in Sahelian weather patterns based on various length cycles (Albouy and Boulenger, p. 58; Caldwell, p. 20; and Lamb, p. 36). However, according to Rasmusson, "decadal-scale fluctuations associated with...long and persistent wet and dry spells...are the dominant mode of rainfall variability [in the Sahel]" (Rasmusson, p. 8).

[28]Based on meteorological data and mathematical modelling, Schove concludes that the drought decade of 1964/74 "the worst such decade since at least the 1830s" (Schove, p. 50).

2.2.3.1. Ecological Destruction

Ecological destruction hinged on an intensification of the ratio between land and demography — both people and animals — as a result of ill-considered public policies and investments and the unanticipated consequences of expansion into areas in fragile equilibrium. The forces which hastened this ecological destruction are historically, politically and socially complex. Only a few themes will be highlighted here.

First, successive colonial and post-independent governments were long uneasy with the autonomy of nomads, whose 'irrational wanderings' put them beyond the reach of administrative controls.[29] A dual strategy emerged to develop a commercialized livestock sector in order to promote cattle exports, a leading source of foreign exchange, and to induce the nomads to lead a sedentary lifestyle. This strategy entailed two campaigns, one to drill wells for herders and the other to inoculate livestock against disease. The number of new wells proliferated in Mali and across the Sahel.[30] Improved veterinary services lead to rapid growth in the size of Mali's herd, from 1.5 million cattle in 1928 to 5.4 million in 1970, and

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[29]Conquest by the French reduced the Tuaregs from a powerful and wealthy people to nomadic pastoralists (Berry, Campbell and Emker). Under colonialism, the locus of trade switched from trans-Saharan routes to West African coastal ports, and motorized traffic competed with camel caravans for long-distance commerce. Not only did the importance of salt caravans decline (Franke and Chasin), but there were fewer caravans to protect (or beseige). The Tuaregs lost their power over agricultural communities when the French administration put an end to raids on villages for cereals. With less success, the administration tried to free the Bellas. Colonial and Malian administrators even placed restrictions on livestock grazing in expanding agricultural areas (Bernus, 1977; Piché and Gregory). This long succession of events undermined access to traditional sources of income, leaving the nomads only one course of action to ensure survival, expansion of their livestock holdings.

[30]Two colonial programs drilled more than 1,100 new wells expressly for herders (*hydraulique pâturage*) in the Sahel (Franke and Chasin, pp. 101-102). Post-independence donors financed the boring of new water holes; USAID alone drilled 1,400 new wells in the Sahel by the early-1970s (Somerville, p. 23).

from 10.2 million small ruminants in 1965 to 11.2 million small ruminants in 1970 (Amin, in Franke and Chasin; ECA, in E. Berg, 1975).

The increase in the availability of wells for livestock greatly reduced one of the constraints on herd size, migration to natural watering sites. However, there was water but no forage. The radius from a well that a given herd could travel in search of forage was limited to half the distance that the slowest species could travel in one day. As more and more animals began to congregate around wells, surrounding vegetation became depleted. Increase in livestock density as a result of planned sectoral expansion generally exceeded rangeland carrying capacity.[31]

Second, rural demographic pressures led to an expansion of area under cultivation for food crops or cash crops, coinciding with natural population increases and northward migration of sedentary households.[32] This increase in demand for land led to cultivation on the periphery of the grazing zone and a reduction in fallow land. Declining soil fertility exacerbated the stress on land as yet more distant and marginally productive land was brought under cultivation. With more people came higher demands for fuel wood. The detrimental effects of woodcutting and loss of vegetative cover went unchecked and unnoticed during the generally wetter decades preceding the drought (Berry, Campbell and Emker).

Third, as expansion of cultivated land blocked access to traditional dry-season pastures, conflicts emerged between cultivators and pastoralists over water and land rights

[31] The notion of carrying capacity is complex, and agreement about the consequences of exceeding the carrying capacity is by no means universal. See Horowitz and Little for a discussion of the alternative equilibrium, degradation and resiliency models.

[32] Mali's estimated population increased from 2.475 million in 1921 to 4.100 million in 1960 (*Ministère du Plan*, 1976). The census of 1976 counted 6.395 million Malians and the census of 1987 counted 7.620 million (*Ministère du Plan*, 1987) — a threefold increase within one lifespan.

(Watts, 1987). The complex relationships of interdependency between sedentary and non-sedentary populations that served as a defense against disaster broke down (Caldwell, 1975). Social and economic individualism increased (Berry, Campbell and Emker) as herders were forced to overgraze, not so much in pursuit of unregulated self-interest as survival of their animals, leading to further resource depletion of the commons.

Lastly, plowed land or land denuded of sparse vegetative cover, due to woodcutting or increased grazing and trampling by larger herds, is particularly susceptible to wind erosion during dry years (Grove). Some meteorologists theorize that silt and dust in the air is a factor in local weather modification. As dust blocks out sunlight, less of the sun's thermal energy reaches the lower atmosphere; this lowers the temperature, creating a cold spot of air that cannot hold as much moisture as warmer air — in other words, drought (Winstanley).

2.2.3.2. Social Dislocation

While drought disrupted agriculture,[33] livestock was devastated. Non-sedentary herders bore the brunt of the cumulative effects of six years of drought (Iliffe).

Dry pasture decreases sharply in nutritive value (Topps), meaning that the longer the dry season, the greater is the required grazing area (Dresch, in Berry, Campbell and Emker). Forced to go further and further in search of fodder and water, animals grew weaker and weaker. Livestock in the Northeast succumbed in droves, the cattle often dying first. Mali is estimated to have lost 1.65 million head of cattle and 2.25 million sheep and goats between

[33]Cereals production in Mali in 1972/73 dropped to less than 60 percent of predrought levels (FAO): low cresting of the Niger and Bani Rivers allowed sufficient water to irrigate only one-eighth of the rice perimeters, and some 40 percent of the millet and sorghum crop was lost (Messiant).

70 and 1974, 31 percent and 18 percent respectively of the national herd (FAO, 1975).[34] en these figures understate the extent of the damage by omitting the losses before 1970.

Herder diets are overwhelming based on milk and millet. Animals and milk are changed for millet, sugar, tea, clothing and other essentials. Herder terms of trade dropped ecipitously as herders flooded the market with weak and dying animals when cereals prices re already high due to scarcity.[35]

Faced with imminent starvation, entire herder families crowded into refugee camps r Gao and Tombouctou and further south of their normal migratory patterns into Burkina o and Niger.[36] Surveys by the Center for Disease Control (CDC) found camp inhabitants sedentary villagers in Gao Circle subsisting on 100 grams of cereals per day (about 350 ries), a "starvation diet". Pockets of extreme undernutrition were found in the Northeast re up to 80 percent of children surveyed in nomad camps were acutely malnourished. CDC found undernutrition in Mali to be "much more acute" among nomads than

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[34]Eighty percent of the herd in the Northeast perished (*Direction générale du plan*, 1974). a region, the Sahel lost 6.26 million cattle (29 percent) and 4.61 million sheep and goats percent) between 1970 and 1974 (FAO, 1975).

[35]Malian refugees from the Northeast arriving in northern Burkina Faso at the end of 1972 cattle at 750 CFA francs per head, compared to the usual, seasonally variable price of 00 to 20,000 CFA francs; this price dropped further to 200 CFA francs per head ssiant, p. 66) during which the price of millet tripled to about 60 CFA francs per kilo lemand, p. 49) — one cow per 3.33 kg of millet. See also Bernus (1977), p. 144; dwell (1975), p. 50; and Watts (1987), p. 193.

[36]About 250,000 Malians were forced into towns within Mali during the peak period of il-May 1974 (E. Berg, 1975, p. 62). Some 50,000 displaced nomads were set up in gee camps in the Gao and Tombouctou regions, some 40,000 Malian nomads were ped in distribution centers outside Niamey, Niger and another 35,000 in Burkina Faso as eptember 1973 (CDC, in Sheets and Morris, pp. 160-161).

sedentary persons and more in the drier north than the south (CDC, in Sheets and Morris).[37] Reliable mortality data were difficult to obtain, but based on death rates found in nomad camps, the CDC estimated about 100,000 deaths attributable to famine during 1973 in Mali and its neighbors, Burkina Faso, Mauritania and Niger (CDC, in Sheets and Morris). Separate figures for Northeastern Mali are unavailable.

The social dislocation due to prolonged drought and famine profoundly transformed nomads. For an animal-centered culture and economy, the longer-term consequence of the loss of animals spells the collapse of a whole way a life (Bernus, 1977). Social relations, no longer defined around animals, tend to break down (Caldwell, 1975). Unlike farmers who lost only current income (their crops), nomads lost current income (revenue from the sale of milk), assets or capital stock (animals) and reinvestment capacity (reconstitution of the herd) (E. Berg, 1975).[38] These inequalities in asset-holdings and income-earning opportunities between herders and cultivators and *within* herder groups have implications for local supplies of cereals and their effective demand by households in the Northeast.[39]

2.2.3.3. Relief Efforts in 1972/73

Despite early and repeated warnings from field offices to donor headquarters about worsening conditions across the Sahel, little action was taken, in part because donors waited until the affected countries acknowledged the drought and requested aid officially (Sheets and Morris; Franke and Cashin). Once the world was aroused by the staggering human

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[37]In addition to acute malnutrition, nomadic children had much higher rates of edema, a symptom of protein deficiency, than sedentary children, 40-43 percent compared with 1 percent, respectively (Sheets and Morris, p. 158).

[38]Although animal traction is rarely used in the Northeast, farmers who lost work animals and animal traction equipment also suffered loss of capital stock.

[39]The related concepts of chronic and transitory food insecurity and food exchange entitlements and food availability decline will be discussed in Chapter 3.

dimensions of the drought[40] and began to respond, deficiencies in infrastructure slowed the relief effort down.

First was the failure to react to accumulating evidence of the severity and duration of the drought and to develop contingency plans for mounting a relief effort. The disproportionate number of deaths suffered by the nomads during 1972/73 has even been blamed on Mali's refusal to draw attention to the drought because at first it only affected the nomads, a force of political opposition (Somerville, p. 32). Administrative capabilities in Mali were already stretched thin, technical resources weak and data unused. The donor side was characterized by a bureaucratic ineptitude and "lack of coordination and cooperation" (AID, in Sheets and Morris). Only belatedly, as people and livestock began dying five years into the drought, did donors step in.

Delivering aid overwhelmed the underdeveloped transport system. The railroad from the port of Dakar could accommodate only half of the relief supplies to Mali. Other deliveries by sea were diverted to Abidjan for overland transport to Mali. Once in Mali, getting food aid to the Northeast proved costly, given the poor road network. For several months U.S. C-130 transport planes airlifted supplies daily to airports in the Northeast in Goundam, Tombouctou and Gao, though barely enough to meet minimum needs in the camps (CDC, in Sheets and Morris). Trailer-truck convoys brought supplies across the desert from Algeria in an effort to speed delivery and distribution.

Distribution was plagued by inefficiency and waste, hoarding and corruption (Somerville) or evidence of discrimination in the allocation of rations against nomads in favor of sedentary victims (Sheets and Morris). For many, help arrived too little and too late.

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[40]The international League of Red Cross Societies (LICROSS) cited the figure of 12 million "severely affected" drought victims across the Sahel in 1973 (Sheets and Morris, p. 40).

2.2.3.4. Relief Efforts in 1983/84-1984/85

Widespread drought which recurred in Mali in 1983/84 and 1984/85 tested the workability of institutional arrangements to coordinate relief and development efforts. It also gave birth to new ones (section 2.3.2.). Thanks to greater openness and contingency planning, a calamity of previous proportions was averted.

Cereals production dropped to its lowest levels since the major drought of the early 1970s. Irrigation did not compensate for low rainfall as the level of the Niger River was at a 100-year low (USAID, 1987b). Net per capita cereals availabilities fell as low as 97 kg in 1983/84 and 76 kg in 1984/85 (OSCE, 1989).[41] The economic costs of the drought escalated as Mali lost some 40-50 percent of its livestock during 1983-85 (Somerville; FAO, 1986). As livestock prices plummeted, cereals prices rose, sharply cutting the purchasing power of herder families and leaving many destitute. Malnutrition was accompanied by increases in illness and outbreaks of disease. To escape famine, many in the Northeast migrated south in search of food, water and other help (FAO, 1985a). Surveys counted about 7,400 displaced families in Gao-City alone in mid-1984, more than 42,000 people (Davies and Thiam, 1987a). The United Nations estimated that 200,000 people were displaced in Mali as of September 1985 (Somerville).

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[41] Mali used to have two official agricultural production statistical series, which often diverged widely in a given year, one from the Ministry of Plan (*Direction nationale de la statistique et l'informatique*, or DNSI) and the other from the Ministry of Agriculture (*Direction nationale de l'agriculture*, or DNA). The Plan (DNSI) series was thought to use a more reliable sampling technique (USAID, 1984), but its net production estimate for 1983/84 has been criticized for being particularly high (1,199,000 tons) in view of known severe drought conditions (OSCE, 1989), also accounting for the high per capita cereals availabilities in Table 2.3. The Ministry of Agriculture (DNA) estimates for 1983/84 were 42 percent lower, at 695,000 tons. Since 1987/88, these two agencies have harmonized their methodologies and conducted joint estimates of the harvest.

Despite better mobilization of aid, critical breakdowns in delivery still occurred, first in getting food aid out of port cities and then transporting it within Mali. Lack of trucking capacity caused food aid cereals to pile up in Abidjan. Food aid blocked in Dakar due to low railroad capacity had to be airlifted to Bamako and Tombouctou; other aid was flown in from Algeria when the Northeast became isolated during the rainy season (FAO, 1985a, 1985b). A more serious problem was late-arriving food aid or food aid that arrived just prior to the recovery harvest of 1985/86 (USAID, 1987a). Donors agreed to suspend deliveries to Mali in 1986 and convert food aid commitments to direct financial aid where possible.

There were mixed signs of improvements from the standpoint of marketing and distribution. Some 40,000 tons of cereals were released from the strategic grain reserve for distribution (FAO, 1984b). Regular and emergency food aid were effectively channeled through the government's annual marketing plan (USAID, 1987b). Some early indications of the effect of cereals market liberalization (Annex 2.1) were also present as the system for supplying food aid through commercial markets worked well in urban areas, although emergency food needs in rural areas were grossly underestimated, and planning for emergency distribution there was "largely ad hoc and often uncoordinated" (USAID, 1987b).

2.3. An Overview of the Cereals Market in the Northeast

2.3.1. The Long March to Cereals Market Liberalization: A Regulatory Summary

The question arises why the market did not transmit signals of cereals scarcity in the Northeast during the 1972/73 drought which might have elicited supplies from the south. The immediate answer, of course, is that the south was also in deficit and unable to respond. The more fundamental answer is that due to a misunderstanding of market mechanisms, distrust of ıders and excessive concern for urban consumers, the government attempted to appropriate ɔst functions of the cereals market for itself. Ineffective at best and destabilizing at worst, vernment intervention snapped under the logistical stress of meeting emergency needs in stant regions. A sad irony, having blocked the development of the private sector, the vernment was unable to fall back on a dynamic network of grain traders for support.

Since then, the government's role in the market has undergone a remarkable nsformation. Mali has become a unexpected pioneer in cereals market liberalization. In ny respects, Mali has a much more open cereals market than its West African neighbors, ıe of which still fix producer and consumer prices and restrict imports and exports, ılting in a dual market structure such as Mali had recently (Hibou).

Over the past twenty-five years, the cereals market has progressed from 1) an official e monopoly over cereals marketing, to 2) a troubled coexistence between official and vate marketing channels, to 3) the present arrangement whereby the private sector handles -to-day operations of matching supply and demand while the public sector handles the ro controls (see Annex 2.1). In terms of cereals pricing policy, these respective phases respond to fixed official prices, attempts at stabilizing prices and prices for the most part ermined by the market.

Markets have become more reliable as a stable supply source because the tensions ween the government's cereals marketing agency, OPAM, and the private sector have been but eliminated. During the monopoly period, forced cereals procurement at low official ducer prices, requisition of trucks, threats of confiscation of trader stocks and secrecy of rations by producers and traders are thought to have increased marketing margins at all els of the parallel market to compensate for risk (Wilcock *et al.*). Liberalization reduced these risks and improved trader incentives to invest in large-scale grain storage and transport operations, thereby driving down unit costs.

The immediate impact of deregulation of the cereals market was probably felt most keenly in the south, where government planners had tried hardest to make the official marketing system work, rather than in the Northeast, where markets functioned with greater autonomy. The longer-term ramifications for the performance of an integrated cereals market linking the south and Northeast are inescapable, of course. Too significant a story to ignore, Annex 2.1 to this chapter presents a summary analysis of the events leading to market deregulation and some of the achievements of the reform effort, with particular emphasis on the Northeast where possible.

Table 2.7 summarizes the main cereals marketing regulations and associated programs in effect in Mali at the beginning of the 1990s.[42]

2.3.2. Evolution of Key Elements in the Government's Cereals Marketing Policy in the Northeast

A cereals marketing policy for the "deficit zones" of the Northeast predates independence. Elements of this policy have not varied greatly over the years, as best shown by the italicized objectives in Table 2.8 for OPAM, the government cereals marketing agency, and its predecessors. The common theme of these objectives pertains to *supply-side availability of cereals* — through regular sales outlets, release of security stocks or distribution of food aid.

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[42] Annex 2.1 gives more information on these regulations and policies. Most of these will be addressed more fully in Part III. It should be noted that these are the official regulations, not necessarily the rules that get enforced.

For the effect of selected marketing regulations on trader conduct, see Steffen and Dembélé (1990).

Table 2.7. Principal Cereals Marketing Regulations and Programs, 1990

Official Regulations		
1.	Producer Prices	Determined by the market, except for floor price for paddy (*prix minimum garanti*) of 70 FCFA/kg at the Office du Niger and other rice producing ODRs.
2.	Consumer Prices	Determined by the market; no subsidies.
3.	Transport Pricing	Rates negotiable for domestic transport of cereals; rates fixed for transport originating or terminating outside of Mali.
4.	Import of Cereals	Subject to simple registration of intent to import; no quantity restrictions; rice imports subject to protective import tariffs and *ad hoc* import bans.
5.	Export of Cereals	Subject to simple registration of intent to export; no quantity restrictions; no export taxes.
Programs		
1.	Cereals Food Aid	Sold by bid by OPAM except approved volumes ceded to the public relief agency, CNAUR, for free distribution according to updated marketing action plan.
2.	Producer Marketing Credit	Annual marketing credit programs available for Village Associations through PRMC; interest rates regulated by central bank (BCEAO) with no explicit subsidy.
3.	Trader Marketing Credit	Annual marketing credit programs available for cereals wholesalers and semi-wholesalers through PRMC; interest rates regulated by central bank (BCEAO) with no explicit subsidy.
4.	Reconstitution of the Strategic Grain Reserve (SNS)	Routine purchases of millet, sorghum and maize by OPAM based on periodic calls for bids; emergency reconstitution by food aid.
5.	Release of Grain from the Strategic Grain Reserve (SNS)	Routine sales by OPAM based on periodic auctions; emergency release as food aid.
6.	Market Information System (SIM)	Weekly radio broadcast of producer and consumer market prices and related developments; publication of quarterly market bulletin.
7.	Early Warning System (SAP)	Continual surveillance of food security status of "deficit zones" based on market and non-market indicators.

Sources: Hibou; PRMC (1990); SAP; Steffen and Dembélé (1990).

Several emergency preparedness and marketing programs adopted since the drought of 1972/73 have contributed significantly to reducing the worst ravages of drought and improving cereals market performance in the Northeast. Not unexpectedly, their development coincides with the progressive liberalization of the market. These programs concern the strategic grain reserve, agency for drought relief, early warning system, marketing action plan and the market information system.

2.3.2.1. Strategic Grain Reserve

Proposals for a strategic grain reserve as a safeguard against anticipated shortfalls in cereals production assumed new urgency following the drought of 1972/73. The second five-year plan proposed a national security stock, known as SNS (*Stock national de sécurité*), reaching 70,000 tons of coarse grains and rice, "sufficient for the consumption needs of the deficit zones (including Bamako) for six months during a year of normal rainfall." Twenty thousand tons would be stored in the Northeast (*Direction Générale du Plan*, 1974). The objective of the SNS was modified in 1976 to "ensure the availability of cereals to populations in the most vulnerable areas in the event of a 50 percent shortfall in production" although nearly two-thirds of the SNS would remain in southern producing zones and only 10,000 tons positioned in the Northeast (CRED, 1977). On the basis of emergency scenarios established by the FAO in 1977, a ceiling of 58,500 tons was placed on the SNS (USAID, 1984).

While the buildup of the SNS has proceeded slowly, several spot readings indicate that, in practice, the Northeast has retained a higher proportion of stocks than planned: about 25 percent (6,700 tons) in August 1981; 21 percent (7,400 tons) in 1983/84; 22 percent (8,950 tons) in December 1986 (USAID, 1981, 1984, 1987).

Stock management rules of the SNS allow immediate release of cereals to meet identifiable emergency needs pending arrival of food aid. Drawdowns for non-emergency

Table 2.8. Evolution of OPAM's Statutory Objectives

OCS/OCFLM (1959-65)	OPAM (1965-82)	OPAM (1982-88)	OPAM (1988-)
Constitute regional market regulatory cereal stocks, as required.	Develop and consolidate the patrimony of the people.	Supply cereals to public service agencies.	*Constitute and manage the national cereals security stock.*
Orient national cereals production to meet market needs.	Set an example of a model state enterprise.	*Supply cereals to deficit zones of the country on the basis of an annual plan.*	*Supply cereals to deficit zones of the country on the basis of an annual plan.*
Recommend cereals market regulations.	Accumulate capital for future national industrial development.	*Constitute and manage reserve and security cereals stocks at national levels.*	*Manage and distribute cereals food aid.*
Constitute a special security stock when necessary.	Address worker concerns and improve working conditions.	Assure adherence to official producer and consumer prices through market stabilization.	
Organize cereal imports and exports.	*Satisfy the cereals needs of the entire population.*	*Manage and distribute cereals food aid.*	
	Train and promote managerial staff.		
	Purchase, transform, and sell cereals through nationwide commercial outlets.		

Sources: 1) **OCS** (1959-64): Law No. 59-29/AL-RS: Articles 7, 12 and 14; December 4, 1959. Note: Objectives of the **OCFLM** (1964-65) are essentially identical to those of the OSC. See Law No. 64-25/AN-RM; Article 23; July 15, 1964.
2) **OPAM** (1965-82): Law No. 65-7/AN-RM; Articles 5 and 6; March 13, 1965.
3) **OPAM** (1982-88): Law No. 82-36/AN-RM; Article 2; February 8, 1982.
4) **OPAM** (1988-): Law No. 88-67/AN-RM; Article 2; December 26, 1988.

Notes: OCS (*Office des céréales du Soudan*) and OCFLM (*Office des céréales, fruits et légumes du Mali*) refer to OPAM's predecessor agencies. Italicized text refers to OPAM objectives which particularly influence cereals markets in the Northeast.

purposes, such as the out-rotation of old stocks, can be made only on the basis of guarantees of replacement of an equal quantity and quality of stocks (USAID, 1984). Only coarse grains are stored in the SNS, with preference given to domestically procured millet and sorghum; no rice is permitted.

2.3.2.2. Public Agency for Drought Assistance

The National Aid Commission for Drought Victims, known as CNAVS (*Comité national d'aide aux victimes de la sécheresse*) was created in 1973 under the Ministry of Territorial Administration and Local Development as the central government agency for identifying drought-related needs and mobilizing emergency relief operations. Originally an interministerial consultative group, a permanent joint working group between CNAVS and food aid donors was added in 1984 to improve logistical coordination.

In order to reorient the exclusive focus from short-term emergency relief to medium term rehabilitation, the CNAVS was reorganized in 1988 as the National Emergency Action and Rehabilitation Commission for Zones at Risk, or CNAUR (*Comité national d'actions d'urgence et de réhabilitation des zones à risque*). Most importantly, a permanent secretariat was authorized for the CNAUR with a budget and small professional staff charged with anticipating potential crises and coordinating emergency aid, identifying and implementing development-oriented relief operations such as labor-intensive public works projects, and setting up a centralized information and data collection network including regular exchanges with international scientific and climatological centers.

2.3.2.3. Early Warning System

An effective measure for safeguarding the food security position of households in the deficit zones is the acquisition of reliable data on cereals production, marketing and prices to allow authorities to pinpoint food emergencies in time to take preventive measures. Thus, a direct outgrowth of the CNAVS/CNAUR was the establishment in 1987 of an early warning system for food emergencies, known as SAP (*Système d'alerte précoce*), for the continual and direct monitoring of zones traditionally "at risk," those north of the 14th parallel, including all of the Northeast.[43]

The SAP identifies populations at nutritional risk and the type of aid and/or rehabilitative measures to alleviate that risk by collecting diverse data on rainfall, attacks of depredatory insects, the local harvest, pasture conditions for livestock, non-seasonal migration of population groups, market prices and terms of trade between cereals and livestock, recourse to consumption of emergency foods (Chapter 3), household food reserves and indicators of health and nutrition status. These data are radioed monthly to headquarters in Bamako for analysis. Sub-districts are classified according to food situation: nothing unusual, under extra surveillance, and at risk. In conjunction with the food donor/CNAUR working group (see 2.3.2.2. above), the SAP recommends the quantity and timing of food aid for distribution in "at risk" sub-districts. If a localized acute deterioration in food security is suspected, medical-nutritional teams are dispatched immediately to survey vulnerable groups and recommend accelerated aid, if necessary.

2.3.2.4. Marketing Action Plan

One of the earliest duties of OPAM (and its predecessors) has been supplying the Northeast with cereals from the south. Since the 1972/73 drought, OPAM has also become the central agency for handling and distribution of food aid. In order to rationalize these interdependent operations, as well as protect OPAM from domestic political pressures leading to haphazard cereals shipments and poorly substantiated requests for food aid deliveries, a

[43]These include 155 of Mali's 286 sub-districts.

marketing action plan (*plan de ravitaillement*) for OPAM was put into place in 1982 as part of the market liberalization program.[44]

On the basis of crop forecasts, projected purchases and releases from the strategic grain reserve, and increasing reliance on the market information system (below) and early warning system data, OPAM draws up a marketing plan in December for the calendar year to follow. Occasional disagreements used to emerge over the selection of sub-districts for food aid distribution between OPAM and the Ministry of Territorial Administration and Local Development which oversees the CNAUR and the SAP and which used to have sole approval authority for the marketing plan. This approval authority was transferred to a broader-based interministerial coordinating group (*Comité d'orientation et de coordination*, or COC) in 1988, presumably to put the marketing plan on a more technical basis. OPAM is charged with updating the action plan each quarter for COC approval, based on the latest market information system and early warning system data.

2.3.2.5. Market Information System

Lastly, a new Market Information System (*Système d'information sur les marchés céréaliers*, or SIM) got off ground within OPAM in mid-1988, then covering some 40 rural producer markets and the consumer markets in Bamako and all regional capitals. The SIM publishes a quarterly market bulletin, sends a summary analysis of market price trends to key government offices each week, and broadcasts a weekly market price report on the radio. Although market coverage to date is concentrated in the producing zones and not the

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[44]In theory, this marketing plan permitted orderly management of OPAM's buying and selling by determining the geographic location and seasonal credit needs for OPAM's crop purchases (including advances to the agricultural development projects, ODRs, which bought on OPAM's behalf) and by systematic planning of least-cost cereals transfers to minimize interregional transport. In fact, the action plan was only as good as the underlying production and demand data which, as demonstrated in 1985/86, turned out to be less than reliable (see Annex 2.1.).

Northeast, the SIM has become, in many senses, the southern complement to the northern-focused early warning system. Indeed, a closer coordination between the SIM and the SAP is thought to be desirable in some government and donor circles.[45]

2.3.3. Political Economic Motivations for Government Intervention in the Cereals Market in the Northeast

In view of the measured progress achieved in liberalizing the market (Section 2.3.2.), a host of emergency preparedness programs (Section 2.3.1.) and the potential for an equitable redistribution of cereals through commercial channels (Section 2.1.4.), what else compels the government to maintain a watchful eye on food security and marketing policy for the Northeast?

The answer lies in considerations of political economy — the political constraints with which the Government of Mali must deal — and often the hardest part to incorporate into any analysis of marketing policies (Stiglitz, 1987). Several political-economic factors, whose relative importance has varied over time, motivate the Government to take a special interest in the deficit zones of the Northeast.

2.3.3.1. The National Unity Argument

The first factor embodies the quest for national unity. Loyalty of the Northeast, particularly that of the Tuaregs who consider themselves culturally and racially distinct, has remained somewhat tenuous since independence.[46] Accommodating divergent regional and

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[45] The SAP used to cover 13 markets for the SIM. The SIM took these over in September 1991. See section 8.4.2.1. in Chapter 8.

[46] The Iforas Tuaregs launched an armed revolt in 1962, supposedly supplied by neighboring Algeria and Morocco, a revolt suppressed by the Malian Army the following year (Imperato). In turn, it has been charged that the Malian government used the drought of 1972/73 to settle old political scores and bring the nomads into submission by delaying aid (Somerville). Tensions heightened again in the early 1980s as Libya sought to draw Saharan

social interests virtually compelled special considerations for the deficit zones. This social contract between the south and Northeast was reinforced by the uniform cereals pricing policy in effect during the first two decades of independence as part of the political compromise.

By conveniently encompassing all of the Northeast, a distinct marketing policy ostensibly removed food insecurity as a possible grievance. Prepositioning a good part of the strategic grain reserve (SNS) in the Gao and Tombouctou regions, for example, demonstrated evidence of national government concern for the welfare of the Northeast.

A symbiotic relationship has emerged in which both parties coopt the other. Regional and local government authorities, on the one hand, and traditional leaders and local elites, on the other, have proven adept at turning the deficit zones policy to mutual advantage. The latter seek special favors (such as distribution of food aid in their respective districts) on whose behalf the former intercede in order to garner local political support.

2.3.3.2. Regime Survival

A related factor concerns regime survival. An effective food emergency preparedness system, including surveillance of market conditions and other early warning indicators, is perceived as government concern and competence, both critical elements in ensuring regime support in times of crisis. Perceptions of government disregard for the plight of drought victims, blatant misuse of food aid and other corrupt practices, or plain ineptitude have the

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nomads into the Pan-Arab sphere by supporting rebellion in Chad and stirring up underlying separatist sentiments among Tuaregs in Niger and Mali. In 1990 disaffected Tuareg "renegades" struck fear by attacking random local public administrators in the Tombouctou and Gao regions until the central government offered certain concessions. The government prohibited movement of civilians in the northern two-thirds of the region of Gao, disrupting seasonal migratory patterns and forcing pastoralists into a relatively small area in the southwest (USAID/FEWS, 1991).

opposite effect of undercutting regime legitimacy.[47] Allegations of theft of food aid by government officials were one of the causes of the 1990/91 Tuareg rebellion.

These lessons are not lost on the new Malian leaders who overthrew the discredited Traoré government in March 1991.

2.3.3.3. Regionalization and Internationalization of Development

The magnitude of the Sahelian food crisis during the early 1970s spawned new international institutional arrangements to prevent similar disasters by confronting emergencies early in coordinated fashion. Mali thus found its deficit zone policy exposed to outside scrutiny.

2.3.3.3.1. New Pressures for Regional Collaboration. Mali and the other drought-affected Sahelian countries banded together in 1973 to form the CILSS (Permanent Interstate Committee for Drought Control in the Sahel) in effort to formulate a joint strategy for the phased economic development of the region and coordinate its implementation. The CILSS established regular ministerial-level consultations and set up a permanent headquarters and two regional institutions, the Sahel Institute (to function as a clearinghouse for research and training activities pertinent to Sahelian countries) and AGRHYMET (to strengthen the development of national agrometeorological and hydrological services of member countries).

2.3.3.3.2. Mobilization of International Resources. Donors set up a flexibly structured Club of the Sahel to support the work of the CILSS by encouraging cooperation among donors and providing an international forum for Sahelian countries to articulate their development priorities and seek funding for implementation. Characterized as "an

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[47]Two *coups d'état* in 1974 were attributable to the African drought and its consequences. The Hamani Diori regime in Niger was overthrown in part because officials hoarded scarce grain to benefit from price increases; the Haile Selassie regime in Ethiopia was overthrown in part for having deliberately concealed the gravity of famine rather than seeking aid which might have saved lives.

extraordinary alliance between the developed Western world, several of the OPEC states and the countries of Sahelian Africa" (Franke and Chasin), the CILSS/Club arrangement was unusual in North-South relations up to that time in that it was based on aid rather than trade, rural rather than urban development, and agricultural rather than industrial development (Somerville). No less important, this new institutional arrangement enabled Mali to diversify its aid relationships (E. Berg, 1975).

The massive commitment of bilateral and multilateral donor financing and support to Sahel development[48] led to a remarkable mobilization of scientific research into problems and possibilities for the region.[49] Based largely on this research, joint Sahelian-donor working groups launched a comprehensive multi-sectoral development program, including analysis of the critical linkages between cereals pricing, marketing and storage (CRED, 1977).[50]

2.3.3.4. Private Voluntary Organizations and Locally Based Development

The expansion of private voluntary organizations (PVOs) in the Northeast dates from distribution of emergency food aid during drought periods. Inspired by the remarkable courage of the local population during the bleak years of drought, many PVOs have stayed

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[48]This financing raised aid levels to Mali and the Sahel considerably, especially in the area of rural development, a typically neglected sector. Official development assistance to the Sahel rose fivefold between 1971 and 1976, from $196.5 million to $1,105 million. Aid reached $1,513 million in 1982 (Somerville, p. 179). From a level of $21 million in 1970, aid to Mali reached $144 million in 1975, $267 million in 1980, $380 million in 1985 and $427 million in 1988 (World Bank, 1981b, 1989b, 1990).

[49]Franke and Chasin detail these studies (pp. 141-143).

[50]The initial blueprint for a Sahelian development strategy was approved by the CILSS and the Club of the Sahel in 1977. See OECD, *Strategy and Programme for Drought Control and Development in the Sahel.* (OECD: Paris), 1977. The cost of proposed investments for the "First Generation Program" in the Sahel, 1977-82, totalled $3.3 billion (Somerville, p. 176).

on, transforming themselves into small-scale, locally-based development agencies. More than a dozen international and domestic PVOs operate in the regions of Tombouctou and Gao in a wide spectrum of activities.[51]

PVOs enjoy certain comparative advantages over larger donors. They are often more flexible in policy, they operate at grass-roots levels and have demonstrated their scope for innovative development in a difficult region where pragmatic solutions are tested in the field. PVOs seem to enjoy the trust of the local population with whom they work and for whom they become advocates in many instances. Most PVOs seem also to have earned the respect of local administrators who recognize the effectiveness of PVOs in bringing services to distant and dispersed populations. Such is the perceived autonomy and fairness of PVOs that the CNAUR seeks out PVOs to distribute food aid in place of the local administration (where PVOs are present). In view of the valuable services they perform, some PVOs, especially the Malian ones, seem to have become a permanent feature in the deficit zones whose valuable services the Government cannot ignore nor afford to alienate.

2.3.3.5. The Interplay of Demography and the Scope for Long Term Development

The probability that drought will strike again with damaging effect on agriculture and herding is an ever present danger in the Northeast. This danger enters the realm of political economy because the choice of longer-term reconstruction and development strategies entails assigning social welfare weights among various groups and between current and future generations. While it is commonly admitted that unregulated expansion of agriculture and herding is neither economically nor ecologically sustainable, the question of which development path to take is charged with politically sensitive overtones. Answers to this

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[51]Personal communication from Mamadou Sékou Touré, *Comité de Coordination des Actions-ONG*, July 8, 1988.

question also have both direct and indirect implications for the role and strength of the cereals market.

Demographic evidence points to accelerating population growth in Mali as a result of slowly increasing life expectancy and declining infant mortality.[52] Urbanization in Mali, currently 19 percent (World Bank, 1990), will likely continue to exceed average growth rates. At this point, it is unclear whether the population decline of 2.9 percent in the Northeast between the census years of 1976 and 1987 will reverse itself or continue as a longer-term trend. The proportion of nomads in the population, even maintaining their absolute numbers, will decrease to about 6 percent by the year 2000 (Caldwell, 1977). Livestock numbers suggest that the national herd recovered from the drought of 1968-73 by 1978 (FAO, 1984), but had not quite recovered from the drought of 1983-85 by 1990 (FAO *Production Yearbook*, 1991).

In the drier Sahelo-Saharan zone (100-200 mm rainfall), animal and human carrying capacities seem to have reached their limit. Access to pastures there may have to be limited to present or even lower numbers. While similar limitations are probably less critical in the Sahelian rainfall zone (200-400 mm), the social implications are profound: None of the projected population growth for the Northeast can be absorbed by pastoral areas; the majority must become sedentary farmers (Caldwell, 1977).

This transfers the burden of economic growth to agriculture and rural non-farm activities. Here prospects are mixed. Changes in cultivation methods and intensity and in agricultural technology may permit greater densities of sedentary settlement. However, with

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[52]The average annual rate of population growth for Mali over the period 1988-2000 is projected to be 3.0 percent. It is hypothesized that Mali will achieve a stationary population of 63 million people in the year 2050, compared to a 1987 population of 7.6 million (World Bank, 1990, Tables 26 and 27).

2.4.

limited rainfall, it is unlikely that the Northeast can take major advantage of advances in maize technology, such as higher-yielding hybrids. The situation with respect to higher-yielding rice varieties is more hopeful but over the medium term, irrigated rice production will be hampered by incomplete water control and unlevelled perimeters. Unfortunately, no technological breakthrough has occurred in breeding improved millet and sorghum varieties for West Africa (USDA, 1981; World Bank, 1986).

Even this limited scope for expansion of sedentary agriculture rather than nomadic pastoralism, therefore, tilts investments in favor of farmers over herders.[53] Continued government intervention and oversight in the cereals market, among other means to safeguard and promote food security, will become all the more essential during this sectoral adjustment.

The overall effect of these political economic constraints has been to broaden the channels of development discourse. Regional and international collaboration and debate expose the government and donors to more rigorous analysis and public scrutiny of the consequences of their policies and actions, including those which bear on the cereals markets of the Northeast. Such exposure has created an atmosphere of greater accountability.

2.4. Summary Remarks

The central question posed by this dissertation concerns the adequacy of the cereals market in assuring food security in the Northeast, a cereals-deficit region characterized by permanent vulnerability to random drought, a high covariance between rainfall levels and

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[53]An indication of the relative dominance of the agriculture is seen in the "First Generation Program" of investments for Mali proposed by the CILSS/Club du Sahel for the period, 1977-82. The estimated costs of investments in rainfed and irrigated agriculture accounted for 61 percent whereas the costs of investments in livestock and in village and rangeland water engineering accounted for only 11 percent (Somerville, p. 176).

household incomes through agricultural and livestock production, and a long cereals supply line from the south which is often disrupted.

Chapter 2 has described the backdrop to the volatile cereals supply and demand in the Northeast, current marketing regulations, implications for the market arising from the calamities of recent droughts, and the government's rationale for maintaining a special food security and cereals marketing policy for the Northeast.

Part II of the dissertation will proceed from this backdrop to examine household food security in the Northeast in relation to the cereals market.

Part II. Analysis of Rural Household Food Insecurity in Northeastern Mali

Part II examines household food security in the Northeast, specifically within the Gao Region, in the context of household reliance on grain markets as a source of supply and as an income-generating outlet for grain sales.

Chapter Three sets the conceptual framework. The first section of Chapter Four introduces the rural household sample and discusses several methodological considerations. The following sections of Chapter Four will analyze rural household incomes and expenditure patterns. Chapter Five analyzes cereals consumption, models determinants of household food security and concludes Part II by summarizing the implications of rural household economic behavior for grain market performance.[1]

Annex 3.1 describes the rainfall and crop production context of the survey year. Annex 4.1 compares household income and expenditure patterns. Annex 4.2 provides key reference tables on household income, Annex 4.3 tables on household expenditures and Annex 5.2 tables on household cereal consumption. Annex 5.1 determines a consumption security threshold based on cereals per adult-equivalent. Rather than confining a review of relevant research to a separate section, references to other research results will be made throughout the chapter.

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[1]This chapter focuses on the household as the unit of analysis. On the premise that urban households are better served by markets than rural households, research design and data collection for this dissertation concentrated exclusively on questions of rural household food security.

Lastly, the emphasis on detailed analysis of household welfare in the Northeast is motivated, in part, by the conclusions and recommendations of the evaluation of the 1984/85 emergency assistance program for Mali, calling for comprehensive studies to "increase knowledge of local conditions affecting populations in drought-prone areas..." and to "illuminate food security...problems and potentials" (AID, 1987). Part II of this dissertation attempts to fill those knowledge gaps.

Chapter Three. A Conceptual Framework of Food Security

The conceptual framework for this chapter will define food security, describe and critique the exchange entitlements approach to analyzing food security at the household level and look at household strategies for coping with famines and less severe food insecurity.

3.1. Food Security Defined

The notion of "food security" has evolved considerably from alarms about price shocks to the world grain market in the early 1970s and the specter of rapid population growth outstripping tight supplies of grain. Supply-side concerns dominated the 1974 World Food Conference in Rome and thereafter, as manifested by projects and policies to raise aggregate production levels in deficit countries, a set of new international institutional arrangements and proposals for a coordinated system of national and international buffer stocks and commodity agreements (FAO, 1980; Eicher and Staatz, 1985). Fears of another round of price increases prompted countries such as Mali to pursue national self-sufficiency in cereals in attempt to withdraw from world market conditions.[1]

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[1]Mali's Food Security Strategy Statement, adopted in 1982, set national self-sufficiency as an objective to attain by the 1990s. The Strategy Statement recommended that planning and investment decisions for each agro-ecological zone be guided by achieving the highest degree of self-sufficiency possible (*Minstère de l'Agriculture*, 1982, pp. 4, 18, 44).

More recently, the concept of food security has shifted to a more reasoned assessment of factors determining effective demand for cereals, particularly at the household level — from the gloomy reckoning of aggregate numbers in danger of starvation to conceptual, methodological and statistical issues of analyzing how hunger affects vulnerable groups linked by poverty. The international focus on food and hunger has slowly shifted in a geographic sense from Asia to Africa (whose undernourished outnumber those Asia in percentage terms). Analysis of food security also reflects a keener appreciation of the role which specific food strategies and policies can play in remedying problems of malnutrition (WFC, 1984)[2]. Above all, meeting household effective demand requires that food distribution systems work reliably.

Many of the early concerns about world hunger turned out to be ill-founded (World Food Council, 1984). Today, the world has ample food stocks, many formerly destabilizing features of international trade have been corrected (Donaldson, 1984) and real cereals prices have been falling (World Bank, 1986a). Yet, many people suffer from a lack of food security, caused mainly by a lack of purchasing power (World Bank, 1986a).

Food security is now accepted as the "access by all people at all times to enough food for an active, healthy life" (Reutlinger, 1984). This deceptively simple definition embodies the complex requirements that special nutritional needs of all household members (on the basis of age, gender, health status and pregnancy) be met across all seasons for all occupations and lifestyles. While there is a clear supply dimension, the key to food security lies with "access"

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[2]Supply and demand management through policies affecting production, trade, food aid, grain reserves, price and through special programs to protect the poor and nutritionally vulnerable fall within the variables that national governments can manipulate. These options for national food security policies will be discussed in Chapter 6.

— the ability to acquire food through adequate real incomes. To the extent that supplies matter, it is in driving down the cost of obtaining food in real terms.[3]

Conversely, food insecurity is the lack of access to sufficient food, "basically a lack of purchasing power of people and nations" (World Bank, 1986a). Food insecurity has both chronic and transitory dimensions.

3.1.1. Chronic Food Insecurity

Chronic food insecurity is a "continuously inadequate diet caused by the inability to acquire food" (World Bank, 1986a).[4] Chronic insecurity bears considerable social and economic costs in terms of lower human capital development (higher susceptibility to disease and parasites, reduced benefits from education and training due to weakened mental development, and lower productivity) which depresses output. Combatting chronic food insecurity is deeply rooted in problems of alleviating poverty. In principle, an integrated economic growth-with-equity strategy will extricate families from the cycle of poverty and chronic food insecurity, although this remains a long-term solution. Interim measures, such

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[3]The link between self-sufficiency and consumption appears to be statistically weak. Econometric analysis by the World Bank of growth rates in the energy content of per capita diets (for developing countries, including Mali, in which more than 40 percent of all food energy is derived from cereals) for the period 1970-80 provides strong evidence that changes in per capita income are "the most single important determinant" of caloric improvement in the diet (Reutlinger, 1984b, p. 9). Income variables were found to have very high levels of statistical significance in average calorie consumption, whereas the growth rate in the self-sufficiency ratio of cereals was weakly significant (about the 90 percent confidence level). (These results are repeated as Table C-3 in World Bank, 1986a).

In a related analysis of per capita energy consumption (again for developing countries, including Mali, in which more than 40 percent of all food energy is derived from cereals) for the period 1976-80, per capita income was strongly significant while the self-sufficiency ratio in cereals supply was not (Table C-4, World Bank, 1986a).

[4]Inability to acquire food, of course, is not the only cause of malnutrition. Spoiled or unhealthy food, infectious diseases, unsanitary drinking water resulting in diarrhea and dehydration prevent the body from using food to maintain weight and strength.

as income transfers, targeted assistance, or food subsidies are required to combat chronic food insecurity.[5]

3.1.2. Transitory Food Insecurity

Transitory food insecurity may be less intractable. Transitory food insecurity is a "temporary decline in a household's access to enough food" (World Bank, 1986a). Transitory insecurity may be caused by temporary and unexpected fluctuations in domestic harvests, domestic (and world) food prices and household purchasing power. It may be caused by poorly functioning capital markets that limit interseasonal borrowing. For some rural households, transitory insecurity is a seasonal and predictable phenonomen of the agricultural cycle resulting from low real incomes, low food supplies and high energy requirements — during the pre-harvest "hungry season," for example.[6]

3.2. Food Exchange Entitlements

3.2.1. The Concept

Chronic and transitory food insecurity *describe* two different states of vulnerability to malnutrition. A powerful paradigm for *analyzing the causes* of food insecurity was advanced by the pioneering work of Sen (1981). Although Sen directed his inquiry into the causes of

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[5]See World Bank (1986a) for a discussion of measures that can be taken at the national and international level to combat chronic food insecurity and Pinstrup-Andersen (1988) for case studies of the experience with food subsidies.

[6]Transitory food insecurity may lead to the nutritional concept of *wasting* in children, as measured by weight-for-height, as a result of short-term protein-energy malnutrition (PEM). Chronic food insecurity, on the other hand, is closely associated with *stunting* where, due to chronic PEM, children do not meet standards of height-for-weight.

famines, the worst form of transitory insecurity, application of his paradigm to chronic insecurity also bears critical insights.

Looking at four famines in recent history,[7] Sen concludes that with increases in world food production surpassing an already accelerated population growth rate, famine is no longer an act of nature, but an act of faulty policies. Starvation, according to Sen, is the characteristic of some people not having enough to eat, not there being not enough to eat. Famine and food insecurity thus distill to the "acquirement problem." Some people starve because they are too poor to acquire enough food while others acquire more than they need. In Sen's terminology, people starve due to *failures in exchange entitlements* (FEE) when ownership conditions do not permit sufficient exchange rights to obtain enough food, rather than on an aggregate *food availability decline* (FAD).[8]

How a household acquires food depends on its "exchange entitlements" — the ability to lay claim to a healthful diet either by producing enough food or by producing other goods

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[7]These include the famine in the Sahel in the early 1970s (see Chapter 2).

[8]Although Sen (1985) argues that long-run policies must be geared to "enhancing, securing and guaranteeing entitlements, rather to some simple formula like expanding food output," he does not ignore agriculture entirely. Sen cautions that it is essential to distinguish between food production as a vital source of supply and food production as a source of income and entitlement. Expansion of food production in Sub-Saharan Africa should receive "full priority," Sen argues, primarily because food production generates entitlements.

Viewed from the opposite perspective, declines in food output often go hand in hand with a collapse of entitlements. Two factors explain this phenonomen. First, the agricultural sector typically represents the main source of livelihood for large sections of the population. Without the compensating effect of growth in other economic sectors (whose output is more or less immune from climatic variations), the impact of declines in agriculture are quickly transmitted throughout the economy.

Second, low growth and instability in agriculture reinforce the link between production and consumption. The World Bank (1980) found that average per capita cereals consumption in Africa was "as unstable as production" during the period 1961-76 (p. 5). Correlation coefficients between total consumption and production for six selected African countries were consistently and exceptionally high for this period (Table 2). Thus, Reutlinger (1985) and Eicher and Staatz (1985), among others, make a compelling argument for improving the productivity of the staple food system (production, marketing, processing and transport).

and services to exchange for enough food. The adequacy of a household's entitlement is determined by its endowments — the distribution of material and physical assets,[9] the productivity of these assets and the prices of goods (particularly food) and services. "Entitlement exchange mapping" defines what can be obtained from the exchange of each ownership bundle (including the exchange of own labor) for another.[10]

Famines can occur during economic booms or economic slumps. Economic stimulus during a boom period may suddenly expand purchasing power, also known as a demand shock, causing food prices to rise beyond the reach of lower income households (unless compensated by increased demand for labor which bids up wages). It is equally possible for a famine to occur during a boom period due to supply shock, for instance, due to hoarding from speculation and panic. Conversely, a slump famine, all things equal, may result from decreased aggregate demand for non-food goods and services causing a loss of employment or collapse of purchasing power instead of a significant price rise in food staples signalling scarcity. Alternatively, disease could wipe out considerable numbers of livestock, leaving herders fewer entitlements with which to procure cereals despite the lower prices due to reduced aggregate demand.

Famines can also occur during abundant harvests as well as crop failures, with or without a food price rise. Much depends on which households are net buyers of food, partly a function of the structure of land ownership and tenurial relations. In times of abundance,

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[9]Endowments relate not only to ownership patterns but *access* to the means of production (Desai).

[10]Sen (1985) notes that "entitlements" is a descriptive term based on legally sanctioned property and contract rights, rather than a prescriptive term connoting a moral endorsement of a given household's endowment.

there is a mutual dependence between the food and non-food production sectors as each sells to and buys from the other.

But in times of shortage, the food production system becomes pivotal and asymmetric with respect to the non-food system. Intra-rural terms of trade between food and non-food sectors shift in favor of food producers. As food prices rise, the share of food expenditures by the non-food sector also rises. Moreover, households which are providers of non-food consumer goods and services will experience declines in employment or a drop in sales — hence a deterioration in exchange entitlements — because transitory food insecurity depresses the economy. With a collapse in local effective demand for cereals, it has been observed that traders will evacuate supplies in search of other markets (D'Souza, 1988).

The apparent "primacy of food production entitlements" may be a misleading notion under either boom or slump conditions because it aggregates all producing households without reference to the distribution and productivity of their entitlements and the critical difference such a distribution makes in terms of food security. It is therefore essential to examine the *mode* of income to appreciate the uneven incidence of famine on different households (Desai).

To illustrate, a landless sharecropper paid in kind in boom conditions may be better off than a landless agricultural labor earning wages if those wages represent insufficient entitlements in food markets. A famine may ensue for landless wage-earning agricultural workers. On the other hand, the position of herding households may improve to the extent that boom conditions increase demand for meat and animal products which more than offset increased grain prices. However, terms of trade for the herder, say goats for millet, will likely differ depending with whom he trades (depending on the respective exchange mapping) — the sharecropper, the farm wage earner or a market grain trader — because each places a different value on the contribution of millet and/or goats to his own food security.

The point is that any household whose endowment to produce food or to produce exchange entitlements is very low can easily slip into chronic or transitory food insecurity and ultimately become a victim of famine when factor markets (especially capital markets) are imperfect. Ultimately, there is no substitute for an in-depth economic analysis of the exchange entitlements of all vulnerable groups (Sen, 1985).[11]

To conclude, food consumption is closely associated with the level of real household income in terms of food prices. While the rich rarely starve, income and price elasticities for staple food commodities tend to be high in absolute terms among the poor (Rao; Alderman, 1986, in Pinstrup-Andersen, 1988; Pinstrup-Andersen, 1988). Thus, as to the causes of food insecurity, what the World Bank calls a lack of purchasing power, Sen terms a failure of exchange entitlements. Both reach the same analytical outcome.

To Sen, the entitlement approach is "quite inescapable" for analyzing starvation and poverty. Looking at the multiple causes of lapses in a household's food supply through FEE, rather than FAD, leads to a better understanding of household food insecurity. Most importantly, proper analysis of causes of household food insecurity improves the prospects for effective policy prescriptions.

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[11]Austin and Zeitlin (1980) identify types of groups or households whose poor entitlements make them vulnerable to food insecurity: 1) the urban poor (with no agricultural base, low wages and irregular employment); 2) rural landless (who are net buyers of food but are likely to be seasonally unemployed); 3) rural subsistence farmers (outside of the market economy but yet dependent on the market when their crops fail and unable to find alternative employment); 4) refugees (often having abandoned their physical entitlements, afforded little legal protection and whose plight may go largely unnoticed); and 5) nomads (whose viability closely depends on the well-being of their herds, weather conditions and cereals/animals terms of trade and who are usually the least accessible for nutrition interventions). To this group Reutlinger (1984b) adds 6) professional beggars and destitutes (whom the rest of the population is unable or unwilling to support during famines).

3.2.2. Critiques and Extensions

The concept of exchange entitlements has won widespread acceptance as an analytical approach clarifying the economic relationship between food supply and the household's ability to obtain food (Reutlinger, 1984a; Gittinger *et al.*, 1987; G. Harrison, among others). While the approach has not gone without criticism, the theory offers great potential for extension and development (Desai).

Some limitations of the entitlements approach were anticipated by Sen (1981), such as ambiguities in the specification of entitlements, neglect of nonlegal transfers (theft) to obtain food, and the influence of tastes and values in causing hunger despite sufficient entitlements. Another criticism may be due to misinterpretation of Sen's juxtaposition of FEE and FAD as mutually exclusive. Attributing a famine to FAD is a testable hypothesis, but attributing a famine to FEE cannot be tested since, by definition, famine is a FEE (Reutlinger, 1984a).

3.2.2.1. Need for a Dynamic Framework

A more fundamental criticism is that the entitlement approach lacks a dynamic framework of analysis and as such the approach is static and only partial equilibrium (Desai). Critiques by three reviewers illustrate this point.

Srinivasan (1983, in Desai) points out that shifts in household purchasing power would have to be sudden and drastic for the exchange entitlements analysis to hold. A less drastic shift in real purchasing power would otherwise allow households to adjust on their own and government authorities to take famine prevention measures. Srinivasan concludes that the entitlement approach is deficient for failing to take the dynamics of price-wage movements into account.

A second critique, anticipated by Sen, is the omission of biological considerations of the interplay of disease and malnutrition in famine mortality. Unlike Srinivasan, Rangasami

(1985, discussed in Desai) contends that famine and starvation are *not* the result of sudden collapses in purchasing power but the culmination of drawn-out biological and socio-economic processes leaving certain households more vulnerable than others. She proposes that famines be broken down into three stages, dearth, famishment and morbidity, within which there is a steady loss of the endowments of the victim household and a deterioration in its exchange entitlements with others. Rangasami's critique is that Sen's approach emphasizes only the final stage of famines without due consideration of the dynamic process of starvation.[12]

Lastly, Desai identifies three sets of dynamic considerations that the entitlements approach neglects. One is the multi-period relationship between the economy and ecology. Even if rainfall returns to normal, crisis one year affects the next year's output when seed reserves are exhausted or when long gestation periods slow restocking of the herd. Thus, it is critical for recovery whether the event triggering famine (or lesser transitory insecurity) occurs following a good harvest or a succession of harvest failures where household options for coping with food insecurity are severely weakened.

Desai's second set concerns the dynamic interactions between different socio-economic groups and households and the impact of famine on the inter-household distribution of endowments. Asset holdings or other reserves, saving propensities and opportunities for investment determine how well a household can withstand famine or longer chronic food insecurity. Adequate grain reserves and other assets determine which households benefit from famines. A famine causes a non-Pareto optimal redistribution of endowments as those

[12]In this vein, Watts also criticizes Sen's focus on the "immediate and proximate causes of famine" whose lead time may in fact take years.

households starting in a vulnerable position are made worse and those who were well-off to begin with have strengthened their position.[13]

Third, dynamic considerations must take into account the impact of famines and other transitory food insecurity on physiological adjustments at the individual level. The body can achieve an approximate energy balance between intake and expenditure at low levels of food consumption for prolonged periods, but at the cost of a drop in weight, reduction of physical activity, change in mental abilities and a fall in the basic metabolic rate (WHO, 1985). Vulnerability to communicable diseases is increased (Rivers). Without eventual recovery, lower activity levels have detrimental consequences for future output as inadequate nutrition reduces effort and productivity.

It is likely that Sen would agree with these critiques for the most part. He acknowledges that extending the exchange entitlements theory from transitory famines to less acute but chronic food insecurity requires a dynamic framework to capture the effect of household decisions in use of their entitlements (Sen, 1985).[14]

In reality, exchange entitlements and consumption are related to a broader income measure than just current income. A central question is whether poor households can manage savings and credit to smooth consumption over multiple periods despite fluctuations in current income. If a longer timeframe is used, therefore, adjustments in the exchange entitlements theory would have to consider the implications of how households manage their current as well as future income and assets.

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[13]Watts and Horowitz and Little relate how grain trading patterns and loss of exchange entitlements intensify the inequalities between socioeconomic groups in the Sahel.

[14]See Phillips and Taylor (1990) for a conceptual framework expressing household insecurity in terms of a multi-period optimal control problem.

As predicted by models of intertemporal utility under *certainty*, a household maximizes utility over time subject to income in each period, prices in each period and the interest rates that determine the tradeoff between current and future consumption (for instance, foregoing current consumption in order to increase future consumption).[15] One such theory, the permanent income hypothesis of consumption advanced by Friedman, holds that people plan their consumption behavior based on the permanent or long-term consumption opportunities remaining in their lifetime, given present wealth and current and expected income. To the extent that seasonal income patterns can be reasonably predicted, seasonal income can be considered part of permanent income. Cycles in food consumption would therefore mainly reflect price elasticities of demand, rather than income elasticities.

These standard intertemporal utility models, however, may not be particularly useful for analyzing household economic behavior under *uncertainty*. For example, Alderman and Sahn (1989) question the applicability of the permanent income theory to developing countries and its implicit relationship to exchange entitlements. In the context of the West African Sahel, random weather shocks easily disrupt the regularity of seasonal income patterns and thereby upset expectations about "permanent" income. Theory predicts that people whose current income is highly variable (such as deficit-zone farmers and herders) exhibit a lower marginal propensity to consume out of transitory income than out of permanent, long-term income (Dornbusch and Fischer).[16]

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[15]Without follow-up interviews, for example, it is not clear whether certain household expenditures are for immediate consumption or investment in some future income stream to escape food insecurity in a later period. What appears to be dissavings by rural households may really be investment.

[16]Evidence shows that the marginal propensity to consume is less than unity, even for destitute low-income households, which will save for productive investments to enhance their future entitlement exchange position (UNICEF, 1985; World Bank, 1986b).

Second, liquidity constraints prevent the poor from realizing planned levels of consumption. Assumptions that credit is readily accessible and that returns to investment are symmetrical with the costs of borrowing (where information is costless and/or collateral eliminates risk of default for the lender) do not hold where credit markets are imperfect. For poor households in particular, credit is either unavailable (due to rationing at nominal interest rates) or high costs of borrowing above nominal interest rates (due to lack of collateral) reduce potential returns to investment.

Third, by ignoring the strong influences of seasonality, the permanent income theory cannot be generalized to subsistence households with few assets, if any. These households are usually unable to absorb seasonal shocks by reducing current consumption significantly or planning future consumption without suffering extreme consequences such as malnutrition.[17]

Nonetheless, it is reasonable to assume that virtually all households in developing countries *attempt* to follow multi-period strategies to acquire food and extend food supplies, despite the many uncertainties these households face.[18] Where the underlying assumptions of

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[17]Other theories suffer from similar drawbacks for developing countries with imperfect credit markets generally and for subsistence level households with no savings cushion.

The life-cycle theory of consumption and saving, advanced by Modigliani and others, emphasizes motives for saving. It states that individuals (or households) plan their consumption and saving behavior in order to maintain constant consumption spending over their lifetimes by saving during periods of high income and dissaving during periods of low income. Assets are built up chiefly to finance consumption during retirement.

The relative-income hypothesis of Duesenberry argues that the consumption level associated with the highest previous income level strongly affects current consumption levels. People adjust their savings to allow consumption to be maintained close to the habitual level (Dornbusch and Fischer).

[18]Sherman demonstrates, using a two-period, two-commodity and one-asset model in which the objective of the additively separate utility function is to maximize household income over the two periods (subject to minimum subsistence constraints), that consumption and inventory decisions between periods will depend on the expected rates of return to the household's commodities and asset. With risk aversion (due to uncertainty about relative price movements), the household will dispose of some (but not all) of the commodity or asset whose value is expected to appreciate the least during the first period in order to benefit from

standard economic models are inappropriate or where their time horizons are too distant, new models (and data collection methods) will be required to predict intrahousehold economic behavior concerning exchange entitlements (Alderman and Sahn, 1989; Guyer; Messer; Staatz).

3.2.2.2. Intra-Household Distribution of Food

A second critique of the food exchange entitlements approach is that it stops short of addressing the distribution of food *within* the household.

The rural household combines the profit-maximizing functions of the firm with the utility-maximizing functions of the consumer, two fundamental units of microeconomic analysis. The household is usually depicted as a single economic unit where cereals production and consumption decisions are reached interdependently and where effective demand for cereals is constrained by total household resources (principally labor, capital and time) and the cost of cereals.

Nonetheless, Von Braun and Kennedy, among others, question whether assumptions about the household as one homogenous decision-making unit, maximizing a single utility function and pooling income, are appropriate in developing countries. The allocation of household income to procure food (including cereals) is influenced by the regularity of income (whether "lumpy" or continual), the type of income (whether received in cash or in kind), and the preferences of the income earner in relation to those of other household members — in other terms, who controls the pattern of food consumption preferences and allocation within the household (Kumar, 1981; Pinstrup-Andersen, 1981; Poleman; Von Braun and Kennedy). Sen (1985) acknowledges that to truly capture the acquirement problem, the entitlement

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the faster appreciating commodity or asset in second period.

approach would have to be extended to analysis of the determinants of food distribution patterns within the household.

Consequently, it is essential to distinguish between household food security and intra-household distribution of food and the nutritional status of household members. Household food security is a necessary but insufficient condition to assure good nutrition, an individual measure strongly influenced by diet composition and nutritional balance as well as sanitary conditions — how well the body utilizes ingested food (Pinstrup-Andersen, 1989).

The nutritional effect of changes in food entitlements may depend on who decides how household consumption patterns will be adjusted and his or her own consumption preferences.[19] A real increase in household entitlements, for example, may result in higher food expenditures (the income effect), expenditures on more expensive nutrients (the substitution effect) or expenditures on food with low nutritional value or on non-food items.

Conversely, a decrease in food entitlements may force hard choices: whether to allocate sufficient food to income-earners (usually adult males who work outside the home) to maintain their productivity at the cost of malnutrition among non-income earners (usually women, small children and the elderly); or whether to protect children against nutritional risk through larger food rations to the detriment of adult household members (Pinstrup-Andersen, 1981).

Lipton (1983) found that these concerns may be overstated. According to his extensive review of studies examining the variable access to food among poor families, intra-

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[19]Von Braun and Kennedy suggest that the issue of budget control may be more critical in Africa than Asia. In many cultures, men control cash income and women control food income and thus have separate expenditure responsibilities within the household. Guyer points out that women among the Beti in southern Cameroun, who are in charge of the diet, receive routine cash transfers from the men to smooth household food expenditures. In Northeast Mali, expenditures are shared between men and women among the Songhaï villages, while men in non-Songhaï households tend to control all expenditures.

household allocation of food rarely discriminated against adult women in favor of men but sometimes against infant girls.[20] Svedberg's review of 50 studies in Sub-Saharan Africa (cited in Alderman and Sahn, 1989) found that women were not at nutritional disadvantage within the household. According to Lipton, persistence of poor nutritional distribution in some households is due to misinformation (suggesting a greater role for nutrition education), rather than overt discrimination. Food allocation discrimination in favor of income earners may represent a last resort of desperately poor families where severe child malnutrition is not permitted until the family suffers an average calorie deficit of 40 percent (Chaduri, 1982; cited in Lipton, 1983).

In the absence of contrary evidence for Northeastern Mali, any poor allocation of food within the household *may* be the result of traditional food beliefs and taboos and poor nutrition education, rather than economic triage or discrimination.[21]

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[20]Even this appears to prevail only in parts of the Indian subcontinent which Lipton attributes to lower expected lifetime earnings due to salary discrimination against women in labor markets. Rogers (cited in Von Braun and Kennedy) found the opposite in Africa, that girls were not discriminated against because of the bride price they ultimately command.

[21]Sundberg (1988) discusses some of the child feeding practices and dietary restrictions prevailing among different ethnic groups in Mali.

Based on household nutrition surveys in Mali in 1977/78, including two survey sites in the Northeast, Mondot-Bernard concluded that, "Dietary restrictions, principally religious, are not sufficient to cause imbalances in the diet, but the belief that milk is the only food suitable for the young infant is a cause of infantile malnutrition" (IDRC, 1981).

3.3. Household Strategies for Coping with Food Insecurity

Seasonality dominates production, income and consumption patterns.[22] How successful a household will be in smoothing these seasonal fluctuations — and coping with seasonal hunger — depends on how well it maintains its exchange entitlements. Evidence shows that when entitlements to food are exposed to recurrent risk, households turn to established strategies to minimize that risk (Corbett). Over time, this "known repertoire of strategies to cope with food insecurity" becomes part of customary knowledge, a resource to mobilize when needed (Guyer).

Rainfall drives seasonality in the Northeast. Due to the strong probability of random disturbances in the rainfall pattern, seasonal rhythms there are less regular, less known and hence less predictable. A single failure in rainfall can trigger a downward spiral in exchange entitlements and a succession of failures can culminate in devastating famine (Chapter 2). It is little wonder that perennial uncertainties about rainfall pervade household coping strategies.[23]

Moreover, the *order* in which households respond to maintain their entitlements is just as critical as the overall strategy itself. Households respond serially, not randomly or haphazardly (Watts; Corbett; Lallemand). Precautionary responses to expected seasonal variability are distinct from responses of last resort under acute stress. Using Rahmato's

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[22]From an anthropological perspective, seasonality enters into all dimensions of the food system — patterns of food acquisition, cultural preferences, rules for social distribution and consumption — and their evolution (Messer).

[23]Uncertainty occurs where an event (such as rainfall) has more than one possible outcome. Risk describes the set of possible outcomes with the capacity to alter the welfare (exchange entitlements) of the household for better or worse (Robison). Uncertainty about the level, intensity, frequency and duration of rainfall, for example, implies that households face a set of risks which could alter their degree of food security.

terms, household coping strategies entail first a set of *anticipatory* strategies and then a set of *crisis* strategies (Rahmato, in Corbett).[24]

3.3.1. Anticipatory Coping Strategies

Anticipatory coping strategies concern seasonal adaptations in home production and marketing of cereals, gathering of wild cereals, income diversification, gift-giving and other redistributive mechanisms, food consumption behavior, and selective decapitalization. Increasingly, participation in the market — land, labor and credit markets as well as cereals markets — is an element of these strategies. While each coping strategy entails its own disadvantages (which will be mentioned briefly), their overall effectiveness determines whether the household is seasonally food secure. In a sense, households in the Northeast are on permanent alert. Experience has led them to internalize anticipatory strategies as a matter of course.

The following are general elements of anticipatory coping strategies.

3.3.1.1. Seasonal Adaptations of Production and Marketing

Given the certainty of rainfall variability as part of the seasonal order of events, agriculturalists and pastoralists are "expert practitioners" of their respective livelihoods (Watts). Much of the discussion of the agro-pastoral economy in Chapter 2, in fact, mirrors this skillful adaptation to seasonally variable conditions and evolving expectations about the

[24]A sampling of household coping strategies in the Northeast shows considerable complexity and attention to detail. See Steffen and Koné; Davies and Thiam (1987a, 1987b); IFAD; Lindland; Maïga and Rutten; Swift (1975, 1981); and quarterly bulletins of the *Suivi Alimentaire du Delta Seno* (SADS) project in the Niger Delta/Seno Plains area which are especially thorough. Household coping strategies elsewhere in Mali and the Sahel countries are discussed in Dioné, 1987b; Goetz; Harts-Broekhuis and de Jong (1990a and 1990b); Reardon, Matlon and Delgado; Ross; Sherman; and Staatz, D'Agostino and Sundberg.

harvest. Above all, both pastoral and agricultural production systems seek to preserve their responsive flexibility.

Several studies indicate that the food security status of farming households in Mali and elsewhere in the Sahel is closely correlated with the timing of its cereals sales and purchases to take advantage of the normal seasonal price variations (Dioné, 1987; Reardon and Matlon; Staatz, D'Agostino and Sundberg). This might apply just as well to the timing of cereals purchases by pastoral households. In either case, the capacity to take advantage of the most favorable terms of trade is largely related to a household's productive endowments (for farmers, security of land tenure and ownership/access to animal traction equipment, access to alternative sources of cash-flow; for herders, herd size and diversification).

Despite a keen awareness of price cycles, however, poorly endowed households have considerably less latitude in the optimal timing of their production and marketing strategies. Many, if not most, farming households in the Northeast are deficit producers of cereals. Without alternative entitlement exchange possibilities, the poorest producer households, in particular, may be compelled to sell heavily during the post-harvest period when market prices slump and buy during the hungry season when prices peak.[25] Demand for cereals puts pressure on poor households to borrow at high rates of interest against future crops or seek off-farm employment at the expense of neglecting their own fields.

Terms of trade for herders are most favorable immediately following the cereals harvest when cereals prices are at their yearly low and when animals, fattened by rainy season

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[25]The issue of forced sales of cereals is investigated in Chapter 5.

grazing, fetch their highest prices.[26] Conversely, terms of trade are least favorable during the hot season when animals in poor condition are sold at low prices.

Poor herding households are often unable to take advantage of these price cycles. The ability to trade requires an endowment of animals. Some pastoral households in the Northeast own no animals of their own but herd animals for others as wage laborers (Davies and Thiam, 1987a). Storage of cereals presents a second obvious constraint. Nomadic herders can "store" only as much as they can transport. Otherwise, they have to buy cereals as they need them, particularly before setting out on distant rainy season migration when prices are highest. Third, seasonal increases in the output of milk (and milk products) cannot be sold because nomadic households are isolated from markets. This potential source of income is instead consumed.

As a result of economic dislocation and the weakening of complementary exchange relationships between herders and farmers (Chapter 2), home provisioning in cereals has entered the coping strategies of many pastoralist households. These households are forced to cultivate on a part-time or full-time basis (where cultivation is technically feasible) because they have lost their livestock assets or because they *fear* losing their livestock under duress to the superior bargaining power of wealthy farmer-traders. Others cultivate to acquire recognition of land rights where tenure conditions for herders may be otherwise insecure (Horowitz and Little). Based on distrust of grain markets dating from previous droughts, some herder households cultivate in order to circumvent the grain market altogether — either

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[26]Terms of trade (number of goats per 100 kg sack of millet) are as much as four times more favorable in November/December than in June (Steffen and Koné).

as an unreliable supply source or an institution of "unequal exchange" (Horowitz and Little; Watts).[27]

3.3.1.2. Gathering Wild Food

Gathering wild foods, particularly wild cereals, is a seasonally critical response by households to low cereals supplies, high prices and distant markets. An important side benefit is that the dietary diversity from wild foods adds essential nutritional balance (Messer). Households in the deficit zones follow a well-ordered calendar of gathering and exchange of these wild foods whose consumption is not necessarily limited to times of stress.[28]

Chapter 2 has already noted the major role that wild fonio and cram-cram play. The irony is that these wild cereals may not be available when most needed during years of low rainfall. The covariance of supply between wild cereals and locally cultivated cereals is likely to be positive and large due to their mutual dependence on rainfall patterns. Fortunately, the greater drought tolerance of wild cereals means that limited supplies can be found even when local cereal crops fail. A good fonio harvest, however, may not raise food entitlements for the very poor without access to animals for return transport (Davies and Thiam, 1987b).

3.3.1.3. Aid and Transfers

Redistributive mechanisms — aid, transfers and loans from rich to poor households — constitute a means for communities to cope with seasonal hunger. Alms-giving (*sadara*) is

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[27]Working among the Fulani in the Senegalese Ferlo, Sutter (cited in Watts) found that pastoral households can be usefully stratified on the basis of herd size. Unlike poor herders, wealthy herders have enough animals to be able to pursue optimal off-take and price strategies. Sutter claims that large herds represent a rational adaptive response to uncertainties of the climate *and* the grain market.

[28]An example of how diverse household production systems (dryland and flood-plain cultivators, agro-pastoralists, agro-fishermen, transhumant fishermen and transhumant pastoralists) draw upon wild foods for consumption and trade is found in *"Stratégies Vivrières No. 4"*. *Rapport saisonnier du SADS*, July-September 1988, Table 1. Refer also to footnote 33 below.

sanctioned by the Koran and thus carries religious and moral approbation. Charity aid in cash or kind is an expected part of social and economic relations, particularly within family ties where generous giving confirms high status (Messer; Raynaut). Moreover, sharing serves as a form of social security against future hardships. For example, Swift (1975) documents four types of sharing of animals among the Kel Adrar Tuareg according to household need, duration of the loan, contingent claim for the recall of the animal by the donor, and implicit degree of reciprocity.

Seasonal feasting is also a means of social redistribution. Among the Kel Adrar, animals are slaughtered in an informal rain-making ceremony and the meat widely shared, serving as a food supplement at a time of nutritional stress; the ceremony may be repeated until the rains start (Swift, 1981).[29]

3.3.1.4. Income Diversification

Households attempt to diversify their incomes as a two-fold strategy to spread the risk of income failure from any one source and to offset seasonal fluctuations in the predominant source of income. As most deficit zone households purchase food from the market, steady income contributes to stable exchange entitlements. Sundberg and D'Agostino found that income sources tend to be more diversified in consumption secure households in the OHV zone of southern Mali. Reardon *et al.* (1988) found similar results for the Sahelian zone of Burkina Faso.

Farmer and herder households alike are compelled to diversify their income base, although perhaps with a different sense of urgency. Poverty and few prospects for reintegration into the pastoralist economy (lack of livestock endowments or capital to

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[29]Section 4.2.3. will contrast the "unimportance" of inter-household transfers in northern Nigeria, Senegal and Burkina Faso (Reardon, Delgado and Matlon, 1992) with Northeastern Mali.

reconstitute herds) have pushed many pastoralist households into economic diversification. Land-owning agriculturalists practice mixed farming and livestock to even out seasonal labor requirements and income. Landless agriculturalists with few assets, however, are forced to seek casual employment for which wages may be low and demand inelastic.

Within the household, activities to diversify income are often distinguished by gender. Women engage in small-scale food processing for retail sale (smoking fish, dehulling rice, preparing condiments and sauces) or seasonal crafts (manufacture of artisanal products such as cushions, sandals and straw mats).

Men are more likely to engage in off-season or off-farm wage labor. Longer term salaried labor (or where an implicit labor contract is involved) is considered more desirable than daily wage labor in terms of lower search costs for the employer and reduced risk of unemployment for the worker.

When such long term opportunities are unavailable locally, the ablest men in the household may migrate in search of alternative or temporary employment.[30] Remittances from a successful migrant can represent a sizeable source of investment income and, if money arrives on time, a means to pay daily agricultural workers during peak labor demand periods.

The outcome of attempts to diversify income may thus depend on the household's inward or outward orientation. The scope for inward-oriented income diversification is often limited, especially during the recessionary effects of drought, where the local market for good

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[30]The decision to migrate seasonally is a function of the magnitude of the wage differential and the likelihood of finding a job in the destination market, demographic characteristics of the remaining household members (so that the migrant does not constitute a drain on available household labor) and the household's access to land or tenancy rights (Alderman and Sahn, 1989). Singh found that the decision to migrate depends on low demand for labor in the home market and the supply of accurate information about job possibilities in the destination market, itself a function of previously successful migration ("early adopter") experiences by household members or other contacts.

and services varies as a function of cropping incomes or low rural demand. The *liquidity* aspect of diversification is also critical in the absence (or near-absence) of local credit markets (Reardon *et al.*, 1992), pushing some households to an outward orientation.

3.3.1.5. Adjustments in Food Consumption

The challenge facing households in the Northeast is to transform various lump sum payments and incomes in kind into a steady food supply. The dilemma is that seasonal food availabilities poorly coincide with seasonal food needs — what Guyer calls "discrepant seasonalities." This requires that households manage and adjust their resources to augment their diets so that seasonal energy consumption matches energy requirements, a process that few deficit households are able to undertake and if so, only at some cost.[31]

Instead, many households practice austerity when confronted with food shortages or inadequate exchange entitlements. Households adjust their seasonal consumption habits by rationing quantities — cutting back generally or reducing the number of daily meals. Households also adjust by reducing food quality — buying cheaper and less-preferred staples, gathering wild foods, adding bran or coarse fillers to produce a bulkier, more satiating product and eating cold meals to save fuel costs (Lallemand; Messer; SAP; Simaga). Among the physical consequences of these adjustments, people experience weight loss, exhibit signs of seasonal infertility and tend to conserve energy by resting more.

Lastly, some households are able to change consumption habits by adjusting household composition. Sending children away to live temporarily with relatives or seasonal

[31]Agricultural households, for instance, face two imperatives in terms of managing their grain reserves: to set aside enough seeds for the next planting and to ensure that all farm hands have extra rations to maintain their productivity during energy-intensive field preparations in June and July — right during the hungry season. Low reserves make such management seldom possible for grain-deficit households which, under normal seasonality, accord priority to saving their seeds.

migration of some members represent adjustments in consumption if the net effect is to increase food availabilities for remaining members.

Some social and cultural customs in the Northeast actually contribute to a countercyclical pattern of high energy consumption during periods of low need. Celebrations, feasts and marriages are often postponed until the post-harvest season when cereals are abundant (personal interview, 1989). While such practices could be criticized as poor planning for the hungry season to come, this feasting represents a recovery period for the hungry season just past.[32]

3.3.1.6. Decapitalization of Household Assets

A final anticipatory response involves decapitalization of household assets. In its most benign form, decapitalization may mean no more than drawing down cash savings set aside expressly for seasonal difficulties (as distinct from residual unspent income). If the household is subjected to increasing stress, decapitalization progresses from the sale of "non-essential" housewares (such as transistor radios or surplus bedding) and personal effects (such as jewelry and clothing) to the sale of goods which are vital for daily welfare and future income generation.

What the household disposes of depends on its timeframe, credit opportunities and mode of production. Pastoralists with animals are more likely to sell or barter cattle during a drought, due to their more rapid deterioration and loss of value, than camels or small ruminants, whereas agricultural households are more likely to sell sheep and goats in order to save their cattle for animal traction. Decapitalization also occurs when, in desperation, a household consumes its reserve of seeds for the next planting season.

[32]In all likelihood, rearranging social consumption practices will come about only when market performance improves and when a demographic shift to majority non-agriculturalist population delinks farming cycles from consumption.

Of all coping strategies, decapitalization may run the greatest risks. It not only deprives the household of its productive assets, thereby weakening prospects for future recovery (*expected* exchange entitlements), decapitalization of goods may become a self-defeating exercise if other households decapitalize simultaneously, provoking a sharp depreciation in exchange values. Decapitalization has then become a crisis coping strategy.

3.3.2. Crisis Coping Strategies

The time-honored anticipatory strategies above allow households considerable resilience in dealing with "normal" seasonality, but may fail in the face of more drastic vicissitudes of climatic variability. The onset of a food crisis simply expands and intensifies what is to many households with little slack a period of stress and anxiety (Watts).

In general, crisis is synonymous with the failure of useful rainfall. Failure over several successive years will set into motion recursively adverse effects on exchange entitlements where at some point, the household decides that actions to ensure current survival take precedence over future welfare. These actions are distinguished by a degree of desperation and irreversibility not seen in the anticipatory strategies. To maintain daily existence, the household may forage for non-cereal wild foods.[33] To earn income, the

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[33]Non-cereal wild foods consumed in exceptionally poor years are known as "famine foods" (*aliments d'exception*). Famine foods are usually neglected in normal years because of their disagreeable taste or lengthy preparation requirements. A partial listing of these foods shows great diversity.

The "most important" famine food is the nut of the fruit of the tree, *Boscia senegalensis*, which needs to be boiled in water for at least one day, sometimes more, to remove its bitter taste (Bernus, 1980); generally, there are no restrictions on its gathering (Davies and Thiam, 1987b). The wild berries of *Ziziphus mauritania* and *Zisyphus jujuba* are pounded, winnowed and used as a flour. From December to February, nomads living near the banks of the Niger or large seasonal ponds exploit the aquatic tuber "nénuphar" (*Nymphaea spp.*) for its leaves and flowers, consumed after drying and pounding. Access is loosely controlled in some areas by agriculturalist-herders. Pods of leguminous trees, such as tamarinds, and wild watermelons may also be eaten (Roche). Wild dates are also gathered in household may sell off key productive assets or required possessions, including animals.[34] Males may migrate in search of wage labor, rather than tend household fields or animals.[35] To obtain credit, the household may mortgage the future harvest or even farmland. As a last resort, the household may split up[36] or engage in mass migration to refugee centers in search of food and charity, including official food aid.

Poor households suffer most profoundly and reach later stages in this process first. Their lower initial endowments predispose them to greatest vulnerability, putting longer-term recovery in jeopardy. Prolonged stress often provokes a temporary breakdown of social

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the Northeast.

A related desperate measure occurs when households break into ant hills to recover grains and other wild foods stored there (personal interview, 1989).

[34]A social trap arises when unusually large numbers of households take the same actions, such as distress sales of livestock. By influencing the market simultaneously, these households become inadvertent price setters. A glut of animals on the market turns the terms of trade against the seller (cereals or other staples in terms of livestock) which engenders more sales of animals, further depressing the terms of trade.

Hesse and Thera explain how livestock market data can serve as an early warning indicator of stress in the pastoral economy.

[35]In "normal" times, permanent relocation (as distinct from temporary migration) is typically a function of the present value of expected earnings (the magnitude of the wage differential, the cost of the job search as well as the probability of its success). Todaro hypothesizes that migration will continue until there is equality between the actual rural wage and the expected urban wage. It is doubtful, however, that this equality would be achieved under crisis conditions with an influx of job-seeking refugees into urban centers.

Long-term absent members may contribute to the deterioration of household consumption in several ways. By reducing labor availability at critical moments in the crop cycle, the absence of household members may reduce output. Borrowing by remaining household members against expected remittances may exceed actual remittances, causing hardships later as the household decapitalizes further to pay off its outstanding debt. Unless secure means are found by the migrant to send remittances home, the remaining members will have to await his return before benefiting from his income. Lastly, prolonged absences erode relations between migrant and those left behind and may cause the family to break apart permanently.

[36]In the past, children were sold into slavery in exchange for food and some are still pawned for food (Alvorson, in Messer).

relations and reciprocal obligations among entire communities — and the demise of old coping strategies (Corbett; Swift, 1981). For some, this may mean profound changes in the mode of production, lifestyle and loss of identity with all its psychological manifestations.[37] In the absence of effective relief programs or social redistributive mechanisms, more or less "permanent" marginalization or pauperization may result (Horowitz and Little; Davies and Thiam, 1987a).

3.3.3. A Three-Stage Model of Household Coping Strategies

In her review of four case studies, Corbett observes that asset management plays a pivotal function in the coping strategies of African agro-pastoralist households in determining current and future income. Assets fall into two broad categories, those which are used as savings assets (assets expressly acquired as "self-insurance" for liquidation during crises) and productive assets (less liquid assets acquired for generating income). Corbett develops a model in which households respond to famine and food insecurity by the "selective and sequential disposal of assets" in three distinct stages.

In the first stage, households draw down their savings assets while preserving their key productive assets as long as possible. The household will undertake sequential precautionary actions (like those described in section 3.3.1. above) which do not compromise their holdings of productive assets or cut into their subsistence base. These initial responses represent the "smallest possible commitment of domestic resources" (Watts). Food rationing within the household is a "deliberate and early response" in Stage One (Corbett).

[37]The most vulnerable societies are probably those in transition, whose traditional mechanisms for coping are gone and new mechanisms have not been devised (Messer).

Malnutrition should be interpreted as a *cost*, not a failure, of the household's coping strategy to hold on to its productive assets — going hungry matters less than avoiding destitution.[38]

The second stage is reached when the household can no longer postpone disposal of its productive assets. Distress sales occur during this stage. Stage Two is reached reluctantly, not only because reduced bargaining power forces the household to take heavy losses on the sale of its semi-liquid assets, but more importantly because disposal of key productive assets will jeopardize its future economic welfare.[39] Inter-household loans and transfers tend to fall off as the crisis deepens. Sharing of food and traditional displays of hospitality cease as households retreat into nuclear units or pretend to have nothing to offer to outsiders (Messer).

The third stage is reached when the household is destitute and virtually assetless and with severely diminished prospects for earning income, including wages from labor because household members are too weakened by hunger and hunger-related illness to work. Stage Three culminates in distress migration in search of relief for survival.

Corbett's model complements and conforms closely with Sen's exchange entitlements theory as a means for analyzing the economic behavior of households before and during famines. The model is reproduced in Figure 3.1. with minor modifications for the Northeast (Corbett, p. 1107).

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[38]It may instructive to reinterpret post-harvest grain sales by consumption-insecure households in this light. These households may in fact sell grain in order to avoid selling productive assets, anticipating income from other sources later in the year with which they can buy cereals.

[39]Corbett says that famine conditions are created when large numbers of households are more concerned with maintaining current consumption than safeguarding future income streams.

Figure 3.1. A Three-Stage Model of Household Coping Strategies

Stage One: Insurance Mechanisms
1. Changes in cropping, planting and herding practices
2. Sale of small stock
3. Reduction of current food consumption levels
4. Gathering of wild cereals
5. Recourse to interhousehold transfers and loans
6. Increased production of low-value commodities and crafts
7. (Seasonal) migration in search of employment
8. Sale of non-productive assets (jewelry and housewares)

Stage Two: Disposal of Productive Assets
1. Sale of livestock
2. Sale of agricultural tools
3. Mortgaging or sale of land
4. Use of credit from traders and moneylenders
5. Further reduction of food consumption levels and/or foraging for wild foods

Stage Three: Destitution
1. Distress migration

Adapted from Corbett.

If the household successfully reaches outside help (such as food aid distribution centers), the model has an implicit fourth stage taking the household from immediate survival to recovery. Corbett points out that which of the three stages the household has reached by the time the immediate crisis has eased has enormous implications for its ability to recover fully.[40]

[40]Correct identification of where particular socio-economic households are in their respective coping strategies will likewise facilitate the operation of early warning systems and design of famine recovery programs (Corbett; D'Souza, 1983). Conversely, taking a coping measure out of contextual sequence could lead to erroneous conclusions about social vulnerability to famine and result in an inappropriate recovery program.

For example, Davies and Thiam (1987a) warn against attributing the same degree of food insecurity to different socio-economic groups on the basis of apparently similar coping

3.4. Summary

This chapter has considered concepts of food security, food insecurity, exchange entitlements and household coping strategies. In view of the successive favorable years of rainfall in the Gao region (Annex 3.1), where the CESA-MSU survey households are located, it will be seen that most households carry out insurance mechanisms within Stage One in attempt to assure household food security. However, some households operate within Stage One rather than Stage Two by default, having few remaining productive assets to dispose of. Their food security may be more tenuous.

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mechanisms. Sales of livestock by a sedentary farm household may represent a drawdown of savings assets as a hedge against low cereals stocks — an example of a Stage One insurance mechanism in Corbett's terminology. Sales of livestock by pastoralists, however, might signal a distress sale of productive assets within Stage Two.

Chapter Four. Rural Household Incomes and Expenditure Patterns

The purpose of Chapter Four is to set the stage for modelling rural household food security in Chapter Five. Section 4.1 presents the household sample. Section 4.2 examines the seasonal levels of household incomes and diversification of sources of income. Section 4.3 examines seasonal household expenditure patterns and reliance on the market for cereals. A summary of the main points will be given after each of the last two sections rather than in a separate section.

4.1. Presentation of the Rural Household Sample and Market Villages

The household component of this dissertation research is conceptually linked to the rural market component. Assessing rural market performance goes hand in hand with assessing the food security status of the rural households whom the markets serve. In this sense, selection of rural markets and nearby rural households constitutes a joint product coming in fixed proportions: one sample of nearby rural households per one market.[1]

Following a rapid reconnaissance of grain markets in Northeastern Mali (Steffen and Koné), a preliminary research proposal identified a dozen possible rural market research sites in the Tombouctou and Gao Regions. Finite resources limited the choice to one region or the other. Selection of sites in the Gao Region instead of the Tombouctou Region was compelled

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[1]In addition, two rural markets were selected without household samples. See Chapter 7.

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by two considerations. First, the Gao Region has a lower per capita level of cereals production than the Tombouctou Region (Table 2.3 in Chapter 2), thereby possibly yielding more distinct and robust research results as concerns reliance on the market. Secondly, the Gao Region is more accessible year-round, making staff supervision and quality control in the field more feasible (although getting around *within* the Gao Region is no less slow and arduous than the Tombouctou Region).

4.1.1. Selection of Survey Villages

Criteria for the selection of rural sites in the Gao Region included: 1) location within the 18 districts in the Northeast categorized as "chronically deficit", often requiring market intervention for food security; 2) relatively difficult seasonal or year-round access, due to poor roads and trails which flood during the rainy season, becoming impassable, and/or due to low levels in the Niger River making navigation impossible during the dry season; 3) a generally equal division of villages and markets between sites on the River and those in the vast hinterland away from the River; and 4) a generally equal division of occupations between farmer-fishermen and farmer-herders, a division corresponding more or less to the principal ethnic groups in the region.

Thus, five villages (and their rural markets) were selected *purposively* on the basis of their qualifications, not at random. These villages are identified in the following section.

4.1.2. Stratification and Weighting of Survey Villages

By pooling the results from several villages on the basis of one or more mutually exclusive characteristic, stratification facilitates the *generalization* of survey results to the Gao Region and the deficit zones as a whole.[2] Rural survey villages have been stratified according to geographic location, North and South, and On-River and Off-River as shown in Figure 4.1.

Figure 4.1. Stratification and Weighting of Survey Villages

NORTH *(lower rainfall)*: Almoustarat Temera	**OFF-RIVER** *(farmer-herders)*: Almoustarat Djebok Tessit
SOUTH *(higher rainfall)*: Bara Tessit	**ON-RIVER** *(farmer-fishermen)*: Temera Bara

The North villages correspond to the Sahelo-Saharan climatic zone (receiving less than 200 mm annual rainfall) and the South villages correspond to the Sahelian zone (receiving 200-400 mm rainfall), or the "lower rainfall" and "higher rainfall" strata. The North villages also correspond to the sub-districts designated "at nutritional risk" by the Early Warning System from December 1988 until October 1989, when their status was revised to "under

[2]Statistical inferences can be made about the characteristics of randomly selected samples with a known probability of selection to the population at large. Purposive selection of villages (and their rural markets) violates the assumption of random selection, meaning that inferences cannot be made in a strict statistical sense (Kalton). Nonetheless, results are applicable in a general sense to other villages (and markets) in the same stratum — hence, use of the less precise "generalization". Note that within the selected village, rural households were selected randomly (section 4.1.3. below), permitting statistically valid inferences from the sample households to the village as a whole.

surveillance" like that of the Southern villages (Annex 3.1.). In simplified terms, On-River households and Off-River households refer respectively to the "farmer-fisherman" (or "Songhaï") stratum and the "farmer-herder/ex-herder" (or "non-Songhaï") stratum. It is cautioned at the outset not to confuse Off-River households with traditional pastoralists. Although most Off-River households retain some of the attributes and habits of pastoralist cultures, few remain full-time herders. For the most part, these are relatively recently sedentarized ex-herder households still in economic transition.[3] See Figure 4.2 for the location of these rural household survey sites.[4]

Stratification requires assigning weights to data sources both within a stratum and between strata. Weighting responses from households in a particular village according to the relative importance of the village within the stratum, for example, avoids giving a disproportionate influence to that village within the stratum. Similarly, combining different strata into one composite result requires weighting the contribution of each stratum on the basis of its importance within the population at large.

Such weighting is not possible for the household surveys in this chapter. The two recent censuses[5] summarize population at the regional, district and sub-district levels but do not report the population of individual villages. Thus, the relative weight of the population

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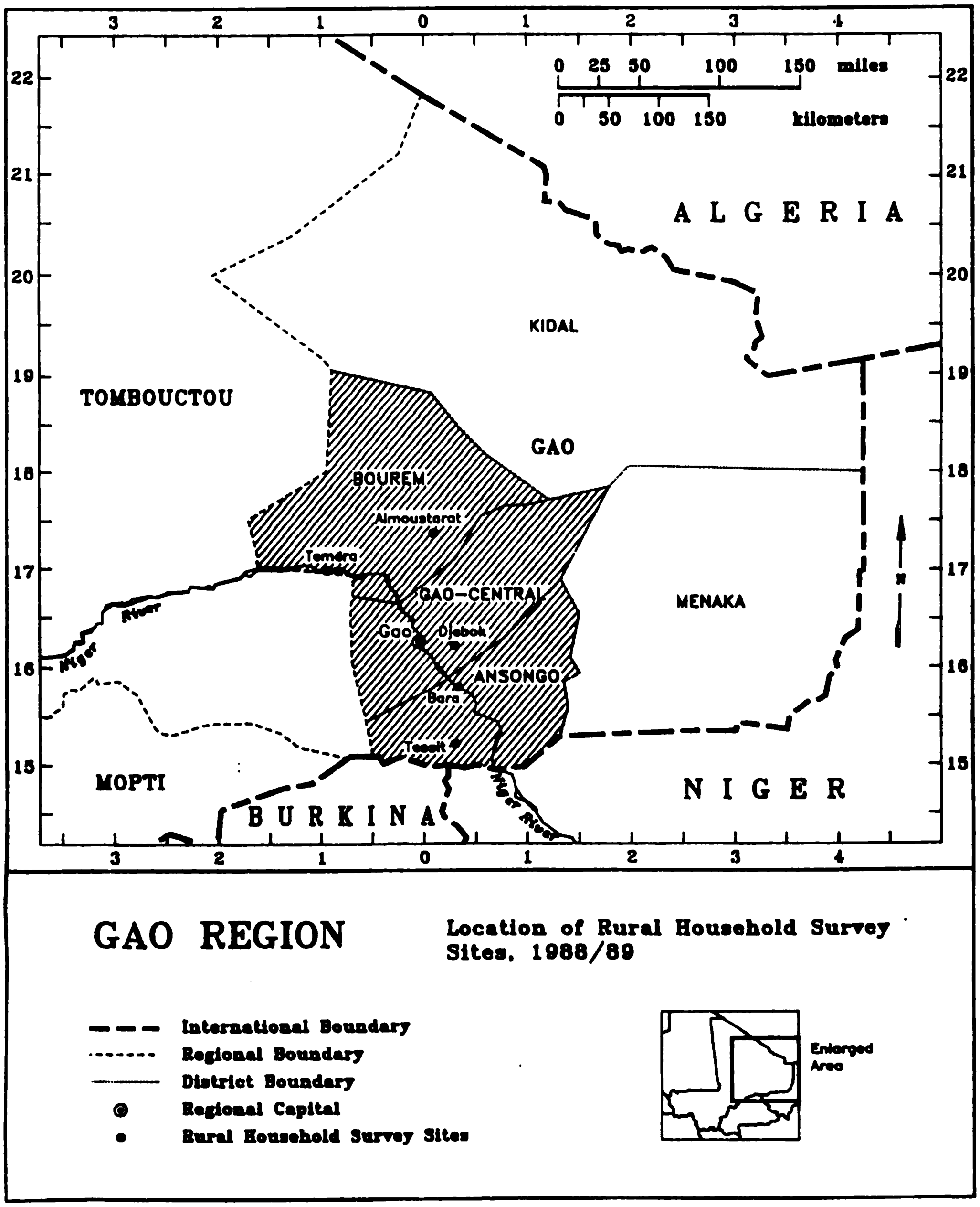
[3]See Table 4.2 for a comparison of average years of residency between Off-River and On-River households.

[4]Of the Off-River villages, Tessit is the only site lying in the *gourma* (interior of the Niger River bend, or "right bank"), reputed to be a harsher environment. Almoustarat and Djebok lie in the *haoussa* (or "left bank").

[5]MATDB, Recensement Administratif et Fiscal du 2 mai 1986, and *Ministère du Plan*, Recensement Général de la Population et de l'Habitat (du 1er au 14 avril 1987).

Figure 4.2. Location of Rural Household Survey Sites.



living in villages in the Niger River Valley, for instance, cannot be ascertained, nor that of the population living north of a given latitude.

In the absence of relative weights, households are simply pooled by stratum. One implication is that a given stratum will be slightly skewed in favor of those survey villages with more present and reporting households. Generally, the sedentarized On-River villages reported fewer absent households than the Off-River villages, particularly Almoustarat and Djebok (see section 4.1.3.2.).

A second implication is that without weights, households in Djebok were dropped from the North/South stratification of villages. Djebok lies in the middle by latitude, raising the question of where to place it. Based on absolute rainfall levels during 1988 and 1989 (Annex 3.1.), a case could be made for grouping Djebok with the other North villages, Almoustarat and Temera. However, Djebok was dropped for two considerations. First, removing the middle village highlights any North/South differences more sharply.[6] Second, placing Djebok in the North stratum would result in an imbalance between On-River and Off-River villages whereas the South stratum would have just one of each. This desire for symmetry within the North/South stratification does not necessarily represent an implicit equal weighting between On-River and Off-River villages as much as it does the need to maintain a similar configuration of villages for comparison between the two strata.

A final implication is that a single *regional* figure for all participating households will not be reported. Once more, such a composite figure would be biased in the absence of demographic weights towards those villages with a greater number of valid responses. Research results will be reported only in terms of strata.

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[6]In this manner, the North/South stratification reduces to a comparison between villages in the districts of Bourem (North, or north of 17° N) and Ansongo (South, or south of 16° N). The middle district (Gao) and 16th latitude (16° 00' N to 16° 59' N) drop out.

4.1.3. Seasonality of Household Data

Seasonality, like the division of households into North/South and On-River/Off-River, adds another dimension to stratification. Grouping monthly observations by season highlights differences more clearly and permits presentation of summary data.

Seasons in the Gao Region, however, cannot readily be divided into four seasons of three months each.[7] Herding seasons, for instance, lag about one month behind farming seasons. Instead, seasonality will be based on the regional crop calendar, which determines the marketing cycle of locally grown crops and in turn, influences household incomes and reliance on the market for cereals. Throughout this dissertation, analysis of data will be based on three seasons of four months duration as follows:

Harvest/Post-Harvest Season:	November-February
Hot Dry Season:	March-June
Rainy Season:	July-October

The **harvest/post-harvest period**, extending from November through February, encompasses the harvests of the major crops, floating rice (December/January) and pond recession sorghum (December through February), as well as the smaller crops, off-season rice (December) and rainfed sorghum and millet (November). During this period, farm families consume amply (Chapter 5). Locally grown crops are widely available on the market (Chapter 7).

The **hot dry season**, from March through June, is a difficult period for farmer and ex-herder households alike. These difficulties are relieved for herders during the **rainy**

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[7]A plausible argument could be made for four seasons of three months each, had the surveys started one month earlier in October. However, all time-series surveys for this dissertation were planned to correspond with the official crop year running from November through October, the accounting period on which all production statistics are based and compared.

season from July to October who are able to graze their animals on new pastures and increase household milk consumption. For farmer households, however, this is the "hungry season" when household cereals stocks are low or run out, when cereals prices surge upwards and when greater physical labor is required for field preparation and planting. Only households gathering wild cereals or farming households harvesting an off-season irrigated rice crop are likely to see an improvement in their cereals consumption during this period.

4.1.4. Selection of the Rural Household Sample

4.1.4.1. Size of the Household Sample

For a simple random survey, where every element of the population has a known, non-zero probability of being selected for the sample, the larger the sample size n, the more the statistical inferences about the total population are considered valid. Since standard errors and confidence intervals depend on n ($\sqrt{n}$ is in the denominator of both), increasing the sample size decreases the standard error and shortens confidence intervals. Formulas prescribe the number of observations necessary from a representative sample for attaining the desired level of precision (say, within $\pm$ 3 percent of the population mean) and level of confidence (say, with 95 percent probability). The number of necessary observations typically runs into several hundred or more, more than the total number of households in all but one village (Bara). Moreover, this number may require adjustment depending on the sampling technique and anticipated non-response rate.

In practice, sample size depends on time and cost considerations in both the sampling operation and in processing and analyzing the data, as well as precision (Kalton; Battacharyya and Johnson). In this case, considerations of enumerator workload and mobility were also factors. The sample size in each village was set at 25 households, toward the high end of a "small" sam

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"small" sample. Statistical theory shows that small random samples (where $n \approx 30$) from a normal population will produce unbiased estimates of the population mean based on a *t*-distribution with *n-1* degrees of freedom.

4.1.4.2. Selection of Households

The sample of households in each of the rural market towns was drawn either from the *Household Registry* (*Régistre de Familles*), based on the 1986 census in the Gao Region, or from a household sampleframe compiled expressly for this survey.[8] Although the probability of selection differed between villages, households within a village had the same probability of selection, with modifications in Almoustarat and Tessit (below). All households on a given sampleframe, once constructed, had the same probability of selection.

Household Registries were available for the sedentary River Valley villages of Temera and Bara, enumerating 168 and 404 households respectively. Twenty-four households were selected from the *Registry* in Temera by systematic sampling using a random-start, fixed-interval procedure.[9] Twenty-five households were selected in similar fashion from the *Registry* in Bara.

In contrast, households in Almoustarat and Djebok had been previously surveyed not by village but by major clan (*fraction*).[10] Without an official village-level *Household*

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[8]The Malian census of 1987 defines "household" as "a group of related or unrelated individuals, living under the same roof under the responsibility of a head of household whose authority is recognized by all household members" (*Ministère du Plan*, 1987a).

[9]The intervals were fixed by dividing the number of households by the desired sample size, 25. This method ensured a known and equal probability of selection from the *Registry* while avoiding any intentional or unintentional bias due to the order in which households were registered. For example, the first entry in the *Registry* is customarily reserved for the household of the village chief.

[10]Clan-based *Registries* are used for nomadic and semi-nomadic groups. The difficulty for sampling is that clan-based *Registries* reflect genealogical relations, not necessarily residency. Further investigation was necessary to determine which households were actually based in the

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Registry to serve as sampleframe, it was necessary to construct an informal one. In Almoustarat the Local Development Committee constructed a list of households which were physically present at the moment, regardless of clan, residing within a radius of 10 kilometers. Another list was drawn up of households expected to return during the course of the year. Nineteen of 51 present households were selected from the first list while 5 of 18 absent households were selected from the second list for interviewing upon their return. In the interest of starting the surveys with as many *known and present* respondents as possible, the probability of selection from the resident sampleframe was set higher (one household of 2.68 households) than selection from the absentee sampleframe (one household of 3.60 households).

The enumerator in Djebok, a long-time resident, took a census of all households within a 6-7 kilometer radius to establish the sampleframe. Twenty-two of 72 households were selected from this census.

The household sample selected for Tessit represented a hybrid case in that a *Household Registry* was available for 44 village-based households and separate *Registries* were available for about 800 nearby households divided among six clans. A two-stage sampleframe of 94 households was established by selecting every other village-based household (21 of 44) and 73 present households of 420 households from the *Registries* of two clans selected at

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random, Eugedeche I and Eugedeche II.[11] Twenty-five households were randomly selected from this composite sampleframe.

At each site, a list of 25 potential substitute households was drawn at the same time based on the same procedure to replace any households on the original list unwilling to participate in the surveys or those which might drop out later. The enumerators in Temera and Tessit had to resort to the substitute list in order to establish the initial sample of respondents. Once the surveys got underway, however, the participation of households in the initial sample was notably stable, despite occasional absences by non-sedentary households during the rainy season.

4.1.4.3. Adjustments to the Household Sample

This research set out to survey households capable of supplying clear, unbiased and accurate information. Several adjustments had to be made to maintain this criterion. During the course of the survey year, it became clear that two single-member sample households of widows in Almoustarat depended virtually entirely for their personal welfare on other households under which they had been subsumed. These two households were dropped from the analysis because their responses were unclear or discontinuous, not because they relied on others. Another household in Tessit was supported by the enumerator, in position to influence results, and was also dropped from the analysis.

In addition, a small number of households were intermittently dependent on other households and unwilling to supply information. These cases were treated as missing

[11]The proportion of the town residents in the sampleframe was arbitrarily set at one in two. Semi-sedentary households from the clan *Registry* were not selected in the same proportion but on the basis of physical presence. Present semi-sedentary households were added by systematic selection to the sampleframe of town residents until the composite sampleframe reached 100 households. Six semi-sedentary households were dropped from the list after it was determined that they were absent after all, resulting in a composite sampleframe of 94.

observations. In several cases, households which had been temporarily or seasonally supported by other households became independent later during the year and were reinstated. One survey household was picked up by another survey household for two months; the number of present household members of the latter household was adjusted upward accordingly for the period in question.[12]

In a final matter, responses from five full-time civil servants in three villages (Almoustarat, Temera and Djebok), selected at random from an exclusive sampleframe for civil servants, were dropped from the analysis of household survey data in order to facilitate comparison with the results of household survey data from Bara and Tessit, whose samples contain no full-time civil servants.

Table 4.1. Number of Total Responses per Household-Month: November 1988 - October 1989

	Household Income	Household Expenditures	Household Cereals Consumption
Almoustarat	215	217	216
Temera	287	264	287
Djebok	248	228	231
Bara	297	276	296
Tessit	280	256	273

Note: Observations for household income are missing for Almoustarat for November. Observations for household cereals consumption are missing for Almoustarat and Djebok for November. Household expenditure surveys cover eleven months, beginning in December 1988 for all sites.

[12]This "in-out" participation may bias some seasonal patterns of economic behavior upward. However, the households in question are few, lessening the magnitude of any such bias.

These adjustments, plus occasionally missing responses from absent households, resulted in an uneven number of valid household-month responses across rural villages and across questionnaires, as shown in Table 4.1 for the three main household questionnaires. This slight variation compounds the question of weighting of responses within and between strata (section 4.1.2.).

4.1.5. Determination of Adult Equivalents

The number of household members is converted in terms of adult-equivalents where, on the basis of the administrative and tax survey of 1986, one child less than 13 years old is equivalent to 0.6075 adults. This concept is particularly useful for standardizing cereals consumption for comparison with adult calorie consumption norms (see Annex 5.1). Reporting income and expenditures in terms of adult-equivalents (AEs) facilitates comparison between Chapter 4 and Chapter 5.[13]

4.1.6. Some Basic Demographic and Economic Indicators

Table 4.2 shows selected demographic indicators for sample households by strata. On average, household size for all strata exceeds the regional average in 1987 of 5.2 persons and the national average of 5.6 persons (*Ministère du Plan*, 1987). South and On-River households have slightly larger families and are more likely to have an absent household

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[13]For readers who are more accustomed to per capita indicators as reported in other research summaries and government and donor reports, data expressed in this dissertation per adult-equivalent may be converted to data per person, where children and adults are weighted equally, by multiplying by 0.884, the conversion factor for the Gao Region.

member.[14] South and On-River households have a higher number of absent members as well as a higher number of absent males, typically in their 20s and 30s, on temporary economic migration.[15] The dependency ratio, or the ratio of total present household members to present employable, able-bodied and working age household members, varies little across strata.[16]

South and On-River households are more likely to have a male head of household. Age of household head and length of household residence between North and South are roughly similar while the age difference is more pronounced between On-River and Off-River. More striking is the period of household residency in the village, about twice as long for On-River households, perhaps reflecting the newly sedentarized status of Off-River households and the more recent growth of permanent settlements away from the Niger.

In terms of ethnicity, the Off-River stratum is the most diverse while the On-River stratum is composed entirely of Songhraï-speaking households. The Songhaï constitute the largest single group overall.[17]

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[14]Households in Almoustarat, the most northern site, reported no absent household members. This may reflect the timing of the census questionnaire in July, during which five households were away on rainy season migration.

[15]One adult male was absent for non-economic reasons (pilgrimage to Mecca) and was excluded from this category.

[16]As this ratio falls toward 1.0, the smaller is the proportion of underage, infirm or elderly members needing support from working-age members.

The age range for employable household members is 13 to 59. Age 59, above which the person is no longer considered productive, is used in Mali as the upper age limit for assessment of annual head taxes. Partial weights were not given to household members 12 years or younger nor 60 years and older.

[17]Of the households responding to the census questionnaire, 56 (or 50.5 percent) identified themselves as Songhaï, or Songhraï speakers. This percentage corresponds to the 1976 census in which 52 percent of the population of the Gao Region were Songhaï (Davies and Thiam (1987a), p. 21). The ethnic composition of the Gao Region from the more recent 1987 census is unavailable.

Table 4.2. Key Demographic and Economic Indicators of Rural Households by Strata: Gao Region, Mali, 1988/89

	North (N = 40)	South (N = 50)	Off-River (N = 61)	On-River (N = 50)
1. Household Size[a]				
Present Members				
Number	7.5	8.7	7.5	8.0
Adult-Equivalents	6.3	7.1	6.2	6.7
Absent Members				
Number	0.4	0.7	0.2	0.8
Adult-Equivalents	0.4	0.7	0.2	0.8
(of which Adult Males)[b]	0.3	0.5	0.2	0.6
Dependency Ratio	2.1	2.3	2.1	2.3
2. Head of Household[a]				
Percent Males	77.5	84.0	73.8	84.0
Average Age	50.6	48.9	43.9	54.4
Years of Residence	22.6	22.1	13.7	26.9
3. Household Ethnicity				
Arab (Percent)	35.0	.	23.0	.
Maure	.	.	3.3	.
Tuareg	5.0	6.0	27.9	.
Bella	.	24.0	31.1	.
Sonraï	60.0	64.0	9.8	100.0
Others	.	6.0	4.9	.
4. Annual Average Monthly Income, 1988/89				
CFA F per AE	2,203	3,341	2,071	3,351
CFA F per capita	1,851	2,748	1,767	2,750
5. Households with 1987/88 Carry-over Cereals Stocks (Percent)[c]	.	12.2	1.7	12.0
6. Average Possession per Household of:[c]				
Carts	.	0.02	0.02	.
Canoes	0.48	0.08	.	0.46
Cattle	0.85	1.22	0.28	1.56
Camels	0.13	0.20	0.30	0.02
Donkeys	0.48	0.68	0.79	0.32

[a]As of July 1989. [b]On temporary economic migration as of July 1989. [c]As of December 1, 1988.
CESA-MSU Food Security Project Surveys

By coincidence, the pattern of average monthly household income between North and South is virtually replicated between Off-River and On-River households. South and Off-River incomes are about 50 percent higher than their respective counterparts, suggesting that access to water resources (River and/or higher rainfall) may be a factor.

Of the households reporting available carry-over cereals stocks from the previous year's harvest at the beginning of the survey period, all but one reside in Bara (South and Off-River strata).

Possession of selected semi-liquid assets indicates household wealth. Results are reported by household, rather than units per capita or per AE, due to the small fractions involved. It is estimated that pastoral subsistence requires a household to keep about 30-35 sheep and goats and one or two transport animals, usually camels and donkeys (IFAD; Swift, cited in Davies and Thiam, 1987a). By combining the average possession of camels and donkeys, Off-River households have about one animal for transport. Only cattle appear as greater than one unit in the South and On-River. All strata exceed average regional household ownership of 0.14 cattle and 0.30 donkeys. Only possession of camels by Off-River households reached the regional average of 0.30 per household.[18] Many households also owned goats, sheep and chickens.[19]

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[18]Regional household ownership figures were arrived at by dividing 1986 data on household possessions (*Ministère de l'Administration Territoriale*, 1986) by 1987 data on average household size (*Ministère du Plan*, 1987). The 1986 data were collected for tax purposes and hence may be underreported, causing a downward bias in average household ownership.

[19]No data were collected on household ownership of sheep and goats. An approximate calculation (dividing 1986 data on household possessions by 1987 data for average household size) shows that the average household in the Gao region owned about 1.88 sheep or goats two years before the CESA-MSU surveys started.

4.2. Rural Household Incomes

4.2.1. The Questionnaire and Income Categories

Household income is the fundamental measure of food exchange entitlements. A monthly recall questionnaire concerning household income was designed, pretested during the rapid reconnaissance (July and August 1988) and revised for the household samples in the Gao Region.[20] The enumerators interviewed each adult household member according to a coded master list of income categories broken down into more than 160 possible individual sources of income, recording the name of the income earner, category of income, source of income, a brief description of the source of income, the unit of income, the number of units, the value per unit and the total income. In the case of income received in kind, the value was estimated.

The questionnaire was modified early in the survey period to account for net income received (deducting the value of inputs) for the categories of general commerce, cereals trade, livestock trade, manufacture and sale of artisanal products, preparation and sale of food products and independently earned wages. Previously collected data for these categories were corrected by recall questionnaires. All labor income was valued as net income.

A post-survey modification of questionnaire data incorporated the imputed value of home consumption of cultivated cereal crops or gathered wild cereals, information taken from the questionnaire on household cereals consumption (Chapter 5) and valued at average monthly rural market prices weighted by quantity (Chapter 7). Two critical assumptions in

[20]The recall period of the household income questionnaire was set at one month, rather than a shorter period, based on the consistent ability of respondents under pretest cross-questioning to recall the same source and value of income received up to one month before (Steffen and Koné).

this instance are that all households were price-takers, meaning that the additional supply of cereals released on the market by the household would not have had an appreciable impact on market prices, and that market prices accurately reflect the opportunity cost of cereal sales foregone by the household. Given the primary focus of this dissertation on access to cereals, no attempt was made to measure and record other home-produced goods and services.[21] Excluding the value of home consumption of non-cereal products has the effect of underestimating real incomes. However, a check of the pattern of livestock ownership across terciles and strata, mentioned in Annex 4.1, does not show evidence that omission of the imputed value of home consumed animal products, particularly milk, has resulted in a systematic downward bias in the incomes of rural non-sedentary households.

Survey data were manipulated in several ways. First, the lengths of months were set equal by dividing each income observation by the number of days in the month and then multiplying by 30.4167 (365 days ÷ 12 months). Second, household income was converted to a seasonal basis by averaging monthly income during each four-month season. Several households with fewer than two monthly observations per season were dropped from the analysis for the given season and several households with less than three monthly observations were dropped from the annual average.[22] Next, income was divided by the number of adult-

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[21]Many goods and services produced within the household for home use represent potential sources of income valued at their market price. Household consumption of milk and butter during the rainy season by herder households, for example, represents implicit income foregone. However, a problem arises in placing a value on the opportunity cost of home consumption where no market exists. Using the previous example, milk and butter production peaks during northward seasonal migrations away from population centers and markets where trade is most likely to occur (see Chapter 5).

[22]This minimum of two household observations per season or three per year also holds for household expenditures (section 4.3) and cereals consumption (Chapter 5). Note that certain households were mobile between income terciles over seasons, accounting for the situation where some annual averages do not fall within seasonal ranges for that tercile.

equivalents in the household in order to standardize results on an adult-equivalent basis. However, income remains in nominal terms, neither detrended (due to the lack of a long time series), nor deflated (due to the lack of a price deflator).[23]

Figure 4.3 displays the main categories and sources of household income. Agricultural production and sales refers to *own-grown* cereals, vegetables and fruit.[24] Livestock production and sales refers to *own-raised* livestock and poultry and their products (such as butter and eggs) and by-products (such as hides); *own-caught* fish are included as products within this source. Gathering and sales of natural products refers to *own-gathered* wild cereals, forage, fuelwood and plants. Together, these three sources constitute "farm" income, where output levels are highly dependent on rainfall.

Commercial and rental income is limited to the net value-added component, chiefly labor and other unpaid inputs. The feature distinguishing the purchase and sale of agricultural products from the production and sale of agricultural products (under farm income above) is that the former were bought while the latter were grown at home. By the same token, the purchase and sale of livestock and livestock products differs from the livestock production and sales in that the former were bought and the latter raised at home. By distinguishing income derived from primary production from income derived from trading, these separate categories permit an indirect assessment of the strength and reliability of the market.

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[23]A consumer food price index is available for Bamako, but would not be applicable to the Northeast. Mali's overall rate of inflation during 1989 was a relatively low 2.7 percent (World Bank, 1991).

[24]Agricultural production, including cereals, was measured in terms of income, not stocks. As sales were made from harvest stocks, this was recorded as income. As cereals were consumed at home from stocks, the imputed value was recorded as income. Consumption of food produced and stored at home can be seen as a continuous income source because it is available to the household on a daily basis (Kumar, 1981). Thus, the value of unsold, unconsumed cereal stocks was not counted as income.

Figure 4.3. Categories and Sources of Rural Household Income

1. Farm Income	a. Agricultural production and sales b. Livestock production and sales c. Gathering and sale of natural products
2. Own Consumption of Cereals	a. Consumption of cultivated cereals b. Consumption of gathered cereals
3. Commercial and Rental Income	a. General commerce b. Purchase and sale of agricultural products c. Purchase and sale of livestock and livestock products d. Production and trade of artisanal products e. Retail sales of prepared foods f. Rental income
4. Wages and Salaries	a. Wage income b. Salaried income
5. Credit	a. Credit received from creditors
6. Decapitalization	a. Sale of household durables b. Drawdown of household savings
7. Aid and Transfers	a. Remittances from absent household members b. Aid from present household members, friends and neighbors c. Institutional transfers
8. Other Income	a. Reimbursement of credit by debtors b. Social gifts

Wages refer to returns to labor for task-oriented work, usually intermittent and of short duration. As mentioned, wage income may be considered less secure than salaried income with its explicit or implicit guarantee of longer term employment. Examination of survey data shows that household members received salaries from their jobs as shop manager, school guard, school cooks, midwife/clinic staffer, religious leader/instructor, laborers for a PVO, postal clerk and brick-maker's apprentice. Several households received pensions and social security allocations, also treated as salaried income. The emphasis here is not on the source of wages or salaries, but on the *expectation* of steady income and its possible influence on household expenditure and consumption patterns.

The credit category refers to credit received by the household. In contrast, the "other" category mainly includes reimbursement of credit previously extended by the household.[25] The "other" category also includes a small number of baptism and wedding gifts.

Decapitalization occurs when a household reduces its wealth (excluding any sales of products defined in the above categories). In this manner, the household transforms part or all of its wealth stock into an income stream by selling durables or other semi-liquid assets to meet current cash needs. Decapitalization also occurs as a household dissaves by drawing down previously unrecorded liquid savings. There is an implicit notion of non-replacement in both instances.[26]

Lastly, the aid and transfers category comprises remittances from household members or relatives employed outside of the survey village; charity transfers in the form of alms-giving by local relatives, friends and neighbors; and institutional transfers (such as food aid) by the government, private voluntary organizations or religious organizations.

By including the valuation of credit received and extended as current income, this definition of income may be closer to definitions of net resource flows into and out of the household. Credit received has to be repaid and credit extended is only a cash outflow.

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[25]These loans by the household are recorded as expenditures in the household expenditure questionnaire (section 4.3).

[26]An exception would be when semi-liquid or liquid assets are invested in income-producing activities. "Decapitalization" for the purpose of investment is captured in the household expenditures questionnaire.

Although both inflows and outflows may change current household behavior, these offset each other over time. As will be seen shortly, the contribution of "credit" and "other income" to household income was usually a minor one. Thus, the term "household income" will be used as shorthand for "household cash flow."

4.2.2. Measures of Absolute Household Income, Variability and Inequality

A first look at household income data reveals that average monthly incomes per adult-equivalent are low, variable and unequally distributed. These relative terms must be put into perspective.

According to the World Bank, the average annual per capita income in Mali during 1989 was $270, about 7,180 CFA francs per month in per capita terms or about 8,235 CFA francs per month in terms of adult-equivalents (World Bank, 1991).[27] As shown in Table 4.3 (*before* outlier households were removed, section 4.2.3.), average monthly income per AE of sample households in Gao Region ranged between 2,142 CFA francs (Off-River) and 3,521 CFA francs (On-River) — about one-fourth to less than one-half of the national average in nominal terms. The South and On-River strata have decidedly higher incomes than the North and Off-River strata, respectively. No income at all, as defined, was recorded during twenty-five household-months, all households in the Off-River stratum.

Variability of income is measured by the coefficient of variation (the standard deviation divided by the mean). The coefficient of variation (CV) represents a simple, unit-free indicator of variability for comparison of measures, for example, between village strata or between seasons within the same stratum. Table 4.3 shows that average monthly income

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[27]The average weighted exchange rate during 1989 was $1.00 = 319.01 CFA francs (IMF. International Financial Yearbook. (Washington, D. C.), 1990, p. 497).

Table 4.3

Comparison of Seasonal Average Monthly Household Income per Adult-Equivalent (Gao Region, Mali)

	Mean Monthly Income (CFA F)	Coefficient of Variation	Gini Coefficient	N
North	2,301	0.85	0.413	45
South	3,464	0.71	0.360	54
Off-River	2,142	0.84	0.394	69
On-River	3,521	0.75	0.391	52

Outlier households not removed.
CESA/MSU Food Security Project Surveys, 1988/89

per AE is most variable in the North (CV = 0.85) and least variable in the South (CV = 0.71).

Another measure of income inequality is the Gini coefficient, which is related to the Lorenz curve. The Lorenz curve is a geometric presentation tracing the relationship between the percent share of aggregate income enjoyed by a given percent of population. Percentages of the population are ordered from poorest to richest along the horizontal axis and the percent of total income enjoyed by each percent of population on the vertical axis, where each axis is depicted as one side of a square. With perfect income equality (all individuals enjoying the same income), the Lorenz curve would be a 45° line from the origin to the opposite corner of the square, or simply the diagonal. In the typical case without perfect income equality, the Lorenz curve lies below the diagonal. Its slope increasingly rises when moving along the curve from poorer to richer sections of the population.

The Gini coefficient, therefore, is the ratio of the difference between the line of absolute income equality (the diagonal) and the Lorenz curve to the triangle lying beneath the diagonal, or one half of the arithmetic average of the absolute values of differences between all pairs of incomes for incomes in descending order.[28] Table 4.3 shows rather similar Gini coefficients for average monthly income per AE among the sample strata, all indicating "low inequality."[29] Notice that despite the relative disparity in average incomes between the Off-River and On-River strata, Gini coefficients showing the distribution of that income are identical.

Lastly, distribution of income is often measured in terms of income quintiles, the portion of total income going to the top income quintile (highest 20 percent) and the portion going to the bottom quintile (lowest 20 percent), and so forth. In each stratum, the top quintile received more than half of all income while the lowest quintile received less than 4 percent, as shown in Table 4.4.

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[28]Sen (1973) simplifies the Gini coefficient to the following expression: $G = 1 + (1/n) - (2/n^2\mu)[y_1 + 2y_2 + \ldots + ny_n]$ for $y_1 \geq y_2 \geq \ldots \geq y_n$. The attraction of the Gini coefficient is its direct measure of income differences between every pair of incomes rather than the singular emphasis on differences relative to the mean that other measures have, such as variance, coefficient of variation and standard deviation of logarithms (Sen, 1973).

[29]One criticism of the Gini coefficient is its difficulty to interpret in a normative sense (Oster, *et al.*). However, the FAO (1986) interprets a Gini coefficient of less than or equal to 0.41 as "low inequality"; between 0.41 and 0.45 as "moderate inequality"; between 0.46 and 0.50 as "relatively high inequality"; and greater than 0.50 as "high inequality".

Table 4.4. Distribution of Rural Household Income per Adult-Equivalent between Top and Bottom Income Quintiles (Gao Region, Mali)

(Percent)

	Top Quintile	Bottom Quintile
North	56.2	3.1
South	51.8	3.5
Off-River	55.3	2.8
On-River	54.1	2.7

Outlier households not removed.
CESA/MSU Food Security Project Surveys, 1988/89

4.2.3. Analysis of Seasonal Household Income by Income Terciles

By smoothing fluctuations in income between seasons and households, measures of annual average monthly income hide more than they reveal. Breakdown of average monthly household income data by season and income terciles gives a better picture.[30]

These average income figures may be skewed by statistical outliers (more than three standard deviations from the tercile mean). According to Chebyshev's rule, the interval which is $\pm$ 3 standard deviations from the mean contains at least 8/9 (or 89 percent) of all observations. Thus, outliers can be dropped with minimum loss of observations (Bhattacharyya and Johnson). Consistent with the analysis in Annex 4.1, *combined* household

[30]Households were disaggregated into income terciles rather than quartiles in order to have more observations per grouping and to facilitate the explanation of results. Income terciles, moreover, correspond to upper income, middle income and lower income groupings — or, rich, middle and poor — and thus, a convenient shorthand description.

income and household expenditure outliers have been dropped for the remainder of the income tables.[31]

The first column of the following tables represents an annual average of monthly household observations, not an average of the seasonal averages. At least two observations were required for a household to be included in each seasonal average and at least three observations to be included in each annual average. Note that a seasonal outlier household, whose observation was removed for a seasonal average, may not be an outlier for the annual average, for which its observation is included. Thus, the number of households in the annual average exceeds the number in any given seasonal average, causing some households to shift between terciles. Moreover, inclusion of previously dropped seasonal outlier households, whose observations were all *greater* than three standard deviations from the mean, tends to raise annual averages. For this reason, the annual average exceeds the range of the seasonal averages in a few instances.

4.2.3.1. North/South Stratification of Households

Tables 4.5 and 4.6 show seasonal income by terciles grouped by North and South households. Income sources have been grouped by category according to Figure 4.2.[32]

Three general patterns emerge from the tables. First, total household income is consistently higher in the South than the North across seasons and terciles. Next, total

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[31]The following total number of household-season outliers were dropped: North, 6 (4.6 percent); South, 5 (3.4 percent); Off-River, 8 (4.2 percent); and On-River, 7 (4.8 percent). For annual average incomes, the following household outliers were dropped: North, 1 (2.2 percent); South, 3 (3.7 percent); Off-River, 2 (2.9 percent); and On-River, 3 (5.8 percent). All outliers were greater than three standard deviations from the mean.

[32]See Annex 4.2 for average monthly income by season and by *sources* of income by household strata not disaggregated by income terciles. Annex 4.2 also shows seasonal coefficients of variation and Gini coefficients.

Table 4.5. Average Monthly Household Income per Adult-Equivalent by Season: North Villages (Gao Region, Mali), by Income Terciles

	Annual Average (N = 44)		Harvest/Post-Harvest (N = 41)		Hot Dry Season (N = 43)		Rainy Season (N = 40)	
	CFA F	Pct	CFA F	Pct	CFA F	Pct	CFA F	Pct
Upper Income								
1. Farm Income	261	*6.5*	669	*12.0*	234	*6.4*	235	*9.3*
2. Home Consumption[a]	277	*6.9*	909	*18.1*	92	*2.5*	31	*1.2*
3. Wages and Salaries	1203	*29.9*	1209	*21.9*	1147	*31.4*	596	*23.5*
4. Commerce	998	*24.8*	842	*19.5*	1180	*32.3*	124	*4.9*
5. Decapitalization	66	*1.6*	97	*0.6*	101	*2.8*	118	*4.7*
6. Credit	216	*5.4*	20	*9.2*	65	*1.8*	181	*7.1*
7. Aid and Transfers	821	*20.4*	690	*17.2*	742	*20.3*	951	*37.5*
8. Other	178	*4.4*	24	*1.6*	91	*2.5*	302	*11.9*
Total	4019	*100.0*	4461	*100.0*	3652	*100.0*	2539	*100.0*
Middle Income								
1. Farm Income	254	*16.2*	265	*11.7*	212	*17.7*	18	*1.7*
2. Home Consumption[a]	351	*22.4*	808	*40.5*	90	*7.5*	54	*5.2*
3. Wages and Salaries	323	*20.5*	517	*17.6*	348	*29.1*	221	*21.4*
4. Commerce	104	*6.6*	138	*12.7*	9	*0.8*	78	*7.6*
5. Decapitalization	86	*5.5*	14	*3.2*	51	*4.3*	55	*5.3*
6. Credit	122	*7.8*	29	*0.6*	64	*5.4*	277	*26.8*
7. Aid and Transfers	282	*18.0*	373	*13.6*	380	*31.8*	263	*25.4*
8. Other	49	*3.1*	.	.	42	*3.5*	69	*6.7*
Total	1570	*100.0*	2146	*100.0*	1197	*100.0*	1035	*100.0*
Lower Income								
1. Farm Income	98	*11.5*	206	*20.0*	62	*9.9*	32	*5.8*
2. Home Consumption[a]	220	*26.0*	375	*36.4*	66	*10.5*	98	*18.0*
3. Wages and Salaries	191	*22.5*	137	*13.3*	170	*27.1*	175	*32.4*
4. Commerce	38	*4.5*	127	*12.4*	29	*4.6*	26	*4.8*
5. Decapitalization	10	*1.2*	9	*0.9*	17	*2.8*	34	*6.2*
6. Credit	63	*7.5*	.	.	37	*5.9*	62	*11.6*
7. Aid and Transfers	218	*25.7*	173	*16.8*	200	*32.0*	114	*21.2*
8. Other	9	*1.1*	3	*0.2*	45	*7.2*	.	.
Total	848	*100.0*	1030	*100.0*	627	*100.0*	540	*100.0*

[a]Imputed value of cereals produced or gathered by the household and consumed by the household.
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Table 4.6. Average Monthly Household Income per Adult-Equivalent by Season: South Villages (Gao Region, Mali), by Income Terciles

	Annual Average (N = 51)		Harvest/Post-Harvest (N = 45)		Hot Dry Season (N = 47)		Rainy Season (N = 48)	
	CFA F	Pct	CFA F	Pct	CFA F	Pct	CFA F	Pct
Upper Income								
1. Farm Income	2116	*38.6*	5303	*63.0*	1003	*22.8*	1300	*29.7*
2. Home Consumption[a]	1214	*22.2*	2431	*28.9*	940	*21.3*	938	*21.4*
3. Wages and Salaries	547	*10.0*	46	*0.5*	620	*14.1*	545	*12.5*
4. Commerce	216	*3.9*	249	*3.0*	167	*3.8*	107	*2.5*
5. Decapitalization	172	*3.1*	99	*1.2*	103	*2.3*	.	.
6. Credit	28	*0.5*	.	.	114	*2.6*	70	*1.6*
7. Aid and Transfers	1152	*21.0*	285	*3.4*	1409	*32.0*	1408	*32.2*
8. Other	31	*0.6*	.	.	50	*1.1*	4	*0.1*
Total	5477	*100.0*	8414	*100.0*	4406	*100.0*	4373	*100.0*
Middle Income								
1. Farm Income	592	*21.7*	1020	*27.7*	515	*26.0*	550	*23.9*
2. Home Consumption[a]	744	*27.2*	1094	*29.7*	323	*16.3*	610	*26.5*
3. Wages and Salaries	668	*24.5*	511	*13.9*	534	*27.0*	443	*19.3*
4. Commerce	99	*3.6*	409	*11.1*	47	*2.4*	72	*3.1*
5. Decapitalization	18	*0.7*	.	.	62	*3.1*	74	*3.2*
6. Credit	37	*1.4*	31	*0.8*	17	*0.8*	11	*0.5*
7. Aid and Transfers	525	*19.2*	547	*14.8*	447	*22.6*	453	*19.7*
8. Other	48	*1.8*	71	*1.9*	35	*1.7*	89	*3.9*
Total	2732	*100.0*	3682	*100.0*	1981	*100.0*	2302	*100.0*
Lower Income								
1. Farm Income	397	*28.7*	447	*35.1*	159	*17.1*	349	*26.4*
2. Home Consumption[a]	330	*23.9*	311	*24.4*	136	*14.7*	347	*26.2*
3. Wages and Salaries	324	*23.5*	375	*29.4*	224	*24.1*	325	*24.6*
4. Commerce	26	*1.9*	16	*1.2*	48	*5.1*	77	*5.8*
5. Decapitalization	51	*3.7*	.	.	93	*10.0*	.	.
6. Credit	30	*2.2*	3	*0.2*	52	*5.6*	13	*1.0*
7. Aid and Transfers	183	*13.2*	94	*7.4*	179	*19.2*	182	*13.7*
8. Other	41	*3.0*	29	*2.3*	39	*4.2*	32	*2.4*
Total	1382	*100.0*	1275	*100.0*	931	*100.0*	1325	*100.0*

[a]Imputed value of cereals produced or gathered by the household and consumed by the household.

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household income in the South falls in the hot dry season but recovers in the rainy season (for all terciles) whereas household income in the North declines steadily from harvest/post-harvest levels. Lastly, income from the two highest sources is most concentrated during the harvest/post-harvest period in the South for all income terciles, but most concentrated during the hot dry season in the North for all terciles.

It appears that the more favorable rainfall regime in the South is the driving force behind higher incomes there. The additional 100 mm of annual average rainfall that the South receives (Annex 3.1) represents not only an absolute difference between North and South, but a qualitative one in terms of enhanced cropping and gathering opportunities.[33] For the North, poor rainfall severely restricts production and gathering of cereals. Both farm income and the value of home consumption of cereals are consistently higher across annual averages, seasons and income classes in the South than in the North.[34] Tables A4.2.2 and A4.2.4 in Annex 4.2 indicate that combined farm income and home consumption income averaged 56.2 percent annually in the South, but only 22.4 percent in the North, less than half.

Table 4.7 looks more closely at income from the sale of cultivated cereals (within agricultural production) and sale of gathered wild cereals (within gathering of natural products) in comparison with the imputed value of cereals consumed at home. Table 4.7 shows that sales of produced (or gathered) cereals are concentrated by value in the upper income terciles in both the Northern and Southern strata, similar to the pattern found by Dioné (1989b) in southern Mali. The table also shows that the value of home consumption of cereals exceeds the income from cereals sales (except for upper income households in the

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[33]Access to full water control irrigation by households in Bara for an off-season paddy crop further expands agricultural opportunities in the South.

[34]Except home consumption in lower tercile North households in the harvest/post-harvest season.

Table 4.7.

Comparison of Sales of Cereals from Home Production and Gathering with Home Consumption of Cereals: Average Monthly Household Income per AE, by Terciles

(Percent of Total Income)

	Annual Average		Harvest/ Post-Harvest		Hot Dry Season		Rainy Season	
	CFA F	Pct	CFA F	Pct	CFA F	Pct	CFA F	Pct
North Villages								
Upper Income								
1. Sales	92	*2.3*	237	*6.2*	43	*1.2*	.	.
2. Home Consumption	277	*6.9*	909	*20.4*	92	*2.5*	31	*1.2*
Middle Income								
1. Sales	82	*5.2*	161	*7.5*	51	*4.3*	.	.
2. Home Consumption	351	*22.4*	808	*37.7*	90	*7.5*	54	*5.2*
Lower Income								
1. Sales	37	*4.4*	87	*8.5*	34	*5.5*	7	*1.3*
2. Home Consumption	220	*26.0*	375	*36.4*	66	*10.5*	98	*18.0*
South Villages								
Upper Income								
1. Sales	1664	*30.4*	5208	*61.9*	550	*12.5*	630	*14.4*
2. Home Consumption	1214	*22.2*	2431	*28.9*	940	*21.3*	938	*21.4*
Middle Income								
1. Sales	332	*12.2*	937	*25.4*	118	*5.9*	176	*7.6*
2. Home Consumption	744	*27.2*	1094	*29.7*	323	*16.3*	610	*26.5*
Lower Income								
1. Sales	104	*7.5*	84	*6.6*	.	.	42	*3.2*
2. Home Consumption	330	*23.9*	311	*24.4*	136	*14.7*	347	*26.2*

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South during the harvest/post-harvest season). That these households retain more of their produced (or gathered) cereals than they sell may suggest that retention of own production (own gathering) is believed to be less costly than market purchases, given the transaction costs of using the market. Note the exceptionally high contribution of home production and home consumption to total income for the upper income tercile in the South during the harvest/post-harvest season, compared to the much smaller counterpart contribution in the North.[35]

Referring again to Tables 4.5 and 4.6, wages and salaries and net income from commerce figure more prominently in absolute and percentage terms for the upper income bracket in the North than in the South. No pattern is discernible for the middle or lower income terciles.

Decapitalization of assets is relatively low or non-existent among lower income households in the South and the North, never exceeding 10 percent. These low levels may simply reflect the fact that households in the poorest tercile held few assets to begin with.[36]

Credit income reflects the expected credit worthiness of the borrowing household, the ability to repay on the basis of its future income stream or collateral. Thus, credit income is intuitively correlated with higher incomes or wealth. Such a hypothesis is not consistent with the results, North or South. This raises an alternative hypothesis, all things equal, that higher-income households need to borrow less, but results here are also inconclusive. It is possible that some aid, extended to lower-income households in the guise of credit (and recorded as credit), was never expected to be repaid.

Income from aid and transfers constitutes more than one-third of the income of upper income households in the North (during the rainy season) and nearly one-third in the South

[35]Without a longer-term perspective, the large contribution of home production and home consumption in the South could be interpreted in diametrically opposite ways: either as an alarming overexposure to income sources that depend on unreliable rainfall or as serendipitous income arising from an unusually good harvest.

[36]Sales of household durables as part of decapitalization mainly entailed sales of used clothing, several carpets and prayer rugs and, in one case, a radio-cassette player. These are not goods which could be considered productive assets (Stage Two in Corbett's model).

(during the hot dry and rainy seasons). Households in the lower two terciles in the South receive consistently less income from aid and transfers. This apparent paradox, whereby the best-off households receive the most aid, is deceptive.

Table 4.8 disaggregates income from aid and transfers into charity aid and remittances.[37] Charity aid is more important in the North for all terciles in all seasons whereas in the South, remittances consistently contribute more than charity for the top two terciles. This suggests that family composition (members available to migrate) and willingness to migrate (as seen by the average number of adult males on economic migration in Table 4.2) are significant contributing factors. More simply, it may mean that South households are closer to employment opportunities in more densely populated areas and are better able to afford the non-negligible costs of transportation. Overall, remittances in the South account for 13.6 percent of average annual income, more than four times greater than in the North (Tables A4.2.2 and A4.2.4 in Annex 4.2). Charity income in the North represents the highest source of average income, 17.6 percent overall, and exceeds *one-quarter* of average income during the rainy season, suggesting both extreme vulnerability to the good will of others and a relative inequality of income distribution (Table 4.3) by which the rich can afford to contribute to the poor. In contrast, charity in the South represents only 5.8 percent of the seasonal average.

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[37]As no institutional aid was received in any strata during the survey year, it has been omitted from Table 4.8 as a component of aid and transfer income. However, three households received income from the Government of Mali (military pension and associated benefits in the case of two households and salary and benefits as part-time postal agent in the case of the third household). This income was treated as salary income.

Table 4.8. Comparison of Charity Aid and Transfers with Remittances: Average Monthly Household Income per Adult-Equivalent, by Terciles

(Percent of Total Income)

	Annual Average		Harvest/ Post-Harvest		Hot Dry Season		Rainy Season	
	CFA F	Pct	CFA F	Pct	CFA F	Pct	CFA F	Pct
North Villages								
Upper Income								
1. Charity Aid	712	*17.7*	673	*15.1*	430	*11.8*	809	*31.9*
2. Remittances	109	*2.7*	17	*0.4*	311	*8.5*	142	*5.6*
Middle Income								
1. Charity Aid	212	*13.5*	373	*17.4*	305	*25.4*	247	*23.9*
2. Remittances	70	*4.4*	.	.	75	*6.3*	16	*1.5*
Lower Income								
1. Charity Aid	208	*24.5*	170	*7.9*	177	*28.3*	107	*19.8*
2. Remittances	10	*1.2*	3	*0.1*	23	*3.7*	8	*1.4*
South Villages								
Upper Income								
1. Charity Aid	324	*5.9*	53	*0.6*	309	*7.0*	97	*2.2*
2. Remittances	828	*15.1*	233	*2.8*	1099	*24.9*	1311	*30.0*
Middle Income								
1. Charity Aid	97	*3.6*	242	*6.6*	161	*8.1*	177	*7.7*
2. Remittances	428	*15.7*	305	*8.3*	287	*14.5*	275	*12.0*
Lower Income								
1. Charity Aid	137	*9.9*	94	*7.4*	79	*8.5*	136	*10.3*
2. Remittances	45	*3.3*	.	.	100	*10.7*	45	*3.4*

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A final observation is that household income per AE in the North is somewhat more diversified than income in the South (and the most diversified of all four strata). The four highest sources contribute 59.3 percent of household income in the North, compared with 65.6 percent in the South (Tables A4.3.2 and A4.2.4 in Annex 4.2).

A parallel is available from Burkina Faso in 1984/85, a poor production year, as reported by Reardon, Matlon and Delgado (1988), in which higher rainfall Sudanian zone sample households were more dependent on agricultural income (crop sales and agricultural wages) than lower rainfall Sahelian zone households. For Sahelian households in Burkina Faso, 69 percent of annual income came from non-crop, non-transfer sources, compared to 63 percent for households in the North stratum in Mali (Annex 4.2). For Sudanian households in Burkina Faso, only 37 percent of annual income came from non-crop, non-transfer sources, very similar to the 36 percent for households in the South stratum in Mali. This outward-oriented diversification of income in the North stratum in Mali (and the Sahelian stratum in Burkina Faso) is evidence of coping strategies by which households seek to insulate themselves against the higher probability of crop failures.

4.2.3.2. On-River/Off-River Stratification of Households

Tables 4.9 and 4.10 show seasonal income by terciles grouped by Off-River and Off-River households. Some differences between these strata are just as striking as those between the North/South stratification of households.

In this second stratification, total household income is consistently higher across seasons and the top two terciles in On-River households than in Off-River households (paralleling the observation between Southern and Northern households). This disparity is most pronounced in the harvest/post-harvest season, when average On-River incomes are more than double average Off-River incomes for the respective tercile. However, these high

Table 4.9. Average Monthly Household Income per Adult-Equivalent by Season: Off-River Villages (Gao Region, Mali), by Income Terciles

	Annual Average (N = 67)		Harvest/Post-Harvest (N = 59)		Hot Dry Season (N = 62)		Rainy Season (N = 62)	
	CFA F	Pct	CFA F	Pct	CFA F	Pct	CFA F	Pct
Upper Income								
1. Farm Income	211	*6.1*	372	*10.4*	334	*9.6*	211	*7.7*
2. Home Consumption[a]	205	*5.9*	203	*5.6*	117	*3.3*	315	*11.5*
3. Wages and Salaries	1502	*43.1*	1323	*36.8*	1635	*46.9*	1104	*40.4*
4. Commerce	619	*17.8*	728	*20.3*	421	*12.1*	262	*9.6*
5. Decapitalization	27	*0.8*	.	.	71	*2.0*	52	*1.9*
6. Credit	44	*1.3*	2	*0.1*	33	*0.9*	65	*2.4*
7. Aid and Transfers	778	*22.3*	925	*25.8*	723	*20.7*	660	*24.2*
8. Other	95	*2.7*	40	*1.1*	153	*4.4*	62	*2.3*
Total	3482	*100.0*	3593	*100.0*	3486	*100.0*	2732	*100.0*
Middle Income								
1. Farm Income	381	*24.6*	440	*27.3*	313	*23.8*	350	*23.2*
2. Home Consumption[a]	310	*20.0*	374	*23.2*	102	*7.7*	291	*19.3*
3. Wages and Salaries	472	*30.5*	479	*29.7*	435	*33.1*	476	*31.5*
4. Commerce	109	*7.0*	59	*3.7*	74	*5.6*	80	*5.3*
5. Decapitalization	49	*3.1*	.	.	39	*3.0*	16	*1.0*
6. Credit	37	*2.4*	23	*1.4*	20	*1.5*	74	*4.9*
7. Aid and Transfers	178	*11.5*	225	*13.9*	297	*22.6*	218	*14.4*
8. Other	14	*0.9*	14	*0.9*	34	*2.7*	7	*0.5*
Total	1551	*100.0*	1614	*100.0*	1314	*100.0*	1512	*100.0*
Lower Income								
1. Farm Income	231	*27.5*	255	*32.9*	96	*13.3*	198	*27.0*
2. Home Consumption[a]	125	*14.9*	198	*25.5*	107	*14.8*	69	*9.4*
3. Wages and Salaries	224	*26.6*	162	*20.9*	186	*25.7*	178	*24.3*
4. Commerce	26	*3.1*	34	*4.3*	31	*4.3*	30	*4.1*
5. Decapitalization	11	*1.3*	.	.	47	*6.5*	8	*1.1*
6. Credit	40	*4.8*	.	.	65	*9.0*	91	*12.5*
7. Aid and Transfers	162	*19.3*	105	*13.5*	160	*22.1*	140	*19.1*
8. Other	21	*2.5*	23	*3.0*	31	*4.2*	18	*2.5*
Total	839	*100.0*	776	*100.0*	724	*100.0*	733	*100.0*

[a]Imputed value of cereals produced or gathered by the household and consumed by the household.
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Table 4.10. Average Monthly Household Income per Adult-Equivalent by Season: On-River Villages (Gao Region, Mali), by Income Terciles

	Annual Average (N = 49)		Harvest/Post-Harvest (N = 46)		Hot Dry Season (N = 47)		Rainy Season (N = 47)	
	CFA F	Pct	CFA F	Pct	CFA F	Pct	CFA F	Pct
Upper Income								
1. Farm Income	2193	*37.3*	5303	*63.0*	1116	*28.0*	1357	*31.1*
2. Home Consumption[a]	1305	*22.2*	2431	*28.9*	837	*21.0*	852	*19.5*
3. Wages and Salaries	572	*9.7*	46	*0.5*	227	*5.7*	236	*5.4*
4. Commerce	266	*4.5*	249	*3.0*	268	*6.7*	194	*4.4*
5. Decapitalization	138	*2.4*	99	*1.2*	132	*3.3*	79	*1.8*
6. Credit	192	*3.3*	.	.	157	*3.9*	14	*0.3*
7. Aid and Transfers	1157	*19.7*	285	*3.4*	1226	*30.7*	1540	*35.3*
8. Other	49	*0.8*	.	.	29	*0.7*	87	*2.0*
Total	5870	*100.0*	8414	*100.0*	3990	*100.0*	4358	*100.0*
Middle Income								
1. Farm Income	801	*28.7*	1487	*35.4*	365	*22.0*	484	*25.1*
2. Home Consumption[a]	735	*26.3*	1672	*39.7*	231	*13.9*	234	*12.1*
3. Wages and Salaries	465	*16.7*	450	*10.7*	474	*28.5*	391	*20.3*
4. Commerce	110	*4.0*	241	*5.7*	27	*1.6*	48	*2.5*
5. Decapitalization	83	*3.0*	84	*2.0*	166	*10.0*	43	*2.2*
6. Credit	55	*2.0*	18	*0.4*	19	*1.2*	127	*6.6*
7. Aid and Transfers	454	*16.3*	233	*5.5*	341	*20.5*	380	*19.7*
8. Other	85	*3.0*	21	*0.5*	37	*2.3*	222	*11.5*
Total	2789	*100.0*	4207	*100.0*	1662	*100.0*	1929	*100.0*
Lower Income								
1. Farm Income	133	*12.2*	226	*14.5*	78	*10.9*	27	*4.2*
2. Home Consumption[a]	336	*30.9*	827	*53.2*	97	*13.5*	110	*17.0*
3. Wages and Salaries	208	*19.1*	237	*15.2*	232	*32.2*	197	*30.4*
4. Commerce	62	*5.7*	161	*10.4*	25	*3.4*	55	*8.4*
5. Decapitalization	97	*8.9*	21	*1.4*	16	*2.3*	29	*4.5*
6. Credit	52	*4.8*	28	*1.8*	20	*2.7*	101	*15.7*
7. Aid and Transfers	167	*15.3*	53	*3.4*	210	*29.1*	116	*18.0*
8. Other	32	*2.9*	2	*0.1*	42	*5.9*	11	*1.8*
Total	1087	*100.0*	1554	*100.0*	720	*100.0*	647	*100.0*

[a]Imputed value of cereals produced or gathered by the household and consumed by the household.
CESA-MSU Food Security Project Surveys, 1988/89

seasonal On-River incomes plummet by more than 50 percent in each income tercile between the harvest/post-harvest and hot dry seasons while Off-River incomes dip only slightly.

As expected, farm income and home consumption contribute strongly to On-River income during the harvest/post-harvest season, accounting for no less than two-thirds of income in all terciles and reaching 91.9 percent for upper income households. Like results in the North, farm income and home consumption contribute about half of all income for the middle and low income terciles Off-River during the same season. Table 4.11 shows that the value of home consumption of cereals exceeds the sales value of home production of cereals everywhere except during the harvest/post-harvest season for upper income On-River households, exactly paralleling the pattern observed between Northern and Southern households. Note the extraordinarily high contribution of home production and home consumption to total income for the On-River upper income tercile during the harvest/post-harvest season (a combined contribution of 90.8 percent of all income), compared to the counterpart contribution Off-River (a combined contribution of 12.2 percent, or less than one-seventh). Tables A4.2.6 and A.4.2.8 in Annex 4.2 indicate that combined farm income and home consumption income was more than twice as important for On-River households than Off-River households, averaging 56.4 percent and 24.9 percent per year, respectively.

As shown in Tables 4.9 and 4.10, wage and salary income contributes the largest portion of total income for Off-River households for all seasons and income terciles (except the lower income tercile during the harvest/post-harvest and rainy seasons). Together, wage and salary income contribute more than one-third of average annual income (Table A4.2.6 in Annex 4.2). Wage and salary income is singularly unimportant in percentage terms for the On-River upper income tercile but more significant elsewhere.

Table 4.11. Comparison of Sales of Cereals from Home Production and Gathering with Home Consumption of Cereals: Average Monthly Household Income per AE, by Terciles

(Percent of Total Income)

	Annual Average		Harvest/ Post-Harvest		Hot Dry Season		Rainy Season	
	CFA F	Pct	CFA F	Pct	CFA F	Pct	CFA F	Pct
Off-River Villages								
Upper Income								
1. Sales	54	*1.5*	164	*4.6*	.	.	7	*0.3*
2. Home Consumption	205	*5.9*	203	*5.6*	117	*3.3*	315	*11.5*
Middle Income								
1. Sales	52	*3.4*	75	*4.6*	46	*3.5*	36	*2.4*
2. Home Consumption	310	*20.0*	374	*23.2*	102	*7.7*	291	*19.3*
Lower Income								
1. Sales	20	*2.4*	70	*9.1*	2	*0.3*	.	.
2. Home Consumption	125	*14.9*	198	*25.5*	107	*14.8*	69	*9.4*
On-River Villages								
Upper Income								
1. Sales	1719	*29.3*	5208	*61.9*	627	*15.7*	643	*14.7*
2. Home Consumption	1305	*22.2*	2431	*28.9*	837	*21.0*	852	*19.5*
Middle Income								
1. Sales	489	*17.5*	1051	*25.0*	96	*5.8*	149	*7.7*
2. Home Consumption	735	*26.3*	1672	*39.7*	231	*13.9*	234	*12.1*
Lower Income								
1. Sales	82	*7.5*	188	*6.6*	45	*6.2*	6	*1.0*
2. Home Consumption	336	*30.9*	827	*24.4*	97	*13.5*	110	*17.0*

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Decapitalization represents a small part of household income in absolute and percentage terms for Off-River and On-River households. Credit income likewise constitutes a small part of household income but reaches 12.5 percent and 15.7 percent during the rainy season for lower income Off-River and On-River households, respectively.

The contribution to income from aid and transfers placed either first or second for On-River upper and lower income terciles during the hot dry and rainy seasons (and third for middle income households during the rainy season). Aid and transfers appear to be less important contributors to Off-River incomes. Table 4.12, however, shows that charity aid is higher than remittances for all Off-River terciles in each season, replicating the pattern found for the North. For On-River households, charity aid exceeds remittances twice for middle income terciles and during every season for poor households. It is now clear that the anomalous 40 percent contribution of aid and transfers to On-River upper income households during the hot dry season (Table 4.10) is mostly comprised of remittance income (Table 4.12). Charity aid is the second most important source of income overall for Off-River households and fairly stable across seasons (Table A4.2.6 in Annex 4.2) while remittances are the third most important source of income overall for On-River households, although skewed to the end of the year (Table A4.2.8 in Annex 4.2). But in no case looking at the Off-River and On-River stratification, as with the North-South stratification, is the receipt of charity aid alone enough to boost an average household to a higher income tercile.

When monthly income sources are averaged over the year, the four highest sources contribute about two-thirds of household income, 62.9 percent Off-River and 66.9 percent On-River (Tables A4.2.6 and A4.2.8 in Annex 4.2). Average annual income from non-crop, non-transfer sources is delineated even more sharply between Off-River households (68.0 percent) and On-River households (34.0 percent) than shown previously between North and South households (Tables A4.2.6 and A4.2.8 in Annex 4.2).

Table 4.12. Comparison of Charity Aid and Transfers with Remittances: Average Monthly Household Income per Adult-Equivalent, by Terciles

(Percent of Total Income)

	Annual Average		Harvest/ Post-Harvest		Hot Dry Season		Rainy Season	
	CFA F	Pct	CFA F	Pct	CFA F	Pct	CFA F	Pct
Off-River Villages								
Upper Income								
1. Charity Aid	569	*16.3*	668	*18.6*	493	*14.1*	487	*17.8*
2. Remittances	209	*6.0*	139	*3.9*	230	*6.6*	173	*6.3*
Middle Income								
1. Charity Aid	128	*8.3*	266	*16.5*	227	*17.3*	168	*11.1*
2. Remittances	50	*3.2*	28	*1.7*	70	*5.3*	50	*3.3*
Lower Income								
1. Charity Aid	160	*19.0*	148	*19.1*	138	*19.0*	140	*19.1*
2. Remittances	2	*0.3*	.	.	23	*3.1*	.	.
On-River Villages								
Upper Income								
1. Charity Aid	281	*4.8*	53	*0.6*	202	*5.1*	150	*3.4*
2. Remittances	875	*14.9*	233	*2.8*	1024	*25.7*	1390	*31.9*
Middle Income								
1. Charity Aid	172	*6.2*	141	*3.4*	186	*11.2*	244	*12.6*
2. Remittances	283	*10.1*	92	*2.2*	156	*9.4*	136	*7.1*
Lower Income								
1. Charity Aid	132	*12.2*	51	*3.3*	131	*18.2*	110	*17.0*
2. Remittances	34	*3.2*	2	*0.1*	79	*10.9*	7	*1.1*

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4.2.4. Summary of Main Points

The main points from this examination of household income patterns in the Northeast are summarized as follows:

- South and On-River households have distinctly higher nominal incomes than Off-River and North households.
- Household incomes are highest during the harvest/post-harvest season for all strata. Average incomes decline during the following two seasons for North and Off-River households, but recover somewhat for South and On-River households. Average monthly income fluctuates least for South households. Average monthly income is also most equally distributed among South households, although differences among strata are minor.
- Average household income is distributed most evenly during the season when income is lowest for North and Off-River households, when income is highest for On-River households and when income is recovering for South households.
- Farming and home consumption contribute more than twice as much income for South and On-River households than for North and Off-River households, peaking during the harvest/post-harvest season.
- North and Off-River households have more successfully diversified their incomes toward non-cropping and non-transfer sources with a low covariance with uncertain rainfall patterns, whereas South and On-River households are strongly dependent on cereal production and gathering.

4.3. Rural Household Expenditure Patterns

4.3.1. Overview

This section first examines weekly household expenditure patterns by strata and season with respect to total expenditures (including analysis of expenditures on all foods and cereals by expenditure tercile and analysis of the seasonal stability of cereals purchases). It then examines weekly household expenditures on individual cereals within all cereal purchases.

It is often argued that household expenditure surveys are better measures of current and long-term welfare than measures of current income because households are able to smooth consumption more than income[38] (Rogers and Lowdermilk, 1988a; Strauss and Thomas) and because expenditure data avoid measurement errors where values must be imputed for income received in kind and where people have incentives to distort their income levels (Poleman). Expenditure surveys have proved indispensable for calculating elasticity relationships.

4.3.2. The Questionnaire

The questionnaire on weekly household expenditures records the category and the item purchased within the category, a brief description of the item, total purchase value in CFA francs, objective of the purchase and mode of payment. Possible objectives included household consumption, resale, charity or donation to someone outside the household, reimbursement in kind, and "other" (to be specified). Modes of payment included cash, credit and barter. Other information on the unit of measure, number of units purchased and price per unit was recorded as a check on the total purchase value. Total expenditures,

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[38]Even poor households with few assets are usually able to smooth consumption through small amounts of seasonal saving and overspending (credit).

excluding items bought for resale, were next divided by the number of household adult-equivalents.

Figure 4.4 lists expenditure categories. The cereals category includes millet, sorghum, maize, maizemeal, paddy, local rice, "other rice," wild fonio, cram-cram, wheat and "other" cereals.[39] Although items within the other categories are too numerous to list, processed foods refer primarily to industrially prepared and packaged items (such as instant coffee, macaroni and concentrated milk), but also include locally prepared foods for retail. Housewares includes durables (such as mats and cooking utensils) and non-durables (such as soap and fuel wood). Live animals include those intended for consumption as well as those intended for agriculture (animal traction) and transport (people and goods). The miscellaneous category includes agricultural expenses (implements, seeds and fertilizers); school fees; medicine and health care; stimulants (tobacco, cigarettes and *kola* nuts); transport; and "other" expenses, including investments. Reimbursement of debts, cash gifts and gifts in kind are considered as expenditures as well, and are included within the miscellaneous category.

Enumerators based their questioning on the list of categories and items to ensure comprehensive enumeration of all expenditures. This list was repeated for any member of the household having made purchases during the week. The name of the purchaser was also noted on the questionnaire.

To facilitate accuracy and completeness of recall, the observation period was set at one week, ending on the weekly market day when the household was likely to have made

[39]"Other rice" includes all varieties of imported rice and Malian rice (BB, RM-25 and RM-40) not grown in the Gao Region.

Figure 4.4. Categories of Household Expenditure Data

1. Cereals
2. Legumes and Tubers
3. Meat, Poultry, Fish and Edible Animal Products
4. Vegetables
5. Fruit
6. Condiments and Spices
7. Processed Foods
8. Housewares
9. Clothing and Accessories
10. Live Animals
11. Miscellaneous

most of its purchases. In the absence of a weekly market in Almoustarat, Friday was designated as market day for purposes of the questionnaire.

Initially, weekly household expenditure data were collected twice per month based on the week terminating with the first and third market days of the month, respectively. After two months of data collection, it was decided that one weekly observation per month was sufficient. The week ending with the third market was retained in order to spread the workload of the enumerators more evenly within the month. Thus, results reported by season (or month) refer to discontinuous weekly observations within the season (or month).

Unlike the household income and consumption surveys which covered one full year (November 1988 - October 1989), the expenditure surveys covered one weekly observation per month over eleven months starting in December 1988. The harvest/post-harvest season for household expenditures, therefore, is based on the average of three possible observations per household, rather than four.

The rainy season also includes only three observations. Weekly observations during July 1989 have been dropped from all strata to remove the uneven and unavoidable influence across villages of household spending for Tabaski,[40] a major Moslem holiday of feasting lasting up to three days which is preceded by large-scale spending on consumer goods, especially new clothes and live animals for slaughter, often on credit.[41]

4.3.3. Analysis of Weekly Household Expenditures by Category

Section 4.3.3. looks at the pattern of weekly household expenditures by strata, seasons and terciles, excluding weekly observations for July 1989. To explore the functional relationship between household incomes and household expenditures (Chapter 3), expenditures are analyzed by *income* terciles.[42]

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[40]Weekly observations differ across villages because market days differ. Holiday spending for Tabaski, which fell on July 14, 1989, was picked up in Djebok and Bara, but not in Almoustarat, Temera and Tessit.

[41]Tabaski (*id al fitr*) commemorates Abraham's sacrifice of a ram in place of his son, Isaac. Households who can afford it slaughter a sheep for the holiday and often share the meat with poorer neighbors. This may represent the sole occasion during the year for some households to consume meat (personal interviews, July-August 1988).

[42]Annex 4.1 compares incomes and expenditures for household pairs by strata, seasons and income terciles. It was found that average adjusted monthly expenditures usually exceed average monthly incomes. After discussing several possible explanations, Annex 4.1. proposes how to handle this discrepancy for econometric modelling of cereals consumption in Chapter 5.

4.3.3.1. North/South Stratification of Households

Tables 4.13 and 4.14 present average weekly household expenditures per adult-equivalent for the North/South strata according to the categories listed in Figure 4.3. Average expenditures in the North fall sharply with each season for upper income households, whose rainy season expenditures are less than half of harvest/post-harvest expenditures. Even so, upper-income household expenditures in the rainy season remain several times greater than lower-income expenditures, which are very low in absolute terms (and the lowest of all four strata). One result of arranging expenditures according to income terciles is that lower income household expenditures in the harvest/post-harvest season exceed middle income expenditures (the only such reversal of all strata).

Tables A4.3.1 and A4.3.3 in Annex 4.3, reporting seasonal expenditure data not disaggregated into terciles, show that overall weekly total expenditures are distinctly more variable in the North than South (CV of 1.08 and CV of 0.69, respectively). Seasonal average weekly expenditures per AE were about 50 percent higher in the South than in the North.

Table A4.3.1 shows that total expenditures are more variable per AE at harvest/post-harvest and less variable during the rainy season in the North while Table A4.3.3 shows the inverse pattern for total expenditures in the South. One likely explanation is that in the lower rainfall North, access to own-produced (own-cultivated) cereals is unevenly spread among households during the harvest/post-harvest season, causing average cereal purchases per AE to be more variable as not all households rely on the market. Later in the year when almost no households hold own-produced (own-gathered) cereal stocks, almost all households buy their cereals from the market incrementally as a function of income, causing average cereal purchases per AE to be less variable. In the higher rainfall South, most households hold

Table 4.13. Average Weekly Household Expenditures and Budget Shares per AE: North Villages (Gao Region, Mali), by Income Tercile and by Season

	Annual Average (N = 44)		Harvest/ Post-Harvest (N = 41)		Hot Dry Season (N = 43)		Rainy Season (N = 40)	
	CFA F	Pct	CFA F	Pct	CFA F	Pct	CFA F	Pct
Upper Income								
1. Cereals	416	*42.7*	469	*43.7*	459	*45.5*	232	*57.7*
2. Legumes and Tubers	1	*0.1*	3	*0.3*	.	.	.	.
3. Meat, Poultry, Fish	86	*8.8*	84	*7.8*	116	*11.5*	16	*4.0*
4. Vegetables	13	*1.3*	13	*1.2*	20	*2.0*	7	*1.8*
5. Fruit	1	*0.1*	1	*0.1*	.	.	.	.
6. Condiments and Spices	135	*13.9*	139	*13.0*	151	*14.9*	65	*16.2*
7. Processed Foods	84	*8.6*	96	*9.0*	70	*7.0*	31	*7.8*
8. Housewares	63	*6.4*	45	*4.2*	56	*5.5*	27	*6.7*
9. Clothing	85	*8.7*	140	*13.0*	56	*5.6*	.	.
10. Live Animals	17	*1.7*	.	.	33	*3.2*	18	*4.5*
11. Miscellaneous	74	*7.6*	83	*7.7*	49	*4.9*	5	*1.3*
Total	975	*100.0*	1073	*100.0*	1010	*100.0*	402	*100.0*
Middle Income								
1. Cereals	213	*51.6*	153	*50.7*	182	*50.1*	171	*59.1*
2. Legumes and Tubers	0	*0.0*	0	*0.1*	0	*0.0*	.	.
3. Meat, Poultry, Fish	15	*3.5*	9	*3.1*	31	*8.5*	12	*4.0*
4. Vegetables	9	*2.2*	4	*1.3*	3	*1.0*	7	*2.5*
5. Fruit	0	*0.1*	1	*0.3*	0	*0.1*	.	.
6. Condiments and Spices	56	*13.7*	44	*14.5*	48	*13.3*	38	*13.3*
7. Processed Foods	34	*8.3*	18	*6.0*	32	*8.8*	28	*9.8*
8. Housewares	20	*4.8*	19	*6.4*	12	*3.4*	13	*4.4*
9. Clothing	31	*7.5*	28	*9.4*	35	*9.6*	.	.
10. Live Animals	.	.	.	.	.	.	.	.
11. Miscellaneous	34	*8.3*	25	*8.4*	19	*5.2*	20	*7.0*
Total	412	*100.0*	303	*100.0*	363	*100.0*	289	*100.0*
Lower Income								
1. Cereals	120	*49.8*	157	*36.0*	132	*56.2*	76	*59.4*
2. Legumes and Tubers	0	*0.1*	1	*0.1*	.	.	.	.
3. Meat, Poultry, Fish	23	*9.4*	40	*9.2*	10	*4.3*	1	*0.7*
4. Vegetables	5	*2.1*	20	*4.5*	3	*1.4*	1	*0.8*
5. Fruit	0	*0.1*	.	.	0	*0.1*	.	.
6. Condiments and Spices	36	*15.0*	77	*17.7*	29	*12.4*	16	*12.4*
7. Processed Foods	20	*8.1*	55	*12.6*	15	*6.4*	9	*7.1*
8. Housewares	8	*3.5*	27	*6.3*	2	*0.9*	2	*1.4*
9. Clothing	12	*4.8*	47	*10.9*	5	*2.1*	17	*13.0*
10. Live Animals	.	.	.	.	.	.	.	.
11. Miscellaneous	17	*7.2*	12	*2.6*	38	*16.1*	7	*5.2*
Total	241	*100.0*	436	*100.0*	234	*100.0*	128	*100.0*

Weekly observations for July 1989 have been excluded. CESA-MSU Food Security Project Surveys, 1988/89

Table 4.14. Average Weekly Household Expenditures and Budget Shares per AE: South Villages (Gao Region, Mali), by Income Tercile and by Season

	Annual Average (N = 51)		Harvest/ Post-Harvest (N = 45)		Hot Dry Season (N = 47)		Rainy Season (N = 48)	
	CFA F	Pct	CFA F	Pct	CFA F	Pct	CFA F	Pct
Upper Income								
1. Cereals	379	*31.4*	76	*9.3*	427	*30.6*	514	*50.6*
2. Legumes and Tubers	20	*1.6*	15	*1.8*	31	*2.2*	19	*1.8*
3. Meat, Poultry, Fish	263	*21.8*	225	*27.4*	271	*19.4*	152	*15.0*
4. Vegetables	49	*4.1*	52	*6.3*	36	*2.6*	37	*3.6*
5. Fruit	1	*0.1*	.	.	2	*0.1*	3	*0.3*
6. Condiments and Spices	164	*13.6*	156	*18.9*	157	*11.2*	116	*11.4*
7. Processed Foods	88	*7.3*	78	*9.5*	77	*5.5*	62	*6.1*
8. Housewares	77	*6.4*	73	*8.9*	109	*7.8*	55	*5.4*
9. Clothing	78	*6.5*	118	*14.4*	143	*10.2*	28	*2.7*
10. Live Animals	42	*3.5*	24	*2.9*	60	*4.3*	1	*0.1*
11. Miscellaneous	46	*3.8*	5	*0.6*	84	*6.0*	30	*2.9*
Total	1207	*100.0*	821	*100.0*	1396	*100.0*	1015	*100.0*
Middle Income								
1. Cereals	223	*31.3*	129	*18.2*	267	*31.3*	285	*43.0*
2. Legumes and Tubers	11	*1.6*	7	*1.0*	11	*1.3*	5	*0.7*
3. Meat, Poultry, Fish	72	*10.1*	107	*15.1*	116	*13.5*	78	*11.7*
4. Vegetables	14	*2.0*	24	*3.4*	20	*2.4*	16	*2.3*
5. Fruit	2	*0.3*	1	*0.2*	2	*0.2*	2	*0.3*
6. Condiments and Spices	112	*15.8*	123	*17.4*	117	*13.6*	120	*18.0*
7. Processed Foods	55	*7.8*	69	*9.7*	55	*6.5*	54	*8.1*
8. Housewares	51	*7.2*	47	*6.6*	57	*6.6*	36	*5.4*
9. Clothing	55	*7.7*	28	*4.0*	98	*11.5*	17	*2.6*
10. Live Animals	21	*2.9*	27	*3.8*	32	*3.9*	23	*3.5*
11. Miscellaneous	94	*13.3*	146	*20.6*	80	*9.4*	28	*4.2*
Total	711	*100.0*	708	*100.0*	856	*100.0*	663	*100.0*
Lower Income								
1. Cereals	182	*32.7*	193	*30.7*	264	*46.2*	202	*38.9*
2. Legumes and Tubers	4	*0.8*	11	*1.7*	5	*0.9*	2	*0.3*
3. Meat, Poultry, Fish	69	*12.4*	88	*14.0*	62	*10.8*	39	*7.5*
4. Vegetables	7	*1.3*	5	*0.8*	12	*2.2*	6	*1.2*
5. Fruit	3	*0.5*	1	*0.2*	3	*0.5*	6	*1.2*
6. Condiments and Spices	102	*18.4*	95	*15.0*	88	*15.5*	105	*20.2*
7. Processed Foods	54	*9.6*	47	*7.5*	54	*9.4*	48	*9.3*
8. Housewares	40	*7.2*	47	*7.5*	37	*6.4*	46	*8.9*
9. Clothing	41	*7.4*	81	*12.8*	25	*4.4*	31	*6.0*
10. Live Animals	5	*0.9*	.	.	.	.	10	*1.9*
11. Miscellaneous	49	*8.8*	61	*9.7*	22	*3.8*	25	*4.8*
Total	556	*100.0*	629	*100.0*	571	*100.0*	520	*100.0*

Weekly observations for July 1989 have been excluded. CESA-MSU Food Security Project Surveys, 1988/89

temporary cereal surpluses during the harvest/post-harvest season, which obviates the need to buy from the market, causing cereal purchases to be relatively less variable. As some households draw down their surpluses sooner than others, average cereals purchases become more variable.

In the North, purchase of cereals represents the largest budget share for all terciles and seasons, increasing in importance between the harvest/post-harvest season and the rainy season. Cereal expenditures in the rainy season account for more than half of all purchases, for all terciles. Table A4.3.2 in Annex 4.3 shows that average spending on cereals reaches 58.6 percent in the rainy season (and 45.2 percent overall). Expenditures on condiments and spices generally follow in distant second.

In the South, seasonality in household cereal expenditures offsets seasonality in cereals production and gathering. During the harvest/post-harvest season, cereals expenditures are a decreasing function of income terciles in both absolute and percentage terms. Upper-income spending on meat, poultry and fish or condiments and spices exceed spending on cereals during the harvest/post-harvest season as households mainly consume their own production or gathered cereals. Thereafter, cereal purchases take over as the largest budget item for all terciles. According to Table A4.3.4 in Annex 4.3, average cereal purchases rise much more rapidly from one season to the next in the South than in the North.

4.3.3.2. Off-River/On-River Stratification of Households

Tables 4.15 and 4.16 present average weekly household expenditures per AE for the Off-River/On-River strata. Table 4.15 indicates that cereals expenditures take the biggest part of the household budget in the Off-River stratum in all seasons and for all terciles, a pattern that also holds for On-River households for the last two seasons, as shown by Table 4.16. Condiments and spices and meat, poultry and fish alternate as the next most important expenditure categories. Spending patterns appear to vary randomly and do not exhibit noticeable seasonal declines or increases.

Tables in Annex 4.3 show that some average indicators are rather similar between the two strata. Off-River weekly expenditures averaged 668 CFA francs per AE while comparable On-River expenditures averaged 643 CFA francs. Rainy season expenditures on cereals accounted for about half of total household budget in both Off-River and On-River strata, 49.4 percent and 49.9 percent, respectively.

The strata differ, however, in that On-River cereal purchases jump dramatically each successive season as deficit producing households exhaust their consumption stocks and turn to the market as a supply source. Seasonal increases in Off-River cereal purchases are more moderate. Although average weekly expenditures are marginally less variable in the Off-River stratum than the On-River stratum (CV of 0.85 and CV of 0.88, respectively), the stability of seasonal expenditures goes in opposite directions. Off-River expenditures become progressively less variable over the year while On-River expenditures become increasingly variable as production-based exchange entitlements diminish for households at differing rates.

Table 4.15. Average Weekly Household Expenditures and Budget Shares per AE: Off-River Villages (Gao Region, Mali), by Income Tercile and by Season

	Annual Average (N = 67)		Harvest/ Post-Harvest (N = 59)		Hot Dry Season (N = 62)		Rainy Season (N = 62)	
	CFA F	Pct	CFA F	Pct	CFA F	Pct	CFA F	Pct
Upper Income								
1. Cereals	448	*43.0*	434	*43.9*	406	*33.0*	328	*54.0*
2. Legumes and Tubers	5	*0.5*	0	*0.0*	14	*1.2*	.	.
3. Meat, Poultry, Fish	114	*11.0*	92	*9.3*	143	*11.6*	44	*7.2*
4. Vegetables	17	*1.7*	17	*1.7*	24	*2.0*	6	*0.9*
5. Fruit	2	*0.2*	3	*0.3*	2	*0.1*	4	*0.7*
6. Condiments and Spices	148	*14.2*	146	*14.7*	173	*14.0*	118	*19.4*
7. Processed Foods	87	*8.4*	93	*9.4*	89	*7.2*	51	*8.3*
8. Housewares	49	*4.7*	31	*3.2*	76	*6.2*	17	*2.8*
9. Clothing	90	*8.6*	104	*10.5*	131	*10.6*	7	*1.2*
10. Live Animals	15	*1.4*	43	*4.3*	27	*2.2*	12	*1.9*
11. Miscellaneous	64	*6.2*	28	*2.8*	145	*11.8*	21	*3.5*
Total	1040	*100.0*	991	*100.0*	1230	*100.0*	607	*100.0*
Middle Income								
1. Cereals	193	*32.5*	220	*30.7*	247	*40.5*	201	*40.4*
2. Legumes and Tubers	3	*0.5*	7	*1.0*	0	*0.0*	.	.
3. Meat, Poultry, Fish	42	*7.1*	82	*11.4*	58	*9.5*	26	*5.2*
4. Vegetables	8	*1.4*	16	*2.2*	7	*1.2*	5	*1.0*
5. Fruit	3	*0.5*	0	*0.1*	3	*0.6*	4	*0.8*
6. Condiments and Spices	105	*17.7*	91	*12.7*	75	*12.4*	88	*17.7*
7. Processed Foods	60	*10.2*	64	*9.0*	50	*8.2*	47	*9.4*
8. Housewares	36	*6.1*	35	*4.9*	16	*2.6*	29	*5.8*
9. Clothing	67	*11.3*	102	*14.2*	106	*17.4*	21	*4.3*
10. Live Animals	23	*3.9*	33	*4.6*	.	.	39	*7.8*
11. Miscellaneous	52	*8.8*	66	*9.3*	45	*7.4*	38	*7.7*
Total	594	*100.0*	716	*100.0*	608	*100.0*	499	*100.0*
Lower Income								
1. Cereals	170	*45.5*	139	*38.8*	266	*47.8*	147	*56.7*
2. Legumes and Tubers	0	*0.0*	2	*0.4*	3	*0.6*	.	.
3. Meat, Poultry, Fish	41	*11.1*	40	*11.0*	41	*7.4*	18	*7.1*
4. Vegetables	8	*2.1*	6	*1.5*	10	*1.7*	5	*1.8*
5. Fruit	1	*0.3*	1	*0.2*	3	*0.5*	1	*0.6*
6. Condiments and Spices	52	*13.9*	66	*18.4*	70	*12.6*	40	*15.5*
7. Processed Foods	30	*8.0*	33	*9.1*	46	*8.3*	23	*8.9*
8. Housewares	14	*3.7*	19	*5.3*	21	*3.7*	15	*5.7*
9. Clothing	23	*6.2*	13	*3.7*	54	*9.8*	2	*0.9*
10. Live Animals	7	*1.9*	.	.	.	.	.	.
11. Miscellaneous	26	*7.1*	42	*11.6*	42	*7.5*	8	*2.9*
Total	372	*100.0*	359	*100.0*	556	*100.0*	259	*100.0*

Weekly observations for July 1989 have been excluded. CESA-MSU Food Security Project Surveys, 1988/89

Table 4.16. Average Weekly Household Expenditures and Budget Shares per AE: On-River Villages (Gao Region, Mali), by Income Tercile and by Season

	Annual Average (N = 49)		Harvest/ Post-Harvest (N = 46)		Hot Dry Season (N = 47)		Rainy Season (N = 47)	
	CFA F	Pct	CFA F	Pct	CFA F	Pct	CFA F	Pct
Upper Income								
1. Cereals	366	*31.3*	76	*9.3*	233	*25.3*	487	*48.2*
2. Legumes and Tubers	21	*1.8*	15	*1.8*	18	*1.9*	21	*2.1*
3. Meat, Poultry, Fish	250	*21.4*	225	*27.4*	175	*19.0*	161	*15.9*
4. Vegetables	42	*3.6*	52	*6.3*	23	*2.5*	40	*4.0*
5. Fruit	0	*0.0*	.	.	.	.	2	*0.2*
6. Condiments and Spices	156	*13.3*	156	*18.9*	105	*11.4*	111	*11.0*
7. Processed Foods	89	*7.6*	78	*9.5*	54	*5.8*	66	*6.6*
8. Housewares	82	*7.0*	73	*8.9*	73	*7.9*	64	*6.3*
9. Clothing	79	*6.7*	119	*14.5*	109	*11.8*	28	*2.7*
10. Live Animals	38	*3.2*	24	*2.9*	58	*6.3*	3	*0.3*
11. Miscellaneous	47	*4.0*	5	*0.6*	73	*8.0*	28	*2.7*
Total	1170	*100.0*	822	*100.0*	921	*100.0*	1011	*100.0*
Middle Income								
1. Cereals	204	*36.0*	154	*23.6*	278	*44.6*	230	*51.8*
2. Legumes and Tubers	4	*0.8*	9	*1.3*	6	*0.9*	3	*0.6*
3. Meat, Poultry, Fish	55	*9.6*	72	*11.1*	73	*11.7*	48	*10.7*
4. Vegetables	16	*2.9*	19	*3.0*	19	*3.0*	16	*3.6*
5. Fruit	0	*0.1*	1	*0.2*	0	*0.0*	.	.
6. Condiments and Spices	68	*12.0*	82	*12.6*	75	*12.0*	56	*12.6*
7. Processed Foods	34	*6.1*	39	*6.0*	42	*6.7*	31	*7.0*
8. Housewares	36	*6.4*	52	*8.0*	36	*5.8*	25	*5.7*
9. Clothing	34	*6.0*	49	*7.5*	35	*5.6*	8	*1.9*
10. Live Animals	24	*4.2*	15	*2.3*	30	*4.8*	22	*4.9*
11. Miscellaneous	90	*16.0*	158	*24.3*	30	*4.8*	5	*1.1*
Total	565	*100.0*	650	*100.0*	623	*100.0*	444	*100.0*
Lower Income								
1. Cereals	84	*48.3*	92	*41.8*	82	*52.5*	90	*55.2*
2. Legumes and Tubers	1	*0.6*	1	*0.3*	0	*0.3*	1	*0.9*
3. Meat, Poultry, Fish	9	*5.3*	7	*3.4*	9	*5.6*	5	*2.9*
4. Vegetables	4	*2.4*	3	*1.4*	4	*2.6*	3	*1.6*
5. Fruit	0	*0.3*	1	*0.3*	0	*0.3*	1	*0.3*
6. Condiments and Spices	32	*18.3*	43	*19.7*	26	*16.7*	22	*13.8*
7. Processed Foods	20	*11.2*	24	*10.9*	15	*9.3*	13	*8.3*
8. Housewares	9	*5.3*	14	*6.4*	5	*3.1*	7	*4.5*
9. Clothing	9	*5.0*	16	*7.5*	9	*5.9*	14	*8.9*
10. Live Animals	.	.	.	.	.	.	.	.
11. Miscellaneous	6	*3.2*	19	*8.4*	6	*3.8*	6	*3.7*
Total	174	*100.0*	221	*100.0*	157	*100.0*	162	*100.0*

Weekly observations for July 1989 have been excluded. CESA-MSU Food Security Project Surveys, 1988/89

4.3.3.3. Expenditures on Cereals within Total Expenditures

One means to evaluate the linkage between income and consumption is to examine food expenditures as a proportion of total expenditures (where expenditures are a proxy for income), the relationship known as Engel's Law. Engel observed that the smaller the household income, the higher will be the proportion of income spent on food. This percentage will decline as household incomes rise (because human capacity to ingest food is ultimately limited), although absolute food expenditures may rise as the household improves the quality of its diet. A "reasonable rule of thumb" is that about two-thirds of disposable income will be spent on food in the poorer developing countries (Poleman).

Table 4.17 compares food expenditures and cereals expenditures for the rural household sample in the Northeast as a percentage of total expenditures by season, strata and tercile (based on expenditure levels by income tercile seen in Tables 4.13-4.16). Each set of three points traces out a simple Engel curve.

Table 4.17 reveals several critical points. The first is that the "two-thirds rule" for appears to represent the lower bound for total food expenditures looking at the annual average and first two seasons (with one distinct exception in the On-River stratum) before climbing to 75-90 percent in the rainy season. Total food expenditures never fall below 75 percent for any income class in the North stratum.

The second point is that percentage figures for food expenditures (and cereal expenditures) often "behave" poorly with respect to a continuous and unambiguous decline as expenditure classes rise. While the cereal shares of the household budget in the North during the rainy season exemplify the expected pattern, South households in the same season violate the expected pattern as the proportion spent on food and cereals consistently *increases* with expenditures.

Table 4.17. Food Expenditures and Cereal Expenditures per Adult-Equivalent as Percent of Total Expenditures, by Income Tercile and by Season (Gao Region, Mali)

	Annual Average		Harvest/Post-Harvest		Hot Dry Season		Rainy Season	
	Percent All Food	Percent Cereals	Percent All Food	Percent Cereals	Percent All Food	Percent Cereals	Percent All Food	Percent Cereals
North								
Upper Income	75.4	42.7	75.1	43.7	80.8	45.5	87.5	57.7
Middle Income	79.4	51.6	75.9	50.7	76.6	50.1	88.7	59.1
Lower Income	84.5	49.8	80.2	36.0	81.0	56.2	80.4	59.4
South								
Upper Income	79.9	31.4	73.2	9.3	71.6	30.6	88.0	50.6
Middle Income	68.8	31.3	65.0	18.2	68.8	31.3	84.3	43.0
Lower Income	75.6	32.4	69.9	30.7	85.5	46.2	78.5	38.9
Off-River								
Upper Income	79.0	43.0	79.2	43.9	69.2	33.0	90.7	54.0
Middle Income	69.9	32.5	67.1	30.7	72.5	40.5	74.5	40.4
Lower Income	81.2	45.5	79.4	38.8	78.9	47.8	90.5	56.7
On-River								
Upper Income	79.1	31.3	73.1	9.3	66.0	25.3	87.9	48.2
Middle Income	67.0	36.0	57.7	23.6	79.0	44.6	86.4	51.8
Lower Income	86.4	48.3	77.7	41.8	87.2	52.5	83.0	55.2

Weekly observations for July 1989 have been excluded. CESA-MSU Food Security Project Surveys, 1988/89

Next, some expenditure shares *go up* between lower and middle terciles before they go down between middle and upper terciles. Or they may not go down at all. While measurement errors or random statistical aberrations cannot be discounted here, Poleman notes that Engel's Law fails to manifest itself clearly in developing countries, one principal reason being that per capita food expenditures can be very responsive to increases in income, especially among poor households. In fact, Poleman hypothesizes that destitute households near starvation will use an increase in income to increase food intake and that the "full Engelian relationship" should be depicted as a kinked curve, first rising and then falling more gradually (Poleman, p. 28).[43] This suggests that a fair number of sample households in the Northeast perceive themselves to be undernourished.

Among others, Rao also observes that expenditures are highly income elastic for abjectly poor households. Rao uses the proportion of income spent on food to measure the incidence of poverty and the incidence of deprivation. Since the relationship between consumption/nutritional status and poverty is well established empirically, Rao defines households spending below the point of inflection on the Engel curve as "deprived," unable to satisfy basic food needs. Once households reach this critical level, food expenditures no longer make the most urgent claim on income. Rao proposes that average expenditures at the kink in the Engel curve be used to develop a poverty line. On this basis, looking at the kink in the percent spent on all food for the North stratum in the rainy season (Table 4.17), for instance, the poverty line would lie between total expenditures of 289 CFA francs per AE per

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[43]Strauss and Thomas recently found a different sort of kink in the Engel curve. Based on an extraordinarily large data set from Brazil, they demonstrate that the calorie-expenditure curve is positively sloped below 2500 daily calories per capita (corresponding with the lower three expenditure quartiles), but kinks somewhere between 2500 and 3000 calories, beyond which there is no slope (corresponding with the upper quartile).

week (middle tercile, Table 4.13) and 402 CFA francs per AE per week (upper tercile, Table 4.13) — perhaps around 350 CFAF.

Finally, expenditure data for the Northeast in 1988/89 indicate that households generally spent an equal or higher proportion of their budgets on all food and on cereals than households elsewhere in the Sahel, although observation periods differ, weakening comparisons. Furthermore, only urban data are available for comparison. The DNSI/Tufts University Urban Food Price and Consumption Study[44] shows that during the hot dry season of 1986 (the third round of data collection), average households in Gao-City and Tombouctou spent 77 and 78 percent of their budgets on food, respectively (Rogers and Lowdermilk, 1987, *Tableau VIII*), figures close to the percent spent by middle tercile rural households in the Northeast households during the hot dry season 1989 (Table 4.17; see also Tables A4.3.2, A4.3.4, A4.3.6 and A4.3.8 in Annex 4.3). An IFPRI budget-consumption study shows that households in Ouagadougou, Burkina Faso, spent 50-59 percent of disposable income on all foods from October 1984 to September 1985 (Reardon, Delgado and Thombiano, Table 3), compared to 67-86 percent annually for the Northeast during 1988/89 (Table 4.17; see also Annex 4.3).

The DNSI/Tufts study found that during the hot dry season 1986, average households in Gao-City and Tombouctou spent 21 and 39 percent of their budgets on cereals, respectively, compared to a range between 31.3 percent and 50.1 percent for middle tercile rural households in the Northeast households during the hot dry season 1989 (Table 4.17; see also Annex 4.3). The IFPRI study in Ouagadougou found that cereals expenditures ranged

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[44]The DNSI/Tufts University Study was based on three rounds of household budget surveys in all the regional capitals in Mali and in Bamako from May 1985 to May 1986. These initial surveys by DNSI only collected expenditure and price data. A Tufts University team repeated these rounds during the appropriate season in 1987 to retroactively impute quantity data to the original price data.

from 15.8 to 38.4 percent during 1984/85, depending on the expenditure tercile, compared to 31.3 to 51.6 percent of households in the Northeast during 1988/89, depending on the stratum and tercile.

4.3.4. Expenditures by Cereal

Section 4.3.4. examines weekly household expenditures on cereals by strata and seasons by the same expenditure terciles in Section 4.3.3. Some cereals are disaggregated according to the form in which they were bought or source of origin. They include millet, sorghum, maize, maize grits, paddy, local rice, "other rice," wheat, wild fonio and cram-cram. Again, weekly observations for July 1989 have been excluded.

4.3.4.1. North/South Stratification of Households

Tables 4.18 and 4.19 consider weekly cereal expenditures of households in the North and South strata. Annual averages of weekly cereal purchases are roughly similar between the upper and middle income terciles North and South, although the annual average for the lower income tercile in the South is half again as large as that in the North. Average cereals purchases by South households, all terciles, exceed average cereals purchases by counterpart North households in the rainy season. Otherwise, the picture is mixed. Cereals purchases in the North are unmistakenly more stable in the North than the South during the harvest/post-harvest season (average CVs of 1.05 and 1.48, respectively), but similar over the year (average annual CVs of 0.93 and 0.95, respectively; Tables A4.3.9. and A4.3.11. in Annex 4.3).

Table 4.18. Average Weekly Household Cereal Expenditures per Adult-Equivalent: North Villages (Gao Region, Mali), by Income Tercile and by Season

	Annual Average (N = 44)		Harvest/ Post-Harvest (N = 41)		Hot Dry Season (N = 43)		Rainy Season (N = 40)	
	CFA F	Pct	CFA F	Pct	CFA F	Pct	CFA F	Pct
Upper Income								
1. Millet	231	55.4	223	47.6	255	55.6	202	87.1
2. Sorghum	0	0.1	.	.	.	.	1	0.5
3. Maize	4	1.0	.	.	5	1.2	.	.
4. Maize Meal	8	2.0	4	0.9	24	5.2	1	0.5
5. Paddy	66	15.9	73	15.5	93	20.3	28	11.9
6. Local Rice	30	7.3	12	2.6	32	7.1	.	.
7. Other Rice	66	15.9	111	23.7	44	9.6	.	.
8. Wheat	.	.	.	.	.	.	.	.
9. Wild Fonio	6	1.5	22	4.6	4	0.8	.	.
10. Cram-cram	4	0.9	24	5.0	1	0.1	.	.
Total	416	100.0	469	100.0	459	100.0	232	100.0
Middle Income								
1. Millet	137	64.4	80	52.0	124	68.0	147	86.2
2. Sorghum	.	.	.	.	.	.	.	.
3. Maize	8	3.9	3	2.3	4	2.3	.	.
4. Maize Meal	12	5.5	5	3.6	9	5.2	6	3.3
5. Paddy	27	12.8	41	26.5	23	12.6	.	.
6. Local Rice	12	5.5	9	5.9	10	5.4	7	3.8
7. Other Rice	.	.	.	.	.	.	.	.
8. Wheat	1	0.2	2	1.1	.	.	.	.
9. Wild Fonio	7	3.1	4	2.6	.	.	11	6.7
10. Cram-cram	10	4.6	9	6.0	12	6.6	.	.
Total	213	100.0	153	100.0	182	100.0	171	100.0
Lower Income								
1. Millet	85	71.2	91	58.0	93	70.7	48	63.8
2. Sorghum	.	.	.	.	.	.	.	.
3. Maize	5	4.3	5	3.5	15	11.5	9	11.4
4. Maize Meal	4	3.6	.	.	13	9.6	5	6.7
5. Paddy	4	3.2	7	4.5	9	6.5	.	.
6. Local Rice	6	4.6	14	8.7	1	0.4	6	8.0
7. Other Rice	0	0.2	1	0.6	.	.	.	.
8. Wheat	.	.	.	.	.	.	.	.
9. Wild Fonio	8	6.3	15	9.6	.	.	8	10.2
10. Cram-cram	8	6.6	24	15.1	2	1.3	.	.
Total	120	100.0	157	100.0	132	100.0	76	100.0

Weekly observations for July 1989 have been excluded. CESA-MSU Food Security Project Surveys, 1988/89

Table 4.19. Average Weekly Household Cereal Expenditures per Adult-Equivalent: South Villages (Gao Region, Mali), by Income Tercile and by Season

	Annual Average (N = 51)		Harvest/ Post-Harvest (N = 45)		Hot Dry Season (N = 47)		Rainy Season (N = 48)	
	CFA F	Pct	CFA F	Pct	CFA F	Pct	CFA F	Pct
Upper Income								
1. Millet	97	*25.7*	8	*10.4*	142	*33.3*	150	*29.2*
2. Sorghum	99	*26.0*	11	*14.3*	176	*41.2*	210	*40.9*
3. Maize	.	.	.	.	.	.	.	.
4. Maize Meal	.	.	.	.	.	.	.	.
5. Paddy	68	*17.9*	33	*42.6*	47	*11.0*	11	*2.2*
6. Local Rice	102	*27.0*	25	*32.7*	55	*12.8*	98	*19.1*
7. Other Rice	.	.	.	.	.	.	.	.
8. Wheat	.	.	.	.	.	.	.	.
9. Wild Fonio	13	*3.5*	.	.	7	*1.6*	44	*8.6*
10. Cram-cram	0	*0.0*	.	.	.	.	.	.
Total	379	*100.0*	76	*100.0*	427	*100.0*	514	*100.0*
Middle Income								
1. Millet	83	*37.1*	45	*35.0*	58	*21.8*	105	*36.8*
2. Sorghum	53	*23.9*	5	*3.6*	95	*35.4*	94	*33.0*
3. Maize	.	.	2	*1.7*	.	.	.	.
4. Maize Meal	.	.	.	.	.	.	.	.
5. Paddy	25	*11.2*	17	*13.4*	45	*16.8*	33	*11.4*
6. Local Rice	47	*20.9*	49	*37.7*	67	*25.0*	29	*10.3*
7. Other Rice	.	.	.	.	.	.	.	.
8. Wheat	.	.	.	.	.	.	.	.
9. Wild Fonio	14	*6.5*	11	*8.6*	1	*0.3*	24	*8.4*
10. Cram-cram	1	*0.3*	.	.	2	*0.8*	.	.
Total	223	*100.0*	129	*100.0*	267	*100.0*	285	*100.0*
Lower Income								
1. Millet	61	*33.7*	33	*17.2*	125	*47.2*	80	*39.6*
2. Sorghum	26	*14.3*	24	*12.4*	32	*12.2*	23	*11.6*
3. Maize	1	*0.7*	.	.	2	*0.7*	.	.
4. Maize Meal	.	.	.	.	.	.	.	.
5. Paddy	1	*0.8*	.	.	11	*4.3*	20	*9.8*
6. Local Rice	63	*34.7*	93	*48.0*	59	*22.4*	55	*27.0*
7. Other Rice	.	.	.	.	.	.	.	.
8. Wheat	.	.	.	.	.	.	.	.
9. Wild Fonio	29	*15.7*	43	*22.4*	35	*13.1*	24	*12.0*
10. Cram-cram	0	*0.1*	.	.	0	*0.1*	.	.
Total	182	*100.0*	193	*100.0*	264	*100.0*	202	*100.0*

Weekly observations for July 1989 have been excluded. CESA-MSU Food Security Project Surveys, 1988/89

Millet is clearly the cereal of choice in the North, surpassing purchases of all other cereals in each tercile and season. Looking at annual averages, millet takes well over half of the weekly household cereals budget per AE, reaching 71.2 percent in the lower income tercile (and 59.2 percent of average annual cereal expenditures, according to Table A4.3.10). Thus, expenditures in the North are strongly skewed toward a cereal produced outside the Gao Region. No such single cereal dominates in the South. Cereal expenditures favor paddy or local rice in all terciles during the harvest/post-harvest season[45] and are then disbursed among either millet or sorghum. Table A4.3.12 shows that average annual purchases of millet and local rice in the South are about the same (rice purchases exceed millet if the milled equivalent of paddy were added to local rice). Sorghum purchases take a respectable third place.

Maize and maize meal are two other cereals produced outside the region which found their way onto the market, mainly in the North. Both trace their origins to the distribution of food aid in mid-1988 (Annex 3.1).[46] Purchases of wheat, which may have been produced in the Tombouctou Region, were recorded only by middle tercile North households during the harvest/post-harvest season.[47]

As a final note, wild cereals gathered from common property resources were bought by households in both strata and, with one exception, in all income terciles and seasons.

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[45]Retail sales of local rice provide a source of income for the women who transform paddy by hand. The relatively high ratios of local rice purchases to paddy purchases by all terciles in the harvest/post-harvest season in the South was not expected, suggesting a strong consumer preference for convenience of form.

[46]Most maize meal was purchased in Temera (North and On-River strata), from several trader-transporters from Bamba, 55 km to the west, who milled food aid maize mechanically.

[47]However, no wheat was recorded by the household cereal consumption surveys (Chapter 5).

Taken together, purchases of wild fonio and cram-cram represented one-fourth of all cereal purchases during the harvest/post-harvest season by North lower income households. Even in the higher rainfall South, lower income households spent nearly one-fourth of their cereal budget on wild cereals during the harvest/post-harvest period and more than 10 percent in the following seasons.

4.3.4.2. Off-River/On-River Stratification of Households

Tables 4.20 and 4.21 turn to cereals expenditures by the Off-River and On-River strata. Cereal purchases by Off-River households, all terciles, exceed cereal purchases by cereal-producing On-River households in the harvest/post-harvest season. Cereals expenditures by lower income Off-River households are considerably greater in all seasons than those of lower income On-River households. On average, upper and lower income Off-River households spend more on cereals than their On-River counterparts, while middle income households in both strata spend nearly the same amount. Cereals purchases in the Off-River stratum are slightly stable than those in the On-River stratum (average annual CVs of 0.93 and 0.96, respectively; Tables A4.3.13. and A4.3.15. in Annex 4.3), paralleling the pattern observed between North and South strata where cereals purchases are slightly stable in the respective lower-production stratum.

Of all cereals, Off-River households purchase millet by far most often for all terciles and seasons, reflecting the dietary preference of these semi-sedentarized households (Chapter 5). Millet expenditures take more than half of the weekly household cereals budget per AE on average, amazingly consistent across terciles. Relatively little paddy is bought by Off-River households (none at all by lower income households), likely due to the low profitability of transporting an unmilled cereal to distant and poorly accessible Off-River markets.

Table 4.20. Average Weekly Household Cereal Expenditures per Adult-Equivalent: Off-River Villages (Gao Region, Mali), by Income Tercile and by Season

	Annual Average (N = 67)		Harvest/ Post-Harvest (N = 59)		Hot Dry Season (N = 62)		Rainy Season (N = 62)	
	CFA F	Pct	CFA F	Pct	CFA F	Pct	CFA F	Pct
Upper Income								
1. Millet	243	*54.4*	239	*55.1*	240	*59.1*	162	*49.5*
2. Sorghum	23	*5.2*	13	*3.1*	27	*6.5*	35	*10.8*
3. Maize	.	.	.	.	.	.	.	.
4. Maize Meal	.	.	.	.	.	.	.	.
5. Paddy	22	*4.9*	5	*1.2*	.	.	17	*5.0*
6. Local Rice	99	*22.0*	77	*17.6*	89	*21.9*	100	*30.4*
7. Other Rice	45	*10.1*	78	*17.9*	39	*9.7*	.	.
8. Wheat	.	.	.	.	.	.	.	.
9. Wild Fonio	15	*3.4*	22	*5.1*	11	*2.7*	14	*4.3*
10. Cram-cram	.	.	.	.	.	.	.	.
Total	448	*100.0*	434	*100.0*	406	*100.0*	328	*100.0*
Middle Income								
1. Millet	101	*52.4*	77	*34.9*	176	*71.6*	122	*60.8*
2. Sorghum	25	*12.7*	26	*12.0*	19	*7.7*	26	*12.7*
3. Maize	5	*2.7*	9	*4.3*	.	.	.	.
4. Maize Meal	.	.	.	.	.	.	.	.
5. Paddy	.	.	4	*1.9*	.	.	.	.
6. Local Rice	46	*23.8*	72	*32.6*	50	*20.4*	44	*21.9*
7. Other Rice	.	.	.	.	.	.	.	.
8. Wheat	.	.	.	.	.	.	.	.
9. Wild Fonio	16	*8.4*	29	*13.2*	1	*0.3*	9	*4.7*
10. Cram-cram	.	.	2	*1.0*	.	.	.	.
Total	193	*100.0*	220	*100.0*	247	*100.0*	201	*100.0*
Lower Income								
1. Millet	90	*52.9*	43	*31.1*	128	*48.1*	96	*65.7*
2. Sorghum	31	*18.3*	17	*12.2*	61	*23.0*	30	*20.3*
3. Maize	0	*0.3*	2	*1.2*	7	*2.7*	.	.
4. Maize Meal	.	.	.	.	.	.	.	.
5. Paddy	.	.	.	.	.	.	.	.
6. Local Rice	32	*18.8*	37	*26.4*	47	*17.7*	10	*6.8*
7. Other Rice	0	*0.1*	1	*0.5*	.	.	.	.
8. Wheat	.	.	.	.	.	.	.	.
9. Wild Fonio	13	*7.5*	28	*20.2*	22	*8.4*	10	*7.2*
10. Cram-cram	4	*2.2*	12	*8.3*	0	*0.1*	.	.
Total	170	*100.0*	139	*100.0*	266	*100.0*	147	*100.0*

Weekly observations for July 1989 have been excluded. CESA-MSU Food Security Project Surveys, 1988/89

Table 4.21. Average Weekly Household Cereal Expenditures per Adult-Equivalent: On-River Villages (Gao Region, Mali), by Income Tercile and by Season

	Annual Average (N = 49)		Harvest/ Post-Harvest (N = 46)		Hot Dry Season (N = 47)		Rainy Season (N = 47)	
	CFA F	Pct	CFA F	Pct	CFA F	Pct	CFA F	Pct
Upper Income								
1. Millet	95	*26.0*	8	*10.4*	104	*44.6*	151	*30.9*
2. Sorghum	100	*27.4*	11	*14.3*	28	*12.1*	195	*40.0*
3. Maize	4	*1.0*	.	.	5	*2.2*	.	.
4. Maize Meal	.	.	.	.	17	*7.5*	.	.
5. Paddy	71	*19.3*	33	*42.6*	65	*28.0*	31	*6.4*
6. Local Rice	85	*23.4*	25	*32.7*	12	*5.2*	75	*15.4*
7. Other Rice	.	.	.	.	.	.	.	.
8. Wheat	.	.	.	.	.	.	.	.
9. Wild Fonio	11	*2.9*	.	.	.	.	35	*7.2*
10. Cram-cram	0	*0.0*	.	.	1	*0.4*	.	.
Total	366	*100.0*	76	*100.0*	233	*100.0*	487	*100.0*
Middle Income								
1. Millet	49	*24.2*	21	*13.8*	67	*24.3*	69	*29.9*
2. Sorghum	32	*15.8*	0	*0.2*	74	*26.5*	75	*32.8*
3. Maize	2	*1.2*	2	*1.3*	2	*0.8*	.	.
4. Maize Meal	13	*6.4*	4	*2.4*	12	*4.4*	1	*0.4*
5. Paddy	73	*36.1*	81	*52.8*	81	*29.3*	50	*21.6*
6. Local Rice	20	*9.7*	25	*16.0*	33	*12.0*	20	*8.6*
7. Other Rice	.	.	.	.	.	.	.	.
8. Wheat	.	.	.	.	.	.	.	.
9. Wild Fonio	9	*4.6*	.	.	3	*1.1*	15	*6.7*
10. Cram-cram	4	*2.0*	21	*13.4*	5	*1.7*	.	.
Total	204	*100.0*	154	*100.0*	278	*100.0*	230	*100.0*
Lower Income								
1. Millet	30	*35.8*	13	*14.3*	30	*36.3*	42	*47.3*
2. Sorghum	4	*4.3*	.	.	2	*2.9*	4	*4.3*
3. Maize	7	*8.7*	8	*8.6*	8	*9.7*	8	*8.4*
4. Maize Meal	8	*9.5*	5	*5.5*	12	*14.8*	10	*10.7*
5. Paddy	11	*12.6*	30	*32.9*	15	*18.4*	6	*6.3*
6. Local Rice	10	*11.4*	17	*18.4*	1	*0.7*	5	*5.9*
7. Other Rice	.	.	.	.	.	.	.	.
8. Wheat	0	*0.5*	2	*1.7*	.	.	.	.
9. Wild Fonio	3	*4.1*	6	*6.3*	4	*5.1*	15	*17.2*
10. Cram-cram	11	*13.2*	11	*12.4*	10	*12.2*	.	.
Total	84	*100.0*	92.3	*100.0*	82	*100.0*	90	*100.0*

Weekly observations for July 1989 have been excluded. CESA-MSU Food Security Project Surveys, 1988/89

However, Off-River households purchase a fair amount of local rice — in fact, usually more in absolute and percentage terms than the On-River households which produce it (see also Annex 4.3). Off-River households also buy "other rice" from outside the Gao Region, whereas On-River households buy none whatsoever.

Paddy and local rice are most often purchased by On-River households, all terciles, during the harvest/post-harvest season, after which millet and sorghum are most often purchased. Unlike the Off-River case, no particular cereal dominates average expenditures across all On-River terciles, although paddy and local rice, taken together, account for more than one-third (40.5 percent) of all cereal purchases (and about one-third in paddy milled equivalent), according to Table A4.3.16.

Wild cereals were bought by households from all terciles in both strata and in each season,[48] with most purchases made following the rainy season 1988. Curiously, middle and lower income On-River households spent about 13-19 percent of their cereal budget on wild cereals during the harvest/post-harvest season, when many of these same households were temporarily in production surplus — possibly to save their own production for later consumption, possibly to economize on a lower-cost cereals, or possibly for more variety in the diet.

[48]Except the upper income On-River tercile during the harvest/post-harvest season.

4.3.5. Summary of Main Points

The major points and conclusions from this analysis of household expenditures are summarized as follows:

- Household expenditures are considerably more variable across seasons in the North than South; variability of demand is fairly similar between the On-River and Off-River strata (Annex 4.3).
- Cereals take the largest share of *annual* average weekly household budgets for all strata and terciles. Cereals take the largest *seasonal* share of the weekly household budget in the North and Off-River strata across all seasons and terciles. Cereal purchases take the largest budget share in the South and On-River strata, all seasons and all terciles, only after the harvest/post-harvest season.
- Cereal purchases per AE are decreasingly variable over the seasons in the North and Off-River strata. A likely explanation is that on average, households begin the year in a semi-deficit state, resulting in variable reliance on the market (higher variability of cereal purchases), and end the year in a completely deficit state, resulting in nearly universal reliance on the market for cereals (lower variability).
- In contrast, cereal purchases are increasingly variable in the South and On-River strata. Average households begin the year with a temporary cereal surplus, resulting in little reliance on the market (lower variability), and end the year in a semi-deficit state, resulting in variable reliance on the market (higher variability).

- On annual average, total food expenditures claim about 75 percent of the weekly household budget and cereal expenditures take about 40 percent, on the high side of expected figures for developing countries. Occasionally increasing food/cereal expenditure shares from lower to upper terciles suggests both a high income elasticity of demand and signs of deprivation.
- Cereal purchases are least variable in the North and in Off-River strata. Cereal purchases are somewhat more variable in the South and On-River strata where access to own-produced (own gathered) cereals is greatest.
- Dependence on the market for cereal supplies is more acute for North and Off-River households, which buy a higher portion of cereals originating outside the Northeast than Southern and On-River households, which may be "less deficit" in home production and gathering of cereals.
- Purchases of wild cereals from the commons constitute a non-negligible expenditure for household of all terciles and strata.

Chapter Five. Rural Household Cereals Consumption and Demand Patterns

Section 5.1 presents a general overview of cereals consumption in the Northeast. Section 5.2 discusses methodological and measurement considerations. Household consumption is analyzed by cereal in Section 5.3 and by source of supply in Section 5.4. Section 5.5 investigates the issue of post-harvest forced sales as well as the numbers of consumption-secure households in the sample. Section 5.6 models determinants of household food security.

5.1. Overview of Cereals Consumption in the Northeast

5.1.1. General Observations

Twenty years ago, it used to be thought that cereals consumption in the Northeast fell substantially below that elsewhere in Mali, partly as a result of low cereals production and partly due to the influence of predominantly milk-based diets among the nomadic population. While average annual per capita cereals consumption was estimated at 212 kg in the primary cereals producing region of southern Mali, cereals consumption in the Northeast was put at only 76 kg (*Direction générale du plan*, 1974). The structure of cereals demand has undoubtedly changed in the intervening years. Large numbers of former nomads have become sedentarized part-time agriculturalists, while the new highway linking Mopti with Gao has been credited with increasing millet consumption by lowering the delivered price of millet

Table 5.1. Average Annual Per Capita Cereals Consumption in Kilograms

	Millet	Sorghum	Maize	Rice	Fonio	Wheat	Total
Kayes	27.2	91.0	53.7	18.9	5.2	0.5	196.5
Koulikoro	74.4	102.6	40.4	21.6	3.8	3.4	253.3
Sikasso	93.6	58.7	71.5	17.2	7.8	0.5	249.3
Ségou	117.1	31.5	36.8	47.7	4.1	0.5	237.8
Mopti	124.4	35.4	20.5	72.6	5.4	0.6	258.9
Tombouctou	71.3	43.2	21.3	78.0	25.5	15.2	254.4
Gao	59.8	44.2	17.3	81.5	3.1	7.1	212.9
Bamako	24.2	40.3	13.2	64.5	1.3	1.0	144.4
Average	64.8	55.4	35.4	50.1	4.4	2.4	212.4

Ministère du Plan/DNSI/PADEM, Enquête Budget-consommation du Mali 1988-89, 1991b, pp. 23-24, 31-37.

supplies from south (Samaké and Touya). All indicators seem to point to an increasing trend in cereals consumption in the Northeast.

The most recent evidence comes from the first nation-wide budget and consumption survey of 3,400 households undertaken in 1988/89 (fortuitously coinciding with the CESA-MSU survey year), whose results are reproduced in Table 5.1. Average consumption in the Gao Region approximately equals the national average while that for the Tombouctou Region lies about 20 percent higher. The fact that the Northeast is the only part of the country where more rice is typically grown than millet-sorghum (USAID, 1984; OSCE, 1989) is reflected in the high per capita consumption figures for rice for Tombouctou and Gao, even higher than urban rice consumption in Bamako. If these survey results are accurate, they suggest that taken together, consumption of millet and sorghum is lowest in the Northeast, although it considerably exceeds that of Bamako.

It is not clear whether the national survey captured the consumption of wild cereals. Unless wild fonio, for example, is subsumed under cultivated fonio, the national survey may understate total cereals consumption, especially for the Northeast.

5.1.2. Rural Sedentary Diets

Agriculturalists in the Northeast consume a varied diet based on millet, sorghum, fonio and/or rice. Legumes such as cowpeas (*niébé*), bambara groundnuts (*vouandzou*) and peanuts are secondary foods which, like animal proteins (fresh or dried fish, milk, meat) constitute a small part of the diet (Brun).

For centuries, millet was considered the supreme cereal as a food or transformed as beer; it constituted an essential element of a number of social and economic rituals; it was the preferred gift for bestowing prestige on the giver; and it was the main item traded with the Tuareg for salt (Raynaut). Some forty years ago, the principal crop and traditional food staple among the Songhaï was still millet (Rouch).

Once pounded into a flour, millet is prepared in the form of fritters (*beignets*), thick or runny porridge, dough-balls (*boules*), sour milk cakes or couscous (Rouch). When consumed in couscous form, millet and other cereals are accompanied by various sauces based on the leaves of *fakouhoye*.

As indicated by survey data for the On-River stratum (Table 5.7), the promotion of rice cultivation appears to have already led to a change in consumption preferences from millet to rice. The local rice, *koroboro*, is much preferred over other rice.

5.1.3. Rural Non-Sedentary Diets

Traditional pastoralist diets are much less varied but amazingly consistent throughout the Northeast and Sahelian West Africa (Bernus, 1980). The two main components are milk and millet, often mixed together. When milk is available, meals are based on fresh or curdled milk (1-2 liters per day), millet or wheat in couscous form, dates, some cowpeas, beans or dried fruit. Millet is the preferred cereals of herders in the Northeast, even for those far from the producing zones (Bernus, 1980).[1] Meat is marginally important, offered to visitors and consumed on religious holidays or other rare occasions.[2]

The availability of milk during summer rainy season and beginning of the dry season, corresponding to the "hungry season" when cereals are more expensive, allows herders to limit their cereals consumption. Milk is a highly seasonal food, depending on the breeding cycle of female animals, which is regulated according to annual pasture conditions. With the exception of small quantities of cheese and clarified butter for household use, milk is not processed because it does not store well. As mentioned in Chapter 4, milk is rarely sold when it is most available because surpluses occur during the rainy-season northward migrations far from potential markets. As a result, herder families consume great quantities during this period (Swift, 1981).

The contribution of purchased cereals in the diet is therefore inversely related to the availability of milk. However, recourse to *wild* cereals brings an important source of nutritional balance to the milk-based diets of nomads during the rainy season (Bernus, 1980). More wild fonio may be consumed among nomads in years of good rainfall because fonio is

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[1]A Tuareg proverb cites the three elements of the good life: "Millet porridge with milk, a beautiful, light tunic and a handsome camel saddle for staying young" (reported in Bernus, 1980).

[2]Annual meat consumption averages only 12 kg per person among nomads (Brun).

preferably consumed with its complement, fresh milk, both of which are in greater availability during this time (Davies and Thiam, 1987b). When fonio and milk are unavailable, poorer households prefer millet which makes its own "cream" when water is added. Millet prepared this way requires no cooking and therefore economizes on fuel (Steffen and Koné).

Depending on the season, milk contributes between 25 and 75 percent of total food energy; where pastoralists practice no agriculture, the energy contribution of milk does not fall below 40 percent (Swift, 1981). Thus, survey data of the consumption patterns of herders vary seasonally and across different nomadic groups, depending on the size and composition of household herds and proximity to agricultural populations for trading.[3]

It bears repeating from Chapter 4 that the household sample contained recently sedentarized and semi-sedentarized pastoralist families, but no pure pastoralists as such. The description of traditional agriculturalist and pastoralists diets — and cultural preferences — is intended for comparison with contemporary consumption patterns.

5.2. The Questionnaire

The questionnaire to measure household cereals consumption was based on a five-part accounting approach in which monthly cereals disappearance, or apparent consumption, equals

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[3]Survey data attest to the variability of cereals within pastoralist diets. A 1981-82 survey of Tuareg diets in the inner Niger delta area found that the percentage of calories from cereals varied between 45 and 67 percent between two different camps (Hill, as reported in Sundberg, 1988). A 1983 survey of Tuareg diets in the Northeast found that 68 percent of caloric consumption derived from milk, 24 percent from cereals and 8 percent from meat (Sidibé, as reported in Sundberg, 1988).

Lindland estimates that in the District of Gourma-Rharous in the Tombouctou Region, a "rich" nomadic household consumes as much as 50 percent of its diet in milk from July through February and nearly all of its diet in cereals from March through June. Poor households, on the other hand, consume about 12 percent of their diet in milk from July through December in a good rainfall year, but none in a bad year (Lindland, p. 33).

initial cereal stocks plus additions to stocks minus drawdowns of stocks for non-household consumption[4] plus ending stocks, according to the equation:

Consumption = (Initial stocks + Additions) - (Drawdowns + Ending stocks).

Ending stocks were carried over as initial stocks for the following month. Total consumption was next divided among household members, converted to adult-equivalents. After the first month of data collection, enumerators were instructed to collect consumption data directly from the household, both as a check on the other four components and a means to avoid exclusive reliance on computer-generated consumption data as the residual value.

Figure 5.1 displays the categories of cereals consumption data collected. Maize includes maize meal. Other rice includes all varieties of imported rice and Malian rice (BB, RM25 and RM40) not grown in the Gao Region.

Figure 5.1. Categories of Household Cereals Consumption Data

By Cereal	By Source of Procurement
1. Millet	1. Home Production[5]
2. Sorghum	2. Gathering
3. Maize	3. Market Purchases
4. Paddy	4. Non-Market Barters
5. Local Rice	5. Aid and Transfers
6. Other Rice	6. Consumption of Seed Reserves
7. Wild Fonio	
8. Cram-cram	

[4]Primarily for sales and gifts.

[5]Home production, as a source of calories consumed from cereals, corresponds to home consumption in Chapter 4 (the imputed value of cereal calories consumed from own-cultivated or own-gathered cereals), and not to home production (a source of income from crop sales).

5.2.1. Linking Cereals Consumption to Food Security

The concept of food security depends ultimately on the nutritional status of the individual, particularly his health (Pinstrup-Andersen, 1989). While this dissertation stops short of assessing the health status of household members or measuring actual food intake, Annex 5.1 describes a procedure for establishing a threshold value of food security from cereals consumption which is applicable to each adult-equivalent member of the household.

In brief, Annex 5.1 notes that international nutrition standards may be summarized in terms of energy requirements, expressed as calories.[6] Thus, the adequacy of nutritional intake for a healthy person can be measured in terms of calories consumed (Reutlinger and Selowsky). Second, energy requirements are largely determined by energy expenditure as adjusted for age, weight, gender, level of physical activity, health and, for women of child-bearing ages, pregnancy and lactation (FAO/WHO/UNU). Third, the binding constraint to adequate nutrition is usually sufficient intake of calories, rather than protein (Sukhatme, in Strauss and Thomas). Even cereal-based diets high in calories typically provide sufficient protein and some of the other essential nutrients (Dos Santos and Damon; Watier). Lastly, in view of the large contribution of cereals to the diet in the Northeast, calories from cereals embody a good deal of information about the adequacy of nutritional intake.[7] While a diversity of food sources in the diet is required to ensure desirable nutritional balance, calories from cereals represent a robust proxy measure for the food security status of rural household members.

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[6]The term calories refers to kilocalories.

[7]Generally, in a diet where the protein-energy ratio is at least 10 percent (the percent of calories coming from protein as measured in grams), meeting calorie requirements will also meet protein requirements (Sundberg, 1988).

When international calorie requirements are applied to demographically weighted data for the Gao Region, given the stated assumptions, the average child needs to consume 1610 calories per day and the average adult needs 2650 calories per day, according to Annex 5.1. The calorie needs of a child are equivalent to 0.6075 times those of an adult. Children below age thirteen, therefore, represent 0.6075 adults, the coefficient used to convert children into adult-equivalents (AEs).

Annex 5.1 establishes a threshold of food security based on a contribution of cereal calories to total calories of 85 percent (or 2250 calories per day). As this percentage lies on the high side of historical data, the adequacy of cereals intake will also be measured at the 80 percent and 75 percent levels (2120 calories and 1990 calories, respectively) to determine the sensitivity of consumption data to the higher cutoff between "secure" and "insecure". To inject a note of caution, households whose adult-equivalent members consume at or above the minimum level of cereal calories will be labeled "consumption secure," rather than food secure (Reardon, *et al.*, 1988).

5.2.2. Intra-Household Distribution of Cereals

Evidence shows convincingly that poor and malnourished *households* are capable of managing their daily food consumption needs rationally by obtaining the most nutrition possible, while wasting little (Donaldson and Lewis). By aggregating the special requirements of infants, children, active adults, pregnant and nursing mothers and older people into a single, demographically weighted index of calorie requirements per adult-equivalent, this research attempts to determine the adequacy of cereals consumption for the average household member.

While recognizing that the dynamics of *intra-household* food distribution remain an issue for investigation (Chapter 3), "allocation" of cereals calories on the basis of adult-equivalents within the household assumes that households are able to make equitable, if not perfectly informed, decisions on distribution of cereals.

5.2.3. Conversion of Cereals into Kilocalories

Conversion of cereals into average daily consumption into calories requires up to three steps. As a first step, local units of measure were converted to kilograms (section 5.2.4).

The second step entailed converting cereals into calories as the unit of measure for household consumption, based on the conversion coefficients shown in Table 5.2.

Table 5.2. Calorie Conversion Table for Cereals (Kcal per 1000 grams edible portion)

	Kcal		Kcal
Millet, grain	3400	Wheat, grain	3320
Millet, flour	3350	Wheat, flour	3400
		Wheat pasta, dry	3690
Sorghum, grain	3420	Fonio, hulled	3490
Sorghum, flour	3350	Fonio, paddy	3320
Maize, grain, dried	3640	Cram-cram, paddy	3600
Maize, meal	3680	Cram-cram, cleaned	3700
Rice, hulled	3620		
Rice, paddy	3530		

Sundberg and Adams, based on HEW/FAO, Food Composition Table for Use in Africa, 1968; West *et al.*, "The Composition of Foods Commonly Eaten in East Africa," 1988. Caloric value of uncleaned cram-cram is estimated by the author.

For the final step, total household consumption was divided by the number of present adult-equivalents and days in the month.

Table 5.2 shows that cereals are similar in caloric value.[8] It also points out an additional rationale for choosing calories as the unit of measure: Caloric values are less sensitive to assumptions about milling rates than weight measures. There is only a slight difference in calories between milled and unmilled forms of cereals (compared to a larger difference between milled and unmilled forms in terms of weight).[9] Assigning caloric values directly to milled and unmilled cereals avoids the question of appropriate milling rate.

5.2.4. Dealing with Measurement Error

The cereals consumption data to be discussed in the following two sections are reasonable and credible. However, the *scope* for measurement error of consumption is probably the broadest of all three household questionnaires. Unlike the questionnaire on monthly income (where income earned was a memorable and usually discrete event) or the questionnaire on weekly expenditures (where the recall period was much shorter), the questionnaire on monthly cereals consumption involves a daily and continuous occurrence.

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[8]Despite differences in the composition of cereals consumed, the national average and the average for the Gao Region (Table 5.1) are equally similar in terms of calories. The national average is equivalent to 2034 cereals calories per day per capita (or 2333 calories per AE) while the Gao average is equivalent to 2044 calories per day per capita (or 2312 calories per AE).

[9]For example, based on a milling rate of 65 percent, 1.0 kg of paddy yields 0.65 kg of rice (or 1.54 kg of paddy is required to yield 1.0 kg of rice). Removal of the bran through milling thus reduces gross weight significantly. The caloric value of paddy does not reduce to 65 percent of that of rice, however, because the bran has relatively low caloric content. In this instance, the milled and unmilled calorie values are very similar (i.e., 3620 calories per kilogram of rice compared to 3530 calories per kilogram of paddy, a difference of 2.5 percent).

At the respondent level, errors may have arisen in the reporting of cereals consumed away from home or cereals consumed at home by non-household members. While the questionnaire made provision for both scenarios (by allowing reporting of cereals received and cereals given away), these provisions may not have been considered during the questionnaire interview. On the one hand, cereals consumed outside the home and cereals consumed by outsiders at home may have balanced each other. On the other hand, sharing of food is not symmetrical between households of unequal social status. For still other households, this issue may not even have arisen. Harts-Broekhuis and De Jong (1990a) report, for example, that poor households in the Gao Region that depend on gathering wild cereals usually do not share or give their cereals away.

Measures of household consumption security also depend a lot on the initial stock position at the beginning of the survey. Unless periodically updated by the respondent, an error in reporting or measurement would result in a consistent bias from month to month. One problem requiring the judgement of this researcher during post-survey data cleaning arose where farming households reported large additions to stocks during the harvest/post-harvest season, as high as several tons, but which were not carried over from month to month nor reported as sold or given away, and clearly not consumed. It was assumed that these large stocks were put into "long term storage". In several instances, this author attributed additions to stocks not carried over from the previous month (nor reported as sold or given away) to current consumption when that consumption was abnormally low.[10]

Measurement error may also have been compounded by the number of conversions of cereals into calories. Enumerators were equipped with hand-held Roman scales, accurate to

[10]Measurement error with household grain stocks is the main reason why stocks were not entered as a household assets regression variable for modelling cereals consumption in section 5.6.

the nearest 500 grams, and an empty sack (of known weight) for weighing and recording local measures. The enumerators in some instances were unable to use these scales if the household was unwilling to have its cereals weighed (a privacy the Project respected) or unwilling to open its granaries for inspection. In such cases, the enumerator recorded the declared volumes (and converted them into metric- denominated units as described below).

A considerable effort was made to convert local units of measure into reliable metric units. Using an initial cash allowance, enumerators bought cereal samples of all local measures in the context of rural market surveys (Chapter 7). These measures were weighed during the monthly site visits by the researcher or his supervisor using a battery-powered digital scale accurate to the nearest gram. These metric weights (or averages of weights where the size of the local unit varied) were established as standard conversion coefficients for both household and marketplace local measures. The enumerators purchased new samples every time they observed a change in the size of the unit, the manner in which the unit was filled (level or with a "cone") or use of the unit for a cereal for the first time (or in a different form, milled and unmilled). Enumerators were instructed to use the most recent conversion coefficient when filling out their questionnaires. These coefficients were verified during data cleaning.

As expected, the volumes held by "natural" units, such as gourd bowls (*calebasses*), varied widely; average conversion coefficients for these measures may have a relatively larger variance. Fortunately, with the exception of paddy, most cereals traded in the market were measured in a standard-sized tin can (*pot Lahda*), formerly containing powdered milk from Algeria. For cereal units not traded in the market but used at home, such as sheaves (*gerbes*) of millet and sorghum, average weights were established from representative samples, these same samples pounded using local mortars, and then the cereal weighed again to get its milled equivalent. Samples of wild fonio were similarly weighed in unmilled and then milled form to obtain an average milling ratio and average metric weight.[11]

5.3. Analysis of Seasonal Consumption of Cereals by Type of Cereal

This section presents stratified household consumption data by cereal to assess the adequacy of cereals calories according to the household samples divided into consumption terciles. Table 5.3, comparing *annual* average daily cereals consumption data by strata per household adult-equivalent, after dropping outlier households, allows some preliminary judgements.

Table 5.3

Comparison of Annual Average Daily Cereals Consumption (Kcal) per Household Adult-Equivalent (Gao Region, Mali)

	Mean Daily Consumption	Coefficient of Variation	Gini Coefficient	N
North	1736	0.38	0.210	45
South	2371	0.34	0.189	53
Off-River	1936	0.41	0.227	69
On-River	2096	0.38	0.212	51

Outlier households removed.
CESA-MSU Food Security Project Surveys, 1988/89

[11]These conversion coefficients are available from the author.

Table 5.3 shows that the greatest difference in average daily cereals consumption (635 calories) is between the North and South strata, also defining the lowest and highest consumption levels. Note that the Gao Region average of 2312 calories per AE (footnote 8) is exceeded only by the South strata. Cereals consumption in the South stratum appears to be the most stable across households and the most equally distributed among AEs — as will be seen, influenced by access to wild cereals in the rainy season. Yet, the coefficients of variation are similar among all strata and the Gini coefficients suggest low levels of inequality. Only the South appears to be consumption secure in cereals calories when cereals contribute 85 percent (2250 daily calories) of all calories. However, if the contribution of cereals calories is reduced to 80 percent (2120 daily calories), the On-River strata also becomes consumption secure.

For the tables which follow in this chapter and annexes, as in Chapter 4, outlier households (whose observation lies $\pm$ 3 standard deviations from the mean) have been dropped with minimal loss of observations.[12]

At least two observations were required for a household to be included in each seasonal average and at least three observations to be included in each annual average. Note that a seasonal outlier household, whose observation was removed for a seasonal average, may not be an outlier for the annual average, for which its observation is included. Thus, the number of households in the annual average exceeds the number in any given seasonal

[12]One outlier household was dropped from the North stratum and from the South stratum in the rainy season (2.4 percent and 2.0 percent of the observations, respectively). One outlier household was dropped from the Off-River stratum in the hot dry and rainy seasons each (1.5 percent and 1.6 percent, respectively). Two outlier households were dropped from the On-River stratum in the hot dry season (4.0 percent). No annual average outliers were found in the North, one outlier household was removed from the Off-River and On-River strata each (1.4 percent and 1.9 percent, respectively), and two were removed from the South stratum (3.6 percent).

average, causing some households to shift between terciles. Moreover, inclusion of previously dropped seasonal outlier households, whose observations were all *greater* than three standard deviations from the mean, tends to raise annual averages. For this reason, the annual average exceeds the range of the seasonal averages in a few instances.

5.3.1. North/South Stratification of Households

Tables 5.4 and 5.5 display seasonal consumption data, cereal by cereal, by consumption terciles, grouped by North and South households.

Some patterns mirror the patterns previously seen in household incomes due to the influence of counting home consumption of cereals as income. Adult-equivalent cereals consumption in the North declines steadily from the harvest/post-harvest season through the rainy season.[13] Consumption in the South also declines from the harvest/post-harvest season but recovers somewhat during the rainy season. Cereals consumption in the South during the rainy season is almost double that in the North for the comparable terciles. As shown in Tables A5.2.1. and A5.2.3. in Annex 5.2, seasonal average cereals consumption in the North and South strata progressively diverges so that by the end of the rainy season, the average adult-equivalent in the South consumes about 1000 cereals calories more than his counterpart in the North. Cereals consumption is somewhat more stable in the South than the North, based on coefficients of variation of 0.34 and 0.38, respectively (Table 5.3).

South cereals consumption is consistently higher across seasons and terciles than the respective consumption in the North. On average, middle tercile households are consumption secure in cereals only during the harvest/post-harvest season, both North and South. Upper

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[13]The extent to which rainy season increases in milk consumption may have offset this decline in cereals consumption is not known.

Table 5.4. Average Daily Cereals Consumption per Adult-Equivalent by Cereal: North Villages (Gao Region, Mali), by Tercile and by Season

	Annual Average (N = 45)		Harvest/Post-Harvest (N = 45)		Hot Dry Season (N = 45)		Rainy Season (N = 41)	
	Kcal	Percent	Kcal	Percent	Kcal	Percent	Kcal	Percent
Upper Tercile								
1. Millet	1186	*47.2*	654	*18.0*	1259	*53.5*	1335	*72.5*
2. Sorghum	6	*0.2*	7	*0.2*	3	*0.1*	5	*0.3*
3. Maize	142	*5.6*	90	*2.5*	299	*12.7*	153	*7.9*
4. Paddy	782	*31.0*	2197	*60.3*	467	*19.8*	219	*11.3*
5. Local Rice	96	*3.8*	50	*1.4*	73	*3.1*	74	*3.8*
6. Other Rice	150	*5.9*	26	*0.7*	146	*6.2*	.	.
7. Wild Fonio	108	*4.3*	304	*8.3*	92	*3.9*	77	*5.2*
8. Cram-cram	50	*2.0*	317	*8.7*	15	*0.6*	.	.
Total	2520	*100.0*	3645	*100.0*	2355	*100.0*	1864	*100.0*
Middle Tercile								
1. Millet	777	*47.5*	513	*21.9*	1010	*77.8*	837	*73.2*
2. Sorghum	4	*0.3*	3	*0.1*	.	.	8	*0.7*
3. Maize	164	*10.0*	148	*6.3*	152	*11.7*	107	*10.2*
4. Paddy	335	*20.5*	800	*34.2*	86	*6.7*	6	*0.6*
5. Local Rice	21	*1.3*	39	*1.7*	18	*1.4*	12	*1.1*
6. Other Rice	15	*0.9*	195	*8.3*	.	.	12	*1.0*
7. Wild Fonio	233	*14.3*	513	*21.9*	2	*0.1*	156	*12.5*
8. Cram-cram	85	*5.2*	131	*5.6*	30	*2.3*	13	*1.2*
Total	1634	*100.0*	2341	*100.0*	1299	*100.0*	1149	*100.0*
Lower Tercile								
1. Millet	506	*48.0*	636	*46.3*	418	*48.5*	420	*57.0*
2. Sorghum	25	*2.3*	61	*4.4*	25	*2.9*	3	*0.4*
3. Maize	110	*10.4*	71	*5.2*	180	*20.9*	97	*13.2*
4. Paddy	184	*17.5*	226	*16.3*	59	*6.8*	39	*5.4*
5. Local Rice	12	*1.2*	12	*0.9*	10	*1.1*	5	*0.7*
6. Other Rice	3	*0.3*	69	*5.0*	.	.	.	.
7. Wild Fonio	146	*13.9*	262	*19.1*	25	*3.0*	167	*22.7*
8. Cram-cram	68	*6.5*	35	*2.5*	145	*16.8*	6	*0.8*
Total	1055	*100.0*	1372	*100.0*	862	*100.0*	737	*100.0*

CESA-MSU Food Security Project Surveys, 1988/89

Table 5.5. Average Daily Cereals Consumption per Adult-Equivalent by Cereal: South Villages (Gao Region, Mali), by Tercile and by Season

	Annual Average (N = 53)		Harvest/Post-Harvest (N = 49)		Hot Dry Season (N = 49)		Rainy Season (N = 49)	
	Kcal	Percent	Kcal	Percent	Kcal	Percent	Kcal	Percent
Upper Tercile								
1. Millet	680	*20.4*	157	*3.8*	1486	*44.2*	780	*24.0*
2. Sorghum	361	*10.8*	184	*4.5*	456	*13.6*	332	*10.2*
3. Maize	1	*0.0*	.	.	.	.	.	.
4. Paddy	1428	*42.9*	3521	*85.3*	1068	*31.8*	753	*23.1*
5. Local Rice	188	*5.6*	135	*3.3*	191	*5.7*	104	*3.2*
6. Other Rice	.	.	.	.	.	.	.	.
7. Wild Fonio	668	*20.1*	134	*3.2*	158	*4.7*	1286	*39.5*
8. Cram-cram	.	.	.	.	.	.	.	.
Total	3326	*100.0*	4132	*100.0*	3359	*100.0*	3255	*100.0*
Middle Tercile								
1. Millet	701	*30.7*	615	*22.6*	674	*35.4*	556	*26.7*
2. Sorghum	137	*6.0*	132	*4.9*	298	*15.6*	294	*14.2*
3. Maize	7	*0.3*	.	.	.	.	4	*0.2*
4. Paddy	993	*43.5*	1122	*41.3*	682	*35.8*	781	*37.5*
5. Local Rice	179	*7.8*	325	*11.9*	131	*6.9*	85	*4.1*
6. Other Rice	.	.	.	.	9	*0.4*	.	.
7. Wild Fonio	264	*11.6*	524	*19.3*	113	*5.9*	349	*16.8*
8. Cram-cram	.	.	.	.	.	.	.	.
Total	2282	*100.0*	2717	*100.0*	1907	*100.0*	2069	*100.0*
Lower Tercile								
1. Millet	480	*30.8*	544	*39.5*	403	*34.6*	231	*17.5*
2. Sorghum	176	*11.3*	70	*5.1*	81	*7.0*	262	*19.9*
3. Maize	1	*0.1*	.	.	27	*2.3*	.	.
4. Paddy	528	*33.9*	356	*25.9*	470	*40.3*	596	*45.1*
5. Local Rice	105	*6.7*	143	*10.4*	135	*11.6*	67	*5.1*
6. Other Rice	3	*0.2*	1	*0.1*	.	.	.	.
7. Wild Fonio	266	*17.0*	262	*19.1*	48	*4.1*	161	*12.2*
8. Cram-cram	.	.	.	.	.	.	.	.
Total	1558	*100.0*	1376	*100.0*	1165	*100.0*	1316	*100.0*

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tercile households in the North are consumption secure during the first two seasons whereas upper tercile households in the South are consumption secure in every season. The average lower tercile household does not reach consumption security in any season in either stratum. During the rainy season, the lower tercile household in the North consumes about *one-third* the assumed level of cereals consumption security. As shown in Tables A5.2.1. and A5.2.3., the degree of equality in cereals consumption is fairly similar in the North and South, based on Gini coefficients of 0.210 and 0.189, respectively.

Comparison with other surveys puts these results in perspective. Many consumption surveys have been carried out under drought or famine conditions, although other than the national cereals consumption survey carried out in 1988/89 (Table 5.1), consumption surveys from *good* rainfall years are rare. The few relevant data that are available correspond to the South stratum.

As part of a national consumption survey, Mondot-Bernard (1982) surveyed eight households in a nomadic settlement, Tin Azir (Ansongo District, Gao Region), during the hot dry season 1978. Cereals consumption was "low" and not compensated by milk consumption, leading to a "very inadequate" *total* calorie intake of 1857 calories per capita per day (Annex 2(b)) (or 2100 calories in terms of AEs),[14] a little less than the average *cereals* calories consumed in the South stratum (2139 calories per AE) during the hot dry season 1989 (Table A5.2.3. in Annex 5.2).

Hopkins and Reardon report cereals and pulse consumption data for 1988/89 from the four IFPRI/ICRISAT survey villages in neighboring western Niger. The Sahelian zone villages, Sadeize Koïra and Samari (Ouallam District, Tillabery Department) lie about 100 km

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[14]These and other survey data are put in terms of 1988/89 Gao Region adult-equivalents only for comparison with CESA-MSU survey results.

to the southwest of the CESA/MSU South stratum but fall within the same rainfall regime of 200-400 mm. The IFPRI/ICRISAT survey year started two months earlier, running from September through August. Seasonal average daily *cereals* consumption (without bran) ranged between 2550 and 2560 calories per AE (Hopkins and Reardon, Table 1) and comprised of about 95 percent millet (Hopkins and Reardon, Table 3a), compared with 2371 calories per AE for the South stratum (Table A5.2.3. in Annex 5.2) for the slightly different period, November through October. While these are very comparable results, it appears that consumption in the IFPRI/ICRISAT sample is more stable across seasons (although aggregation of Sahelian sample with the Sudanian sample (Hopkins and Reardon, Table 4) leaves this unclear).

Considering individual cereals, Poleman and others identify a clear hierarchy of preferences among starchy staple foods.[15] In West Africa, these are typically rice and wheat products at the top, coarse grains somewhere in the middle and tubers such as cassava and yams at the bottom (Delgado; Reardon, Delgado and Thiombiano; Ross). In the Northeast, tubers, which are not grown locally, would be replaced at the bottom by wild cereals.[16]

A hierarchy of preferences is evident in the CESA-MSU survey data as well. Paddy, rice in unmilled form, easily dominates cereals consumption in the harvest/post-harvest season in the North and South for the two top terciles.[17] Paddy also dominates consumption in the

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[15]In addition to reasons of taste and other preferences, substitution between staples in the hierarchy occurs as a matter of changes in price and income as measured by price and income elasticities of demand.

[16]Visual inspection of questionnaires during data cleaning showed that many households held wild cereal reserves which were not consumed but carried over month after month, during which time the household consumed other, presumably more desirable, cereal staples.

[17]Note that paddy is not *eaten* in unmilled form. However, the designation "paddy" is used because of the disappearance method of calculating household consumption.

South for the bottom two terciles during the remaining seasons. Consumption of millet is consistently high in the North, the cereal most consumed with the exception of its displacement by paddy during the harvest/post-harvest season.[18]

A little "other rice" is consumed in the North, but virtually none in the South -- an indication that local agriculture displaces demand for rice grown elsewhere in Mali or for imported rice.

Locally produced sorghum is less important in the North than the South. Maize is almost unknown in the South, unlike the North where most maize on the market is remaining food aid maize distributed in May-June 1988 (Annex 3.1). The wild cereals, fonio and cram-cram, contribute significantly to consumption in the North during the harvest/post-harvest season, whereas in the South, fonio is important during the rainy season as well (particularly for the upper tercile in the rainy season, Table 5.5). No cram-cram consumption is reported in the South, despite minor expenditures on cram-cram (Table 4.19 in Chapter 4).[19]

5.3.2. On-River/Off-River Stratification of Households

Tables 5.6 and 5.7 display seasonal consumption data, cereal by cereal, by consumption terciles, stratified by Off-River and On-River households or, to generalize, by

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[18]Looking at annual monthly averages (all terciles), Table A5.2.4. in Annex 5.2 shows that paddy contributes 41.1 percent of cereals calories in the South, followed by millet at 26.1 percent. Table A5.2.2. shows that this relationship is inverted in the North, where millet calories account for 47.4 percent of average interseasonal consumption (all terciles), followed by paddy calories at 25.0 percent.

[19]Wheat and wheat flour are not included in Tables 5.4-5.7 because no consumption was recorded. Very rarely, some households reported expenditures on bread and pasta (Chapter 4). These finished products were not converted into wheat calories because they fall outside the usual sphere of the whole grain market. To the extent that wheat products have been consumed but excluded, the consumption of cereals calories may be understated by a very slight amount.

"non-farmers" (non-Songhaï) and "farmers" (Songhaï), respectively. As expected, the Off-River/On-River stratification reveals differences in cereals consumption more sharply than the North/South stratification where farmer and non-farmer households are present in both strata.

In terms of total average calories, upper tercile households in both strata are consumption secure in all three seasons. On-River middle tercile households are also consumption secure during the harvest/post-harvest season. On-River farming households consume more than half again as many cereals calories during the harvest/post-harvest season (dominated by paddy calories) than do Off-River households in the same tercile. Thereafter, however, Off-River households consume more cereals calories than their farming On-River counterparts.

Cereals calories decline season by season for On-River households, dropping by more than half for the lower two terciles in just one season from harvest/post-harvest to the hot dry season and by more than one-third for the upper tercile.

The On-River stratum thus shows the greatest seasonal variability in cereals consumption. According to Table A5.2.7 in Annex 5.2, average seasonal calorie consumption (all terciles) fluctuates within ± 1052 calories of the annual mean. The average AE in the On-River stratum consumes *less than half* the cereals calories in the rainy season (1540) than in the harvest/post-harvest season (3148).

In contrast, Table A5.2.5. indicates that seasonal calorie consumption for Off-River households (all terciles) is remarkably stable, falling within ± 51 calories from the annual average in each season (less than 5 percent of the seasonal variability of the On-River stratum). Off-River cereal consumption shows an annual CV of 0.41. During the harvest/post-harvest period, the average AE in the On-River stratum consumes about 1230 cereals calories more than the average AE in the Off-River stratum (64.5 percent more than

Table 5.6. Average Daily Cereals Consumption per Adult-Equivalent by Cereal: Off-River Villages (Gao Region, Mali), by Tercile and by Season

	Annual Average (N = 69)		Harvest/Post-Harvest (N = 65)		Hot Dry Season (N = 64)		Rainy Season (N = 63)	
	Kcal	Percent	Kcal	Percent	Kcal	Percent	Kcal	Percent
Upper Tercile								
1. Millet	1470	*51.6*	1203	*42.6*	1718	*60.4*	1281	*43.7*
2. Sorghum	290	*10.2*	395	*14.0*	582	*20.5*	277	*9.4*
3. Maize	6	*0.2*	27	*1.0*	25	*0.9*	.	.
4. Paddy	43	*1.5*	15	*0.5*	71	*2.5*	37	*1.2*
5. Local Rice	234	*8.2*	320	*11.3*	162	*5.7*	143	*4.9*
6. Other Rice	165	*5.8*	210	*7.1*	139	*4.9*	111	*3.8*
7. Wild Fonio	640	*22.5*	660	*23.4*	144	*5.1*	1075	*36.7*
8. Cram-cram	.	.	.	.	1	*0.0*	.	.
Total	2849	*100.0*	2821	*100.0*	2841	*100.0*	2922	*100.0*
Middle Tercile								
1. Millet	786	*43.4*	615	*32.0*	896	*51.2*	854	*47.9*
2. Sorghum	465	*25.7*	363	*18.9*	501	*28.6*	414	*33.3*
3. Maize	35	*2.0*	115	*6.0*	3	*0.2*	8	*0.5*
4. Paddy	5	*0.3*	29	*1.5*	.	.	.	.
5. Local Rice	75	*4.1*	82	*4.3*	80	*4.6*	52	*3.2*
6. Other Rice	104	*5.7*	189	*9.8*	137	*7.8*	35	*3.0*
7. Wild Fonio	337	*18.7*	531	*27.6*	141	*8.1*	288	*17.5*
8. Cram-cram	0	*0.0*	.	.	.	.	.	.
Total	1808	*100.0*	1924	*100.0*	1756	*100.0*	1650	*100.0*
Lower Tercile								
1. Millet	605	*52.5*	480	*45.7*	742	*70.5*	658	*66.0*
2. Sorghum	302	*26.2*	197	*18.7*	200	*19.0*	366	*29.4*
3. Maize	40	*3.5*	55	*5.2*	29	*2.7*	15	*1.4*
4. Paddy	2	*0.2*	6	*0.6*	.	.	.	.
5. Local Rice	43	*3.8*	73	*7.0*	63	*6.0*	4	*0.3*
6. Other Rice	9	*0.8*	12	*1.1*	9	*0.8*	22	*0.8*
7. Wild Fonio	150	*13.0*	228	*21.7*	18	*1.7*	41	*3.8*
8. Cram-cram	0	*0.0*	.	.	1	*0.1*	.	.
Total	1151	*100.0*	1050	*100.0*	1061	*100.0*	1106	*100.0*

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Table 5.7. Average Daily Cereals Consumption per Adult-Equivalent by Cereal: On-River Villages (Gao Region, Mali), by Tercile and by Season

	Annual Average (N = 51)		Harvest/Post-Harvest (N = 50)		Hot Dry Season (N = 48)		Rainy Season (N = 49)	
	Kcal	Percent	Kcal	Percent	Kcal	Percent	Kcal	Percent
Upper Tercile								
1. Millet	313	*10.5*	112	*2.5*	408	*16.9*	346	*14.0*
2. Sorghum	250	*8.4*	16	*0.4*	218	*9.0*	421	*17.0*
3. Maize	95	*3.2*	50	*1.1*	231	*9.6*	32	*1.3*
4. Paddy	2220	*74.6*	3946	*88.3*	1506	*62.2*	1619	*65.4*
5. Local Rice	30	*1.0*	50	*1.1*	41	*1.7*	44	*1.8*
6. Other Rice	.	.	.	.	.	.	.	.
7. Wild Fonio	30	*1.0*	112	*2.5*	10	*0.4*	15	*0.6*
8. Cram-cram	36	*1.2*	185	*4.1*	7	*0.2*	.	.
Total	2975	*100.0*	4471	*100.0*	2421	*100.0*	2476	*100.0*
Middle Tercile								
1. Millet	252	*12.2*	126	*4.0*	382	*26.6*	370	*26.8*
2. Sorghum	147	*7.1*	119	*3.8*	107	*7.5*	163	*11.8*
3. Maize	116	*5.6*	32	*1.0*	151	*10.5*	143	*10.3*
4. Paddy	1312	*63.3*	2505	*79.7*	686	*47.8*	529	*38.3*
5. Local Rice	148	*7.2*	165	*5.3*	76	*5.3*	39	*2.8*
6. Other Rice	.	.	.	.	.	.	10	*0.7*
7. Wild Fonio	62	*3.0*	89	*2.8*	.	.	115	*8.4*
8. Cram-cram	35	*1.7*	106	*3.4*	33	*2.3*	11	*0.8*
Total	2072	*100.0*	3143	*100.0*	1434	*100.0*	1379	*100.0*
Lower Tercile								
1. Millet	219	*17.7*	81	*4.3*	250	*28.1*	250	*32.3*
2. Sorghum	18	*1.4*	19	*1.0*	25	*2.8*	14	*1.7*
3. Maize	125	*10.1*	80	*4.2*	207	*23.2*	124	*16.0*
4. Paddy	585	*47.1*	1332	*69.8*	191	*21.5*	168	*21.7*
5. Local Rice	25	*2.0*	53	*2.7*	32	*3.6*	11	*1.4*
6. Other Rice	3	*0.3*	.	.	.	.	.	.
7. Wild Fonio	158	*12.7*	196	*10.3*	47	*5.3*	204	*26.3*
8. Cram-cram	109	*8.8*	146	*7.7*	138	*15.5*	5	*0.6*
Total	1242	*100.0*	1907	*100.0*	891	*100.0*	775	*100.0*

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Off-River consumption), but during the rainy season, the average On-River AE consumes about 350 calories *less* than the average Off-River AE (18.6 percent).

On an annual basis, cereals consumption in both Off-River and On-River strata are relatively equally distributed among household adult-equivalents (Gini coefficients of 0.227 and 0.212, respectively). Nonetheless, it is noteworthy that cereal consumption is most stable and equally distributed within the On-River stratum during the harvest/post-harvest season (CV of 0.38 and Gini coefficient of 0.21) when cereals consumption peaks. This suggests that most households in the On-River stratum shared in the post-harvest consumption binge, but that the differentiation between surplus and deficit producers manifested itself in later seasons in terms of consumption disparities and higher CVs and Gini coefficients — allowing the former to consume home production longer or otherwise manage their income (from crop sales) and assets (cereals stocks) more successfully.

Three factors explain the pattern of very high apparent consumption of cereals after harvest, followed by low consumption thereafter.[20] The first two factors may be due to measurement error of the type described in section 5.2.4. During discussions of interim research results in August 1989 with members of participating households from On-River villages, respondents confirmed that such a precipitous drop in cereals consumption was not only plausible, but deliberate. Many social events, exchange of gifts and other celebrations are planned for the post-harvest period, boosting consumption then. In addition, measurement error may have occurred by attributing consumption of cereals by guests to consumption by household members.

[20]While the drop-off from post-harvest consumption levels is more extreme in the On-River stratum, this discussion applies equally to the consumption patterns previously observed in the North/South stratification.

Second, as some heads of households recounted in colorful anecdotes, when rice is abundant following harvest, little care is taken in planning meals. Prestige requires that rice is prepared in excess of needs. Leftover rice is thrown out or fed to animals. Given the survey methodology to determine cereals consumption, this wastage would be counted as consumption as well. Such seasonal conspicuous consumption appears to be culturally sanctioned just as the sense of shared deprivation later in the year when farm income and home consumption — and hence expenditures — decline (Tables 4.9 and 4.10 in Chapter 4). Respondents reported skipping the noon meal during the hungry period in order to eat in the evening and not go to bed hungry (personal interviews, August 1989).[21]

A third factor is physiological in nature. Seasonal hunger is temporary and reversible (Rivers). Individuals may consume more cereals following harvest in order to restore net energy losses due to labor-intensive cultivation during the previous rainy season. However, this results in a procyclical pattern of energy consumption and expenditure, rather than a countercyclical one.

As for the low consumption of cereals during the rainy season, Poleman warns against the assumption of underreporting by poor households in such circumstances (and the temptation to inflate figures by a standard percentage to make them look acceptable). It is acknowledged that cereals consumption data alone do not give the complete picture. Other foods also figure as staples, such as milk for herder families during the rainy season (Chapter 3). Households in Tessit (South and Off-River strata) consumed large quantities of "beans," thought to be *niébé* (containing an average 3,420 calories per kilogram). Before data

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[21]A similar situation in the Gao Region was reported one year before (rainy season 1988) by a Dutch-Malian research team which found that 67 percent of the households in Bara (the same CESA-MSU survey site) and Goutchine (4 km to the north), both strongly farming communities, reported eating only one meal per day (Harts-Broekhuis and de Jong, 1990a, p. 52).

collection of bean consumption was discontinued, adult-equivalents in Tessit consumed the following average daily calories of beans:

December 1988:	220
January 1989:	349
February 1989:	270

These calories were equivalent to about 15 percent of average cereals calories.[22]

Patterns of interseasonal instability in cereals consumption among producer households have been long observed. A 1949 report on nutrition in West Africa noted that [cereals] consumption went from about 3000 calories per capita per day (or about 3400 calories per AE) right after harvest to below 750 calories (about 850 calories per AE) in the rainy season, or lower still at times of shortage (Franke and Chasin, p. 74).

More recently, Reardon, Matlon and Delgado (1988) analyzed household food insecurity based on consumption of cereals and pulses in Burkina Faso, contrasting households in the Sudanian and Sahelian zones during 1984/85, a *poor* year in terms of rainfall and agricultural output. The relevant comparison is with the CESA-MSU On-River and Off-River strata, respectively.[23] Being more vulnerable to variability in crop production than their Sudanian zone counterparts, households in the lower rainfall Sahelian zone pursued coping strategies to diversify their sources of income in order to protect their purchasing power which, in turn, allowed them to stabilize consumption better than households in the Sudanian zone. In a revision of the same study, Reardon and Matlon (1989) show that in the five season period from harvest 1984 through harvest 1985, Sahelian zone households a) were

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[22]Given storage problems with *niébé*, it is unlikely that *niébé* consumption held at these levels throughout the year. See Coulibaly.

[23]The Burkina Sahelian zone would be most similar to the South stratum in the CESA-MSU surveys in terms of rainfall, although the argument here more clearly illustrates the contrast between the On-River and Off-River strata.

more likely to have stable cereals consumption per adult-equivalent than Sudanian zone households; b) were more likely to be consumption secure according to consumption average by income tercile; c) consumed more cereals calories on average, tercile by tercile; d) had lower average coefficients of variation of consumption, tercile by tercile; and e) had fewer food-insecure adult-equivalents in percentage terms, season by season and tercile by tercile, than the Sudanian zone sample.

Returning to the Malian households, seasonal coefficients of variation and Gini coefficients are usually lower and less variable for Off-River households after the harvest/post-harvest season, indicating that cereals consumption Off-River is both more stable and more equally distributed than consumption On-River. Given that Off-River households may have fewer local economic opportunities than On-River households, the stability in Off-River consumption is all the more exceptional. While falling short of the consumption security threshold of 2250 daily calories from cereals, average daily consumption of 1936 calories represents a contribution of 73.1 percent of total calories from cereals, just below the bottom range of historical data for Mali (Table A5.1.7. in Annex 5.1.). Lowering the consumption security threshold to 70 percent of total calories from cereals would change the status of the average adult-equivalent in the Off-River stratum to consumption secure in each season, whereas the status of the average adult-equivalent in the On-River stratum would not be sensitive to such a change in the consumption security threshold.

Looking at individual cereals consumed, Table 5.6 shows that millet contributes the most calories across all seasons and terciles in the Off-River stratum. On average, millet accounts for nearly half of cereals calories (49.2 percent) consumed by Off-River households (all terciles, Table A5.2.6). Together, millet and sorghum calories account for two-thirds (67.4 percent) of all cereals calories. In contrast, Table 5.7 shows that paddy contributes the most calories across all seasons for the upper two terciles and for the lower tercile during the harvest/post-harvest season for On-River households. Paddy accounts for two-thirds (65.5 percent) of all cereals calories consumed by On-River households (all terciles, Table A5.2.8).

Two patterns stand out concerning consumption of wild cereals. Wild fonio makes the second highest contribution of calories in Off-River households in all terciles during the harvest/post-harvest season (and again for the upper tercile during the rainy season). This suggests either a certain vulnerability to the vagaries of rainfall and the random availability of wild fonio or a fortuitous boost in consumption not available in poor rainfall years which allows the substitution of wild fonio for cultivated cereals. Cram-cram is presumed to be an inferior good. For all practical purposes, no cram-cram is consumed Off-River. Yet, cram-cram is consumed in the cereals producing On-River stratum by all terciles in all seasons (except by upper tercile households during the rainy season).[24]

5.4. Analysis of Seasonal Consumption of Cereals by Source of Supply

Section 5.4. reexamines the cereal consumption patterns just seen in terms of supply source in order to determine the seasonality of household reliance on the market. Aggregate consumption levels — by strata, terciles and seasons — are the same as those reported in Section 5.3.

[24]This apparent anomaly is partly explained by the consumption of cram-cram exclusively in Temera, the poorer village with only half the rainfall as that of Bara and no full water-control irrigation.

5.4.1. North/South Stratification of Households

Tables 5.8 and 5.9 report cereals consumption for the North/South strata by source of procurement listed in Figure 5.1. In the North, market purchases clearly represent the major source of supply for all terciles and seasons (except the upper tercile in the harvest/post-harvest season). Market purchases account for two-thirds (67.6 percent) of cereals calories consumed in the North stratum (annual average, all terciles, Table A5.2.2.).

This dependence on the market appears most critical during the rainy season when households consume no calories from either home production or non-market barters but dip into their seed reserves (all terciles). For the middle tercile, the market supplies at least half of all cereals calories in each season and for the lower tercile, at least two-thirds. In absolute terms, cereals calories from the market decline from one season to the next (for the upper tercile, starting from the hot dry season).

In the South, home production supplies half or more cereals calories during the harvest/post-harvest season. Thereafter, the market replaces home production as the chief supply source for the lower two terciles (both seasons) and the upper tercile (hot dry season). Calories from home production recover somewhat during the rainy season for the lower two terciles. Home production approaches nearly half (42.4 percent) of cereals calories consumed in the South stratum and that market purchases account for more than one-third (36.4 percent), (annual average, all terciles, Table A5.2.4.).

Own gathering of wild cereals is slightly more important overall in the South than the North, not because Southern households are necessarily poorer (they are not, according to

Table 5.8

Average Daily Cereals Consumption per Adult-Equivalent by Source: North Villages (Gao Region, Mali), by Tercile and by Season

	Annual Average (N = 45)		Harvest/Post-Harvest (N = 45)		Hot Dry Season (N = 45)		Rainy Season (N = 41)	
	Kcal	Pct	Kcal	Pct	Kcal	Pct	Kcal	Pct
Upper Tercile								
1. Home Production	449	*17.8*	1730	*47.5*	100	*4.2*	.	.
2. Gathering	106	*4.2*	519	*14.2*	53	*2.3*	27	*1.5*
3. Market Purchases	1781	*70.7*	1251	*34.3*	1997	*84.8*	1544	*82.8*
4. Non-Market Barters	1	*0.0*	.	.	2	*0.1*	.	.
5. Aid and Transfers	172	*6.8*	145	*4.0*	202	*8.6*	266	*14.3*
6. Seed Reserves	11	*0.4*	.	.	.	.	27	*1.4*
Total	2520	*100.0*	3645	*100.0*	2355	*100.0*	1864	*100.0*
Middle Tercile								
1. Home Production	280	*17.2*	685	*29.3*	66	*5.1*	.	.
2. Gathering	163	*9.9*	350	*14.9*	5	*0.4*	114	*9.9*
3. Market Purchases	1077	*65.9*	1260	*53.8*	1147	*88.3*	887	*77.2*
4. Non-Market Barters	.	.	.	.	.	.	.	.
5. Aid and Transfers	108	*6.6*	46	*2.0*	80	*6.2*	142	*12.4*
6. Seed Reserves	6	*0.4*	.	.	.	.	6	*0.6*
Total	1634	*100.0*	2341	*100.0*	1299	*100.0*	1149	*100.0*
Lower Tercile								
1. Home Production	135	*12.8*	111	*8.1*	61	*7.1*	.	.
2. Gathering	108	*10.2*	85	*6.2*	24	*2.8*	127	*17.2*
3. Market Purchases	665	*63.0*	1019	*74.2*	574	*66.6*	549	*74.4*
4. Non-Market Barters	3	*0.3*	13	*0.9*	.	.	.	.
5. Aid and Transfers	141	*13.3*	145	*10.6*	203	*23.5*	31	*4.1*
6. Seed Reserves	3	*0.3*	.	.	.	.	31	*4.3*
Total	1055	*100.0*	1372	*100.0*	862	*100.0*	737	*100.0*

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Table 5.9

Average Daily Cereals Consumption per Adult-Equivalent by Source: South Villages (Gao Region, Mali), by Tercile and by Season

	Annual Average (N = 53)		Harvest/Post-Harvest (N = 49)		Hot Dry Season (N = 49)		Rainy Season (N = 49)	
	Kcal	Pct	Kcal	Pct	Kcal	Pct	Kcal	Pct
Upper Tercile								
1. Home Production	1421	*42.7*	3413	*82.6*	1296	*38.6*	781	*24.0*
2. Gathering	554	*16.7*	85	*2.0*	.	.	1119	*34.6*
3. Market Purchases	1168	*35.1*	496	*12.0*	1569	*46.7*	1037	*31.9*
4. Non-Market Barters	42	*1.3*	77	*1.9*	.	.	178	*5.5*
5. Aid and Transfers	137	*4.2*	61	*1.5*	494	*14.7*	140	*4.3*
6. Seed Reserves	4	*0.1*	.	.	.	.	.	.
Total	3326	*100.0*	4132	*100.0*	3359	*100.0*	3255	*100.0*
Middle Tercile								
1. Home Production	1141	*50.0*	1380	*50.8*	642	*33.7*	742	*35.9*
2. Gathering	160	*7.0*	298	*11.0*	.	.	293	*14.2*
3. Market Purchases	722	*31.6*	881	*32.4*	1018	*53.4*	910	*44.0*
4. Non-Market Barters	36	*1.6*	.	.	.	.	24	*1.2*
5. Aid and Transfers	223	*9.8*	159	*5.9*	230	*12.0*	69	*3.3*
6. Seed Reserves	.	.	.	.	16	*0.9*	31	*1.5*
Total	2282	*100.0*	2717	*100.0*	1907	*100.0*	2069	*100.0*
Lower Tercile								
1. Home Production	476	*30.6*	716	*52.1*	240	*20.6*	409	*31.0*
2. Gathering	171	*11.0*	177	*13.0*	.	.	69	*5.2*
3. Market Purchases	714	*45.8*	248	*18.0*	771	*66.2*	699	*53.1*
4. Non-Market Barters	38	*2.4*	19	*1.4*	10	*0.9*	22	*1.7*
5. Aid and Transfers	142	*9.1*	214	*15.5*	133	*11.4*	116	*8.8*
6. Seed Reserves	18	*1.1*	.	.	11	*0.9*	2	*0.2*
Total	1558	*100.0*	1376	*100.0*	1165	*100.0*	1316	*100.0*

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Chapter 4), but because rainfall is better. Note the unusually high contribution of wild cereals (own gathering) in the upper tercile during the rainy season.[25]

The portion of calories from aid and transfers in the South (7.1 percent) is roughly equivalent to that in the North (8.1 percent) (Tables A5.2.4. and A5.2.2 in Annex 5.2, respectively).

More generally for the entire Gao Region, Harts-Broekhuis and de Jong estimate that home production accounted for 50 percent of cereals consumption in 1988 while market purchases contributed 26 percent and aid and transfers 8 percent (1990a, p. 55) — somewhat high on the home production side and low on market purchases, compared to the averages for the North and South strata one year later. For comparison with the two Sahelian zone IFPRI/ICRISAT research villages in Niger, Hopkins and Reardon found that home production was twice as important as in the South stratum, accounting for 87 percent and 98 percent of average daily calorie consumption of cereals while market purchases were 7 percent and 1 percent, respectively, in 1988/89 (Hopkins and Reardon, Table 2.).

5.4.2. On-River/Off-River Stratification of Households

Several differences appear in the On-River/Off-River stratification (Tables 5.10 and 5.11) that were not seen in the previous stratification.

Market purchases represent the primary supply source of cereals calories for Off-River households *for all terciles in each season.* Market purchases of calories by Off-River households exceed those by On-River households (except the lower tercile in the harvest/post-harvest season). According to Table A5.2.6. in Annex 5.2, market purchases contribute

[25]Information is unavailable whether any households hired others to gather wild cereals for them.

nearly two-thirds (64.0 percent) of cereals calories consumed in Off-River households (annual average, all terciles). During the hot dry season, this contribution reaches three-fourths (74.8 percent).

Home production supplies from one-sixth to one-fifth of cereals calories during the harvest/post-harvest season but drops off during the next two seasons. No seed reserves are consumed in Off-River households.

Table A5.2.6. shows that overall calorie contributions from home production, gathering and aid and transfers are roughly similar for Off-River households (about 10-14 percent). Gathering wild cereals is nearly four times as important for Off-River households than On-River households and aid and transfers are more than twice as important (Tables A5.2.6. and A5.2.8. in Annex 5.2).

For On-River households, home production provides up to three-quarters of cereals calories consumed during the harvest/post-harvest season. For the remaining seasons, market purchases supply almost two-thirds of cereals calories in the lower terciles and about half in the upper tercile. Overall, On-River households obtain half of their cereals calories (51.5 percent) from home production, a rate five times greater than that of Off-River households (Tables A5.2.8. and A5.2.6.). Nonetheless, a few On-River households in all terciles were compelled to consume from their seed stocks during the rainy season (as well as the hot dry season for the upper two terciles).

Table 5.10

Average Daily Cereals Consumption per Adult-Equivalent by Source: Off-River Villages (Gao Region, Mali), by Tercile and by Season

	Annual Average (N = 69)		Harvest/Post-Harvest (N = 65)		Hot Dry Season (N = 64)		Rainy Season (N = 63)	
	Kcal	Pct	Kcal	Pct	Kcal	Pct	Kcal	Pct
Upper Tercile								
1. Home Production	345	*12.1*	487	*17.3*	288	*10.1*	199	*6.8*
2. Gathering	500	*17.5*	476	*16.9*	15	*0.5*	926	*31.7*
3. Market Purchases	1647	*57.8*	1599	*56.7*	1986	*69.9*	1499	*51.3*
4. Non-Market Barters	41	*1.4*	.	.	.	.	136	*4.6*
5. Aid and Transfers	316	*11.1*	259	*9.2*	553	*19.5*	163	*5.6*
6. Seed Reserves	.	.	.	.	.	.	.	.
Total	2849	*100.0*	2821	*100.0*	2841	*100.0*	2922	*100.0*
Middle Tercile								
1. Home Production	162	*9.0*	343	*17.8*	152	*8.7*	97	*5.9*
2. Gathering	221	*12.2*	244	*12.7*	46	*2.6*	215	*13.0*
3. Market Purchases	1253	*69.3*	1163	*60.5*	1369	*77.9*	1163	*70.5*
4. Non-Market Barters	18	*1.0*	6	*0.3*	.	.	20	*1.2*
5. Aid and Transfers	154	*8.5*	167	*8.7*	191	*10.8*	156	*9.4*
6. Seed Reserves	.	.	.	.	.	.	.	.
Total	1808	*100.0*	1924	*100.0*	1758	*100.0*	1650	*100.0*
Lower Tercile								
1. Home Production	94	*8.2*	229	*21.8*	32	*3.0*	.	.
2. Gathering	89	*7.7*	116	*11.1*	11	*1.0*	36	*3.3*
3. Market Purchases	815	*70.7*	427	*40.7*	879	*82.9*	974	*88.1*
4. Non-Market Barters	11	*0.1*	15	*1.4*	.	.	18	*1.6*
5. Aid and Transfers	143	*12.4*	263	*25.0*	139	*13.1*	78	*7.1*
6. Seed Reserves	.	.	.	.	.	.	.	.
Total	1151	*100.0*	1050	*100.0*	1061	*100.0*	1106	*100.0*

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Table 5.11

Average Daily Cereals Consumption per Adult-Equivalent by Source: On-River Villages (Gao Region, Mali), by Tercile and by Season

	Annual Average (N = 51)		Harvest/Post-Harvest (N = 50)		Hot Dry Season (N = 48)		Rainy Season (N = 49)	
	Kcal	Pct	Kcal	Pct	Kcal	Pct	Kcal	Pct
Upper Tercile								
1. Home Production	1795	*60.3*	3634	*75.2*	1116	*46.1*	1222	*49.3*
2. Gathering	46	*1.5*	259	*5.8*	2	*0.1*	.	.
3. Market Purchases	1033	*34.7*	412	*9.2*	1261	*52.1*	1111	*44.9*
4. Non-Market Barters	25	*0.8*	77	*1.7*	2	*0.1*	.	.
5. Aid and Transfers	68	*2.3*	88	*2.0*	28	*1.2*	104	*4.2*
6. Seed Reserves	7	*0.2*	.	.	12	*0.5*	39	*1.6*
Total	2975	*100.0*	4471	*100.0*	2421	*100.0*	2476	*100.0*
Middle Tercile								
1. Home Production	1050	*50.7*	2093	*66.6*	327	*22.8*	315	*22.8*
2. Gathering	35	*1.7*	137	*4.4*	5	*0.4*	54	*3.9*
3. Market Purchases	903	*43.6*	861	*27.4*	971	*67.7*	878	*63.7*
4. Non-Market Barters	.	.	.	.	.	.	.	.
5. Aid and Transfers	59	*2.8*	52	*1.7*	116	*8.1*	114	*8.3*
6. Seed Reserves	25	*1.2*	.	.	16	*1.1*	18	*1.3*
Total	2072	*100.0*	3143	*100.0*	1434	*100.0*	1379	*100.0*
Lower Tercile								
1. Home Production	393	*31.6*	1081	*56.7*	101	*11.4*	34	*4.4*
2. Gathering	145	*11.7*	182	*9.5*	8	*0.9*	153	*19.7*
3. Market Purchases	535	*43.1*	542	*28.4*	585	*65.7*	478	*61.7*
4. Non-Market Barters	6	*0.5*	10	*0.5*	10	*1.1*	.	.
5. Aid and Transfers	156	*12.5*	92	*4.8*	186	*20.9*	79	*10.2*
6. Seed Reserves	7	*0.6*	.	.	.	.	31	*4.0*
Total	1242	*100.0*	1907	*100.0*	891	*100.0*	775	*100.0*

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5.4.3. Consumption of Cereal Calories from Outside the Northeast

As a prelude to analysis of rural markets in Chapter 7, household cereals consumption data can be briefly reexamined in terms of the *origin* of cereals consumed, whether produced in the Northeast or elsewhere.[26] When cereals calorie shares consumed from production sources outside the Gao Region are aggregated in Table 5.12 for the North and South strata (summarized from Tables 5.4 and 5.5), only the upper tercile in the South during the harvest/post-harvest season is noticeably "autarkic" in cereals consumption. The dependence on outside cereals in the North is high during the hot dry and rainy seasons, particularly for the middle tercile. This dependence is far less pronounced in the South, where outside cereals account for less than half of all calories consumed during the hot dry season and decline further during the rainy season.

Table 5.12 also shows the dependence of On-River and Off-River households on cereals produced outside the Gao Region (summarized from Tables 5.6 and 5.7). All terciles in the On-River stratum are nearly autarkic in cereals consumption during the harvest/post-harvest season, although dependence on outside cereals jumps by a factor of six to seven during the hot dry season. In contrast, the Off-River stratum is consistently dependent on cereals produced outside the region, regardless of season. On an annual average, this

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[26]The production source of these cereals — and the distance they have come — is based on the following assumptions. According to the annual DNSI/DNA crop assessment for 1988/89 (Annex 3.1), no millet or maize was grown in the Gao region. While the non-cultivation of maize is more plausible than that of millet, millet and maize are therefore assumed to originate outside the Gao Region. Rainfed, river-recession and pond-recession sorghum is grown within the region. Likewise, paddy is assumed to have been produced inside the region as paddy is not usually transported long distances commercially. Local rice is the preferred variety of consumers. Some "local rice" may have come from the Tombouctou Region up-river or from Niger down-river, but it will be assumed to have been grown in the Gao Region. "Other rice" includes all varieties of imported and food aid rice and Malian rice (BB, RM25 and RM40) not grown in the Gao Region. Lastly, it may be reasonably assumed that wild fonio and cram-cram were gathered locally.

Table 5.12

Percent of Cereals Calories Consumed per AE from outside the Gao Region, 1988/89

	Annual Average	Harvest/ Post-Harvest	Hot Dry Season	Rainy Season
North				
Upper Tercile	58.6	21.1	72.4	79.8
Middle Tercile	58.5	36.5	89.5	83.2
Lower Tercile	58.7	56.6	69.4	70.2
South				
Upper Tercile	20.5	3.8	44.2	24.0
Middle Tercile	31.0	22.6	35.8	27.0
Lower Tercile	31.1	39.6	37.0	17.5
Off-River				
Upper Tercile	57.6	50.7	66.2	47.6
Middle Tercile	51.1	47.8	58.9	54.3
Lower Tercile	56.8	52.0	73.5	62.8
On-River				
Upper Tercile	13.7	3.6	26.4	15.3
Middle Tercile	17.7	5.0	37.2	37.9
Lower Tercile	28.0	8.4	51.4	48.3

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dependence is up to several times higher than for the corresponding tercile in the On-River stratum.

It is reasonable to assume that the bulk of non-regional cereals first arrive via the market. Given the overall reliance on outside supplies, integration of Northeastern Mali and the southern surplus cereals producing regions of the country through well performing markets becomes critical.

5.5. Counting the Consumption Secure

5.5.1. The Issue of Forced Post-Harvest Sales and Consumption Security

The conceptual framework for Part II has raised doubts about the appropriateness of models of intertemporal utility under certainty for the uncertain environment of the Northeast, but contends nevertheless that households will attempt to follow multi-period strategies to acquire food and smooth consumption.

In this regard, one issue that has long absorbed the attention of researchers of rural household behavior is whether households, especially deficit-production households, are compelled to sell part of their output at typically low post-harvest prices in order to meet post-harvest cash needs, only to have to "buy back" cereals during the hungry season when prices peak. Presumably, better-off surplus-producing households avoid making their greatest sales right after harvest and suffer least from any strong seasonality in prices. Investigation of this issue must determine whether agricultural (or gathering) households possess sufficient savings, other assets and credit-worthiness to avoid forced sales of crops after the harvest.

Using a rich set of coarse grain producer household transaction data for 1985/86 and 1986/87, Dioné (1987, 1989a) provides some of the first empirical evidence of this phenonomen for southern Mali.[27] After stratifying sample households several ways between the CMDT and OHV production zones, between north and south across both zones, and household status as surplus or deficit producers by possession of animal traction equipment, Dioné found strong seasonality in the pattern and concentration of cereals sales and purchases. For example, looking just at partly-equipped households categorized as surplus or deficit

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[27]See Ellsworth and Shapiro for a comparison with farming households in neighboring Burkina Faso in 1983/84.

producers, Dioné found that crop sales per household in 1985/86 were higher both in volume and as a percentage of total production in deficit households than in the surplus households (Table B-1, 1987). Post-harvest sales among households in the OHV, the poorer production zone, were more than double those of households in the CMDT zone with access to cash-crop income (from cotton), whereas OHV household sales during the rainy season dropped to only a fraction of CMDT household sales (Table B-5, 1987). The primary motive for cereals sales was more likely to be purchase of condiments and other ingredients for sauces in the CMDT than the OHV and by surplus producers than deficit producers, for whom the primary motive for sales was more likely to be payment of taxes (Tables B-6, B-7, B-8 and B-9, 1987). Combined data for both years, 1985/86 and 1986/87, show similar results (Table 6, 1989a).[28] Overall, 28 percent of households selling cereals in 1985/86 and 48 percent in 1986/87 were deficit producers (Dioné, 1989a).

Turning to cereals purchases, Dioné found that partly-equipped deficit households purchased several times more cereals in volume terms in 1985/86 than partly-equipped surplus producing households in each zone and sub-zone, both overall and during the rainy season (Tables C-1, C-2 and C-5, 1987). The primary motive for all purchases by partly-equipped deficit households in the CMDT south sub-zone was given as transformation and resale while that for the OHV south sub-zone was immediate consumption (Table C-6, 1987). Partly-equipped deficit households cited sales of animals as for the primary source of financing of

[28]Dioné argues that the timing of tax payments to coincide with the harvest compels deficit producers to behave irrationally in an economic sense by selling the bulk of their cereals when prices are low. This fiscal policy not only compromises the short-term food security status of deficit households but jeopardizes their longer-term productive capacity by forcing them to disinvest (through sales of animals and equipment) to pay taxes, particularly following a poor harvest (Dioné, 1989a).

their cereal purchases in all but the CMDT south sub-zone, where households relied instead on petty commerce (Table C-8, 1987).

Harts-Broekhuis and de Jong (1990a) observe an "apparent contradiction," that as one moves from surplus-producing zones in southern Mali to deficit zones in the Northeast, progressively less and less production goes for home consumption (p. 26) and more and more cereals are purchased (p. 53). Of the households selling their cereals, the most often cited reason for sales was given as payment of taxes (47 percent of households), followed by purchase of condiments (18 percent, p. 35). As in southern Mali, sale of cereals as a means to pay taxes is more frequent than the sale of animals (p. 33).

Unlike the Dutch-Malian team above, the CESA-MSU surveys encountered no mention of payment of taxes as a household expenditure (Chapter 4).[29] Nonetheless, it is fairly straightforward to check the hypothesis that sales of home produced cereals after harvest, whatever the reason, jeopardize household food security in subsequent seasons. This requires converting the value of cereal sales during the harvest/post-harvest season in Tables 4.7 and 4.11 (Chapter 4) into calories and allocating these calories back to consumption in subsequent seasons for the respective stratum and tercile (Tables 5.8-5.11) to ascertain whether these calories would have caused a food insecure household (in terms of AEs) to be reclassified as food secure. This method assumes that none of the money earned from cereals

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[29]Several reasons may explain why the CESA-MSU household expenditure surveys did not register any tax payments. First, efforts had been underway during 1988 to recover back taxes due for which payment had been deferred during the 1983/84 and 1984/85 drought. It could be that taxes had been already repaid by the start of surveys in December 1988. Another possible explanation is that taxes as an explicit expenditure item were omitted from the questionnaire, although each category had a provision for "other expenses" which should have captured any tax payments. A more likely third reason is that, by covering only one week of expenditures per month, the questionnaire missed most expenditures, including possible tax payments. As a check, the questionnaire should have asked for the major expenses taking place during the other weeks of the month.

sales was used to purchase food — that is, these figures represent the gross calorie loss from grain sales, not the net loss.[30]

Take the example of the three terciles in the South stratum during the harvest/post-harvest season in Table 4.7, whose sales are assumed to be paddy. Average monthly income of 5208 CFA francs from the sale of paddy for the upper income tercile would be equivalent to 72.2 kg (20.8 *markassoux*, each of which is equivalent to 3.465 kg), containing 3530 calories per kg (Table 5.2), divided by 30.4167 days per month yielding 8378 daily calories — a considerable amount of energy to spread among later seasons. It is clear, first of all, that since the average adult-equivalent in the upper tercile is consumption secure in all three seasons, these extra calories were not needed. Average monthly income of 937 CFA francs from the sale of paddy for the second income tercile is equivalent to 1507 daily calories which, when divided equally and allocated to consumption in the hot dry and rainy seasons makes the middle tercile consumption secure during all three seasons. Lastly, cereal sales income of 84 CFA francs per month for the lower income tercile translates into 134 daily calories which, whether added entirely to one subsequent season or the other, would be insufficient to make the average AE in the lower consumption tercile consumption secure.

Results for all strata and terciles are shown in Table 5.13. While the number of calories that could be consumed had home produced cereals not been sold is not marginal in some cases, Table 5.13 indicates that the upper tercile in the North stratum could have been made consumption secure in the rainy season. The middle terciles in the South and On-River strata would have become consumption secure in the hot dry and rainy seasons.

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[30]It is further assumed that a given household belongs to the same tercile, by respective strata and season, for both income and consumption.

Table 5.13. Sensitivity Analysis:

Attribution of the Calorie Value of Harvest/Post-Harvest Sales of Cereals to Consumption in Subsequent Seasons and its Impact on Consumption Security Status

	Harvest/Post-Harvest		Hot Dry Season		Rainy Season	
	Calorie Consumption	[Calories from Sales]	Calorie Consumption [+ Calories from Sales]			
North						
Upper Tercile	3645	[445]	2355	[+ 59 = 2414]	1864	[+ 386 = **2250**]
Middle Tercile	2341	[273]	1299	[+ 136 = 1435]	1149	[+ 136 = 1285]
Lower Tercile	1372	[148]	862	[+ 74 = 936]	737	[+ 74 = 811]
South						
Upper Tercile	4132	[8378]	3359	[+ 4189 = 7548]	3255	[+ 4189 = 7444]
Middle Tercile	2717	[1507]	1907	[+ 753 = **2660**]	2069	[+ 753 = **2822**]
Lower Tercile	1376	[84]	1165	[+ 42 = 1207]	1316	[+ 42 = 1358]
Off-River						
Upper Tercile	2821	[133]	2841	[+ 66 = 2907]	2922	[+ 66 = 2988]
Middle Tercile	1924	[6]	1758	[+ 30 = 1788]	1650	[+ 30 = 1680]
Lower Tercile	1050	[57]	1061	[+ 29 = 1090]	1106	[+ 29 = 1135]
On-River						
Upper Tercile	4471	[8378]	2421	[+ 4189 = 6610]	2476	[+ 4189 = 6665]
Middle Tercile	3143	[1690]	1434	[+ 816 = **2250**]	1379	[+ 874 = **2253**]
Lower Tercile	1907	[302]	891	[+ 151 = 1042]	775	[+ 151 = 926]

Bold denotes new status as consumption secure.

Assumptions: Cereal sold for North, South and On-River strata was paddy, where one local unit *(markassou)* of paddy cost 250 CFA francs, weighed 3.465 kg @ 3530 calories/kg ÷ 30.4167 days per month. Cereal sold for Off-River stratum was sorghum where one tin *(pot Lahda)* of sorghum cost 125 CFA francs, weighed 0.900 kg @ 3420 calories/kg ÷ 30.4167 days per month.

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To the extent that conclusions can be drawn from this sensitivity analysis, reallocating the implicit calories represented by harvest/post-harvest sales of cereals to the hot dry and rainy seasons would have benefitted mainly adult-equivalents in middle consumption tercile households. The top tercile didn't need the extra calories. As the bottom deficit-producer tercile had very little to sell in the first place, the concern about their having to "buy back" cereals is a moot point. Yet, this begs the question of how weakly diversified farming households would have met pressing cash needs in the absence of sales.

Rural market price data show no perceptible price rise between seasons (Chapter 7). On balance, the issue of forced cereals sales after harvest appears to be less pertinent to the deficit Northeast in this particular year. If a household is food insecure, it is less likely to be the result of forced sales than a lack of sufficient exchange entitlements.

5.5.2. Comparison of Rural Cereals Consumption with Urban Cereals Consumption

It would be desirable to compare rural cereal consumption in the Gao Region with urban cereal consumption in Gao City based on the same Tufts University study cited in Chapter 4 (Section 4.3.) on household expenditures. Unfortunately, such a comparison as concerns cereal calories would be more misleading than insightful due to two methodological limitations.

The first is that the Tufts study was based on an earlier household expenditure study conducted by the National Statistics Agency (DNSI) over three rounds from May 1985 through May 1986, astride two different types of crop years, during which total expenditures and prices were collected. The Tufts team repeated each of the original rounds during the comparable season from January through December 1987, retroactively measuring quantities (and their nutritional values) corresponding to the original prices. During the intervening period between DNSI and Tufts rounds, prices in the cereals market deflated considerably as Mali passed from a second consecutive poor harvest in 1984/85 to a very good harvest in 1985/86 to an even better harvest in 1986/87. Thus, quantity data collected by Tufts in 1987 based on prices collected by DNSI in 1985/86 would likely *overstate* the quantities that were actually purchased.

A second data limitation is that the Tufts/DNSI data are based exclusively on expenditures. This would *understate* consumption by ignoring home consumption of own cultivated (or own gathered) cereals and cereals from aid and transfers which, depending on the season, contribute a very sizable portion of cereal calories for rural households as just seen in this section. This limitation posed fewer problems in other cities than in Gao where households continued to consume previously distributed food aid, especially during the first round of the Tufts data collection, and many households claimed to have consumed home grown rice (Rogers and Lowdermilk, 1988a).[31]

5.5.3. Household Consumption Security per Adult-Equivalent

Just how many sample households in the Northeast were consumption secure in cereals during 1988/89?

Table 5.14 tabulates the number of households, outliers removed, whose adult-equivalent members were consumption secure according to their seasonal levels of cereals consumption. Consumption security is first assessed at the "equilibrium level" derived in Annex 5.1 whereby cereals contribute 85 percent (or 2250 calories) of a recommended daily intake of 2650 calories per AE, as defined. The sensitivity of a household's status as consumption secure or insecure to other thresholds based on cereal calories is tested at 5

[31]For the record, total estimated per capita urban calorie consumption from all sources in Gao declined steadily from 3241 daily calories during the first round (unusually high due to household consumption of residual free food aid), to 2115 calories during the second round, to 1538 calories in the third round. This consumption averaged 2298 daily calories from all sources (Rogers and Lowdermilk, 1988a). Multiplying this average by 0.8839 (the coefficient for converting from per capita data to per adult equivalent, Annex 5.1) yields 2031 calories, considerably below the daily energy requirement of 2650 calories calculated in Annex 5.1.

Table 5.14.

Cereal Calorie Consumption per AE as a Measure of Household Consumption Security: A Sensitivity Analysis

Contribution of Cereal Calories to Total Calories	Households at or above the Consumption Security Threshold							
	North		South		Off-River		On-River	
	N	Pct	N	Pct	N	Pct	N	Pct
Harvest/ Post-Harvest Season								
1. 85 Percent (2250)	25	55.6	32	65.3	20	30.8	41	82.0
2. 80 Percent (2120)	29	64.4	34	69.4	27	41.5	43	86.0
3. 75 Percent (1990)	31	68.9	34	69.4	29	44.6	43	86.0
4. 70 Percent (1855)	33	73.3	36	73.5	36	55.4	44	88.0
Hot Dry Season								
1. 85 Percent (2250)	9	20.0	17	34.7	18	28.1	10	20.8
2. 80 Percent (2120)	10	22.2	20	40.8	22	34.4	11	22.9
3. 75 Percent (1990)	11	24.4	22	44.9	25	39.1	13	27.1
4. 70 Percent (1855)	13	28.9	26	53.1	29	45.3	16	33.3
Rainy Season								
1. 85 Percent (2250)	3	7.3	20	40.8	17	27.0	10	20.4
2. 80 Percent (2120)	5	12.2	22	44.9	20	31.7	11	22.4
3. 75 Percent (1990)	6	14.6	26	53.1	22	34.9	14	28.6
4. 70 Percent (1855)	6	14.6	29	59.2	23	36.5	16	32.7

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percent intervals descending to 70 percent, the target contribution of cereals to total calories recommended by the Malian Food Strategy (*Ministère de l'Agriculture*, 1982, pp. 20-21).

Looking first at the harvest/post-harvest season, a majority of households are consumption secure at the 85 percent level in all but the Off-River stratum. Indeed, the broadest disparity lies between the Off-River and On-River strata, 30.8 percent of whose households are consumption secure versus 82.0 percent, respectively. It is therefore not surprising that Off-River households should be most sensitive to changes in the definition of consumption security. When the contribution of cereal calories is dropped to 70 percent, about one-fourth of the Off-River sample households are added to the rolls of the consumption secure. On-River households, by comparison, are least sensitive to changes in the definition of consumption security where only three households are added.

During the hot dry season, the number of consumption secure households drop dramatically, especially for On-River households. The formerly least secure Off-River stratum has a slightly higher percentage of secure households than the formerly most secure On-River stratum at each level. The number of consumption secure households in the South stratum is most sensitive to changes in levels.

The North stratum is worst off during the rainy season and least sensitive to changes in levels. Only 7.3 percent of Northern households are consumption secure at the 85 percent level, compared to 40.8 percent in the South, whose households show the only recovery from hot dry season consumption levels. Once again, the Off-River stratum shows a somewhat higher percentage of secure households than the On-River stratum at each level.

The principal conclusion to be drawn from Table 5.14 is that for a cereals-based definition of food security, *seasonality* of cereal consumption matters far more than alternative cereal calorie contribution thresholds. Consumption insecurity appears to prevail during the hot dry and rainy seasons, regardless of the percent contribution of cereal calories to total calories. At the 85 percent level, no majority of households in any strata are consumption secure in cereals. Only the South stratum shows a simple majority of its households enjoying consumption security status in all three seasons at the 70 percent cutoff.

Next, the consumption security status of adult-equivalent household members is analyzed in terms of the three four-month seasons of the survey year, 1988/89. Using the taxonomy of the World Bank (Chapter 3) as applied by Reardon and Matlon, a household is defined as *transitorily* consumption insecure if its level of cereal consumption per adult-equivalent falls below the consumption security threshold in only one of the three seasons. Those who are transitorily insecure are presumed to be able to recuperate in subsequent seasons by increasing consumption to nutritionally adequate levels. A household is *chronically* insecure if its level of cereal consumption per adult-equivalent falls below the consumption security threshold in two or more seasons. A consumption *secure* household is one whose cereal consumption is at or above the defined threshold level during each of the three seasons.

Table 5.15 summarizes the consumption security status of the rural household sample in the Northeast[32] according to the maximum and minimum percent contribution of cereal calories used in the preceding sensitivity analysis. Lowering the consumption security threshold from 85 percent to 70 percent increases the number of consumption secure households and decreases the number of chronically insecure households, as expected, while the number of transitorily insecure household varies (as some households move in and others move out).

About three-fourths of all household adult-equivalents are chronically insecure at the 85 percent level, except for households in the higher rainfall South stratum in which the number of chronically insecure drops to around 60 percent. The South claims the largest

[32]Table 5.15 analyzes only households for whom all three observations are available, a total of 100 households. Removal of five upper-end outlier households reduces the total number of consumption secure households slightly.

Table 5.15.

Consumption Security Status per Household Adult-Equivalent

Households at or above the Consumption Security Threshold

Contribution of Cereal Calories to Total Calories	North		South		Off-River		On-River	
	N	Pct	N	Pct	N	Pct	N	Pct
Consumption Secure								
1. 85 Percent (2250)	0	0.0	8	19.0	7	12.3	3	6.7
2. 70 Percent (1855)	6	15.0	15	35.7	15	26.3	9	20.0
Transitorily Insecure								
1. 85 Percent (2250)	9	22.5	7	16.7	7	12.3	10	22.2
2. 70 Percent (1855)	5	12.5	9	21.4	8	14.0	9	20.0
Chronically Insecure								
1. 85 Percent (2250)	31	77.5	27	64.3	43	75.4	32	71.1
2. 70 Percent (1855)	29	72.5	18	42.9	34	59.6	27	60.0

Note: Consumption secure AEs reached cereal calorie threshold in all three four-month seasons.
Transitorily insecure AEs reached cereal calorie threshold in two of three four-month seasons.
Chronically insecure AEs reached cereal calorie threshold in one or less four-month season.

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number of consumption secure households at both cereal calorie thresholds while the North has the least.

The North stratum is also the least sensitive to lowering the cereal calorie threshold at the chronically insecure level (only 2 households move up to transitorily insecure status, or 5.0 percent), implying that even in a "good" rainfall year and regardless of threshold, about three-fourths of adult-equivalents in the North remain chronically insecure. The South stratum is the most sensitive (9 households move up to transitorily insecure status, or 21.4 percent).

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The Off-River and On-River strata display a very similar pattern in the percentage of consumption secure and chronically insecure households at both cutoff points. Depending on how close households in each stratum are to the cutoffs, this may indicate that there is no net occupational advantage to On-River households as cereal producers or locational advantage from proximity to a permanent water resource. Only at the transitorily insecure level does the On-River stratum include a higher percentage of households than the Off-River stratum.

5.5.4. Summary of Main Points based on Cross-Tabular Analysis

The following points summarize cereals consumption in rural villages in the Northeast based on cross-tab analysis of aggregate cereal calories consumed and source of procurement.

- Pronounced disparities in cereals consumption exist *within* strata. Based on 2250 daily calories from cereals, adult-equivalents in upper tercile households are always consumption secure (except in the North stratum during the rainy season). Adult-equivalents in middle tercile households are consumption secure during the harvest/post-harvest season (except in the Off-River stratum), suggesting evidence of transitory malnutrition. Lower tercile AEs are never consumption secure in cereals. Unless deficits in cereal consumption are compensated by other sources of food energy, adult-equivalents in the lower tercile, in particular, risk chronic malnutrition.
- Disparities in cereals consumption exist between seasons and across strata, especially in farming households, best epitomized by the On-River stratum which shows the greatest seasonal variability. The notable exception is stable

cereals consumption by predominantly non-farming households in the Off-River strata.

- Consumption is concentrated within only a few cereals overall, reflecting a hierarchy of preferences whereby the top two cereals contribute between two-thirds and three-fourths of total cereal calories. Within the On-River stratum, paddy alone contributes about two-thirds of all cereals calories.
- Seasonal reliance on the market as the primary source of cereals is universally strong during the hot dry season (all terciles and all strata) and the rainy season (bottom two terciles, all strata). Within the Off-River stratum, the market is the preeminent supply source in each season for all terciles and more than half in each season for all strata. For the South and On-River stratum, in contrast, home production supplies the majority of cereal calories during the harvest/post-harvest season (all terciles).
- In aggregate terms, the market supplies two-thirds of all cereals calories for the Sahelo-Saharan North stratum and Off-River stratum where opportunities for home production are poor. In the higher rainfall South stratum and On-River stratum where home production is the most important source of supply, the market provides a little more than one-third of cereals calories.
- Consumption security, as defined by the contribution of cereal calories to total calories, is relatively insensitive to alternative thresholds. Rather, consumption security is a seasonal phenonomen, with most households insecure during the hot dry and rainy seasons.

- The percent of consumption secure households is largest in the South, smallest in the North and roughly equal between Off-River and On-River strata. About 60 percent of all households are chronically insecure.

5.6. Econometric Modelling of Determinants of Household Food Security

This chapter has examined a number of detailed relationships between adult-equivalent members of households in the Northeast and their economic behavior concerning income, expenditures and consumption. Up until now, these relationships have been analyzed in cross-table form by strata, season and tercile. This section combines these partial relationships into single-equation econometric models for testing the underlying statistical relationships in order to move from the descriptive to the predictive. Two sets of econometric models will be tested.

5.6.1. Cereal Expenditure and Cereal Calorie Elasticities

The first set calculates cereal expenditure elasticities in terms of both CFA francs and calories. In his review of elasticity studies, Alderman (1986) notes an apparent corollary of Engel's Law: that elasticities for food, like budget shares, decline with increasing income (or expenditures).[33] These models will measure expenditure and calories elasticities for total cereals by strata and by tercile. Elasticities for total food expenditures will also be estimated for comparison.

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[33]Expenditure data are commonly used as a proxy for income data. Expenditures, like consumption, can be smoothed over short periods and may provide a better measure.

5.6.1.1. Choice of Functional Form

Choice of functional form depends on the theoretical and empirical hypotheses to be tested, on the nature and quality of the data used, and on commonly recognized criteria such as goodness of fit, significance of variables and the adequacy with which key variables can be described. Four functional forms were initially considered for these elasticity calculations. Two were rejected on theoretical grounds. The other two were rigorously tested.

For measuring consumption-income relationships, King and Byerlee recommend the ratio semi-log inverse function (RSLI) for its flexibility in representing in allowing rising, falling or constant marginal propensities to consume (MPC) over the range of income levels. In terms of the elasticity coefficient *b*, the effect of changes in household income on the MPC will be monotonically increasing when $b > 0$, constant when $b = 0$ and decreasing when $b < 0$. Thus, the effect of changes in income on expenditure elasticities is indeterminant of the functional form.[34]

The other main argument in favor of the RSLI function is that it conforms perfectly with the additivity criterion, where the sum of marginal propensities to consume for all

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[34]Two functional forms, the double-log and the log-inverse, were rejected partly on marginal propensity to consume grounds. The convenience of the double-log form is that the coefficient on expenditures can be directly read as an elasticity of demand. The drawback is that this elasticity is constant across expenditure classes (or for changes in income), in apparent contradiction of demand theory in that a good cannot be a luxury good for some expenditure class (where the elasticity coefficient $b > 1$) and an inferior good for other expenditure classes (where $b < 0$), a serious limitation.

Thus, the constant elasticity of the double-log function implies that demand (or consumption) remains "unsaturated" at all expenditure levels. The other functional form was not tested based on similar saturation of demand considerations. The elasticity of demand of the log-inverse function approaches zero asymptotically for extremely high expenditure classes, implying saturation, but not substitution. Neither of these forms seemed appropriate, given dietary patterns in the Northeast and seasonally low levels of cereal consumption.

A further difficulty with both of the above forms is that some households failed to purchase during the week under observation. These zero-value observations cause considerable difficulties when the dependent variable is specified in logarithmic form (double-log and log-inverse), since the log of zero is undefined.

commodities should equal unity (where the set of commodity groups is exhaustive of total household expenditures).[35]

Expenditure regressions for all food commodities and for all cereals were first tested for all strata using the RSLI model of King and Byerlee, as manipulated in its final form (page 33).[36] These regressions used unadjusted household expenditures in order to conform to the additivity criterion. Purchases on credit were not netted out because credit purchases and reimbursement of credit roughly offset each other by strata (Table A4.1.5. in Annex 4.1). Moreover, inclusion of credit purchases indicates how households allocated the full set of resources available to them.

Results using the RSLI functional form were disappointing in terms of occasionally insignificant expenditure coefficients and/or signs on expenditure coefficients, leading to unexpectedly inverted marginal propensities to consume and expenditure elasticities by terciles. More serious violations of regression assumptions occurred due to multi-collinearity between the two expenditure variables (total household expenditures and total household expenditures times the natural log of per AE total expenditures). High collinearity results in very high standard errors and makes a collinear regression coefficient difficult to interpret as a partial regression coefficient measuring the change in the expenditure on commodity *i* associated with a unit change in total expenditure, holding all other variables constant. Since the usual procedure is to drop one of the collinear explanatory variables, the modified RSLI

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[35]The double-log and log-inverse functions are not perfectly additive.

[36]King and Byerlee first specified their expenditure model in per capita (per adult-equivalent) terms. They transformed the model from the per capita form to total household expenditures to include household size as an independent variable by multiplying the per capita terms times the number of present household members and then by multiplying both sides of the equation by total household expenditures. As a final step, they added a subsistence ratio variable and regional dummy variables.

model and results were rejected. Lastly, the RSLI form is no longer meaningful for estimating expenditure elasticities for cereal calories because total calories purchased (unlike total money expenditures) is unknown.

This left the semi-log functional form as second choice for estimating total food, total cereals and total cereal calories expenditure elasticities. The semi-log form is less flexible in measuring marginal propensities to consume. Positive changes in household expenditures will lead to monotonically decreasing marginal propensities to consume. The semi-log form does not yield perfectly additive MPCs, although a reasonably good regression fit should satisfy the additivity criterion at mean tercile levels (Prais and Houthakker, in King and Byerlee, p. 29).[37] Lastly, the semi-log form does not run up against the problem of zero-value dependent variables, whose logarithms are undefined. Given the poor applicability of the RSLI form to estimating calorie expenditure elasticities due to data limitations noted above, use of the same semi-log form allows comparison of all three elasticity estimates.

In their study of *urban* household food expenditures in Mali, Rogers and Lowdermilk found no apparent levelling off of consumption at higher expenditure levels nor any consistently inferior food for which consumption falls off as expenditure rises. In other words, the quantities of all foods increase proportionately with increases in expenditure, suggesting that higher income households have expenditure patterns similar to those of lower income households (Rogers and Lowdermilk, 1988a, p. 10).[38] On this basis, Rogers and Lowdermilk justify use of the log-log functional form for their elasticity measures (1988a, pp. 10-15).

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[37]This issue was less critical as it was not intended to estimate MPCs and elasticities for each consumption category.

[38]Regrettably, the recent (1988/89) National Budget Consumption Study does not break down results by expenditure class (see *Ministère du Plan/PADEM*, 1991a, 1991b).

A review of Tables 4.13 through 4.16 nonetheless shows conspicuous differences in expenditure patterns between *rural* household terciles, arguing in favor of the more plausible semi-log functional form permitting elasticity calculations by tercile.

Recalling from Annex 4.1, household expenditures quite often exceeded household incomes, raising questions of measurement error in the data. Since expenditures on food usually represent the most important expenditure category (Table 4.17) and since expenditures on cereals are likely to be inversely related to home consumption of own-produced and own-gathered cereals, an alternative measure of "adjusted expenditures" was used in these semi-log regressions, where the value of home consumed cereals is added to expenditures.

To facilitate interpretation, data have been aggregated over the survey period, with the following adjustments. First, weekly expenditures during July 1989 were excluded to avoid the uneven influence across villages of household holiday spending for Tabaski; data thus include 10 weekly observations per household from December 1988 through June 1989 and from August through October 1989. Next, four households with three or fewer observations were also excluded to remove the bias of one-season expenditure patterns.

Third, it was found that five households purchased no cereals during the weekly observations, resulting in a zero-value dependent variable and violation of the classical regression assumption of equal variance of error terms (Hu).[39] It turned out that these non-

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[39]This issue concerns non-purchase — where households do not buy all cereals — a common problem when commodity groups are disaggregated and the observation period is short. Widespread non-purchase, or a large number of zero-value dependent variables, will bias coefficient estimates using OLS — actual (non-zero) purchases will be normally distributed but the cluster of non-purchase cases (with zero-values) will not be normally distributed. If elasticities are estimated using a truncated subsample of only purchasing households, the subsample coefficients will remain biased (Sahn, 1988) and understate the true population parameters (Rogers and Lowdermilk, 1988a).

A two-stage approach for dealing with the non-purchase problem was developed by Heckman based on two separately specified functions. See Heckman (1976, 1979) for full discussions of his techniques. Alderman (1986) and Sahn (1988) give cogent summaries.

purchases were due to the discontinuous nature of data observations (one week per month) as all of these households had purchased cereals during the course of the survey year (according to the household cereal consumption survey), but simply not during the particular weekly observation. These five households were also dropped.

5.6.1.2. Regression Equations

The dependent variable for the total food elasticity regression is weekly food expenditures per household, adjusted to a monthly basis by multiplying times 4.345 average weeks per month (FOODEXP). The regression equation was run separately for each stratum, taking the simplified form:

$$\text{FOODEXP} = \alpha_1\text{LNAHEXP} + \alpha_2\text{ADEQUIVS} + \alpha_3\text{LSUBSIST}.$$

The dependent variable for the cereal expenditure elasticity regression is average total weekly cereal expenditures per household, adjusted to a monthly basis (CEREXP). The regression equation was run separately for each stratum in the following form:

$$\text{CEREXP} = \beta_1\text{LNAHEXP} + \beta_2\text{ADEQUIVS} + \beta_3\text{LSUBSIST}.$$

The dependent variable for the cereal calorie expenditure elasticity regression is average total weekly cereal calorie purchases per household, adjusted to a monthly basis (CALEXP). The regression equation was run separately for each stratum in the following form:

$$\text{CALEXP} = \gamma_1\text{LNAHEXP} + \gamma_2\text{ADEQUIVS} + \gamma_3\text{LSUBRAT}.$$

The independent variables for all three equations are defined as follows:

LNAHEXP. Adjusted household expenditures, based on the imputed value of home consumption of own-produced and own-gathered cereals, plus total weekly household expenditures adjusted to a monthly basis by multiplying times 4.345 weeks per month, transformed into natural logs.

ADEQUIVS. Household size expressed in terms of *present* adult-equivalents.

LSUBSIST. The natural logarithm of the ratio of home (or subsistence) cereals consumption in calories (home-produced and home-gathered cereals plus consumption of seed stock) to the value of total cereals consumption in calories.[40]

LSUBRAT. The natural logarithm of the ratio of the value of home (or subsistence) cereals consumption to the value of total cereals consumption.[41]

5.6.1.3. Regression Results

Table 5.16 shows the marginal propensities to spend and point of mean expenditure elasticity coefficients by tercile, where the semi-log marginal propensity to consume is defined as the regression coefficient for average total adjusted household expenditure (LNAHEXP) divided by the tercile average total adjusted household expenditure (for example, ∂FOODEXP/∂LNAHEXP = α_1/the antilog of LNAHEXP). The semi-log elasticity is defined as the regression coefficient for average total adjusted household expenditure (LNAHEXP)

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[40]This variable is included as an independent variable because a household's expenditure pattern is related to its orientation towards home-produced goods or towards market-purchased goods.

To avoid problems of simultaneity between either of the dependent variables, FOODEXP and CEREXP, and the subsistence consumption variable, LSUBSIST is expressed in terms of calories, rather than expenditure values. It is assumed that seed stock is home-produced, not purchased.

[41]To avoid problems of simultaneity between the dependent variable, CALEXP, and the subsistence consumption variable, LSUBRAT, is expressed in terms of expenditures, rather than calories.

divided by the tercile average adjusted household expenditure on food, cereals and cereal calories (FOODEXP, CEREXP and CALEXP, respectively).[42] Full equations are not shown.[43]

All total expenditure coefficients (LNAHEXP) are positive, as expected, and significant at the 99 percent level except the calorie equation coefficients for the South and On-River strata (positive and significant at the 90 percent level). Increase in total expenditures are associated with increased purchases of food, cereals and cereal calories.

Household size variables (ADEQUIVS) show mixed results. Coefficients are low, but positive and significant at the 99 percent level of confidence in all strata for cereal calorie expenditures, indicating that higher numbers of present adult-equivalents in the household increase the purchase of calories from cereals. These elasticities are less than unity, indicating that economies of scale exist in purchase of cereal calories. Because these results differ from those of the cereal calories consumption regressions (section 5.6.2.), the household size MPCs and elasticities are also shown in Table 5.16. Coefficients are positive but not significant for cereal cash expenditures (except the North stratum, significant at the 99 percent level).[44] None of the coefficients for all food purchases are significant.

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[42]For example, the food expenditure elasticity, (∂FOODEXP/∂LNAHEXP) * (the antilog of LNAHEXP/FOODEXP), = (α_l/the antilog of LNAHEXP) * (the antilog of LNAHEXP/FOODEXP), or simply α_l/FOODEXP).

[43]Most regressions have acceptable goodness of fit, as measured by the adjusted R^2. The normal distribution and constant variance of regression residuals were somewhat poor due to the low number of observations.

[44]Household size (ADEQUIVS) elasticities of demand for cereal purchases in CFA francs for the North stratum are 0.081 (overall) and 0.051; 0.083; and 0.192 for the upper, middle and lower terciles, respectively.

Table 5.16.
Household Marginal Propensities to Spend and Expenditure Elasticities by Terciles

	LNAHEXP						ADEQUIVS	
	All Food (CFA Francs)		Cereals (CFA Francs)		Cereals (Calories)		Cereals (Calories)	
	MPC	Elast.	MPC	Elast.	MPC	Elast.	MPC	Elast.
North (N=43)	0.643	0.656	0.243	0.419	0.253	0.371	0.056	0.083
Upper Tercile	0.250	0.335	0.095	0.263	0.085	0.257	0.022	0.057
Middle Tercile	0.490	0.783	0.185	0.428	0.193	0.357	0.043	0.079
Lower Tercile	1.204	1.673	0.455	0.992	0.474	0.724	0.105	0.161
Adjusted R^2		*0.684*		*0.727*		*0.581*		*0.581*
South (N=45)	0.568	0.900	0.278	0.950	0.062	0.287	0.020	0.094
Upper Tercile	0.354	0.515	0.174	0.674	0.039	0.293	0.013	0.096
Middle Tercile	0.496	0.750	0.243	0.922	0.054	0.247	0.018	0.081
Lower Tercile	0.808	1.253	0.396	1.696	0.088	0.335	0.029	0.109
Adjusted R^2		*0.726*		*0.462*		*0.468*		*0.468*
Off-River (N=58)	0.639	0.638	0.311	0.549	0.190	0.321	0.035	0.059
Upper Tercile	0.274	0.344	0.133	0.327	0.081	0.235	0.015	0.044
Middle Tercile	0.454	0.635	0.221	0.633	0.135	0.315	0.025	0.058
Lower Tercile	1.219	1.503	0.594	1.193	0.362	0.517	0.067	0.096
Adjusted R^2		*0.645*		*0.442*		*0.531*		*0.531*
On-River (N=50)	0.557	0.727	0.236	0.646	0.059	0.195	0.040	0.132
Upper Tercile	0.209	0.323	0.089	0.398	0.022	0.213	0.015	0.147
Middle Tercile	0.389	0.643	0.164	0.632	0.041	0.135	0.028	0.091
Lower Tercile	1.446	2.508	0.612	1.801	0.153	0.284	0.096	0.192
Adjusted R^2		*0.679*		*0.461*		*0.338*		*0.338*

Note: Coefficients on all total expenditure variables (LNAHEXP) are positive and significant at the 99 percent level except for the South and On-River strata for calorie expenditures (90 percent level). Coefficients on all household size variables (ADEQUIVS) are positive and significant at the 99 percent level.

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Interpretation of the household subsistence ratio (LSUBSIST) in the all food and all cereals equations is more straight-forward. The higher the ratio of home consumption of cereals to total consumption, the fewer purchases the household makes, all things equal. All coefficients are negative, as expected, and significant at the 99 percent level (except for the Off-River stratum at 90 percent for all food and 85 percent for all cereals). The household subsistence ratio (LSUBRAT) coefficients for the cereal calorie equations are negative and significant at the 98 percent level (except for the North stratum for which the coefficient is positive, but weakly significant).

5.6.1.3.1. Marginal Propensities to Consume. The marginal propensities to consume for the lower terciles in the "all food" equations (except the South stratum) are greater than unity, an indication of the imperfect additivity of the semi-log function at very low (or high) expenditure levels. MPCs for the middle expenditure terciles and overall strata are most reliable. The MPCs by strata indicate that of every additional 100 CFAF spent per household per month, about 60 CFAF will be spent on food generally, about 25 CFAF will be spent on cereals by value and roughly half of that will be spent on cereal calories.

The cereal expenditures and cereal calories MPCs reveal differences by strata-pairs. The MPCs for cereals for the North and South strata are fairly similar, but the North MPC for cereal calories is more than four time greater than that of the South. The North MPC for calories is also slightly higher than the MPC for cereals. These marginal propensities suggest that both North and South households would spend about the same portion of an additional increment of expenditures (income) on cereals generally, but that North households would spend their increment on cereals with higher caloric value, such as rice and/or paddy (Table 5.2), of which South households already consume greater quantities (Annex 5.2), and possibly switch from millet and sorghum. A similar pattern appears for the comparison between Off-

River and On-River strata. In general terms, South and On-River households may spend incremental expenditures (income) on more of the same — rice and/or paddy — while North and Off-River households may turn to more rice and/or paddy.

5.6.1.3.2. Expenditure Elasticities. Table 5.16 shows that elasticities vary broadly by tercile, supporting the choice of the semi-log over the double-log form.

All Foods Expenditure Elasticities. Expenditure elasticities for all foods are elastic for lower expenditure tercile households, meaning that a one percent increase in average expenditures results in a greater than one percent increase in expenditures on all foods. Elasticities are less than unitary for middle tercile households, where a one percent increase in expenditures will elicit less than a one percent increase in total food expenditures. Elasticities are moderately low for upper terciles. Strata elasticities converge around 0.67, except for the South stratum with an overall expenditure elasticity of 0.90.

Cereals Expenditure Elasticities. Expenditure elasticities for cereals in money terms are more than double in the higher rainfall South than in the North, possibly reflecting greater extremes in the South in seasonal self-sufficiency in cereals (and seasonal non-participation in the market) and seasonal reliance on the market for cereals. Expenditure elasticities of demand are likewise higher for On-River households than Off-River households, but the differences are slighter. These expenditure elasticities may be picking up a seasonal phenonemon. Farm households with higher incomes rely on own production early in the season and then shift to purchases when supplies run out. As this effect is strongest in the South and On-River, these elasticities are higher. Expenditure elasticities for North and Off-River households who rely more evenly on the market for their cereal supplies are more similar by tercile.

Cereal Calories Expenditure Elasticities. Expenditure elasticities of demand for cereals in terms of calories are consistently lower than expenditure elasticities in terms of CFA francs, as expected (Reutlinger and Selowsky; Alderman, 1986; Sahn, 1988). As expenditures (or incomes) rise, households turn toward more expensive cereals in terms of taste and convenience of preparation. However, the calorie value of cereals at the same stage of transformation is fairly uniform (refer to Table 5.2), implying that cereal prices vary disproportionately to their calorie content. The significance is that lower expenditure households have considerable latitude for meeting calorie requirements from lower-priced cereals, all things equal.

5.6.2. Regression Analysis of Levels of Cereals Consumption

The second set of models, based on cross-sectional household data, uses the approach of Reardon *et al.* (1991) which tests the hypothesis that diversification of income is associated with higher levels of cereals consumption. These models also examine other price and demographic variables of interest.

5.6.2.1. Choice of Functional Form

Two functional forms were considered for these regressions, the semi-log and double-log forms. Once again, the advantage of the semi-log form is that expenditure elasticities vary according to expenditure (or income) class, as predicted by theory, whereas the double-log form yields a constant elasticity. On this basis, the semi-log functional form was retained.

5.6.2.2. Regression Equation and Description of Variables

The previous set of expenditure regressions considered the household as a unit, where total household purchases of food, cereals and cereal calories were dependent variables, respectively, for which total household expenditures and household size were key independent variables.

From a food security viewpoint, however, it is more meaningful and easier to interpret cereal calorie consumption on a per adult-equivalent basis. Thus, the dependent variable for these regressions is average daily consumption of cereal calories per household adult-equivalent per month (AECERCAL). Independent variables were considered for inclusion on the basis of theory or hypotheses specific to the Northeast, transformed into natural logs.

Examining calorie consumption on a per-AE basis would require dropping household size as an independent variable to avoid simultaneity bias. Since AECERCAL (calorie consumption per AE) equals HHCERCAL/ADEQUIVS (household calorie consumption divided by AEs), the variable ADEQUIVS would appear on both sides of the equation.

Nonetheless, there is reason to believe that household size in the Northeast influences daily cereal calorie consumption. A pre-regression sensitivity analysis bears this out. Results are shown in Table 5.17, first, for calorie consumption at or above average household size per AE (AECERCAL) and per capita (PCCERCAL), and below average size. These results show that cereal calorie consumption is consistently higher for smaller-than-average households. Some differences are striking. Adult equivalents in smaller households in the South stratum consume more than 900 calories per day more than adult equivalents in larger households. The same pattern holds for per capita consumption, where members of smaller households consume more daily calories than members of larger families.

Next, Table 5.17 looks at daily cereal calorie consumption at or above and then below an arbitrary cutoff of five AEs per household and again for five (unadjusted) members per

Table 5.17.
A Comparison of Average Daily Cereals Calorie Consumption based on Household Size: Pre-Regression Sensitivity Analysis

	North	South	Off-River	On-River
Average Size:				
Numbers	7.5	8.7	7.5	8.0
AEs	6.3	7.1	6.2	6.7
AECERCAL				
≥ average	1417 147	1752 212	1671 275	1811 200
< average	1774 279	2690 339	2074 359	2262 355
PCCERCAL				
≥ average	1229 170	1442 234	1328 304	1511 242
< average	1463 256	2302 317	1860 330	1894 313
AECERCAL				
≥ 5	1452 246	2099 408	1674 394	1945 376
< 5	1923 279	2985 143	2268 240	2425 179
PCCERCAL				
≥ 5	1293 331	1813 472	1411 496	1700 459
< 5	1636 95	2678 79	2300 138	1857 96

Notes: AECERCAL is average daily cereal calorie consumption per adult equivalent. PCCERCAL is consumption per capita. Average household size was taken from Table 4.2. Numbers in fine type refer to sub-sample size in household-months. Regression outliers were removed.

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household. AEs and members of smaller households alike consistently consume more daily cereal calories than their counterparts in larger households.

In view of these results, the question is how to introduce household size as an explanatory variable and get around the problem of simultaneity. One solution would be to drop the household size variable. But this results in specification error, where the influence of the omitted variable is picked up by the coefficients of other included variables. A second solution would be to take advantage of the unadjusted number of household members, (PERSONS). Yet, difficulties arise in interpretation of regression coefficients on unadjusted household members (or "counting numbers") for adult equivalents, based on adjusted cereal consumption requirements.

A third solution would be to transform the household size variable (ADEQUIVS) into natural logarithms (LADEQUIV). LADEQUIV is no longer in direct *linear* relation with ADEQUIVS. Use of the semi-log functional form already takes care of this. Transforming PERSONS into LPERSONS would also work, although subject to the difficulty of interpretation as noted.

Given the tradeoff between these options, the third solution will be used where the log of household size in AEs will be kept as an independent variable.

A second household demographics variable, the household dependency ratio (LNDEPRAT), can be safely introduced as an explanatory variable without simultaneity bias. LNDEPRAT is the ratio of all (unadjusted) household members to those (unadjusted) household members of working age, 13 through 59 inclusive. Its purpose is to relate the number of employment-aged household members — potential income-earners — to total household members. As it does not concern calorie consumption requirements, it is not expressed in terms of AEs and thus not directly related to ADEQUIVS. Moreover, it is a ratio transformed into natural logs.

The regression equation was run separately for each stratum.[45] The equation took the form:

$$
\begin{aligned}
\mathrm{AECERCAL} = \; & \alpha_1\mathrm{LNINCOME} + \alpha_2\mathrm{LNDIVINC} + \alpha_3\mathrm{LNPMIL} + \alpha_4\mathrm{LNPSOR} + \\
& \alpha_5\mathrm{LNPPAD} + \alpha_6\mathrm{LNPLRICE} + \alpha_7\mathrm{ETHNCITY} + \alpha_8\mathrm{GENHEAD} + \\
& \alpha_9\mathrm{LADEQUIV} + \alpha_{10}\mathrm{LNDEPRAT} + \alpha_{11}\mathrm{LAGEHEAD} + \\
& \alpha_{12}\mathrm{LRESIDEN} + \alpha_{13}\mathrm{LNASSETS} + \alpha_{14}\mathrm{NOV} + \alpha_{15}\mathrm{JAN} + \alpha_{16}\mathrm{FEB} + \\
& \alpha_{16}\mathrm{MAR} + \alpha_{17}\mathrm{APR} + \alpha_{18}\mathrm{MAY} + \alpha_{19}\mathrm{JUN} + \alpha_{20}\mathrm{JUL} + \alpha_{21}\mathrm{AUG} + \\
& \alpha_{22}\mathrm{SEP} + \alpha_{23}\mathrm{OCT}.
\end{aligned}
$$

The independent variables are defined as follows:

LNINCOME. Average monthly household income, defined as total household expenditures (adjusted from a weekly to monthly basis) plus the value of home consumption of own produced and own gathered cereals, on a per adult-equivalent basis.[46]

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[45]Computer-identified outlier cases were removed from the final regressions with minimal loss of observations. Seven outlier cases were dropped from the North stratum (1.9 percent of all cases), 6 from the South (1.3 percent), 9 from the Off-River (1.6 percent) and 6 from the On-River (1.1 percent).

[46]This definition of monthly income was used, rather than the direct measure of reported and implicit income, based on results in Annex 4.1 showing income measures usually less than expenditure measures.

Given the expected importance of monthly income as an explanatory variable for cereals consumption, trial regressions also included a quadratic term for income (LNINCOME squared). Results were not consistently good across strata (in some cases, the coefficients on both income terms were insignificant), so this additional variable was dropped.

LNDIVINC. An index of diversification of average total monthly household income.[47] This variable is the inverse of the percent contribution of the two greatest sources of household income (of a possible 20 sources) to total household income (the inverse of a CR_2).

LNPMIL, LNPSOR, LNPPAD and LNPLRICE. A vector of market cereal prices representing average monthly prices weighted by quantity for millet, sorghum, paddy and "local rice" from weekly rural markets.

ETHNCITY. Ethnicity, a dummy variable for ethnic group (where Sonhraï = 1, otherwise 0).

GENHEAD. A dummy variables for gender of head of household (where male = 1, otherwise 0).

LADEQUIV. Household size expressed in terms of *present* adult-equivalents.

LNDEPRAT. Dependency ratio, or the ratio of total *present* household members to *present* employable, able-bodied and working-age household members. This variable is not expressed in terms of adult-equivalents.

LAGEHEAD. Age of the head of household.

LRESIDEN. Years of residence of the household in the survey village.

LNASSETS. An aggregate value of selected household assets: wooden canoe (*pirogue*), cart, oxen, camels and donkeys, on a per adult-equivalent basis.[48]

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[47]This is based on the initial definition of reported household income plus the implicit value of home consumption of own-produced and own-gathered cereals. This alternative definition is not strictly comparable to LNINCOME. However, it allows the calculation of an income diversification index whereas LNINCOME does not.

[48]Assets were valued as followed based on prevailing prices in the Northeast: wooden canoe (*pirogue*, 60,000 CFAF); cart (80,000 CFAF); adult ox (75,000 CFAF); adult camel (100,000 CFAF); and donkey (25,000 CFAF).

NOV, JAN, FEB etc. Monthly dummy variables (where the month in question = 1, otherwise 0) starting from November 1988. The month of December 1988 is the omitted variable.

All variables have been transformed into natural logs except zero-one dummy variables. The subscript *t* is implicit for each variable as values were observed during the respective month except LNASSETS. LNASSETS was observed once at the beginning of the survey period, meaning that each observation in following months is lagged by the appropriate number of periods.

5.6.2.3. Interpretation of Regression Results

5.6.2.3.1. General Regression Results. Partial regression results, transformed into elasticities, are presented by strata in Table 5.18. Elasticities are shown in bold on the first page of the table and the standard errors of the original regression coefficients are shown directly below in parentheses.[49] Each regression was tested for possible violations of assumptions concerning normal distribution of error terms; equality of error terms with zero expected value and constant variance for all observations (homoscedasticity); independence of error terms (serial correlation); and multi-collinearity of independent variables (Kennedy; Pindyck and Rubinfeld; Norusis).

Some evidence of heteroscedasticity in trial regressions, where the variance of the regression error terms increased with the increasing consumption of cereal calories, was reduced to acceptable levels by the removal of outlier cases (footnote 44). The normality of distribution of error terms also improved as a result. Serial correlation did pose problems based on the Durbin-Watson statistic.

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[49]The regression coefficients themselves can be obtained by multiplying the respective elasticity by the mean of AECERCAL for each stratum.

Table 5.18. Household Consumption Regression Elasticities
Dependent Variable: Daily Consumption of Cereal Calories (AECERCAL)

	North	South	Off-River	On-River
LNINCOME	**0.275**	**0.228**	**0.128**	**0.256**
ln household income per AE	***(43.765)	***(55.860)	***(32.258)	***(41.643)
LNDIVINC	**1.020**	**0.391**	**0.831**	**0.652**
ln diversification of HH income	***(589.995)	***(445.628)	***(476.449)	***(448.409)
LNPMIL	**-0.744**	**0.090**	**-0.314**	b
ln price of millet	(874.342)	(392.459)	***(218.129)	b
LNPSOR	a	c	a	**-1.569**
ln price of sorghum	a	c	a	***(844.660)
LNPPAD	d	a	a	**-0.052**
ln price of rice paddy	d	a	a	(452.053)
LNPLRICE	**-0.817**	**3.713**	c	e
ln price of local rice	**(571.931)	***(1108.595)	c	e
ETHNCITY	**0.384**	**-0.261**	**-0.226**	a
Ethnicity (Sonhraï = 1)	***(233.877)	***(162.543)	***(135.647)	a
GENHEAD	**-0.351**	**0.057**	**0.095**	**0.086**
Gender HH head (Male = 1)	***(156.998)	(146.519)	*(91.759)	(141.483)
LADEQUIV	**-0.212**	**-0.304**	**-0.381**	**-0.357**
ln HH size in AEs	***(104.426)	***(96.372)	***(75.493)	***(108.192)
LNDEPRAT	**-0.066**	**0.030**	**0.048**	**-0.032**
ln HH dependency ratio	(114.971)	(134.205)	(83.666)	(125.385)
LAGEHEAD	**-0.118**	**-0.003**	**-0.134**	**0.035**
ln age HH head	(198.877)	(165.532)	(156.170)	(166.719)
LRESIDEN	**-0.009**	**-0.014**	**0.044**	**-0.097**
ln years of residence	(70.320)	(74.603)	*(46.512)	**(87.126)
LNASSETS	**-0.016**	**0.011**	**0.021**	**-0.002**
ln value of assets per AE	***(10.129)	***(8.852)	***(7.200)	(8.524)
NOV	a	**-0.012**	a	**0.185**
November 1988	a	(254.166)	a	*(204.537)
JAN	**-0.452**	**0.302**	**-0.186**	**-0.304**
January 1989	***(206.149)	***(236.249)	**(170.802)	***(203.337)
FEB	**-0.754**	**0.335**	**-0.090**	**-0.485**
February	***(194.992)	***(235.781)	(166.293)	***(199.986)
MAR	**-0.863**	**0.054**	**-0.135**	**-0.581**
March	***(237.903)	(229.746)	*(167.631)	***(194.414)
APR	**-0.806**	**-0.391**	**-0.042**	**-0.732**
April	***(267.964)	***(0.104)	(163.664)	***(203.549)
MAY	**-0.970**	**-0.721**	**-0.168**	**-0.947**
May	***(275.758)	***(229.226)	*(165.914)	***(212.925)
JUN	**-0.786**	**-0.565**	**-0.047**	**-0.979**
June	***(290.445)	***(222.163)	(167.682)	***(232.240)
JUL	**-1.018**	**-0.975**	**-0.194**	**-1.183**
July	***(311.892)	***(242.972)	**(172.674)	***(228.976)
AUG	**-1.044**	**-0.691**	**-0.094**	**-0.947**
August	***(307.807)	***(250.039)	(171.953)	***(227.866)
SEP	**-1.251**	**-0.580**	**-0.010**	**-1.101**
September	***(316.908)	***(256.741)	(172.060)	***(238.241)
OCT	**-0.969**	**-0.868**	**-0.081**	**-0.768**
October	***(352.664)	***(300.931)	(169.933)	***(227.586)

Table 5.18. (continued)

	North	South	Off-River	On-River
CONSTANT	13909.182	-42844.112	4278.427	14946.966
	***(4166.086)	***(5107.155)	***(1116.776)	***(4571.849)
Adjusted R^2	**0.519**	**0.426**	**0.316**	**0.557**
Standard Error (SE)	757.256	971.632	806.723	920.247
Mean of AECERCAL	1650.022	2258.015	1857.258	2085.539
SE as % mean of AECERCAL	43.9	43.0	43.4	44.1
F Statistic	***19.779	***18.679	***13.935	***33.231
N	366	524	561	539

Standard errors of regression coefficients are shown in parentheses.
***Significant at 99 percent. **Significant at 95 percent. *Significant at 90 percent.

[a]Variable dropped by regression due to missing observations or constant values.
[b]Variable dropped due to high collinearity with LNPSOR.
[c]Variable dropped due to high collinearity with LNPMIL.
[d]Variable dropped due to high collinearity with LNPLRICE.
[e]Variable dropped due to high collinearity with LNPPAD.

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Multi-collinearity of cereal prices[50] was an occasional problem. One of the offending variables was dropped in each case with little loss of goodness of fit (adjusted R^2) and a drop in the standard errors of remaining variables, although at the possible cost of specification error. Anticipated multi-collinearity between the age of the head of household (LAGEHEAD) and years of residence of the household in the survey site (LRESIDEN), especially in the longer-settled On-River stratum, did not materialize.

[50]On the assumption that all households in the same village faced identical cereal prices, market prices were used as regressors. In some markets, nominal local measure prices were often identical among different cereals or moved closely in tandem with each other, giving rise to multi-collinearity. While nominal price stability might have been offset by variability in volume, none was detected.

Goodness of fit as measured by the adjusted R^2 is relatively modest for all regressions, hovering about the 0.50 mark for the North, South and On-River strata. The adjusted R^2 for the Off-River stratum indicates that only about one-third of the variation in cereal consumption is explained by variation in the independent variables. However, econometricians caution against consideration of the adjusted R^2 as the single most important statistic for several reasons because in addition to fitting a line, regression analysis measures and tests the statistical relationship between the dependent and independent variables. First, economic theory, rather than adjusted R^2s alone, should help guide the selection of included independent variables and regression functional form. If theory cannot defend inclusion of a variable as an explanatory variable, for example, it should not be included. Second, a determined search for the equation with the best fit as the sole criterion may fit the particular data set well, but miss the underlying 'true' relationships (Kennedy). Third, the nature of the data may dominate the magnitude of the adjusted R^2. Regressions using time-series data or large-scale aggregate cross-sectional data tend to produce high adjusted R^2s while regressions using data from a smaller number of household surveys, such as these, tend to produce low adjusted R^2s (Hu; Kennedy).

F-statistics in all regressions are high, leading to rejection of the null hypothesis that all independent variable coefficients are *jointly* zero. Each regression has a number of highly significant coefficients on individual variables.

According to Pindyck and Rubinfeld (p. 85), regression standard errors are best interpreted as a percent value of the mean of the dependent variable (AECERCAL), with acceptable standard errors falling in the range of 10-15 percent. On this basis, Table 5.18 shows that regression standard errors are about 3-4 times above the desired range, although Pindyck and Rubinfeld acknowledge that their criterion is somewhat subjective.

5.6.2.3.2. Household Income Variables. As expected, the coefficients on the **household income** variable are positive for each stratum. Each is different from zero at the 99 percent level of significance. All elasticities are less than unity, meaning that income elasticity of cereals consumption (demand) is relatively inelastic. For example, a one percent increase in household income per AE in the North will increase cereal calorie consumption by 0.275 percent. The coefficient on North household income is twice as large as that for Off-River household income, where the income elasticity of cereals consumption is the least elastic. These econometric findings are consistent with the previous cross-tab analysis showing that the North stratum is most calorie insecure (Tables 5.14 and 5.15), as it is expected that North households would have the highest income-elasticity of demand for cereals calories, similar to the highest adjusted expenditures elasticity of demand elasticity (Table 5.16).[51]

All elasticities for the **diversity of household income** variable are positive, indicating that cereals consumption increase the more diversified the sources of household income, corroborating the finding of Reardon *et al.* (1991) in Burkina Faso. The coefficient for income diversification was significant at the 99 percent level in each case. Only the North stratum diversity elasticity of consumption (demand) is greater than one, indicating elastic demand for cereal calories. This result again corroborates previous cross-tab analysis.

5.6.2.3.3. Cereal Price Variables. Turning towards the vector of cereals prices, some prices were excluded due to missing or incomplete observations in some markets within

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[51]Any simultaneity between the dependent variable cereals consumption (AECERCAL) and the independent variable household income (LNINCOME), due to the attribution as income of home consumption of own-produced and own-gathered cereals which is higher for On-River households, would be most pronounced in the On-River regression. Such simultaneity would tend to bias the income elasticity estimate for the On-River stratum upwards towards 1.0.

the same stratum (price of sorghum in the North and Off-River; price of paddy in the South and Off-River). Other prices were excluded due to evidence of high collinearity with other prices (paddy with local rice in the North; paddy and millet Off-River; and millet with sorghum and local rice with paddy On-River).[52]

The **millet price** elasticity of demand was significant only Off-River. As virtually all millet is produced outside the Gao region, millet is typically obtained by purchase. Thus, the expected negative sign on the millet price elasticity for the Off-River strata indicates that a one percent increase in the price of millet results in a drop in consumption of cereal calories of 0.314 percent. The **sorghum price** elasticity for the On-River stratum was also negative, significant and greater than unity, indicating that the price elasticity of demand for sorghum is highly elastic.

Both coefficients for **local rice** were significant at the 95 percent level or above. The local rice price elasticity of demand is negative in the North, where a one percent increase in the price of local rice results in a 0.817 percent drop in consumption of cereal calories, an elasticity approaching unity. However, the sign of the local rice price elasticity is positive in the South, where a one percent price increase results in a highly elastic increase in cereals consumption of 3.713 percent. One possible explanation is that the sale of local rice by double-cropping rice-producing households (chiefly in Bara) permits them to purchase and consume more lower-cost millet and sorghum. Another explanation is that the wealth effect, via a corresponding increase in the value of home-held paddy stocks, allows greater purchase and consumption of other cereals. The **paddy** price elasticity of demand is positive but not significant for the On-River stratum.

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[52]Use of sorghum and rice paddy prices were retained for the On-River stratum because they yielded better regression results overall than use of millet and local rice prices.

5.6.2.3.4. Household Demographic Dummy Variables. The purpose of including a number of household variables is to prevent the income and price parameters from picking up effects that in reality are attributable to household structure and other demographic characteristics.

The dummy variable for ethnic group (where Sonhraï = 1, otherwise 0) was dropped from the On-River regression where all households reported their principal ethnicity as Sonhraï. The **ethnicity** elasticity is low but unexpectedly negative ***and*** highly significant for the South and Off-River regressions, indicating that Sonhraï households (mainly farming households) consumed fewer cereal calories over the observation period than non-Sonhraï households, despite the dominance of cereals in the diet. This suggests that non-Sonhraï households are more successful in obtaining cereals for consumption. On the other hand, the ethnicity elasticity is low but positive and highly significant for the North stratum.

The elasticity for the dummy variable for **gender of head of household** (where male = 1, otherwise 0) was highly significant only in the North stratum where male-headed households consumed unexpectedly fewer cereal calories than female-headed households. The gender elasticity of demand is positive, very low and weakly significant for Off-River households. Elsewhere, there is no significant difference in cereal consumption due to the gender of head of household.

5.6.2.3.5. Household Demographic Non-Dummy Variables. The **household size** coefficient, expressed in terms of number of present adult-equivalents was negative and statistically significant at the 99 percent level across all strata. All household size elasticities of cereal calories consumption indicate that consumption decreased, the greater the number of adult-equivalent members in the household. All elasticities are less than unity. A one percent increase in the number of present AEs would result in a decrease in cereals consumption of about 0.35 percent in the South, Off-River and On-River strata — or about 7 daily cereal calories based on a hypothetical daily consumption of 2,000 cereal calories. Continuing this same example, an increase in household size from ten to eleven AEs, a 10 percent increase in household size, would result in a decrease of 70 daily cereal calories. The household size elasticity is relatively more inelastic in the North stratum.[53]

Whereas the coefficients for the **household dependency ratio** were negative for the North and On-River strata, as expected — more non-workers to workers in the household would decrease income and hence cereals consumption, they were low and insignificant. Coefficients were positive but not significant for the South and Off-River strata.

Taken together, the household size and dependency ratio elasticities indicate that household size matters, but household composition by workers and non-workers does not.[54] These elasticities suggest severe regional structural unemployment as even able and willing workers are unable to find work and/or contribute directly to household cereals consumption through farming and gathering. These results are plausible in that households also see limited local opportunities for work — and the opportunity cost of keeping able-bodied workers in the village. Out-migration of working-age males (reduction of household size and increase in

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[53]These household size results were also tested by running the regression on two subsets within each strata, for a) households at or above the average number of AEs, and b) households below the average number. Elasticitity results were similar to those reported in Table 5.18, although the LADEQUIV coefficients for the above-average size households in the North and South strata were not significant at the 90 percent level. All elasticities were less than unity, but the below-average size households showed higher elasticities, ranging between 0.316 and 0.570, and thus, greater sensitivity in consumption to a change in household size.

[54]In contrast, Dioné (1989b, pp. 200-201) found that household size and age/employment composition striongly affect coarse grains availability (implicit consumption). In the OHV and CMDT zones, a ten percent increase in the ratio of non-workers to workers resulted in a four percent decrease in coarse grains availability per capita in 1985/96 and 1986/87.

dependency ratios) is a fairly extreme household response for coping with the perceived lack of local employment and income-earning opportunities.

Coefficients (and elasticities) on **age of head of household** were negative in all but the On-River stratum, as expected, but not significant. The elasticity of cereals consumption based on **length of household residence** in the survey village was low but positive and significant at the 90 percent level in the Off-River regression. This may mean that more recently sedentarized households have not perfected their coping strategies to obtain cereals as well as the more established households. The same elasticity was low, unexpectedly negative and significant at the 95 percent level in the On-River regression.

The combined **value of household assets** was low but positive and strongly significant in the South and Off-River regressions. This impact may be manifested through the wealth effect, whereby households are able to consume at stable and adequate levels, given possession of semi-liquid assets.[55] More likely, the physical contribution of household assets as income-earning resources in production (oxen, carts, and donkeys) or transportation (donkeys, camels and canoes) explain this positive coefficient.[56] The unexpectedly negative and significant coefficient for household assets in the North stratum is difficult to interpret.

5.6.2.3.6. Monthly Dummy Variables. Coefficients (in elasticity form) for the monthly dummy variables indicate the deviation of cereals consumption from consumption in December, the omitted variable. Because consumption is typically highest in December during the harvest/post-harvest period, nearly all monthly elasticities thereafter are negative, indicating that consumption in later months drops off from December levels. Except for the

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[55]However, no household reported income from the sale of their assets during the year.

[56]The effect of household assets logically might be picked up by the household income variable, although regression diagnostics do not indicate simultaneity between the two variables in either stratum.

Table 5.19.
Seasonality Index: Household Consumption of Cereal Calories (AECERCAL)

	North	South	Off-River	On-River
November	a	1.263	a	2.107
December 1988	2.120	1.279	1.095	1.752
January 1989	1.349	1.730	0.910	1.292
February	0.997	1.798	1.001	1.078
March	0.894	1.349	0.957	0.980
April	0.947	0.865	1.050	0.843
May	0.804	0.622	0.926	0.679
June	0.966	0.727	1.045	0.658
July	0.766	0.483	0.903	0.536
August	0.743	0.641	0.997	0.679
September	0.607	0.716	1.106	0.583
October	0.804	0.537	1.010	0.813
F Test				
without monthly dummies	***27.551	***16.011	***26.478	***34.190
with monthly dummies	***19.779	***18.679	***13.944	***33.231
Sum of Squared Residuals				
without monthly dummies	234602395	640577604	359662839	624452045
with monthly dummies	197262016	472978393	351438170	437824070

[a]Not available due to missing or incomplete observations.

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season. Consumption of cereal calories declines steadily from November through July and is then interrupted by an upward blip, possibly due to the off-season rice harvest in June-July which appears as increased consumption briefly in August. The "hungry season" elsewhere is less clear.

Off-River regression, the coefficients of all but three monthly variables are significantly different from that of the missing dummy for December.

Interpretation of coefficients from the omitted variable is nonetheless awkward. Suits (1984) developed a straight-forward technique to include the omitted dummy for easier interpretation of regression results by adding a constant value to each of the dummy coefficients and subtracting the value from the regression constant. Since the implicit coefficient on the omitted dummy variable is zero, the constant should be chosen to force the sum of the antilogs of the dummy coefficients (including the omitted dummy) to equal one in the case of logarithmic regressions (zero in the case of untransformed regressions). This technique has the advantage of including all dummy variables. Moreover, coefficients on the dummy variables show the extent to which monthly consumption deviates from average monthly consumption which equals 1.0. The resulting antilogs of the dummy coefficients become monthly indices of cereal consumption, as shown in Table 5.19.[57]

The North, South and On-River strata show greatest deviation from the average monthly index of 1.0 (with absolute ranges of 1.513, 1.315 and 1.571, respectively) while the average monthly index for the Off-River stratum varies least (0.203). On-River monthly indices correspond best to the breakdown of seasons derived from the production cycle, where consumption is highest during the harvest/post-harvest season and lowest during the rainy

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[57]Given that the average of the monthly indices should equal 1, a constant k must be added to each dummy coefficient b (including that of December which is 0), such that

$$\Sigma e^{b_i+k} = 12.$$

Since $e^{(b_i+k)} = e^k e^{b_i}$, the desired value of k satisfies

$$e^k \Sigma e^{b_i} = 12$$

or

$$k = \ln\ [12/\Sigma e^{b_i}].$$

The value k is added to each dummy coefficient and subtracted from the regression constant term. Note: For the North and Off-River strata, for which November observations are missing, $\Sigma e^{b_i+k} = 11$.

It is remarkable that month of the year matters little for cereals consumption in the Off-River stratum. Only four (of ten) coefficients for monthly dummies differ significantly from December consumption. Monthly consumption indices oscillate closely around 1.0. This indicates that Off-River households are reasonably successful in smoothing consumption over months, consistent with the stability of annual cereal consumption shown in Table A5.2.5 (Annex 5.2). This also partly explains the low adjusted R^2 for the Off-River regression. In contrast to the other strata, Off-River significant monthly dummy variables were both fewer and weaker. Conversely, the adjusted R^2s for the North, South and On-River strata appear to have been boosted by the strong explanatory power of their monthly dummy variables.[58]

5.6.3. Policy Implications and Summary of Main Points from Econometric Analysis

Econometric analyses for 1988/89, a year without food aid distributions in the Northeast, make the following points:

- High levels of home consumption of own-grown and own-gathered cereals lower market purchases of cereals and cereal calories in each strata. By improving cereal supplies in effort to reduce prices, market-oriented food security policies are more likely to benefit non-farming/non-gathering households, all things equal.

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[58]These dummies can be tested for statistical significance (difference from 1 in the case of logarithmic regressions and zero in the case of untransformed regressions). For example, statistical software which permits the adding (subtracting) of a constant value to dummy variable coefficients and the regression constant will calculate t-statistics directly for all dummies. Alternatively, an F-test will indicate whether the regression with the system of dummy variables lowers the sum of squared residuals of the regression from the case without the dummies. As shown in Table 5.19, the sum of squared residuals decreases with inclusion of the monthly dummy variables. The slight decrease shown for the Off-River stratum reflects the lower explanatory power of the monthly dummy variables in the first place.

- Cereal calorie expenditure elasticities of demand are consistently lower than cereal money expenditure elasticities (tercile by tercile and strata by strata), implying that poorer households are able to choose among lower-priced cereals with calorie values comparable to those of more expensive cereals.
- At least one cereal price variable is significant in each stratum in explaining the level of household cereals consumption. All coefficients are negative, as expected, except for local rice in the South stratum. Since demand for paddy is derived from the demand for local rice, higher prices for rice mean higher prices for paddy, enabling paddy farming households to buy and consume lower-cost cereals. This suggests that the economic feasibility of investments in irrigated paddy production is worth investigating in terms of generating a marketed surplus and higher levels of cereals consumption.
- Seasonality is a far more robust variable for explaining cereals consumption among predominantly farming households and/or households in higher rainfall zones than for predominately non-farming households in the Off-River stratum who rely strongly on the market all year. Food security policies need to take this pronounced seasonality of consumption — transitory consumption insecurity — into account for the design of income-enhancing interventions.
- Income diversity is a key and significant variable explaining the level of cereal calorie consumption everywhere, even in the higher-rainfall South. Development policies for the Northeast, including outside investments, which spur broad-based economic expansion can contribute to household consumption security by delinking cereal consumption from the vagaries of weather and rainfall.

- An increase in household size — present adult equivalents — increases cereal calorie *purchases*. The household-size calorie purchase elasticities (all inelastic) conform with the total-expenditures calorie purchase elasticities in suggesting that the market offers a range of differently priced cereals with comparable caloric value. That is, the household budget can be squeezed a little more to buy extra cereal calories. As long as the expenditure elasticities with respect to household size (in AEs) is less than 1.0 (which thay all are), then consumption per AE falls as household size increases. The household-size consumption elasticities (also inelastic) suggest that able-bodied adults are unable to contribute to household consumption through production, gathering or local income-earning opportunities. Households cope, in part, through remittances from out-migrants. The same regional development policies above can reduce structural unemployment and help to keep more families intact.

5.7. Summary and Conclusions

This chapter has looked at market performance through the perspective of cereal demand patterns and reliance on grain markets at the household level. The crux of the evidence presented here points out incontrovertibly that households in all strata depend to a great degree on the market and other exchange mechanisms for their cereals, at least seasonally, if not all year-round. Performance of the cereal market thus becomes critical to the consumption security of most households in the Northeast.

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THE ROLES AND LIMITS OF THE GRAIN MARKET IN ASSURING HOUSEHOLD FOOD SECURITY IN NORTHEASTERN MALI: IMPLICATIONS FOR PUBLIC POLICY

Volume II

by

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Part III. Analysis of Cereals Markets in Northeastern Mali

Part III of this dissertation examines the performance of rural and urban cereals markets in Mali, particularly the Northeast, using the structure, conduct and performance paradigm, as applied to the subsector approach.

Chapter Six lays out the conceptual framework for this new part. Chapter Seven analyzes rural cereals markets. The first section describes the survey rural markets in the Gao Region. The following sections of Chapter Seven will assess rural market structure, analyze rural market conduct and evaluate rural market performance. Chapter Eight analyzes urban cereals markets. After discussing the trader sampling methodology, Chapter Eight evaluates urban market structure, conduct and performance based on the same conceptual framework used for Chapter Seven.

Reference material concerning the coefficients used to convert local cereal measures used on rural markets into kilograms; the rural market price collection methodology and weekly rural market price data; rural market volumes transacted by season; rural market volumes transacted by gender of seller; and monthly price correlation coefficients may be obtained from the author or USAID/Mali.

Reference material concerning monthly urban market price data; monthly urban market quantity data; and monthly price trends during the survey period for millet and sorghum may be obtained from the author or USAID/Mali.

Chapter Six. A Conceptual Framework of Cereals Market Performance

This chapter builds a conceptual framework to distinguish and analyze the relevant information, factors, institutions and policies which affect performance of the cereals market. The first section of this chapter reviews the commodity subsector approach to market analysis. The second section looks into elements of transaction cost economics. The third section examines the twin problems of thin markets and market failures. Roles for the public sector in marketing are introduced in the fourth section. The fifth section returns to the issue of market performance, defining criteria for investigation in Chapters 7 and 8. The sixth section concludes the chapter.

6.1. Subsector Approach to Analysis

The organization and coordination of the cereals market in Mali has undergone profound change in recent years (Annex 2.1.), particularly from unsuccessful attempts by the government to usurp market functions almost single-handedly toward increasing reliance on the private sector to carry out day-to-day marketing functions while leaving the macro levers of market management in government hands. These changes raise questions about who really exercises strategic control over the market, where the locus of that control is shifting and whether new control patterns will improve subsector performance. Measures of subsector performance usually look at the match between supply and demand as regards a) quality, quantity, timing and location; b) technical and operational efficiencies; c) equity; d) access and entry; and e) reliability and stability (Marion, 1976b) — in essence, how well food subsectors articulate participant preferences within the physical constraints of the system's environment (Shaffer, 1980).

Commodity subsector studies offer an operational approach to assessing opportunities for analyzing market performance.[1] A commodity subsector has both vertical and horizontal dimensions. The *horizontal* dimension refers to firms within a particular industry (or to a particular stage of the commodity subsector where a similar set of functions are performed, such as rice milling). The *vertical* dimension refers to vertical coordination of product transformation and value-added at each stage from farmer to consumer — such as input distribution, production, assembly, storage, transport, processing and production distribution and retailing — within subsectors of single commodities or relatively homogenous groups of commodities, such as coarse grains.

A commodity subsector framework is a dynamic or developmental approach (Harrison, *et al.*; Shaffer *et al.*) which a) seeks to identify opportunities for improving the productivity of food systems; b) seeks to diagnose barriers to improved food system performance; c) prescribes roles for both public and private sector participants; and d) assumes that there are alternative ways of organizing the system to improve productivity and performance. Since alternative programs and policies, institutional arrangements and technologies vary from setting to setting, alternative outcomes will also vary.

The commodity subsector approach argues that the government must often play a vital regulatory and facilitating role in food system development (Holtzman). The ultimate purpose of subsector analysis is to prescribe the set of measures that achieves government policy

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[1]Parts of this section are liberally drawn from Holtzman, pp. 8-17.

objectives at the lowest cost and which is most likely to foster growth and improved productivity.

6.1.1. Evolution of the Subsector Studies Approach

The subsector studies approach, also known as the subsystem approach, is based on the adaptation of the industrial organization theory (Bain; Scherer). A *sector* cuts across several industries, such as the food sector, which includes the complex of related units involved in the production and distribution of food. A *subsector*, therefore, represents a discrete group of economic activities within the food sector related vertically and horizontally by market relationships (Shaffer, 1980).

Subsector studies analyze subsector organization-performance relationships. The distinguishing feature of a subsector study is its focus on the total complex *as a system*. Specifically, subsector studies look at the relationships between the control of critical parts of the subsector, the degree of coordination necessary to synchronize the vertical stages of production, processing and marketing and, lastly, at the balance between supply and demand. Their purpose is to describe, diagnose, predict and prescribe (Shaffer, 1980).

6.1.2. The Subsector Framework

Schematically, the conceptual framework for subsector analysis, as adapted by Marion (1986), includes components of structure, conduct and performance. This framework is a dynamic one. The structure-conduct-performance in one period influences each component in the following period. The underlying assumption of the North Central Regional Research

Project 117 (NC 117) subsector studies is that this modified S-C-P framework can be extended to the study of vertical coordination processes (McLaughlin). Throughout, costs and price margins define many of the parameters of the subsector approach of analysis.

While the subsector approach is similar to industrial organization theory (by focusing on the performance consequences of alternative forms of industrial/economic organization), there are some fundamental differences. The first lies in the "firm decision environment" (see considerations of transaction costs in Section 6.2), an intermediate link between conditions and structure, on one hand, and conduct and performance, on the other. The NC 117 project defines the firm's decision environment as those factors bearing on alternatives, incentives, and control and influence — the opportunity sets of firms (Shaffer, 1980).

The second difference is that a commodity subsector is a vertically linked set of "participants" (firms or organizations) which produce a related output or group of outputs — rather than horizontal links between firms at similar stages in production. The subsector approach emphasizes transformation or value-added at every stage (Shaffer, 1973). Thus, the subsector approach drops the arbitrary and misleading dichotomy between "production" taking place on the farm and "marketing" taking place outside the farmgate (Riley and Staatz).

Participants in agricultural commodity subsectors include input suppliers, farmers, assemblers, wholesale traders, retailers and consumers. Consumers are also considered as subsector participants because their demand for agricultural commodities in the aggregate influences production and marketing decisions of all other participants in the subsector.

Third, the commodity subsector approach is demand-oriented. It closely examines underlying supply and demand conditions and likely trends and changes in commodity output and use. Shifts in demand induced by changes in relative prices, consumer purchasing power, tastes and preferences can significantly alter the set of incentives facing participants throughout the subsector. These shifts in demand may represent important and dynamic forces for change in the commodity subsector — leading to reorganization of the commodity subsectors and/or affecting subsector performance in significant ways.

Lastly, the subsector approach emphasizes the nature of the coordinating mechanisms or institutional arrangements, such as contracts, vertical integration, roles of certain leading firms, cooperatives, industry associations and other active coordinating agents. Due to unforeseeable climatic conditions in Mali, cereal production and prices are uncertain from one season or year to the next. For this reason, "farmers, processors, traders and institutional buyers have a powerful incentive to develop institutional arrangements for coordinating fluctuating supplies so they match demand without excessive price fluctuation" (Holtzman, p. 14). Coordinating mechanisms can also help match quality expectations and standards.

Coordination will move developing country food systems from low levels of productivity (small-scale operations unable to innovate and achieve scale economies, characterized by high costs and minimal specialization) to commodity systems where increasing specialization and achievement of scale economies serve to lower food production and marketing costs and improve producer and consumer welfare alike.

6.1.3. Operational Approach

Systematic review and analysis of subsector documents, as well as rapid appraisals and primary survey data, reveal a great deal about subsector performance.

6.1.3.1. Basic Conditions

A typical subsector study starts by describing the nature of the commodity, or its *basic conditions* (such as geographic distribution and trends of production, consumption and price patterns, and the importance of international trade). These basic conditions are listed in Figure 6.1.

Figure 6.1. Basic Conditions as Applied to the Commodity Subsector Approach

Production trends and geographic distribution;
Consumption characteristics:
- growth or decline (in domestic and foreign markets)
- price, income and cross-elasticities of demand
- differences by socio-economic or income groups
- rural and urban differences;

Time characteristics of production and marketing cycles;
Type and degree of uncertainties:
- commodity price patterns;
- government policies;
- weather and climate patterns;
- access to and/or importance of external markets;

Laws and government policies and regulations;
Macroeconomic variables acting as incentives or disincentives:
- exchange rate and exchange rate policies;
- interest rate;
- inflation rates and their differential impact across sectors; and
- salary rates.

Holtzman, as adapted from Marion (1986), p. 54.

6.1.3.2. Structure

Industry *structure*, "characteristics of the organization of a market which seem to influence strategically the nature of competition and pricing with the market" (Bain), is measured by factors such the degree of concentration (numbers of buyers and sellers and the impact of mergers and acquisitions); degrees of mobility (entry and exit conditions), degree of product differentiation or product characteristics,[2] technological changes, and changes in capacity and capacity utilization. Commodity subsector structure is measured largely in terms of functional structures, number of stages and parallel channels; the subsector information system; the structure of authority; exchange institutions and types of exchange; risk sharing arrangements; and inter-stage differences. Both perspectives are depicted in Figure 6.2.

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[2]For example, the particular physical characteristics of cereals (millet, sorghum, maize and rice) set them apart from many other foods. First, cereals in grain form are easily divisible into small quantities. Any volume can be marketed. Second, cereals can be classified according to standard grades, reducing the need for individual inspection of each lot purchased. Third, cereals are not quickly perishable. Under proper conditions, cereals may be stored for up to several years. Fourth, cereals are easily handled and transported. Special packaging is not required to avoid damage. These last two characteristics allow traders to capture returns to temporal and spatial arbitraging risks.

**Figure 6.2. Structure
as Applied to the Commodity Subsector Approach**

Industry Structure	Subsector Organization
Number and size of buyers and sellers; Entry and exit conditions; Product characteristics: • perishability; • quality requirements; • differentiation; Technological characteristics/cost functions: • capital intensity; • minimum efficient firm size; • rate of change; Capacity; Specialization/Diversification; Vertical Integration; Financing and credit characteristics; Collective organizations: • Cooperatives; • Trade associations; Business objectives, attitudes and capabilities; Frequency of purchases and sales.	Functional structure in terms of location, timing and clustering of functions; Number of stages; Number of parallel channels; Information system: • type of information (grades, prices, market conditions, etc.); • distribution; • cost; Structure of authority, rights and control and decision autonomy; Exchange institutions, such as auctions and buying stations; Types of exchange, such as spot market, contracts, tying agreements; Risk sharing institutions and arrangements; Inter-stage differences: • location, size of enterprises, seasonality and production characteristics; • nature of assembly, sorting and synchronizing tasks.

Holtzman, as adapted from Marion (1986), p. 55.

6.1.3.3. Conduct

Industry *conduct*, "the pattern of behavior which enterprises follow in adapting or adjusting to the markets in which they buy and sell" (Bain), is typically analyzed in terms of price and output policies, sales and product promotion, policy coordination and technical innovation. Commodity subsector conduct is evaluated broadly in terms of coordination activities; the process of determining terms of exchange; and response to change forces. These are shown in Figure 6.3.

Figure 6.3. Conduct as Applied to the Commodity Subsector Approach

Industry	Subsector
Product strategy; Pricing behavior; Advertising; Research and innovation; Mergers and divestitures; Risk management practices.	Efforts to shift control and the type of exchange used; Coordination activities: • prediction of future supply, demand and price; • information communicated; • quality specifications; • scheduling and timing synchronization; • efforts to influence interstage cooperation and/or conflict; Process of determining terms of exchange (private, treaty, administered, bid-offer-acceptance, etc.); Response to forces of change.

Holtzman, as adapted from Marion (1986), p. 54.

6.1.3.4. Performance

Industry *performance* represents the economic results of structure and conduct (Bain), evaluated from the viewpoint of society, rather than market or industry participants. Subsector performance, in addition to the variables cited earlier, evaluates the competitive political-economic environment — the effectiveness of coordinating mechanisms; technical and operational efficiency of the system; system progressiveness and equity of returns to system participants, given the distribution of investments, risks and responsibilities — and the likely course of developments within the subsector. Performance variables are shown in Figure 6.4.

Figure 6.4. Performance as Applied to the Commodity Subsector Approach

Industry	Subsector
Technical and operational efficiency; Pricing efficiency (profit and output levels); Product characteristics: • Quality, wholesomeness; • Variety; Progressiveness (process and product); Selling activities: • Expense; • Influence on consumption patterns and social values; Market access and/or foreclosure.	Allocative accuracy: extent to which supply matches demand preferences in terms of quantity, quality, timing and location; Stability of output, prices and profits; Technical and operational efficiency: • at each stage; • in linking stages (transaction costs); Equity with regards to distribution: • returns *versus* investments and risks; • rights and control *versus* investments and risk; Accuracy, adequacy and equity of information distributed; Subsector adaptability; Level and type of employment; Waste and spoilage: • capacity utilization; • product waste; • resource conservation and avoidance of environmental degradation.

Holtzman, as adapted from Marion (1986), p. 55.

Caution needs to be exercised in defining performance norms. These will vary according to the socio-cultural, political or institutional setting, as well as under different agro-ecological conditions where resources and endowments differ. In this manner, performance standards are relative measures, not absolutes. Hamm warns against mistaking structure characteristics as normative performance measures in themselves, such as automatically equating a large number of parallel channels (structure) with desirable subsector adaptability (performance). Similarly, analysts need to be careful to distinguish the symptoms of poor performance from the root causes of poor performance — an exercise requiring experience and judgement (Holtzman *et al.*, 1993).

A food systems perspective is based on multiple performance goals (Riley and Staatz). According to Brandow, "good performance is a set of conflicting goals." When evaluating food subsector performance, a diverse set of performance indicators should be considered, all of which may not be attainable in a given context (Holtzman).[3]

This chapter will propose performance criteria for evaluating the cereals market in the Northeast in Section 6.5., after introducing additional topics for consideration.

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[3]A synthesis list of performance measures is provided by Holtzman (pp. 15-16), drawing from earlier research by Sosnick (1964), Marion (1976b), French (1977), Helmberger, Campbell and Dobson (1981) and Shaffer (1980).

1. Effectiveness of market coordination, or matching supply and demand at each level of the production/marketing system.
2. Operational efficiency in terms of minimal cost/price relations.
3. Equity of returns to participants in the subsector, in light of the distribution of investments made, risks faced, costs assumed and responsibilities undertaken.
4. Progressiveness, or the ability of the subsector to adapt improved technical, management and institutional innovations which enhance productivity.
5. Minimal degradation of natural resources in agricultural production and processing — minimization of externalities [external diseconomies].
6. Broad participation in food system activities, particularly where employment opportunities are limited and where unemployment and/or underemployment represent an important social and economic problem.
7. Wholesome and nutritious diets for a broad range of rural and urban consumers, particularly those who are most likely to be nutritionally vulnerable.

6.1.4. Strengths and Weaknesses of the Subsector Studies Approach

There are several strengths of the subsector approach. First is the flexibility and adaptability of the framework to the specific subsector under consideration. Second is that the framework melds an immense bit of information and knowledge gathered from diverse sources into a cohesive analysis. Third, subsector studies represent practical attempts to shed light on those sectors undergoing change as a result of new technologies, change in organization and control or government policy, or simply where needed information is lacking. Subsector studies, then, offer a diagnosis of what is going on, which subsector clientele can use to improve the reliability and stability of performance.

The subsector studies approach is most effective in the search for opportunities to improve performance of the system in a) identifying barriers to improved performance; b) taking advantage of new and unexploited marketing opportunities; c) generating significantly higher levels of output; and d) improving food system efficiency — an incremental and iterative process (Holtzman, p. 15).

The subsector approach is not without its shortcomings. A first weakness lies within the theoretical construct itself. Economists differ most as to the importance of the S-C-P paradigm when it comes to the performance dimension. Many in the field (such as Scherer and Sosnick) question the literal interpretation of the S-C-P paradigm — structure begets conduct begets performance — as too unidirectional. Others (such as Shaffer, 1980) have redrawn the paradigm with every possible feedback loop, even within each variable. Others still (Brandow, Mueller) contend that knowledge of structure and conduct are insufficient for understanding the dynamics of performance and have low predictive power, whereas to Sosnick, performance is inseparable from structure and conduct. Marion and Handy criticize the fundamental weaknesses of performance measures as very normative, and hence too subjective.

Subsector studies have also fallen under criticism as a method of inquiry. The first of these, as noted by the NC 117 project itself, is the inadequacy of pertinent information that results in an uneven depth of inquiry and analysis. A second weakness is the charge that subsector analyses serve academic self-interests rather than the subsector clientele (French) or that the analytical base of research, presently limited to agricultural economists, is too narrow and should be broadened to include other disciplines (Schuh).[4] A third criticism is that the subsector approach analyzes recent events. Unless continuously updated, these analyses become a snapshot, valid or accurate for a relatively short period (say, up to one decade) after publication. Granted, some subsectors may be stable enough as not to require frequent updating, but subsector studies still lack a built-in dynamism *in approach* (Shaffer, 1980). This deficiency could be ameliorated by maintaining ongoing research to issue periodic updates, although resource constraints often do not permit this. Where feasible, mandatory reporting of new data by subsector participants would facilitate this task considerably. This last criticism appears dated as subsector studies often focus on identifying change forces.

Used with these shortcomings in mind, the subsector studies approach nevertheless helps place marketing problems in their long-term developmental context (Riley and Staatz).

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[4]This statement no longer holds. Some general economists use the subsector approach to look at non-agricultural enterprises (for example, Boomgard *et al.*). Business schools also use "market channel analysis," which is essentially the same as subsector analysis.

6.1.5. Further Concepts for Consideration in Cereals Subsector Analysis: Perfect Competition and Two Alternatives

Before ending this section, it is worth briefly defining perfect competition and then considering two alternatives to perfect competition related to the commodity subsector studies approach. The first alternative defines "workable competition" in markets and the second discusses "contestable markets."

6.1.5.1. Perfect Competition

The S-C-P paradigm evolved, in part, from the deficiency of neo-classical models in which the structure of a given industry — or market — prescribed industry conduct. A market composed of innumerable small firms gave rise to atomistic or perfect competition. A market composed of one great firm gave rise to monopoly power and no competition. More often than not, however, markets were characterized by structure in between, oligopolies or monopolistic competition (Robinson), giving rise to imperfect competition.

In market economics, elements of a competitive market system and competitive behavior includes the following conditions:[5] First, self-seeking economic behavior pushes producers to maximize profits and consumers to maximize their utility. Buyers and sellers act in an economically rational fashion — they want more income, not less; they want more goods, not fewer.

Second, no market participant is sufficiently large to influence prices alone. Firms are small and numerous enough that their decisions have no influence over market prices. Everyone is a price taker, not a price setter.

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[5]From Timmer, Falcon and Pearson, pp. 165-166.

Third, entry into the market and exit out of the market are basically free. There are no unfair, prohibitive or excessive barriers to entry or exit. All participants have equal access to the market on the same terms.

Fourth, items of the traded commodity are interchangeable and divisible. They can be traded in small or large lots.

Fifth, every market participant has perfect knowledge and foresight of market conditions likely to influence supply and demand which permits him modify his economic strategies.

Under these five conditions, the market will perform efficiently with no scope for excess profits in the short run and zero profits in the long run (where marginal cost equals marginal revenue and each factor of production receives a competitive return).

Marketing research using perfect competition norms has contributed in a) providing a good empirical description of how the marketing system really works; b) challenging prevailing stereotypes regarding inefficient farmer and exploitative trader behavior and indigenous marketing systems; and c) showing that since market participants act in an economically rational manner, standard economic policies can be used to influence market behavior (Riley and Staatz).

Nonetheless, there are serious limitations to marketing research using perfect competition norms — even though they provide a good first approximation (Scherer). Other aspects of performance need to be consider other aspects of performance (product suitability, stability of supplies, prices and equity) in addition to static economic efficiency. Perfect competition norms, moreover, do not address the dynamic aspects of market development (Riley and Staatz).

6.1.5.2. Workable Competition

Likewise, economists have long raised doubts about the validity of perfect competition for prescribing economic policy. For one reason, industry structures falling in between the extremes of perfect competition and monopoly might even produce desirable performance outcomes. Schumpeter (cited in Scherer) argues, for example, that elements of oligopoly are necessary to take new technological risks, a viewpoint echoed by Bain and Scherer who conclude, respectively, that excessive competition is not conducive to technological innovation, although a subtle blend of monopoly power and competition is.

These qualifications of the ideal of perfect competition prompted a search for more operational norms of competition, or "workable competition."[6] Workable competition contends that some departures from perfect competition are not as harmful in a long-term context as otherwise supposed.

Economists have devoted considerable attention to defining norms of workable competition. Rather than paraphrase these norms, Scherer's elements of workable competition, based on Sosnick's lengthy general criteria, are cited directly in Figure 6.5.

Substantial progress has been made, theoretically and empirically, in defining what constitutes market performance, but defining workable competition remains somewhat controversial (Marion, 1986). A main drawback in commodity subsector studies is that "performance norms, partly based on concepts of workable competition, are less clearly defined" (Riley and Staatz, p. 7). As Scherer acknowledges, the most difficult part in

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[6]The term "workable competition" was coined by Clark in 1940. Clark observed that perfect competition "does not and cannot exist and has presumably never existed" and that perfect competition affords no reliable standard for judging real world conditions (Clark, as cited in Scherer, pp. 42-43).

evaluating performance is securing agreement on good and bad attributes of performance. Invariably, value judgements must be made.

Figure 6.5.
Norms of Workable Competition

Structure

- The number of traders should be at least as large as scale economies permit.
- There should be no artificial inhibitions on mobility and entry.
- There should be moderate and price-sensitive quality differentials in the products offered.

Conduct

- Some uncertainty should exist in the minds of rivals as to whether price initiatives should be followed.
- Firms should strive to achieve their goals independently, without collusion.
- There should be no unfair, exclusionary, predatory or coercive tactics.
- Inefficient suppliers and customers should not be shielded permanently.
- Sales promotion should be informative, or at least not misleading.
- Persistent, harmful price discrimination should be absent.

Performance

- Firms' production and distribution operations should be efficient and not wasteful of resources.
- Output levels and output quality (i.e., variety, durability, safety, reliability and so on) should be responsive to consumer demands.
- Profits should be at levels just sufficient to reward investment, efficiency and innovation.
- Prices should encourage rational choice, guide markets toward equilibrium, and not intensify cyclical instability.
- Opportunities for introducing technically new superior products and processes should be exploited.
- Promotional expenses should not be excessive.
- Success should accrue to sellers who best serve consumer wants.

Scherer, p. 42.

6.1.5.3. Contestable Markets

The theory of contestable markets is similar to the theory of perfect competition in that perfectly contestable markets produce equilibrium results that are essentially the same as the perfect competition model. There are three main features of contestable markets. First, a contestable market never offers more than normal profits (economic profits must be zero or negative), even if it is oligopolistic or monopolistic. Second, there are no sources of inefficiency in production because any unnecessary cost, like any abnormal profit, constitutes an invitation to entry. Third, no product can be sold at a price less than its marginal cost.

In perfectly contestable markets, entry is absolutely free. New entrants encounter none of the commonly recognized barriers to entry (Marion, 1986), such as absolute cost advantage (where established firms or incumbents have lower unit costs); scale barriers (where suboptimal-sized firms are subject to significantly higher costs); capital costs (where the absolute size of initial investment limits newcomers); product differentiation (where incumbents enjoy advantages, such as consumer brand loyalty); and strategic behavior by incumbent firms to purposely deter newcomers (such as cross-subsidies or predatory pricing). In short, contestability requires that there be no cost discrimination against entrants. Moreover, in perfectly contestable markets, exit is also absolutely costless in that firms can recoup all their entry costs.

Another feature of contestable markets is that potential entrants are able to evaluate profitability of entry from pre-entry prices of the incumbent firms. This supposes that incumbents adjust their prices too late to prevent entry, profit-making and exit. Thus, perfectly contestable markets are vulnerable to "hit and run" entry by new firms which can exploit temporary profit-making opportunities and exit before established firms reduce their costs. To ward off would-be entrants, established firms must produce efficiently and earn no economic profits.

According to proponents of contestable markets, contestability is a benchmark of wider applicability for desirable industrial organization that is more flexible and applicable than perfect competition. This is because in contestable markets, industry structure is determined "explicitly, endogenously and simultaneously" with conduct of its constituent firms, their pricing, output, advertising and other decisions (Baumol, pp. 2-3) — unlike the older S-C-P paradigm where industry structure was not normally explained by analysis, but taken to be given exogenously, leading to certain assumptions about the resulting conduct and performance. In contestable markets, the "heroes" are the potential entrants who exercise discipline over the incumbents, when entry and exit are free, requiring even a limited number of incumbents to offer to consumers the benefits that competition would otherwise bring.

Some view the contestable markets theory with skepticism. The theory rests on extreme assumptions with limited real-world relevance (Shepherd, cited in Marion, 1986). Prices found to be positively correlated with market share and advertising cast doubt on the applicability of contestability to the food manufacturing subsector (Marion, 1986, p. 290). However, the theory may be more relevant for the cereals market in Mali and the decision by part-time trader-assemblers to buy the marketable surplus of farming households for resale.[7] Indeed, industry structures that approximate cost-minimizing efficiency are similar across countries, such as agriculture (Baumol, p. 8) — and agricultural markets.

[7]See Dioné and Dembélé and Annex 2.1 regarding the applicability of contestable grain markets during 1985/86.

6.2. Transaction Cost Economics

There is increasing recognition that traditional economic theory has ignored the central problems with costly market information. When these costs are considered, the basic propositions of neo-classical analysis — such as the perfect knowledge and foresight assumption — no longer remain valid (Stiglitz, 1989, pp. 103-104).

An alternative perspective, still in its infancy, is called transaction cost economics. It tries to explain how institutions arise within the economic system — markets and alternatives to markets — and to predict the effects of changes in economic institutions or rules under which the economy operates on economic performance (Staatz, 1988b).

6.2.1. Origins of Transaction Cost Economics

In the absence of transaction costs, according to the Coase Rule, resource allocation and use will not be affected by who owns the resources exchanged. Alternatively, all market exchanges — gains from trade — will be efficient and Pareto optimality will hold, based on the initial distribution of resources.[8]

But transactions are not costless. Transaction costs are the "costs of running the economic system" (Arrow, cited in Williamson, 1985, p. 18) or "the economic equivalent of friction in physical systems" (Williamson, 1985). Transaction costs entail the costs and risks associated with carrying out a transaction or exchange of rights for claim on the use of some

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[8]Neo-classical economics assumes that there is an efficient allocation of resources *for a given distribution of endowments and institutional arrangements* which define rights over those resources, such that no one is made worse off. However, it cannot be ascertained from neo-classical theory that one particular efficient allocation is preferable to another.

resource (Staatz, 1988) or exchange of rights to coerce economically (Schmid, 1987). North notes that "the costliness of information is the key to the costs of transacting" (p. 27). In brief, the costs of transacting prevent attainment of cost-free economic equilibria.

Transaction cost economics asks why there are so many forms of economic organization and the purposes they serve.[9] The answer, in brief, is that the main purpose and effect of economic institutions is to economize on transaction costs. In this view, the transaction is the basis unit of analysis.[10] Organizational form matters (Williamson, 1985).

6.2.2. Elements of Transaction Costs Economics

6.2.2.1. Behavioral Assumptions

Transaction costs are influenced by two behavioral assumptions. The first is "bounded rationality" — the notion that people have limited information and limited cognitive ability to process it. In contrast to the perfect rationality assumption of neo-classical economics, economic agents are "*intendedly* rational but only *limitedly* so" (Simon, cited in Williamson, 1989).

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[9]Transaction cost economics owes one of its origins to a more micro analysis of the firm. Orthodox analysis ignored the internal organization of the firm. Firms were assumed to be production functions, whose boundaries were defined by technological processes. Any effort to extend the firm's boundaries was presumed to betray monopoly motives. Notice how little the structure-conduct-performance diagram in Marion (1986, pp. 54-55) deals with firm decision environment.

Transaction cost economics first asked, given the assumptions of a competitive market system which allocates all resources efficiently (Section 6.1.5.1.), why do firms exist? The answer lies in transaction costs — where the cost of relying on the market to allocate resources sometimes exceeds the cost of allocating the resource internally within the firm (Coase, 1937).

[10]Stiglitz (1989, pp. 102-103) notes that if the explanation of important phenomena resides in the nature of transaction costs, then transaction costs need to be the focus of analysis.

The second is "opportunism" — acting in self interest if one can get away with it, if it is too costly for others to find out. Opportunism, also defined by Williamson as "self-interest seeking with guile," compels people to disclose information in a selective and distorted manner by strategic lying, cheating, confusing or obfuscating. Opportunism is thus related also to moral hazard and the agency problem.[11]

Transaction cost economics treats these more complex behavioral assumptions seriously. It places emphasis on the behavioral dimensions of firms and individuals who develop multiple goals and many techniques to satisfy those goals, such as satisficing, organizational slack (Hirshman), X-inefficiencies (Leibenstein) or opportunistic behavior — as distinct from simple profit maximization.

6.2.2.2. Other Major Factors

There are also four major factors affecting transaction costs and reliance on the market. The first is the uncertainty or complexity to which the transaction is subjected. The greater the uncertainty, the greater the incentive to contracting or vertical integration.[12] The greater the complexity of the transaction, the harder it is to describe fully and accurately the obligations of parties to a contract beforehand and to assess whether those obligations have been carried out afterwards.

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[11] Like opportunism, moral hazard and agency depend on imperfect information and information asymmetries. *Moral hazard* refers to risk-increasing actions (or failure to take risk-reducing actions) that a first party can take to affect output which are generally not observable to the second party, thus altering the expected liability or payment of the second party. See section 6.2.3.2. for a discussion of the *agency* problem.

[12] Vertical integration refers to the forward or backward ownership, management and control of transactions — the transfer of goods and services across stages. Vertical integration must be evaluated in terms of a) a firm's capacity to economize on bounded rationality; and b) safeguard transactions against opportunism.

Other uncertainties, arising from things such as bribes and visual inspection of individual lots for sale in the absence of reliable grading, raise transaction costs sufficiently to discourage specialization. Some households produce all their needs at home. This reinforces high transaction costs by raising the cost of cereals assembly when small volumes of marketable surplus are highly dispersed, possibly leading to locally oligopolistic market structures. Alternatively, no exchange may occur at all when transaction costs due to uncertainties are so high.

The second factor is the presence of externalities, by which one market participant (party) imposes a cost on the others which does not enter the first party's profit calculation. Efficient solutions to externality problems hinge on transaction cost considerations (Masten). With externalities, there is a greater incentive to vertically integrate.

The third factor is asset specificity. The more the transaction involves the use of costly specialized assets which are fixed, the less likely the transaction gets handled on the spot market. An asset is "fixed" if its value in the specialized use is greater than its value in the any alternative use, including salvage value. The difference between these values is known as quasi-rents.

Asset specificity can refer to site-specific physical capital, human capital trained in specialized fields, and access to benefits (quasi-rents) from specific institutions (where beneficiaries will resist institutional reforms which cut their quasi-rents). A fourth type of asset specificity refers to temporal specificity, where a product's value is inherently time-dependent, such as perishable agricultural crops.

Fixed assets are especially vulnerable to the actions of relatively autonomous transactors in spot market transactions. One party to the transaction may act opportunistically to appropriate quasi-rents generated by that specialized asset. This concept is known as "hold-up" or "hostage-taking". For example, growers of a tree crop could decide at the last minute to divert their produce away from the usual processor in attempt to negotiate a higher price. The processor, with his stationary fixed assets, must either capitulate, risk sub-optimal processing capacity utilization or quickly look for alternative supply sources. However, the direction of hold-up can be reversed if the processor announces his intention to buy less than the usual supply of the temporal (perishable) fixed asset tree crop. This time, the growers must either capitulate, risk low volume sales and (partial loss of revenues and/or crop) or quickly look for alternative buyers. For hold-up or hostage-taking to be a problem, the market has to be less than competitive (or contestable) in that the aggrieved party doesn't have equivalent options to those originally offered by the other party.

Hold-up and asset fixity may be less of a problem for the cereals market in the Northeast. Yearly (or twice yearly) crops, such as cereals, are less vulnerable to hold-up by farmers against processors (or processors against farmers). Farmers can store their cereals. If necessary, they can plant something else next year.

The asset fixity argument is also a weak one because site-specific, non-trivial fixed investments are few in the cereals trade. No special facilities are required. Little grain traded in the Northeast is processed mechanically.[13] Cereal warehouses can store other goods. Trucks can carry other goods (and do, in the case of backhauling) and are mobile

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[13]Even the neighborhood rice mills (*petites décortiqueuses*) that are prevalent elsewhere in Mali, especially near *Office du Niger* irrigated perimeters, are movable and can handle other grains (Holtzman *et al.*, 1991).

Large, industrial-capacity rice mills of the *Office du Niger* complex represent the major exception. Periodic shut-downs for servicing and irregular supplies of rice paddy mean that these mills operate far below capacity. Without scale economies in milling, these mills are unviable. Consideration given to banning the small street-corner rice mills to divert paddy to the *Office*'s mills did not materialize during this research.

assets, in any case. Jute bags, pallets and fumigation supplies are properly classified as variable costs, rather than fixed investments.

Unfortunately, the virtual absence of fixed assets in the cereals trade does not allow a test of Williamson's (1985) argument that asset fixity prevents contestable markets.[14] While possession of multi-purpose assets certainly helps large scale traders to achieve big shares in the cereals market, the negligible need for specific assets removes one type of obstacle to entry. On this basis, cereals markets can be considered contestable.

However, specific human capital in terms of knowledge of the grain trade and commercial practices represents another form of asset fixity. Such knowledge must be appreciable. According to Table 8.2 (Chapter 8), poor knowledge of the cereals market was cited by 40 percent of the urban trader sample in the Northeast as the "most important" barrier to entry, more than in other markets. Thus, while possession of specific tangible assets may not pose an immediate barrier to entry, ignorance of the market does.

Masten notes a fourth factor of transaction costs, similarity of transactions, as a counterpoint to Coase's argument that internal organizational costs increase with the spatial distribution and dissimilarity of transactions. However, similarity, such as that in repetitive cereal transactions, lowers costs of internal organization and tends to increase the likelihood of vertical integration, all things equal. Even though familiarity between transactors increases the probability of detecting opportunistic behavior on the other's part, such behavior may not be verifiable to a third party in adjudicating a market-based dispute.

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[14] According to Williamson, "contestability theory reduces asset specificity to insignificance, so that hit-and-run entry is easy..." whereas "transaction cost economics...magnifies the condition of asset specificity" (Williamson, 1985, p. 31, footnote).

North would dispute Masten's assertion from a game theoretic perspective that similarity favors a non-market solution.[15] In a one-time game (or transaction), players (traders) have strong incentives to cheat opportunistically. But in an iterated game (similar and repetitive cereal transactions), the cooperative outcome is more likely to occur because the gains from successive iterations exceed the benefits that could derive from a single defection. This view appears to weaken the propensity for hold-up between transactors — that alternative suppliers or processors are not fungible because search costs are too high. Nonetheless, North cautions that even parties in a repeated transactions have to bear the transaction costs of acquiring information about their opposite number.

Whether the imperative to vertically integrate in the case of lower-cost repetitive cereals transactions in the Northeast (similarity) is offset by higher-cost transacting over great distances will be examined in the next chapters.

6.2.3. The Contractual Approach

Transactors in vertical exchanges face the decision of how to govern their relationship. Their joint interest is to transact in ways that enhance total surplus (maximize joint profits). But each transaction also involves a potential source of conflict in that each transactor will wish to arrange the terms of trade in his favor to appropriate as large a share of the gains from trade as possibly. Invariably, efforts to influence the distribution will dissipate some of the potential gains (Masten).

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[15] Although North (p. 34) acknowledges Coase's argument that the greater the specialization and variability of valuable attributes of the product exchanged (dissimilarity), the more reliable institutions have to be to permit complex contracting with a minimum of uncertainty that the contract can be carried out.

From the transactions-cost perspective, organizations, institutions and governance arrangements are the means to regulate opportunism and bounded rationality. The broad goal is to adopt governance structures that align incentives to protect gains from trade while economizing on the costs of reaching agreements and resolving disputes (Masten). The process matters as much as the outcome (Williamson, 1989).

Transaction cost economics adopts a contractual approach, focused on creating institutions to harmonize trading between parties with otherwise at least partially interests. These contracts seek to minimize transaction costs.

The contractual approach pays less attention to conflict resolution between parties through the legal system (what Williamson calls "court ordering") than to efforts by parties to devise their own means for working out differences ("private ordering") through various duties, procedures and sanctions.

To Williamson, transaction costs occur before *(ex ante)* and after *(ex post)* the transaction for both parties to the transaction. In Williamson's terms, these costs include:

Ex ante:

- cost of gathering information;
- cost of processing that information; and
- cost of coming to a decision.

Ex post:

- cost of monitoring performance; and
- cost of resolving disputes.[16]

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[16]Other definitions are similar: Bromley defines transactions costs as the costs of obtaining information, negotiating a particular exchange, and enforcing the terms of exchange. To North, transaction costs consist of "measuring the valuable attributes of what is being exchanged and the costs of protecting rights and policing and enforcing agreements" (North, p. 27). De Janvry *et al.* describe spot market transactions from the farm household perspective in terms of transportation costs, trader mark-ups, opportunity cost of time for searching and supervising, associated risks, and a host of other transaction costs that are largely household specific (pp. 1401-02).

These transaction costs are interdependent. They must be addressed simultaneously, rather than independently (Williamson, 1985).

6.2.3.1. A Schematic Analysis of Contracting

Assuming that uncertainty abounds, Williamson considers the ramifications for contracting based on the presence or absence of bounded rationality, opportunism and asset specificity. Figure 6.6. compares the sets of conditions where only one of these factors is absent and then when all are present and the contracting model associated with each.

Figure 6.6. Attributes of the Contracting Process

Behavioral Assumption			
Bounded Rationality	Opportunism	Asset Specificity	Implied Contracting Process
Absent	Present	Present	Planning
Present	*Absent*	Present	Promise
Present	Present	*Absent*	Competition
Present	Present	Present	Governance

Adapted from Williamson (1985, p. 31)

Under conditions of opportunism and asset specificity but when contracting parties possess unrestricted rationality, contracting is a matter of comprehensive planning, such that all relevant issues are resolved at the *ex ante* bargaining stage, including possible subsequent modifications contingent on observable events occurring.

When bounded rationality and asset specificity are present, but opportunism is assumed to be absent, contracting is a matter of promising, where the commitment of each party is as good as his word. The contract is self-enforced. Because of bounded rationality, flaws in the contract will appear later. This poses no problem, strategic behavior being denied, because each party pledged at the outset to carry out the contract efficiently to maximize joint profits.

When bounded rationality and opportunism are present but asset specificity is not, parties will not contract with each other but compete in the market place. Without asset specificity, there is no need for bilateral trading relations. Legal prohibitions against fraud and deceitful business practices are assumed to deter the worst sort of opportunism.

When bounded rationality, opportunism and asset specificity are all present, planning is incomplete, promises are broken, and "anonymous" market competition gives way to face to face contracting through "governance structures." When the legal system (court ordering) does not prove efficient, recourse is made to private enforcement mechanisms (private ordering).[17] According to Williamson, transaction cost economics is most concerned with this last scenario, where transaction costs determine the governance or institutional arrangements in such a way as to economize on bounded rationality while simultaneously safeguarding transactions against the hazards of opportunism (Williamson, 1985, p. 32.).

6.2.3.2. Measurement and Enforcement Problems

"Safeguarding transactions" usually requires the ability to measure performance and the incentive to enforce compliance. Even though contracts are usually devised with enforcement in mind (an *ex ante* transaction cost), measuring performance remains a problem (an *ex post* transaction cost). Thus, enforcement is typically imperfect — despite substantial resources devoted to measuring and policing agreements (North).

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[17]As will be seen in Chapter 8, this scenario most closely resembles the Mali case in that traders have a lack of confidence in the legal system for prompt and fair resolution of business disputes (see Steffen and Dembélé; Dembélé, 1994).

A primary reason is known as the agency problem. The *agency* problem stems from the relation between a principal and her agent hired to enforce terms of an agreement or contract. Self-interests of the agent are likely to diverge from those of the principal, imposing costs on the principal in terms of shirking by the agent (possibly unobservable to the principal) and monitoring and disciplining the agent by the principal. In other words, the agent's own utility function influences the outcome of the contract in ways not necessarily anticipated by the principal (North; Stiglitz, 1989). Policing the actions of the agent add to costs of enforcing the contract.

North attributes considerable importance to the pervasiveness of informal constraints, such as socially sanctioned norms of behavior, internally enforced codes of conduct, informal extensions of formal rules and market conventions (such as standard weights and measures).[18] Informal constraints make exchange viable by reducing measurement and enforcement costs. These informal constraints are self-enforcing when it pays to live up to them, particularly in cases of personal exchange.

Contract renewal among the same parties can lower information, search, negotiation and performance costs significantly. In their review of case studies applying transaction cost theory in Tunisia, Nabli and Nugent (1989b) found that contract performance "bonding" through a series of renewable short-term contracts can compel both parties to live up to their agreement — provided that prospects for renewal are neither too large or too small. In this sense, the promise of contract renewal as a reward for good performance can be a useful incentive for self-enforcement.

[18]These are similar in purpose to Williamson's "private orderings" formally outside the legal system.

However, many transactions in complex economies can be classified as impersonal exchange with third-party enforcement. A coercive third party is essential, says North, because rewards for opportunism, cheating and shirking rise. While third-party enforcement is seldom ideal, self-enforcement based on "trust" (Williamson, 1985: "promise") is not completely reliable. Successful enforcement requires some communication mechanism to indicate when enforcement is required as well as institutional incentives for carrying out the punishment.

Enforcement has public good characteristics in that society benefits from fair and credible enforcement which lowers the costs of transacting while punishment is borne by individual transgressors. In contrast to complex economies, contract enforcement in developing countries is usually less reliable because of the "ambiguity of legal doctrine" (North),[19] making measurement of performance all the more difficult, but also because the state is weakly developed as a coercive force with the ability to monitor property rights and enforce contracts (see Dembélé, 1994).

6.2.4. Strengths and Weaknesses of Transaction Cost Economics

The strength of transaction cost economics is that it offers new insights and new hypotheses. Its main substantive contribution has been to relate the limits and costs associated with organizational alternatives to the attributes of transactions in a discriminating fashion (Williamson, 1981; 1985). As there has been little systematic analysis of agricultural

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[19]North (p. 45) cautions that informal constraints are culturally derived and do not change immediately to changes in the formal rules. This can pose problems in developing countries, such as Mali, where many legal foundations were adopted directly from the former colonial power with little regard to their relation to existing informal constraints (see Dembélé, 1994).

transactions in transaction cost terms (Masten), the possibilities are challenging. Herrick confidently expects that transaction costs and related concepts will quickly find their way into conventional economic development analysis.

A first strength,[20] transaction cost economics can help to explain the type of organizational form that are likely to arise involving certain transaction costs.[21] Institutions, says North, provide the structure for exchange that determine, along with the technology used, the costs of transformation and transaction.

Second, the attention paid to asset specificity helps to explain rigidities in certain institutions and the unwillingness of institutions to change with changes in supply and demand. In terms of human capital specificity, this suggests that policies are needed to help employees redeploy their assets to make them less specialized.

Third, transaction cost economics helps to design and redesign economic institutions from the perspective of mutual interests in reducing the *ex ante* and *ex post* costs of transacting. It pays simultaneous attention to the twin problems of monitoring and enforcement.

In a related vein, fourth, transaction cost economics helps institutions accommodate changes in technology which change the nature of transaction costs, thereby altering the most appropriate governance structure.

According to transaction cost economics, differences in transaction costs explain the differences in the organization chosen by firms (Schmid, 1991). Whereas neo-classical economics takes institutions (rules of the game: property rights, laws, customs, implicit rules,

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[20]The following four points are based on in Staatz (1988b).

[21]Masten claims that transaction cost economics has become "arguably the dominant methodology for analyzing problems of economic organization."

standard business practices) as a given to investigate the effects of changing prices and incomes on economic performance, transaction cost economics holds prices and incomes constant and measures how economic performance changes when the rules of the game change — in this case, grain marketing regulations.

The direction of causality is reversed: Rather than the institutional setting determining what is efficient economic performance, economic efficiency determines the institutional setting (Staatz, 1988b) — an interesting dialectic.

A first limitation, therefore, is that the predictive powers of transaction cost economics that such and such a transaction cost will lead to such and such an institutional structure are weak. Complementary institutional analysis is needed.[22]

Second, the focus on lowering transaction costs as the prime criterion for institutional choice in agricultural policy may be too narrow. It does not take into account whose interests matter or whose costs get counted.

Nabli and Nugent (1989b) maintain, third, that mechanical application of transaction cost theory to developing countries is likely to fall short on several grounds: Agricultural land is not as vulnerable to opportunistic asset-misuse; opportunistic behavior often occurs at the expense of external parties to the contract (such as the government in the case of tax avoidance and disregard for other regulations); the influence of "non-market" social conventions and societal norms on the choice among contracts may be under-appreciated;[23] and case studies demonstrate remarkable institutional flexibility (not rigidity) in terms of changes in contract form and willingness to consider alternative forms.

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[22]According to Nabli and Nugent (1989b, p. 442), the very breadth, flexibility and generality of the transactions cost approach may be "insufficiently precise" in helping to explain the details of institutional arrangements found in case studies.

[23]Footnote 19 is also applicable here.

Fourth, transaction cost economics is intended to complement, not replace, neo-classical theory. Nonetheless, clearly conflicting assumptions will make this cohabitation difficult.

6.3. Thin Markets and Market Failure

Section 6.3. next applies elements of the subsector approach and transaction cost economics to the related concepts of thin markets and market failure.

6.3.1. Thin Markets

Thin markets are markets with little trading volumes and little liquidity. Since only a small proportion of the crop volume transits the relevant market,[24] only a small proportion is involved in price determination. Individual offers to buy or sell can sometimes exert "undue" or "disproportional" influence on prices or other terms of trade (Hayenga *et al.*).

6.3.1.1. Impact of Thin Markets on Performance

Thin markets may lead to volatile price behavior and related aspects of unsatisfactory performance. The first is the potential ease of price rigging and manipulation of profits. For example, one or two buyers or sellers faced with a large number of eager buyers on the other

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[24]The relevant market can refer to a thin world market, such as that for rice, where a large proportion of the world crop is traded and consumed directly in producing countries and relatively little rice traded internationally. The relevant market can refer to a domestic market in which a large proportion of the crop is traded and consumed directly within high population density producing zones (such as southern Mali), leaving a small proportion to be marketed in the distant, low-density periphery (such as the Northeast). This latter case exemplifies the millet and maize market in Mali.

side of the transaction are likely to take advantage of their short-term market position to extract quasi-monopoly or quasi-monopsony profits.

Prices incorporate countless bits of information reflecting supply and demand conditions into a single index. Under stable conditions, broad market prices capture most of the essential information required by buyers and sellers. But in thin markets, few negotiated transactions per period may transmit unrepresentative or biased price signals, causing errors in incentive structures and resource allocation decisions. The value of prices from thin markets as reliable regulatory standards or government support prices is in doubt.

Furthermore, thin markets increase the perception of risks, possibly leading to higher risk premiums built into prices and therefore higher transaction costs.

6.3.1.2. Causes and Trends of Thin Markets

Economists urge a close examination of the given market before reaching categorical conclusions about the magnitude of its "thinness". Caves notes that in a single-period context, for instance, thinness may be *artificial* (if some force excludes market participants who are willing to transact at the prevailing price) or *natural* (if few market participants are willing to demand or supply at the prevailing price). This thinness depends on the number of transactors, not necessarily the number of transactions. A thin market may be also due to *structural* elements that limit entry (Powers).

A second consideration, also in the single-period context, is that a market might be thin due to scale economies, scale discontinuities or high fixed costs of the transaction itself, regardless of the number of would-be transactors in the infrequent or irregular transactions (Caves). Technical inefficiencies, raising costs to potential transactors, is a related cause of thin markets (Powers).

Third, a market might be thin due to high costs or arbitrage over space, inhibiting the movement of the product, the transactors or both. These high costs result in localized thin markets (Caves), a consideration especially relevant to the cereals market in Northeastern Mali.[25]

Fourth, a market might be thin due to high costs over time or temporal arbitrage. Even though the product may involve many transactors over a given period (due to multiple stages of transformation, particularly storage), the number of potential transactors may be small at any particular moment (Caves).

Fifth, poor information, poor communication facilities or the high costs of gathering information contribute to thin markets (Hayenga *et al.*; Powers). In some instances, the high cost of expanding or maintaining a comprehensive market information system may be a partial cause of thin markets if the cost of price collection becomes prohibitive (Henderson).

Ironically, the unsatisfactory performance of thin markets may be due to the trend away from open, broadly-traded markets to vertically integrated systems or longer-term contracts (Hayenga *et al.*; Caves),[26] particularly in developed economies. This forward and backward integration raises the level of concentration within the subsector, the percentage of market sales held by the largest firms (Marion, 1986). Residual markets become thinner. The stress of accommodating unexpected changes in production or consumption may fall on

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[25]Caves (p. 20) says that these transportation costs shade into general transaction costs or costs of acquiring market information.

[26]Discussion of this topic, and the reasons why certain market participants exit from the spot market, deals with transaction costs, difficulties in meeting heterogenous preferences of buyers and consumers, problems of access to information, asymmetrical exposure to risk (between farmer and processor), risk aversion to capital markets, and avoiding or promoting non-competitive prices (Caves, pp. 21-23).

the residual thin market where the price impact and necessary adjustments may be greater (Hayenga *et al.*).[27]

As the residual spot markets become thinner, the information content of spot market prices is reduced. If the spot market price is weakened as a guide to the current allocation of resources for future production due to the removal from the market of transactor-pairs through integrating arrangements, a different short-run equilibrium price might prevail. According to Caves, this information loss represents an externality of the decision to integrate. Thus, "an incidental social cost arises from otherwise benevolent forms of vertical integration that remove pairs of transactors from the spot markets for some non-trivial period of time" (Caves, p. 24).

6.3.1.3. Household Participation in Thin Markets: A Brief Digression

This section provides a few illustrations from a rich literature of household behavior with thin markets. The following discussion, which could have formed part of Chapter 3, has been reserved for the review of markets and transaction costs in this chapter.

Understanding some basic elements of household behavior from the transactions cost perspective helps to further explain why some markets are thin. The absence of many market "transactors" may be due to the decision by the household not to participate, or participate only occasionally, in the cereals market.[28] Non-participation in the market by some

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[27]Shifting the burden of adjustment to the thinner spot market may be a simple *equity* problem, akin to redistribution of welfare. Adjustment may become an *efficiency* problem if a) widespread vertical integration in a market imposes barriers to new entrants, or if b) there is short-run profit taking by the integrated producer with steady output at the expense of the independent producer, whose short run marginal cost is higher due to variable orders and output (Caves, in Hayenga, pp. 37-38).

[28]As Goetz points out, Timmer's "food price dilemma" exists with equal force within rural areas in that higher prices to farmers translate into higher consumer prices. Net buying farm households are not always able to respond to the producer price incentive in the short run.

households is largely explained by transaction costs which drive a wedge between buying and selling prices. Indifference between buying and selling — that is, participation in the market — creates a set of autarkic households unable to equate the market price of cereals to their own shadow price of the value of cereals. The cereal in question becomes a nontradable good (Goetz; De Janvry, Fafchamps and Sadoulet).

Under thin market conditions, it is costly to discover trading opportunities. Foremost, market prices are not costless for households to observe. In the Northeast, poor access to markets in terms of long distances and lack of transportation facilities adds to transaction costs.[29] Bartering further obscures prices received and observed.[30] Under such conditions, apparent market prices become indicative proxies, or reference prices, for price levels prevailing in any individual transaction. These effects may be mitigated somewhat by off-farm employment or possibly herding, which puts household members in contact with local market prices and conditions, thereby reducing the cost of observing prices.

Market price changes may also be hard to interpret. It is expected that market price changes may also lead to relative changes in the consumption of individual cereals. Where households farm, price changes may also lead to changes in stock levels due to the higher opportunity cost of holding stocks. However, price increases could lead to more food purchases, if these are perceived as signs of impending scarcities.

Market participation may likewise depend on the state of harvest. Where all markets exist and exogenous market prices equal internal household shadow prices, market

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[29]Table 2.6. (Chapter 2) shows the large average radius per marketshed in the Northeast. While the effects of great distance and difficult access is reduced by ownership of transportation-type assets, Table 4.2 (Chapter 4) shows that on average, households in all strata own less than one camel, donkey or cart.

[30]This problem may be less pronounced in the Northeast as Tables 5.8. through 5.11. (Chapter 5) show that survey households obtained almost none of their cereals by bartering.

participation questions can be taken sequentially. Even though farm household production and consumption decisions are usually made interdependently, consumption levels still depend on the outcome of previous production (see, for example, Singh, Squire and Strauss).

Bromley and Chavas contend that marketing constraints are all the more pronounced in the semi-arid tropics due to the high correlation between rainfall variability, household exchange entitlements and food security — *exogenous uncertainty*. Transactions are also subject to *strategic uncertainty*, associated with imperfect knowledge of the situation of other market participants and their propensity toward opportunism.

Where markets are thin, high transaction costs tend to limit exchanges to family and local acquaintances (transactions with limited spatial dimensions) and the present time period (transactions whose costs and benefits are not separated in time). On this basis, rural households are more prone to enter a contingent transaction within the family circle than an anonymous unconditional market transaction in which the terms of exchange are certain at the time of transaction and (subject to buyer protection provisions of the exchange, if any), not subject to recall. Possibilities for changing the terms of exchange are virtually nil.[31]

6.3.1.4. Solutions to Thin Markets

Thin markets in the Northeast, particularly in rural areas, may be inescapable. In view of the low population densities (Table 2.5. in Chapter 2) and low numbers of markets but large radii served (Table 2.6.), thin markets may be of the "natural" variety, to use Caves' term. As will be seen in Chapter 7, rural markets are likely to be thin in terms of numbers of traders at least part of the year.

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[31]This recognizes another variation of the *ex post* costs of contracting (exchange) of Williamson.

How to overcome the thin market problem has occupied the attention of agricultural marketing economists and transaction cost economists alike. While doing nothing — benign neglect of thin markets — is unsatisfactory, the proposed solutions appear more appropriate for resource levels available to industrialized countries than countries.[32] Chapter 9 will attempt to make workable recommendations for the Mali case.

6.3.2. Market Failures

Markets in developing countries, particularly thin markets, are often viewed with dismay. Traditional markets, according to Shaffer *et al.*, are "unpredictable, unreliable and carry very limited coordinating information and incentives." Due to uncertainty and limited perceptions of opportunity, lack of effective coordination means that costs are higher than they need to be. In the extreme, when the costs of transacting become prohibitively high, no

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[32]See, for example, alternative solutions raised by Henderson and by Raikes for thin markets in the United States. Raikes discusses the practicality of a) subsidies for central market transactions reporting; b) prohibiting formula price contracts in order to shift them to the spot market; c) establishing futures markets for related products; d) use of computerized central pricing systems; e) improving committee price determination; f) more complete market reporting where lack of information restricts entry or market arbitrage; and g) strengthening organized spot market exchanges to establish centralized prices.

Henderson addresses improving the accuracy of reported prices from the perspective of the market reporter and integrity of market reports. He discusses the advantages and disadvantages of a) reporting market volumes on which prices are based to let the reader/listener determine the reliability of the reported prices; b) expand reporting of complementary, non-price market information; c) base market reporting on standard contracting terms to force all price reporting into a common framework, an argument for mandatory marketing reporting system for all traders; and d) simulate prices of thin market products based on prices of related products traded in more price-representative markets.

transactions occur and the market fails.[33] This purported unreliability of markets leads to consideration of market failure.

Market failure occurs wherever markets deviate from neo-classical assumptions. Where there is market failure, market prices do not exist, they do not reflect the true value, or they are irrelevant (Meier).

Market failure exists in various forms (Meier; Myers and Oehmke; Steiner; Stiglitz, 1987; Timmer, Falcon and Pearson). One way of defining market failure is in terms of a) market imperfections; b) externalities; c) public goods; d) missing markets; and e) undesirable market outcomes.[34]

6.3.2.1. Market Imperfections

First, the case of market imperfections occurs when the market does not function properly in terms of deviations from any of the neo-classical assumptions of perfect competition and competitive equilibria (section 6.1.5.1.). Efficiency in resource allocation does not occur because some markets are not competitive, for example, due to barriers to entry or exit. As a result, some market participants may be large enough or strategically placed to set prices and reap long-term positive profits. Another example is where a competitive equilibrium does not occur because markets are segmented between a fixed price market (whose quantities are rationed) and the free price market. Segmented markets are in disequilibrium because the elasticity of demand for the same product or service differs between markets. Lastly, as earlier pointed out in terms of bounded rationality, market

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[33]Arrow (1969, cited in Williamson, 1981, p. 1546) says that the origin of market failures lies in transaction costs. Williamson (1989, p. 141) adds that as "market failure is not absolute, it is better to consider a broader category, that of transaction costs, which in general impede and in particular cases completely block the formation of markets."

[34]These categories are loosely based on Meier (p. 515).

participants do not have perfect knowledge and foresight of market conditions, resulting in continual "frictional" disequilibria.

6.3.2.2. Externalities

Next, market failure occurs in the presence of externalities. Externalities are defined as the result of an economic activity by one party which imposes economic costs on a second party for which the first party is not held responsible from a social or legal viewpoint — or, in transaction cost terms, an activity not subject to contractual performance and enforcement which, nonetheless, imposes costs.[35] These costs represent a deviation from the market result which would prevail in the absence of the externality.

Meier claims that externalities lead to "incorrect market results". Others (Schmid, 1987; Timmer *et al.*) take a more benign view, noting that externalities are ubiquitous. Externalities are neither created nor destroyed, but just shifted around due to economic interdependence. According to this view, nothing is "incorrect" from the standpoint of the market, as long as the activity of the first party lies within his opportunity set. This latter view would drop externalities from the domain of market failures.

6.3.2.3. Missing Markets

Market failure occurs where markets are missing or incomplete. Without a complete set of markets, developing economies are said to be "empty economies" (Meier, p. 515).[36] "Nonexistence of a market is thus the extreme case of market failure" (De Janvry, Fafchamps and Sadoulet, p. 1401).

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[35]Schmid (1987) classifies externalities according to the type of cost affected. A *technological* externality affects the use-value of a good, a *pecuniary* externality affects the exchange value of the good, and a *political* externality affects the previous pattern of rights and exposures. Externalities can bring economic rewards as well as impose costs.

[36]According to Meier (p. 515), underdevelopment is largely synonymous with market failure.

For example, the lack of a crop insurance market to protect against drought or hailstorms means that the farmer has fewer options to hedge his risks. Similarly, the lack of a futures market for cereals reduces the opportunity of cereals traders to take off-setting risks. Lack of well-functioning credit markets may prevent under-capitalized traders from undertaking unexpected opportunities for profitable price arbitraging (see Myers and Oehmke; Runge and Myers; Stiglitz, 1987). Missing markets, of course, are closely related to thin markets.

To De Janvry *et al.* (p. 1401), market failure due to missing markets is household specific, not commodity specific. "A market fails when the cost of a transaction through market exchange creates disutility greater than the utility gain it produces, with the result that the market is not used for the transaction." Either the transaction takes place through some other mechanism, or it takes place not at all. "In general, markets exist, but they selectively fail for particular households, making the corresponding commodity a non-tradable for that household." Such a definition also has significant food security consequences, requiring the household to produce enough of the non-tradable through diversification to meet consumption needs.

De Janvry *et al.* also attribute the chronic inelasticity of supply response by farm households to missing markets. The *visible* household response to commodities and factors for which market prices exist is influenced by an internal household response to *non-observable* commodity and factor prices whose market is absent. For instance, without a labor market for small-scale rural-based industries to produce low-cost manufactured consumer goods, an economy (farm households) may turn to foreign-exchange earning cash crop production — instead of food crops — to allow purchase of imported consumer goods.

6.3.2.4. Public Goods

A fourth type of market failure exists where no market exists for a particular good because of its inherent characteristics — the case of public goods. Public goods are also known as "joint-impact goods" (Schmid, 1987).[37] Consumption of a joint-impact good by one person does not reduce the consumption by another person (the marginal cost for someone else to cônsume the good is zero). Moreover, the cost of excluding someone from consuming the good is prohibitively high (in transaction cost terms, the cost of monitoring consumption and enforcing limitations on the right to consume is exorbitant). Lastly, consumption of the good cannot be avoided. Classic examples of public goods are national defense, public health, scientific research and the weather service.

In the strict sense, public goods cannot be bought or sold in the market.[38] Thus, governments use general tax revenues to provide public goods which the market would either not provide or provide in suboptimal quantities (see following paragraph). Public goods yield benefits to society at large that cannot be priced and directly charged to users by private suppliers due to their high exclusion cost and joint-impact characteristics. When therefore the public sector provides goods or services, such as market price information, it is because the social benefit of correcting the market failure is judged to outweigh the social cost.

"Natural monopolies" are another form of public good, this time arising from the inherent character of the cost function in providing the good. In natural monopolies, scale

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[37]Joint-impact goods are distinct from "incompatible-use goods" which can be consumed simultaneously only by one individual or group. In contrast, joint-impact goods can be consumed simultaneously by more than one individual or group (Schmid, 1987) — although Nabli and Nugent (1989a) introduce the notion of "congestion" to illustrate that the difference between purely public goods and purely private goods is a matter of degree.

[38]This is also a matter of degree. As high exclusion cost joint-impact goods create free-riders who benefit at no personal cost, responses to reduce congestion include "sales" of public goods through user fees, subscriptions, licensing and other exclusionary costs.

economies in production — requiring use of specific assets — are large relative to the size of the market. Marginal costs decline over the extent of the market as more goods (or services) are produced, such that determining a global pricing optimum (where marginal costs equal marginal revenues, as prescribed by neo-classical welfare economics) is not possible (Bird). However, pricing output at some administratively-determined level of demand at the marginal cost will not cover the higher average costs.

Unless the difference between the marginal and average costs is met through a tax, natural monopolies will price their product at the average cost — thereby dropping consumers who are still perfectly willing to pay the marginal cost. This causes a market failure of natural monopoly imposed by putatively immutable technology (Caves).[39] For this reason, natural monopolies are often owned or regulated by the public sector.

6.3.2.5. Undesirable Market Outcomes

The last form of market failure occurs when the market yields undesirable results in terms of non-market objectives (objectives other than resource allocation). These results may be socially, economically or politically unacceptable. Sometimes the poor are priced out of the market. Thus, a primary example of an undesirable result is an unequal distribution of income or high incidence of malnutrition among some groups because implicit social prices do not equal market prices for certain transactions.

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[39]Caves (p. 19) handles the asset specificity problem by arguing that this "market failure — the lack of structural conditions necessary to ensure the equality of price and marginal costs — is not technological but instead a contractual one, because no one has had the wit to draw up a contract whereby a large number of enterprises can cooperatively own the efficient scale plant and compete in selling its output."

Williamson would agree (1985, p. 17): Since transaction costs economics adopts a contracting orientation, ..."any issue which can be formulated as a contracting problem can be investigated to advantage in transaction cost terms."

One simple prescription is that governments need to play a far stronger role in correcting market failures through provision of infrastructure and information (Lele, 1984a). The classical prescription is that governments use "non-distortionary" taxes to transfer income to those judged disadvantaged by market outcomes, but not interfere directly in the functioning of the market. Simply providing infrastructure and information, for example, may not overcome the undesired outcomes described in the preceding subsections. Chapter 9 will expand on these prescriptions.

6.4. Market Institutions and Economic Growth

To round out this conceptual framework on analyzing market performance, Section 6.4. looks at the link between market institutions and economic growth.

6.4.1. Importance of Market Institutions

What then should be done about reducing transaction costs, broadening thin markets, correcting for market failures and improving coordination?

This chapter argues in favor of the development of market institutions. The institutional framework, according to North, plays a decisive role in the performance of any economy.[40] Moreover, analysis of economic institutions provides a means for comparing the performance of different economies.[41]

North's general premise is that institutions are a response to the constraints that society imposes on its members. Market institutions determine the opportunity set of market participants.

The cost of information in exchange is high, including measuring the characteristics of the exchange and enforcing agreements. Well-designed institutions can help reduce uncertainty by providing critical information. In turn, this reduces transaction costs and the associated risk premium, whose size depends on the likelihood of the other party not living up to the bargain and the penalty to the transactor. Lower transaction costs facilitate coordinated trade. Development will occur only when the exchange domain (Bromley) is open to a variety of economic transactions through implicit or explicit contracts between market participants that facilitate economic exchange which transcends traditional confines.

[40]The link between agriculture, agricultural institutions and overall economic growth in developing countries is now widely accepted. Timmer (1986, p. 142) claims that, "[Government] policies and public investments determine the efficiency and dynamism of a country's agriculture more than in almost any other sector." For an excellent, comprehensive summary of the evolution of agricultural policies, see Staatz and Eicher, "Agricultural Development Ideas in Historical Perspective," in Eicher and Staatz (1990).

[41]North (p. 54) is emphatic about this, declaring that "...the inability of societies to develop effective, low-cost enforcement of contracts is the most important source of both historical stagnation and contemporary underdevelopment in the Third World."

6.4.2. Roles for the Public Sector in Marketing

This next section considers some general roles for government and critiques past performance of African governments in agriculture and marketing. It then addresses the function of marketing regulations and warns about the risk of government failure.

6.4.2.1. General Role of Governments and Markets

Discussion of the general role of government in the economy begins with a review of market functions. First, markets provide the physical and institutional setting for the transformation of agricultural commodities in time, place and form. Second, they provide mechanisms and institutions for transferring ownership.[42] Third, they allow price discovery through the interaction of literally countless buyers and sellers (Timmer, 1986). The coordinating role of prices determined in competitive markets generates the efficiency that market economies claim. But actual market performance and its impact on welfare depend critically on just how efficiently marketing activities are carried out and thus how efficiently markets generate and transmit price signals.

The foremost function of the public sector, therefore, is to provide market facilitating services and an environment which enables markets to function properly. At minimum, this includes provision of:

- transport infrastructure (especially highways and rural roads), making inaccessible areas more accessible;

[42]Ownership is defined by property rights, a set of institutions. Property rights describe the relation of an individual with respect to a resource or course of action. Property rights are politically created and socially sanctioned (Schmid, 1987).

- a reliable communications network (such as the postal and telephone systems);[43]
- a sound and stable currency (to encourage savings and investment and to aid price expectations);
- domestic security, or law and order (to protect lives and property);
- an independent judicial system (to uphold contracts and resolve business disputes fairly and rapidly); and
- the right to form political and economic associations, both to air grievances and articulate consumer preferences.

Turning specifically to agriculture, a number of analysts have lauded the efficiency and responsiveness of African agricultural markets, despite a host of physical, financial and institutional handicaps (Hopcraft, among others),[44] particularly when compared to poor performance by the state sector (Kreisel, cited in Jones, 1984, among others). These studies, however, may have "gone a bit overboard" in their praise of private marketing systems (Jones, 1984).

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[43]Both transport and communications networks can be provided privately through right-of-way charters or monopoly rights granted by governments to private firms.

[44]Hopcraft's description of the positive features of African markets is worth citing here (Hopcraft, p. 37). "Africa has long traditions of open, competitive marketing, with flexible prices that vary predictably with the scarcity of the commodity, its quality, and with transport and storage costs. These marketing systems are efficient, responsive and self-financing, and are ideally suited to dispersed small-holder economies with variable rainfall and changing market conditions. In small-holder economies in Africa, as elsewhere, marketing activities involve large numbers of transactions dispersed over wide areas in diverse and changing circumstances. They require rapid decisions and decentralized responsibility. Entrepreneurial and trading skills in this area are legendary and are typically acquired in the market place rather than by formal education. There are large numbers of firms and agents, many of them quite small, often involving only one person or family. While market information is at a premium, and family, ethnic and other personal links may be used to advantage, marketing margins tend to be low and barriers to entry into the trade are generally not tolerated."

Indeed, African markets display many deficiencies and imperfections. Timmer *et al.* (p. 151) note that developing country markets "do not always function in the best interests of a broad cross section of society, especially...where communications and transport facilities are poor, markets are highly segmented, and access for marketing participants is greatly restricted," suggesting potentially large efficiency and economic gains for successful market coordination of the food system. Harrison *et al.* observe related marketing problems keeping costs high and coordination difficult to achieve.[45] Shaffer *et al.* find nothing particularly desirable about low marketing margins, which may just indicate a lack of increased services and coordination, or "efficient but poor" markets, which prevent participants from breaking out of their low-level equilibrium trap.

Under such conditions, given calls for privatization of domestic marketing systems, the capacity of the private sector to take over efficiently in many countries has yet to be demonstrated (Kydd and Scarborough). It was a mistake to think that existing marketing systems operated satisfactorily (World Bank, 1990a) or that, in Mali's case, traders could easily step in to fill the vacuum left by OPAM (Dioné and Staatz). At minimum, traders need certain market services and facilities without which privatization programs may falter (Lele and Christiansen).

It is critical to note that coordination of food systems is an *active* process (Shaffer, *et al.*, emphasis added). This coordination is unlikely to be achieved in developing countries

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[45]Based on their review of commodity subsectors in several Latin American countries, Harrison *et al.* (pp. 78-82) cite the following marketing problems: 1) lack of regional specialization and small-scale production units; 2) some tendencies towards monopsonies and oligopsonies in rural assembly markets; 3) "crude and inefficient" handling, packaging, storage and product conservation practices, with little product grading; 4) price distortions and uncertainties arising from thin markets; 5) lack of short-term and longer-term credit facilities; 6) a "pervading failure" of assemblers to link farmers with market opportunities; and 7) a bias in development planning towards high-cost physical infrastructure rather than towards lower-cost, management-intensive market-facilitating services.

without the active intervention of the government, coordinating public and private sector institutions, viable private firms and a systems perspective. Neither benign public sector *laissez-faire* policies nor heavy-handed and direct state involvement in the production, marketing, processing, storage, distribution and pricing of food will work (Holtzman).

To ensure effective coordination, Holtzman (p. 15) advocates "...clearly defining public and private roles in the food system, government provision of public-good type facilitating services or functions, such as market information, communications, funding of production and marketing research and extension, regulation which minimizes abuses and unfair play, and a policy environment which removes disincentives and fosters entrepreneurship and the undertaking of risk". In addition, others call for public-supported storage, transport and marketplace facilities; standardization of grades and units of measure; institutions to broaden access to credit and training; and institutional pluralism to foster competition (among others, Abbott; Harrison *et al.*; Jones, 1984; Lele, 1990; Lele and Christiansen; Kydd and Scarborough; Timmer, 1987; World Bank, 1990a). In short, market coordination requires an enabling environment.[46]

6.4.2.2. Past Performance by African Governments in Agriculture

A major factor affecting agricultural performance is how governments intervene in agricultural markets. During the past decade, much of the criticism aimed at African marketing organizations, such as marketing boards and other parastatals, or non-bureaucratic

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[46]"The invisible hand cannot be trusted completely to guide economies in socially desirable directions, nor can the state rely on the marketing system to perform the tasks assigned to it without appropriate facilitating services best provided by government" (Jones, 1970, in Riley and Weber).

forms of intervention, has been harsh — both in political-economic terms and on economic efficiency grounds.[47]

The litany of complaints about African agricultural policies is by now a familiar one. Until recent years, governments tended to lower prices offered for agricultural commodities and increase the prices of consumption goods by sheltering domestic manufacturers. Policies to increase farm production were usually project-based, rather than price-based. Prices of inputs were lowered through subsidies, rather than increasing output prices for farmers. Typically, governments intervened in ways that promoted inefficiency by a) creating major

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[47]External reviews of African agricultural performance span the past decade. One of the first critiques was provided in the USDA report, *Food Problems and Prospects in Sub-Saharan Africa: The Decade of the 1980s*, (1981). More recently, the World Bank has published *Agricultural Growth, Domestic Policies, the External Environment, and Assistance to Africa: Lessons of A Quarter Century* (1989); *Managing Agricultural Development in Africa: Three Articles on Lessons from Experience* (1989); and *Agricultural Marketing: The World Bank's Experience, 1974-85* (1990).

price distortions;[48] b) reducing competition in markets;[49] and c) investing in poorly conceived agricultural projects[50] (Bates, 1989).

Agricultural policies of restrictive controls, fixed prices and rejection of much private trade were best embodied by parastatals and marketing boards. Objectives varied across marketing boards, but the main ones called for a) protecting the welfare of the poorest groups and equity concerns; b) obtaining higher returns (or guaranteed returns) by operating as production, processing or marketing monopolies; c) generating government revenues; and d) moderating supply and price fluctuations in domestic markets through buffer stock

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[48]One major example concerns maintaining an overvalued currency. One result is to lower the prices received by the exporters of cash crops. While overvaluation lowers the prices paid for foreign imports, the rationale for overvaluation in the first place, it also lowers the cost of imported food — leaving African farmers unprotected from higher levels of competition from abroad in the absence of a protective tariff.

Another example is frequent rationing through subsidies — food crops or agricultural loans — rather than letting the market allocate through the pricing system — prices or interest rates. This results in segmented markets because there is not enough subsidized food staples or low-interest agricultural loans for all quantities demanded. Benefits of rationing are captured by the powerful and influential, rather than the small and poor. Residual demand is met on the open market. When any supply shock hits the fixed price market, such as shortages due to drought, prices on the open market fluctuate disproportionately.

Fixed price policies, where there are fixed margins to be charged at each stage of the marketing chain through a price schedule (*barême*), prevent the market from responding to price signals and contribute to efficiency losses. Uniform pricing of output, involving complex cross-subsidies of inputs and transport and other handling costs across regions, may have achieved regional equity, especially where few attractive alternatives exist. But this discourages crop specialization to exploit different natural resources among regions (Lele, 1984b, p. 334). Pan-territorial prices may cause excessive production in high transport-cost areas. Pan-seasonal prices offer no incentives to maintain stocks, inducing farmers to sell right after harvest or traders to sell with rapid turnover.

[49]Abbott, Hopcraft and others criticize the short-sightedness of developing country governments for neglecting the potential contribution of indigenous private enterprise and traditional market institutions, rather than improving their competitive performance through provision of marketing services.

[50]These interventions often fed on each other. The coercive role of marketing boards or government-sponsored cooperatives was sometimes used to acquire crops and other raw materials for protected processing industries. This guaranteed sufficient supplies to achieve the necessary capacity utilization to justify the investment (Abbott).

arrangements. While marketing boards were intended as one of the primary mechanisms through which African governments transferred resources to and from agriculture, their dismal financial performance contributed to agricultural stagnation and declines and rising food imports. Marketing boards typically became overstaffed, inefficient and a costly drain on government revenues due to multiple constraints and conflicting objectives.[51] In Mali, maintaining inefficient parastatals came at a high opportunity cost (World Bank, 1981a).[52]

In general, it has been claimed that the social (non-market) objectives underlying a policy program rarely determine the particular form the policies assume. And the policy instruments chosen to secure the social objectives are typically inconsistent with the attainment of these objectives (Bates, 1990). Put bluntly, past food marketing policy in Africa — and Mali — appeared to represent a form of political settlement designed to bring peaceful relations between African governments and their urban (or regional) constituents or a means to retain political power, where economic inefficiency can be politically expedient and government-controlled markets politically attractive (Bates, 1989, 1990; E. Berg, 1983; Byerlee and Sain; Constantin and Coulon; Hinderink and Sterkenburg; Hopcraft; Humphreys; and Kébé, among others).

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[51]These included managerial and institutional constraints (inexperienced management, poor record keeping and inventory controls, late arrivals of crop-purchasing teams, insufficient cash reserves and inadequate financial controls, not enough transport resources, but a lack of rewards for management performance); lack of a competitive environment and autonomy in decision-making; and macro-economic policies.

Some inefficiencies resulted from factors beyond management control, such as exchange rate policies and pricing rigidities; outside appointment of managers; forced recruitment and overstaffing; political determination of buying and selling locations; and failure of the government to reimburse revenue losses stemming from carrying out social objectives (see World Bank, 1990a).

[52]In OPAM's case, see Annex 2.1; Steffen, 1994; and Swanson and Wolde-Semait.

Failure to develop market facilitating institutions has cost dearly. Bromley argues that developing country agriculture is characterized by the explicit presence of the state *without* the necessary array of institutional foundations to facilitate exchange. Farmers and traders are limited in their opportunities to engage in transactions over time and space. The lack of exchange opportunities compels farming households to pursue diversified production strategies to spread risk and ensure a more complete consumption set — rather than specialization which requires well-functioning markets. Negotiations between traders are more likely to be protracted because contracts are not routine or standardized. Enforcement is haphazard due to poorly developed business law concepts and cumbersome administrative procedures.

Likewise, the absence of well-developed market systems explains the high costs of transacting. Much exchange occurs within the family and/or local community, rather than the larger market economy, in order to economize on transaction costs. Information is easier to obtain, transacting may be less subject to opportunism and enforcement is easier within the family network.

Mali is well on the way to market reform (Annex 2.1). Fortunately, there is a growing appreciation of the resource-allocating function of markets and market facilitating institutions in agricultural development. But the critical question remains, how can the legal foundations for well-performing markets be established, given the vested interest — and explicit participation — of governments in current arrangements which protect the state's role, while fostering institutional arrangements to encourage increased production and exchange.

6.4.2.3. Marketing Regulations

The question of whether or not to regulate markets is meaningless. No markets are free of rules. As seen in Section 6.2, economic behavior is regulated by institutions and constraints — social customs, laws, standard operating procedures, taxes and subsidies and administrative regulations. The efficiency of market regulation depends on enforcement mechanisms and the nature of incentives. It is therefore useful to consider the market an instrument of regulation rather than an object of regulation (Shaffer, 1979). The market has no content independent of the law which protects rights and makes rights (Schmid, 1991).[53]

The market translates political decisions into economic costs and rewards. An individual's economic behavior is the result of the consequences of the incentives and disincentives of specific actions and enforcement mechanisms. Regulations change the economic choices (and enforcement mechanisms) of individuals, thereby also changing their economic behavior (Shaffer, 1979).[54]

This is a major concern since the performance of the grain market depends on the aggregate consequences of the economic behavior of firms and individuals and the countless economic decisions they make from day to day. In changing the factors taken into account by individuals and firms, regulations can result in apparently irrational economic behavior with unanticipated results. Thus, the micro-economic behavior of individuals and firms can lead to undesirable macro-economic consequences and failure of the intended objectives.

In principle, design and enforcement of market regulations need to anticipate all the costs and benefits that target individuals and firms face in order to predict the desired efficiency of regulations. In other words, regulations should be structured in such a way as to

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[53]North (p. 35) adds that achieving the productivity of a high-income, modern society is not possible in a state of political anarchy. An economy needs the coercive third party enforcement, first by a set of rules that make informal constraints effective, then by an effective judicial system.

[54]Bromley postulates three "domains" of individual behavior, production, reproduction and exchange. For any individual, these domains are strongly influenced by the transaction costs associated with existing institutional arrangements. By defining the sanctions and incentives that transmit signals, outcomes in the exchange domain, for example, influence economic behavior of the other two domains.

align anticipated economic behavior with the intended objectives of the regulations such that market performance corresponds to policy objectives. Otherwise, poorly conceived regulations may run counter to the objective that the government seeks to accomplish by increasing transaction costs and reducing exchange efficiencies. Too much red tape, for example, means that traders forego the advantages of market regulations in order to avoid the high costs of compliance. Regulatory uncertainty also creates a climate which encourages ignoring the regulations or corrupting the agents charged with their enforcement. By accepting bribes, would-be enforcers of disregarded regulations become beneficiaries of illegal activities, weakening economic and financial incentives to reform. Where compliance offers no legal protection, no one will comply. Worse, such consequences can lead to market failure.[55]

In practice, it is impossible to anticipate all the reactions of the regulatory targets *ex ante*. Thus, key characteristics of successful policy regimes are that they monitor reactions of the target individuals and firms and that the regimes are flexible enough to modify their regulations as more is learned about how target groups react to them.

Modifying the regulation in question, rather than direct government intervention, may be more effective in adjusting the market, resulting in more efficient market conduct and socially beneficial performance (Shaffer, 1979). More often than not, however, the private sector has developed *in spite* of government regulations, rather than as a result of them (Newman *et al.*).

Thus, the market is a "mixed bag of institutions" which spin a complex web of informal and formal constraints (North). This mix reflects the costliness of measurement and

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[55]Newman, Sow and N'doye point out that the capital cost of payoffs to enforcement officers to avoid regulatory fines (*arrangements*) constitutes just as much as a capital cost barrier to entry or expansion as inaccessibility to financial credits.

enforcement. Market regulations, which these constraints represent, evolve continuously, although regulatory transparency is critical.

6.4.2.4. Government Failure versus Market Failure

The tension that governments feel between intervening in markets and letting markets function is very strong, particularly when markets appear to fail to guarantee the poor reliable access to sufficient food. Where governments do intervene in cereals markets, they do so for the ostensible purpose of improving the efficiency of resource allocation or to correct unacceptable market failures. Timmer (1987, p. 24) claims that "it is the possibility of market failure that gives agriculture its public dimensions."

However, the point that markets in the Northeast face special problems only identifies potential areas to investigate. It does not necessarily justify government intervention. The government, moreover, may be no better equipped to address a problem than the market. At best, where the public sector has no better access to information than the private sector (due to all the reasons cited in this chapter), the public sector is likely to face similar problems if it intervenes. At worst, it may fail (Stiglitz, 1987).

The unwillingness to leave the Northeast to the devices of the market implies a certain market intervention by the Malian government. Understanding the nature of government intervention requires approaching the problem from the perspective of the second best[56] to determine whether government or market failures are more critical (Stiglitz, 1987). That

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[56]The *first-best* world fulfills the marginal conditions of perfectly competitive equilibrium in all factor and product markets, with no uncertainty, no externalities and a given income distribution (Meier, p. 469).

The *second-best* world reflects the real world which concerns the development practitioner. The theorem of second-best presumes that a regulation or institution to make a market more nearly meet conditions of a perfectly competitive market will not necessarily lead to improved welfare unless all other conditions of the competitive market are met — which is never likely to happen (Shaffer, 1979) — in which case the new regulation would not be necessary in the first place.

being the case, market failure must be weighed against possible government failure (Schmid, 1990).

Careful empirical analysis of the nature and relative importance of market and non-market failures as well as the appropriate policy response must begin by specifying the reasons for market failure and the instruments the government can use to remedy it. General theories provide the analytical framework to identify the circumstances under which certain policies or interventions are more likely to be appropriate. Country-specific knowledge and models put theories into a specific context for analysis (Stiglitz, 1987). It is critical that any government intervention be finely tuned, based on precise policy objectives, ideally with a simulation of its impact.[57]

6.5. Performance Indicators for the Cereals Market

Having considered elements of transaction cost economics, thin markets and market failure and the role of governments in promoting market efficiency, this section returns to the notion of market performance.

Holtzman *et al.* (1993) propose three sets of performance indicators based on static efficiency criteria, dynamic efficiency criteria and institutional and policy attributes. Any evaluation of performance should place greater emphasis on the dynamic forces in the cereals market, as well as key institutional and policy issues, given their importance in market development.

[57]Timmer *et al.* (p. 156) caution that typically, "such [government] interventions call for a scalpel, rather than a sword."

Where data requirements for evaluating efficiency criteria are exhaustive, but not always available, it is still desirable to make careful, reasoned qualitative assessments based on specified standards, an exercise requiring experience and judgement. Even direction of change — positive, negative, increase, decrease or no change — may lend insights to measures of dynamic performance. Cross-country comparisons are appropriate where countries share similar levels of economic development, marketing problems and complexity and historical evolution of institutions, such as the francophone Sahelian countries.

The challenge of the next two chapters is to evaluate good performance in the Sahelian context of chronic supply instability, deficit production, seasonal food insecurity, poor infrastructure and weak market institutions — and data availabilities. Accordingly, Figure 6.7 shows the performance criteria to be examined in Chapter 7, Chapter 8 or both.

As some of these criteria overlap with others, each criterion will not necessarily examined independently in each case, but in conjunction with related criteria.

Stat

Dyna

Inst

Figure 6.7. Cereals Market Performance Criteria

Static Efficiency Performance Criteria

- Degree of market integration;
- Extent to which price changes reflect underlying supply and demand conditions — rather than "imperfect information, speculative excesses, or government intervention" (Holtzman *et al.*, 1993);
- Extent to which supply matches demand at different stages of the marketing system and evidence of supply gluts or scarcities;
- Extent to which marketing margins reflect the real costs of services, including normal returns to labor, management and capital;
- Extent to which firms are large enough to realize available economies of scale; and
- Adequacy and use of human resources in the market (education and training).

Dynamic Efficiency Performance Criteria

- Progressive innovations to reduce costs and increase productivity;
- Progressive innovations to reduce, share and better manage risk;
- Progressive institutional arrangements to increase productivity and improve market coordination over long distances;
- Extent of entrepreneurship and leadership in cereals markets;
- Adaptability of the cereals market (or individual participants) to exogenous change factors; and
- Extent to which the cereals market (or individual participants) generates and uses market information to improve marketing decisions.

Institutional and Government Policies Criteria

- Effectiveness of marketing institutions in organizing and regulating the cereals market;
- Extent to which the policy environment fosters competition, entrepreneurship and innovation in the market, including ease of entry;
- Government policies with respect to integrating public good services (food aid and National Security Stock) into the cereals market; and
- Quality, availability and timeliness of public marketing services.

Figure 6.7. draws from Holtzman *et al.* (1993), Appendix C.

6.6. Summary Remarks

This chapter began by describing the approach commodity subsector analysis, which forms the framework for analysis of the cereals market in the Northeast. This chapter also considered introduced key elements from transaction cost economics, thin markets and market failure. Next, the chapter raised issues concerning the critical role played by institutions — including well-functioning agricultural markets — in a country's economic development. This chapter concluded by enumerating selected market performance indicators for investigation in Chapters 7 and 8.

These concepts provide a theoretical basis for activist government participation in markets and promotion of markets.

Ch

7.1. B

Chapter 7. The Structure, Conduct and Performance of Rural Cereal Markets in the Northeast

This chapter examines rural market structure, conduct and performance, as applied to the subsector approach introduced in the previous chapter, in order to understand better the dynamics of rural grain markets in the Northeast. After discussing basic conditions in Section 7.1, the chapter examines market structure in Section 7.2 and conduct in Section 7.3. Performance of rural cereal markets in the Gao Region is evaluated in Section 7.4. Section 7.5 concludes the chapter.

7.1. Basic Conditions and Presentation of Rural Markets

In addition to the five rural market villages in the Gao Region presented in Part II, this chapter also considers the weekly markets in Ansongo and Bourem, each the seat of the District which bears its name.[1] Figure 7.1 on the following page shows the CESA-MSU rural market survey sites.

Figure 7.2 shows the estimated permanent population of each town as of October 1989. The estimated temporary population refers to people in regular migratory transit or waiting for distribution of food aid (refer to Annex 3.1).

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[1]For survey purposes, Ansongo and Bourem were treated as both rural markets and small urban wholesale markets. Survey results from a small sample of professional wholesalers in each town will be examined alongside those from urban wholesalers from elsewhere in Chapter 8.

Figure 7.1 Map of Rural Market Survey Sites

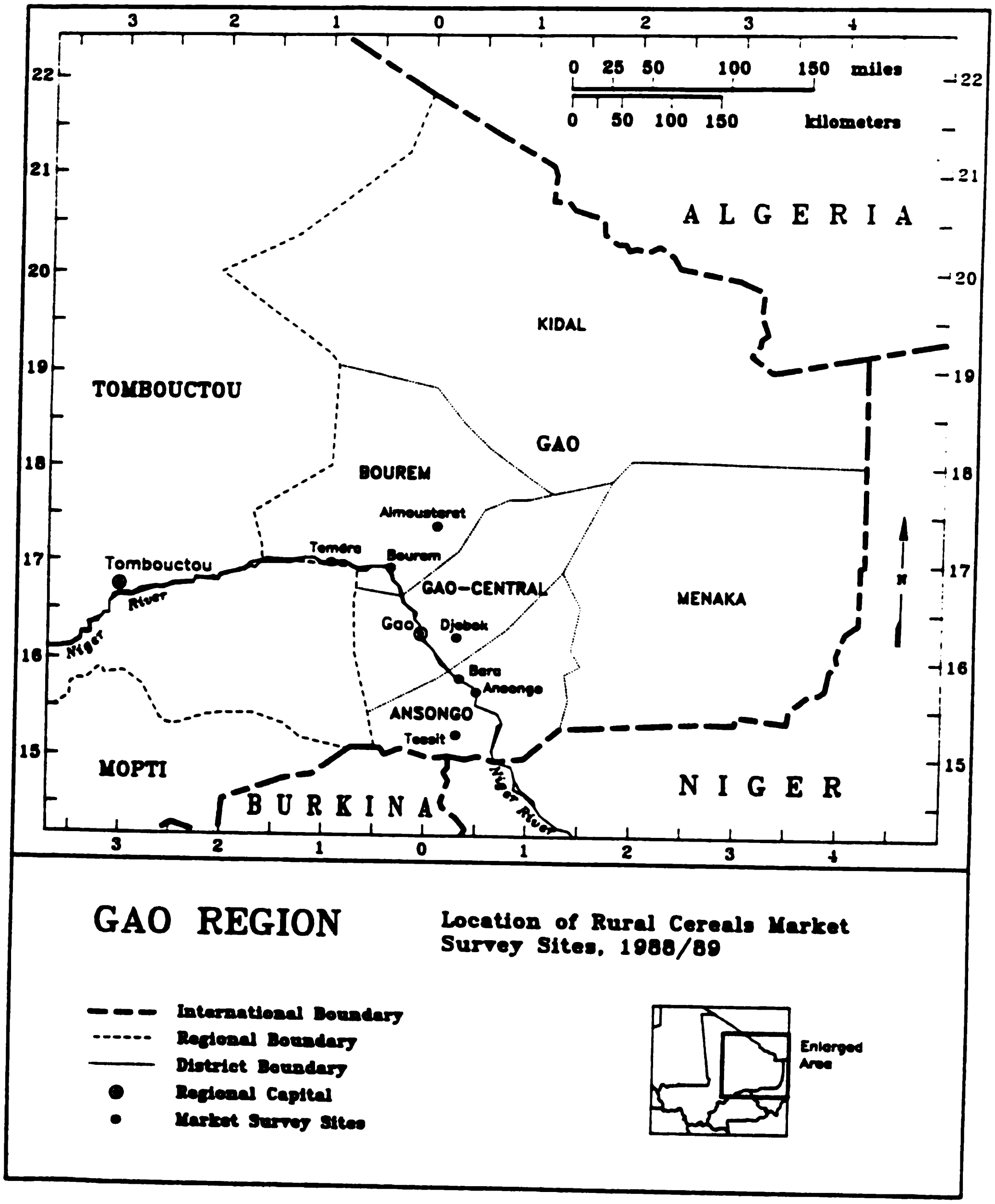

Figure 7.2. Basic Population Indicators for Rural Market Towns and Villages: Gao Region, 1989

Towns and Villages	Permanent Population	Temporary Population	Public School Enrollment
Almoustarat	700	40	82
Temera	1,600	100	64
Bourem	8,000	.	.
Djebok	453	887	235
Bara	3,000	426	273
Ansongo	10,000	.	.
Tessit	6,654	500	223

Note: The permanent population for Ansongo and Bourem is estimated by the author. Temporary population and school enrollment figures are unavailable for Ansongo and Bourem.

CESA-MSU Food Security Project enumerators, October 1989.

The relative size and importance of these towns and villages is measured as well by their physical and social infrastructure. Each village and town offers public education through the middle school level, whose enrollment figures are reported in Figure 7.2. Each has a medical dispensary. Each has at least one public well from which water is free, although an annual service fee is assessed in Almoustarat. OPAM maintains National Security Stock warehouses in Ansongo and Bourem, with a storage capacity of 1,500 tons each.

Telecommunication facilities and transport links are poor. Only Ansongo and Bourem offer public telephone and telegraph services. Four of the seven markets lie on the Niger River, a key transport artery which is navigable year-round for small *pirogues*. The multi-decked riverboats which operate between September and January bypass Temera but stop at Bourem and Gao-City. Transport by rural roads is less dependable, hampered by deep or drifting sand. Rural roads are nearly impracticable during the rainy season. Only Ansongo has scheduled public transportation to Gao, thanks to the bus running between Niamey, Niger and Gao-City twice a week, although actual arrival and departure days vary considerably. Travellers may be able to flag down the bus or other motorized transport from Bara, which lies along the road between Ansongo and Gao-City. Distances between the survey markets are shown in Figure 7.3.

Figure 7.3. Road/River Distances (kms) between Markets, Gao Region

	Almou't	Temera	Bourem	Djebok	Bara	Ansongo	Tessit
Almoustarat	0						
Temera	160	0					
Bourem	75	85	0				
Djebok	102	218	133	0			
Bara	210	255	170	113	0		
Ansongo	235	280	195	138	25	0	
Tessit	295	335	250	193	80	55	0
Gao-City	140	180	95	38	75	100	155

Note: **Rural markets are arranged in order from north to south. Road/river distances are the shortest ones between any pair of markets, with the exception of Djebok and Bara which lie about 65 km apart on a north-south axis.**

Food aid was distributed in Almoustarat, Temera, Bourem and Djebok in May and June 1988, half a year before the CESA-MSU surveys began (Annex 3.1). However, no food aid was distributed during the survey year.[2]

Each town and village has a weekly market, except Almoustarat. Attempts to start a weekly market in 1981 following OPAM's withdrawal from Almoustarat failed. Friday was

[2]The uncertainty regarding possible food aid distributions and its impact on subsector conduct and performance will be discussed in sections 7.3 and 7.4.

designated as market day for Almoustarat for survey purposes.[3] Market days for adjacent villages are staggered, allowing traders to make a weekly circuit of up to three or four markets. Market days for CESA-MSU survey villages are shown in Figure 7.4.

Figure 7.4. Rural Market Days, Gao Region

Almoustarat	Friday
Temera	Thursday
Bourem	Monday
Djebok	Monday
Bara	Tuesday
Ansongo	Thursday
Tessit	Saturday

OPAM closed its retail outlets in Almoustarat in 1980 and Temera in 1984. No such outlets existed in Djebok, Bara or Tessit. During 1988/89, OPAM maintained retail outlets in Ansongo, Bourem and Gao-City for fixed price cash sales in sacks of 50 kg or 100 kg. Civil servants and military were allowed to buy on credit because the regional governor guaranteed repayment on the basis of direct payroll deductions. Although few but credit customers shopped at OPAM, as OPAM's prices were set above market prices, OPAM sold an average of 2.9 tons per month in Ansongo and 2.5 tons in Bourem, nearly all food aid rice in each case, during the first ten months of the survey year (OPAM, *Situation des Ventes et*

[3]Friday was selected on the assumption that people in town for weekly prayer services would make most of their purchases at that time.

Distributions par Cercles, exercice 1988/89, pp. 33-34; no date).[4] These amounts represent a diversion of effective demand from rural markets.[5]

7.2. Rural Market Structure

This section considers three elements of market structure: the number of participants and parallel channels; the information system; and risk sharing institutions and arrangements.

7.2.1. The Number of Participants and Parallel Channels

One element of structure is the number and size of buyers and sellers as well as the numbers of stages and parallel channels.

The typologies of marketing chain participants of Dembélé, Dioné and Staatz, based on rural coarse grain markets in the CMDT and OHV zones in southern Mali, and Gagnon (1986), based on rural markets in the Dioila District, which overlaps the CMDT and OHV

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[4]OPAM sales represented about 1 percent of estimated total sales for Ansongo *arrondissement* and less than 1 per cent for Bourem *arrondissement* (calculations by the author based on April 1989 population figures, an assumption of 3,500 calories per kilogram of cereals, and data extracted from Tables 5.9 and 5.8 for annual average calorie consumption purchased from the market for the middle tercile of the South and North strata, respectively; the percentage of purchased calories for Ansongo was taken as the average percent purchased of the upper and lower terciles).

[5]Excluding sales by bid (Chapter 8), fixed price retail sales by OPAM in Gao-City averaged 37.6 tons monthly during this period, of which more than half was food aid rice and the remainder Malian millet (OPAM, *Situation des Ventes de Céréales, exercice 1988/89*, p. 32; no date). These OPAM sales represented about 7.1 percent of estimated total sales for Gao-City (calculations by the author based on April 1989 population figures and assumptions of 2,000 cereal calories consumed daily of which 50 percent were purchased and 3,500 calories per kilogram of cereals; increasing daily cereal calories to 2,500 and purchases to 75 percent decrease OPAM sales as a percent of total sales to 3.8 percent).

The breakdown between cereals which remained in the city for urban consumption and cereals which found their way to rural markets is unknown.

zones, are very similar. The resident assembler (*assembleur sédentaire* or *assembleur fixe*) buys cereals in small lots from farmers in the village in which he lives using his own funds; the resident assembler may be a farmer himself. The travelling assembler (*assembleur ambulant* or *assembleur forain*) buys cereals from stationary assemblers and on the more important rural markets. If the assembler is an agent for a larger trader, he is advanced funds for cereal purchases, whereas an independent assembler will use his own funds. The independent assembler will undertake short-term storage (up to one week) while the agent assembler will transfer cereals to his employer, typically an urban wholesaler.[6] Transformer-buyers, who are likely to be women, buy and mill cereals for resale.

The typology of market participants in the Northeast is also based on assemblers and a diverse array of professional and informal traders, whose coordinating role is discussed in section 7.3. In years of poor harvests, however, there may be no marketable surplus to assemble. For simplification, the status of market participant in the case of cereal purchases is defined as independent trader or commissioned agent. In the case of cereal sales, status is defined as independent trader, commissioned agent or farmer/gatherer.

The number of links in the marketing chain is closely related to exit and entry conditions. The shortest chain has only one link, represented by a simple transaction between farmer and consumer.[7] Indeed, low-cost exit and entry in rural markets in the Northeast is

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[6]These three levels of professional traders correspond to a hierarchy of markets known as first-assembler (*collecte primaire*), secondary (*regroupement*) and urban markets. Gagnon's typology appears to be more uni-directional (up the chain from resident assembler to the wholesaler, in whom ultimate redistribution and coordination functions are centered) than the CESA-MSU typology which implicitly allows cross-channel transactions.

[7]Harts-Broekhuis and de Jong (1990b) observe that the more locally produced the product, the shorter is the marketing chain. This would hold best for wild fonio and paddy.

reflected in the large volumes of a representative basket of cereals sold directly by farmers (and/or gathers) to consumers.[8]

As shown in Table 7.1, farmers outnumber independent traders and trader agents seasonally for some cereals and all year for other cereals.[9] The stratification of market villages between North and South (first used in Chapter 4) is most clearly pronounced in the harvest/post-harvest season for millet, sorghum, paddy and fonio. Traders dominate market sales in the North and farmers dominate in the South. Farmers sell most of the sorghum in Djebok, reflecting the prevalence of sorghum in the diet and local production possibilities (Annex 5.2). As for maize, which for all practical purposes is not grown in the Gao Region, most sales are handled by traders. Local rice is marketed by a majority of traders in each case except Tessit. Farmers there have a consistently high rate of market participation by default, as Tessit is serviced irregularly by professional traders, if at all. The dominant position of traders in Almoustarat, without a market, is due to the fact that only trader-shopkeepers were surveyed. Non-shop transactions involving farmers/gatherers were not observed but are likely to be few. Lastly, the relatively minor participation by trader agents may simply mean that agents were buying (counted as a sale by the local trader or farmer), rather than selling.

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[8]Three cereals selected for the tables in this chapter are produced largely or exclusively within the Northeast (sorghum, paddy and local rice). Two cereals are largely or exclusively produced outside the Northeast (millet and maize). Lastly, wild fonio is freely available from the commons.

[9]These figures should be considered indicative rather than definitive for three reasons. First, due to confusion in identifying a given transaction as a purchase or sale, it appears (based on discussions with the enumerator) that some purchase volumes were transposed as sales volumes, but without corresponding information about seller status (trader, agent or producer/gatherer) and gender. Second, some observations were recoded *ex post*, based on the enumerator's familiarity with market participants, to account for earlier sales by producers and gatherers. Third, Table 7.1 is based only on recorded status of the seller. Observations for which the status is unavailable were dropped before computations.

Table 7.1

Status of Cereal Sellers in Rural Markets as Independent Trader, Trader Agent or Farmer/Gatherer, by Season

(Percent of Volume Sold)

	Harvest/ Post-Harvest			Hot Dry Season			Rainy Season		
	Trdr	Agnt	Frmr	Trdr	Agnt	Frmr	Trdr	Agnt	Frmr
1. Millet									
Almoustarat	**100.0**	0.0	0.0	**100.0**	0.0	0.0	**100.0**	0.0	0.0
Temera	**98.4**	1.6	0.0	**90.0**	10.0	0.0	**68.1**	31.9	0.0
Bourem	**92.2**	7.8	0.0	**100.0**	0.0	0.0	**100.0**	0.0	0.0
Djebok	**100.0**	0.0	0.0	**100.0**	0.0	0.0	**100.0**	0.0	0.0
Bara	**0.0**	0.0	100.0	**86.7**	1.0	12.3	**60.1**	0.0	39.9
Ansongo	**0.0**	0.0	100.0	**89.3**	0.0	10.7	**19.4**	1.1	79.5
Tessit	**0.0**	0.0	100.0	**0.0**	0.0	100.0	**0.0**	0.0	100.0
2. Sorghum									
Almoustarat	.	.	.	.	.	.	.	.	.
Temera	**100.0**	0.0	0.0	**100.0**	0.0	0.0	**100.0**	0.0	0.0
Bourem	**88.9**	11.1	0.0	**100.0**	0.0	0.0	**99.3**	0.7	0.0
Djebok	**3.1**	0.0	96.9	**0.0**	0.0	100.0	**12.8**	0.0	87.2
Bara	**0.0**	0.0	100.0	**85.7**	0.0	14.3	**65.0**	0.0	35.0
Ansongo	**4.3**	0.0	95.7	**86.7**	0.0	13.3	**29.9**	5.3	64.8
Tessit	**0.0**	0.0	100.0	**0.0**	0.0	100.0	**0.0**	0.0	100.0
3. Maize									
Almoustarat	.	.	.	.	.	.	.	.	.
Temera	**95.9**	4.1	0.0	**98.6**	1.4	0.0	**93.9**	6.1	0.0
Bourem	**100.0**	0.0	0.0	**100.0**	0.0	0.0	**100.0**	0.0	0.0
Djebok	**100.0**	0.0	0.0	.	.	.	.	.	.
Bara	.	.	.	.	.	.	.	.	.
Ansongo	.	.	.	**100.0**	0.0	0.0	**81.4**	18.6	0.0
Tessit	.	.	.	.	.	.	.	.	.

CESA-MSU Food Security Project Surveys, 1988/89

Table 7.1 (continued)

(Percent of Volume Sold)

	Harvest/ Post-Harvest			Hot Dry Season			Rainy Season		
	Trdr	Agnt	Frmr	Trdr	Agnt	Frmr	Trdr	Agnt	Frmr
4. Rice Paddy									
Almoustarat	**100.0**	0.0	0.0	**100.0**	0.0	0.0	.	.	.
Temera	**5.7**	2.1	92.2	**0.0**	0.0	100.0	**0.0**	7.9	92.1
Bourem	**0.0**	0.0	100.0	**0.0**	0.0	100.0	**0.9**	13.3	85.8
Djebok	**0.0**	0.0	100.0	.	.	.	.	.	.
Bara	.	.	100.0	**11.9**	0.0	88.1	**50.1**	3.4	46.5
Ansongo	**4.6**	0.0	95.4	**6.2**	0.0	93.9	**30.9**	0.0	68.9
Tessit	.	.	.	.	.	.	.	.	.
5. Local Rice									
Almoustarat	**100.0**	0.0	0.0	**0.0**	0.0	0.0	.	.	.
Temera	**80.8**	0.0	19.3	**98.2**	1.8	0.0	**81.5**	0.0	18.5
Bourem	**94.6**	5.2	0.2	**100.0**	0.0	0.0	**95.7**	3.7	0.6
Djebok	**94.0**	6.0	0.0	**88.4**	11.6	0.0	**95.3**	4.7	0.0
Bara	**88.8**	11.2	0.0	**90.4**	1.2	8.3	**56.4**	0.0	43.5
Ansongo	**98.2**	1.4	0.4	**97.1**	2.9	0.0	**82.4**	7.9	9.7
Tessit	**0.0**	0.0	100.0	**49.6**	0.0	50.4	**0.0**	0.0	100.0
6. Wild Fonio									
Almoustarat	**100.0**	0.0	0.0	.	.	.	.	.	.
Temera	**2.8**	0.0	97.2	**0.0**	0.0	100.0	**23.1**	0.0	76.9
Bourem	**10.0**	0.0	90.0	**0.0**	0.0	100.0	**16.7**	0.0	83.3
Djebok	**43.9**	0.0	56.1	.	.	.	**100.0**	0.0	0.0
Bara	**0.0**	0.0	100.0	.	.	.	**0.6**	0.0	99.4
Ansongo	**0.0**	0.0	100.0	.	.	.	**0.0**	0.0	100.0
Tessit	**0.0**	0.0	100.0	.	.	.	**0.0**	0.0	100.0

CESA-MSU Food Security Project Surveys, 1988/89

The message from Table 7.1 is that farmers handle sufficient volumes, at least seasonally, to compete with traders at all levels. The consumer can bypass the middleman. Transaction costs may be lower. Markets are contestable (Baumol) and unconcentrated. Trader collusion or other oligopolistic practices are likely to be minimal. While such generalizations safely apply after a good harvest (or succession of good harvests), the direction of sales is expected to reverse itself following a poor harvest and participation by farmer-sellers would diminish considerably.

An indication of the seasonal contraction in the number of sellers and withdrawal of farmers is seen in Table 7.2 for several CESA-MSU markets for 1988, before surveys started.

Table 7.2

Seasonal Contraction of the Number of Sellers for Selected Rural Markets, 1988

	January-April 1988	**August 1988**
Bourem	100	10
Djebok	.	15
Bara	100-200	17
Ansongo	100-200	44

Direction régionale de l'agriculture for January-April and Harts-Broekhuis and de Jong (1990a) for August 1988, as reported in Harts-Broekhuis and de Jong (1990a).

Examination of survey data, not displayed, shows that declared volumes sold on rural markets were small overall. Average weekly sales of millet and sorghum exceeded one ton only in Ansongo (during the first two seasons and all seasons, respectively). Sales of paddy in Bourem (harvest/post-harvest) and Bara (all seasons) exceeded one ton per week on average. Ansongo recorded local rice sales as high as three tons (hot dry season) and sales above one ton in other seasons. Local rice sales also exceeded one ton in Bara during the first two seasons. All other sales are low, sometimes less than the equivalent of one 100 kg sack.[10]

This indicates that weekly sales by farmers are small. One hundred farmers selling paddy in Bara during the harvest/post-harvest season, for example, means that each sold an average of only 17.2 kg per week. Average sales by 200 farmers would be twice as small. Weekly sales of cereals not produced in the Northeast may be no greater. Informal interviews in Djebok, which is mainly supplied from Gao-City, revealed that traders deal in small quantities, buying one 50 kg sack at a time for lack of liquidity (partly because they sell on credit) which may take one and a half months to sell (personal interviews, July 1988) — a rate of about 8 kg per week.

7.2.2. Information Systems

The rural market information system entails information on cereal grades, market prices and conditions as well as distribution channels and costs. This system is unevenly developed.

7.2.2.1. Standard Grades and Measures

Market participants have a keen eye for different cereal qualities and product differentiation. Participants in Djebok, for instance, distinguish red "food aid" sorghum from locally grown yellow sorghum. In Bourem, "male" fonio sells at a premium over "female" fonio. In Bara, IR-15 rice grown on nearby irrigated perimeters sells for less than non-hybrid

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[10]By comparison, weekly millet sales in Sirakorola in the northern OHV (generally, the poorest of four rural market clusters studied by Dioné in southern Mali) averaged several tons after harvest and more than one ton during the rest of the year from 1985 through 1987 (Dembélé and Steffen, 1988b).

local rice. Yet, there are no standardized grades as such. Cereals must be visually inspected at each transfer of ownership, an activity which increases transaction costs and the physical costs of distribution (Shaffer *et al.*).

Another factor which increases transaction costs is the prevalent use of local measures in all markets except Almoustarat. Use of a common size can (*pot Lahda*) for most cereals removes the necessity of visual inspection (if only to check that the can has not been altered). The local measure for paddy, however, appears to change according to the market. The measures themselves are not always uniform.

7.2.2.2. Market Prices and Conditions

The Market Information System (SIM) run by OPAM (Chapter 2) collects cereal price and quantity information at farmer (rural market) and urban consumer levels, which are broadcast by radio every week and periodically published. For all practical purposes, rural markets in the Northeast were lightly covered[11] although the regional capitals of Gao and Tombouctou were covered as consumer markets. It is expected that radio broadcasts of urban prices, which were attentively listened to, served as reference prices for fine-tuning price formation on local markets.

Within a given rural marketshed, participants have a good knowledge of cereal prices. Price discovery is less a matter of iterative negotiation than simply asking. Price information passes between rural markets by way of travellers, the accuracy of which cannot be gauged. Exchange of information between traders, whose commercial relations are built on personal

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[11]The Early Warning System (SAP) covered Ansongo (Gao Region) and Diré, Tonka and Léré (Tombouctou Region) as "secondary consumer markets" on behalf of the Market Information System. The frequency and intensity of coverage of these markets is not known.

trust in the absence of formal contracts, is presumably more reliable.[12] Informal interviews with rural traders indicate that first-hand knowledge about distribution channels and costs does not extend much beyond their immediate supply sources or customers (personal interviews, 1988/89).

The Early Warning System (SAP, Chapter 2) monitors a checklist of factors which influence local market supply and demand conditions such as the unseasonal arrival of migrants, terms of trade between livestock and cereals or the presence of depredatory locusts. This information is centralized and analyzed in the regional capitals and then forwarded to Bamako. Local authorities receive an Early Warning *Bulletin* one month later which summarizes information for all of Mali above 14° N. Even if the contents of the *Bulletin* are shared with local farmers, traders and consumers, its arrival may be too late to aid their marketing decisions. While the population undoubtedly has a good sense of local conditions, their sense of the "big picture" is not known.

7.2.2.3. Missing Markets

The principal missing markets at the rural level are the lack of a capital market for investments in transport and storage and insurance markets against crop failures. As will be seen in the discussion of market performance (section 7.5), much of the rural storage occurs at the farm level.

Even lack of sufficient operating capital limits economies of scale and prevents independent traders from taking advantage of unexpected opportunities. This problem is less constraining for trader agents who may receive credit from their employers.

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[12]Recourse to the legal system for adjudication of contractual rights and obligations is discussed in Chapter 8.

There are few risk-sharing institutions and even these are risky. Consumer cooperatives offer an alternative to the cereals market in some towns. In the past decades, these cooperatives were plagued to varying degree by financial mismanagement and non-recovery of member debts, insufficient training and storage losses. While most of the cooperatives had folded by the 1980s in southern Mali, some cooperatives continue to function in the Northeast, known as FGRs (*Féderations de groupements ruraux*) in rural towns and villages and as herder cooperatives (*Coopératives des éleveurs*) in outlying nomadic areas. Where no cereals markets exist, these cooperatives represent the only source of cereals for purchase.[13] Herder cooperatives are active in Almoustarat and Djebok and an FGR cooperative is active in Tessit, all Off-River sites. Each cooperative does about 1.5 million CFAF (about $5,000) of business per month. Only the cooperatives in Almoustarat and Tessit sell cereals.[14] Cooperatives are stronger in Ansongo and Bourem, each having three active consumer cooperatives.

Attempts to rehabilitate cooperatives on a sounder basis were in a state of flux during the survey year. A pilot program to extend credit to consumer cooperatives in the Gao and Tombouctou Regions in 1989 set stringent eligibility terms that few cooperatives could meet right away, according to the Regional Cooperative Agency (DRACOOP).[15]

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[13]The map in Maïga and Rutten shows that most functioning cooperatives in the Gao Region are found away from the Niger River. See Maïga and Rutten and Harts-Broekhuis and de Jong (1990a) for a discussion of consumer cooperatives in the Northeast.

[14]Enumerators cited diversion of funds and mismanagement as reasons why the herder cooperative failed in Tessit and why the herder cooperative halted cereal sales in Djebok.

[15]The protocol between the PRMC (Chapter 2) and the Mali Development Bank (BDM) stipulated that eligible cooperatives first incorporate themselves under new cooperatives legislation and repay past debts owed to OPAM. Interest rates were set at 12 percent per year, a rate thought "too high" by cooperative spokesmen. Guarantees for loan repayment had to be offered by the cooperatives to the BDM.

According to cooperative officials, their main handicap was securing steady supplies at competitive prices. OPAM outlets in Ansongo, Bourem and Gao-City offered one obvious source of stable supplies, but OPAM's fixed prices were uncompetitive. Efforts by DRACOOP to put consumer cooperatives in contact with rice growing cooperatives failed on two accounts. First, the lack of an information exchange raised the costs of transacting. Second, the economics of transformation of paddy were not attractive, as mechanically milled local rice from farmer cooperatives cost more than hand-pounded local rice found on the market (Chapter 2). Moreover, consumer cooperatives were generally uninterested in buying paddy. Under these circumstances, the volume of cereals purchased by consumer cooperatives was relatively minor, about 175 tons during the first 10 and one-half months of 1988/89 for all the rural cooperatives in the Districts of Ansongo, Bourem and Gao-Central combined (DRACOOP/Gao in Steffen, 1989). Even these volumes posed little threat to rural markets, as many cooperatives provisioned themselves from private traders, an implicit compliment to market performance.

The more urgent problem confronting cooperatives on the eve of the 1989 harvest was to dispose of old stocks in the face of declining market prices and imperatives to remain financially solvent. Some District cooperative officials advised cooperatives to lower their prices, trading off financial losses against the possibility of physical deterioration of stocks. By coinciding with the very good harvest of 1988/89, efforts to reform consumer cooperatives were unable to offer a viable alternative to the market.

Lastly, the National Security Stock (SNS, Chapter 2) has been positioned in the Northeast as the first bastion against local cereal shortages until outside supplies can be brought in. In case of emergencies, grain is released for distribution to sub-districts "at risk" based on need assessments by the Early Warning System. As approximately one-third of the

SNS by volume is rotated out and sold each year, its presence implicitly exerts a downward pressure on steep price increases.

7.3. Rural Market Conduct

Of all the conduct variables, this section will concentrate on questions of rural market coordination: the prediction of future supply, demand and prices; matching supply with effective demand; and synchronization of scheduling and timing.

This section begins by describing vertical coordination as a *state* (what happens) before assessing coordination as a *process* (how it happens; Marion, 1986). The vehicle for describing coordination is measurement of the seasonal expansion and contraction of rural marketsheds in response to shifts in supply and demand patterns.

7.3.1. Coordination as a State: The Seasonal Expansion and Contraction of Rural Marketsheds

Marketsheds[16] are defined spatially from a central or reference market with respect to changes in price. If the reference market is a supply source (or "exporter"), the price of the cereal will increase as one moves away in order to reflect transfer costs. Marketsheds are usually depicted graphically as a reference market (where price = X, or P_x) at the center of a set of expanding concentric circles representing equal increments of price increases, or isoprice lines, away from the reference market, such as P_{x+5}, P_{x+10} and so on.[17] The spatial

[16]The following discussion is drawn from Tomek and Robinson, pp. 155-158.

[17]For example, see Figure 8-2 in Tomek and Robinson, page 157. In the Northeast, isoprice contours are less likely to be perfectly concentric but follow the major transportation routes and Niger River.

boundary between two supply markets is determined where the purchase price plus transfer costs from each market are identical, such that the consumer is indifferent between buying from either market, all things equal. The boundary will be farther from the lower-priced supply market center.[18] The area inside the price boundary is called a marketshed. The boundary between two markets will shift if the cereal price rises in one market relative to the other or if transfer costs change. In the Northeast, seasonal fluctuations in cereal supply and demand influence the size of rural marketsheds.

Without sufficient data on transfer costs between multiple locations to determine marketshed boundaries, an alternative measure of marketshed is proposed, based on seasonal average volume-weighted distances: from supply source to rural market and from rural market to source of demand. These distances will vary by seasons, crops and market strata.

7.3.1.1. Distance and Direction from Supply Source to Rural Market

It is hypothesized that average *supply* distances of On-River markets will be shorter for locally grown and gathered crops (sorghum, paddy and local rice and wild fonio, section 5.4.3. of Chapter 5) than those of Off-River markets. It is further hypothesized that average supply distances will decrease by season as the marketable surplus of these locally grown and gathered cereals diminishes — or simply disappears from some markets. Whether the alternative view holds, that marketsheds expand as they pull in local cereals from farther and farther away, depends on the continued availability of marketable surpluses in distant locations

[18]The direction of argument is reversed where the reference market is a source of demand (or "importer"). The boundary between two markets is thus where the prices paid to a farmer (or other supplier), minus transfer costs, are the same whether she delivers to one market or the other. The boundary will be closer to the lower-priced demand market center.

and the magnitude of effective household demand.[19] It is hypothesized that average supply distances for cereals grown outside the Northeast (millet and maize) will remain fairly constant for both On- and Off-River markets. As a rule, the marketsheds of Off-River markets are expected to be more stable in view of fewer local production possibilities and poorer access to regional supplies.

Random observations of cereal purchases by local traders *in the market* recorded the distance from the seller's supply source.[20] Cereal purchases made elsewhere for delivery to the market were not recorded. The average volume-weighted distance from supply source to market indicates the seasonal expansion and contraction of the rural marketshed for each cereal from the supply side.[21]

Distance data were too spotty to confirm or refute the supply hypotheses above. The absence of distance data means that enumerators observed no purchases by the local trader taking place *in* the market, implying that few of the cereals marketed (or possibly none) were produced or gathered locally, but were bought elsewhere and brought in.[22] Missing observations may also imply a lack of scale economies — and high transaction costs — for

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[19]Recall that absolute total household expenditures decreased to their lowest levels by the rainy season in the North and Off-River strata, all terciles, but budget shares spent on cereals increased to their highest levels. This relation also held for middle-income South and On-River households (Tables 4.13 through 4.16).

[20]For cereal farmers and gatherers selling directly to traders, this refers to where the cereals were grown or gathered. For others, this refers to where the seller obtained the cereals, *not* necessarily where they were first grown or gathered; in the case of more than one previous transaction, the original source may not have been known with certainty, an unavoidable drawback of this measure.

[21]Markets with fewer than two weekly average distances per cereal per season were not counted.

[22]This was not necessarily a question of failing to observe purchases. Enumerators questioned traders who confirmed having made no purchases at all.

local traders in assembling small quantities of a decreasing marketable surplus of local cereals for resale, especially during the hot dry and rainy seasons. As a consequence, farmers and gatherers bypass traders by selling cereals directly to consumers, another indication that participation in rural markets is open and fluid. These explanations are not mutually exclusive.

Even without a full set of distance data, it is known is that supply sources change direction by season and market group, consistent with the schematic presentation by Steffen and Koné and confirmed by questionnaire source of supply information. Only the Off-River markets of Almoustarat and Djebok appear linked to Gao-City suppliers all year-round (section 7.4).

Local and short-distance river traffic supplies the northern On-River markets of Temera and Bourem with paddy and local rice during the harvest/post-harvest season while the riverboat brings millet, sorghum and maize longer distances from southern Mali via Mopti, Tombouctou, Gourma-Rharous and Bamba. During the hot dry season, southern Mali coarse grain brought downstream from Mopti/Tombouctou competes with southern Mali coarse grain brought upstream from Gao-City before the riverboat halts operations. During the rainy season, most cultivated cereals (as distinct from wild cereals) are supplied from Gao-City.

Millet and sorghum reach the southern On-River markets of Bara and Ansongo from higher rainfall border areas with Niger further to the south.[23] Some suppliers come from Labezanga and Ayourou (border posts of Mali and Niger, respectively), even as far as Niamey. Supplies are delivered by Songhaï boatmen as well as Tuareg and Bella camel caravans. Local paddy is also supplemented by paddy supplies from the south. This

[23]Like Mali, Niger had a "very good" cereal harvest in 1988/89 (FEWS, October 1991).

northward expansion is not reversed until midway through the rainy season when supplies from Gao-City are competitive southward.

Supply sources for Tessit are not as distinct. Tessit is also supplied from the border areas with Niger, but less directly, sometimes via Ansongo. However, recession sorghum production during the harvest/post-harvest season and abundant wild fonio during the rainy season offered some degree of market autarky. It is doubtful that grain from southern Mali via Gao reached Tessit in significant quantities.

Whether longer average distances from supply sources necessarily entail a higher risk of supply rupture depends on how well markets perform and the physical accessibility of each market. Inaccessibility during the rainy season might be offset by good supplies of wild cereals.

7.3.1.2. Distance from Market to Destination of Consumer

It is hypothesized that average *demand* distances from rural market to destination of consumer of On-River markets will be shorter for locally grown crops than those of Off-River markets. However, it is hypothesized that average demand distances will increase by season, reflecting growing dependence on the market (Tables 5.8 through 5.11 in Chapter 5) as households draw down their own-grown or own-gathered cereal stocks and/or as some households switch to better supplied but more distant markets during the rainy season. It is further hypothesized that there will be little difference between average Off-River and On-River demand distances for millet and maize, crops grown outside the Northeast. Lastly, it is hypothesized that demand distances for wild fonio will decrease by season as more becomes available locally during the rainy season.

Random observations of cereal sales by local traders indicate the seasonal expansion and contraction of the rural marketshed in terms of average distance from the market to the destination of the consumer-buyer. These distances are shown in Table 7.3, for which data are fuller.

Even large differences between observed market mean distances may not be statistically significant if there is great variability in each market. Because some variability is due to sampling variability alone, a look at just the means may be misleading. Analysis of variance (ANOVA) looks at the variability of mean observations between groups (rural markets) and within the group (a particular market) to test the null hypothesis that the mean distances are equal, while the alternative hypothesis indicates a difference in mean distances. The ANOVA computes groups, or subsets, of average distances among the seven markets which are statistically different from other subsets of distances at the 95 percent level of confidence. These subsets are indicated by asterisks, *arranged vertically*, where statistically greater distances are placed to the right.[24] These distance subsets allow testing of the marketshed expansion and contraction hypotheses stated above. In the rainy season, for example, the mean distance to destination of the consumer buying millet in the Djebok market is statistically different from the mean distances in Almoustarat and Bourem. Here, the Bourem mean distance also lies in the same subset as Temera, Bara, Ansongo and Tessit.

The greater the average distance, the more expansive the marketshed is in geographic terms and, by implication, the more dependent the households are within it on a single, distant market. Alternatively, households within a smaller marketshed are likely to have more options, such as home production or a choice of nearby markets.

The first hypothesis, that distances from the market to destination of the consumer for regionally grown crops (sorghum, rice paddy and local rice) are shorter for On-River markets

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[24]Markets with fewer than two weekly averages per cereal per season are designated as "No sales".

Table 7.3

Seasonal Expansion and Contraction of Rural Marketsheds:
Average Distance (kilometers) to Destination and Statistically Different Subsets

	Harvest/ Post-Harvest			Hot Dry Season				Rainy Season			
1. Millet	Distance	Subsets		Distance	Subsets			Distance	Subsets		
Almoustarat	17.8	*	*	20.5		*	*	24.7		*	
Temera	4.5	*		5.1b	*	*		6.1	*		
Bourem	23.6	*	*	19.1	*	*	*	14.2	*	*	
Djebok	32.8		*	34.4			*	39.3			*
Bara	6.4	*		3.6b	*			5.8	*		
Ansongo	2.8	*		0.0b				3.4	*		
Tessit	5.7	*		16.5	*	*		7.3	*		
2. Sorghum											
Almoustarat	a			a				a			
Temera	12.3	*		4.8	*			3.3	*	*	
Bourem	21.2	*		15.1	*			9.4		*	
Djebok	19.4	*		30.8		*		25.4			*
Bara	17.2	*		3.9	*			4.6	*	*	
Ansongo	2.0	*		6.2	*			5.7	*	*	
Tessit	0.0	*		0.3	*			0.0	*		
3. Maize											
Almoustarat	a			a				a			
Temera	3.1	c		4.2	c			3.9	*		
Bourem	10.4	c		22.3	c			15.1	*		
Djebok	a			a				a			
Bara	a			a				a			
Ansongo	a			a				6.0	*		
Tessit	a			a				a			

[a]No sales observed. [b]Ansongo, Bara and Temera comprised a fourth subset.
[c]No subsets calculated for fewer than three markets. *Off-River markets in italics.*
Statistically different vertical subsets are based on one-way ANOVAs at the 95 percent level.

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Table 7.3 (continued)

	Harvest/ Post-Harvest		Hot Dry Season			Rainy Season			
4. Rice Paddy	Distance	Subsets	Distance	Subsets		Distance	Subsets		
Almoustarat	17.0	*	17.0	*		a			
Temera	8.9	*	3.9	*		2.7	*		
Bourem	14.5	*	10.5	*		7.9	*		
Djebok	a		a			a			
Bara	20.5	*	7.6	*		3.9	*		
Ansongo	17.7	*	2.6	*		5.5	*		
Tessit	a		a			a			
5. Local Rice									
Almoustarat	a		a			a			
Temera	5.8	*	8.6	*		5.1	*	*	
Bourem	63.3	*	19.6	*		9.7	*	*	
Djebok	25.5	*	15.8	*		17.2		*	
Bara	48.0	*	24.7	*		13.5		*	
Ansongo	28.3	*	81.3		*	99.0			*
Tessit	1.8	*	0.3	*		0.7	*		
6. Wild Fonio									
Almoustarat	30.8	*	a			a			
Temera	4.0	*	3.4	b		1.6	*		
Bourem	70.0	*	9.0	b		2.4	*		
Djebok	16.5	*	a			a			
Bara	17.5	*	a			6.0	*		
Ansongo	a		a			0.9	*		
Tessit	1.6	*	a			4.8	*		

[a]No sales observed. [b]No subsets calculated for fewer than three markets.
Off-River markets in italics.
Statistically different vertical subsets are based on one-way ANOVAs at the 95 percent level.

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than Off-River markets, does not hold for rice paddy or local rice. For sorghum, only Djebok shows statistically greater distances than On-River markets during the hot dry and rainy seasons. Sorghum is not sold in Almoustarat and access by Tessit consumers to nearby pond-recession sorghum results in shorter average distances for sorghum.

The average paddy marketshed contracts as a function of depleted supplies as more and more paddy is milled as local rice. This marketshed contraction may also reflect the high transaction cost of observing distant market prices and difficult market access in the rainy season, as fewer outlying consumers are willing to chance the journey to market if prospects of finding paddy are poor. Yet, average distances are not statistically different among markets.

The high average distance for local rice in Bourem in the harvest/post-harvest season is due to occasional small purchases for personal use by migrants to Mopti and Gossi.[25] Note that the long (and statistically different) average destination distance for local rice from Ansongo in the rainy season is equivalent to the distance between Ansongo and Gao-City, suggesting that Ansongo supplies Gao-City part of the year (see discussion in sections 7.4.1.2. and 7.4.2.1.).

The second hypothesis, that average demand distances increase by season, only holds for local rice in the case of Ansongo. For millet, which is not generally grown in the Northeast, this hypothesis holds for Almoustarat, Temera and Djebok for which distances increase from one season to the next. These increases are less consistent for Ansongo and Tessit, whose average distances were slightly longer in the rainy season compared to the harvest/post-harvest season.

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[25]Purchases for personal use by migrants leaving the Northeast — to Bamako (1325 km) and Kumasi, Ghana (1816 km) — were excluded from the calculation.

The third hypothesis, that there is no difference between On-River and Off-River average distances for imported crops, millet and maize, cannot be fully tested for maize. As for millet, each statistically different subset does indeed show a mix of On-River and Off-River markets in each season. Only Djebok falls into its own subset during the rainy season. Djebok distances are in the statistically longest-distance subsets for both millet and sorghum.[26] According to Table 7.3, the average marketshed radii for millet seem to reflect a difference between North and South markets, rather than an On-River and Off-River difference.

Millet and sorghum distances to the destination of the consumer reflect local production potentials and, indirectly, possibilities for substitution among cereals. On-River markets of Temera, Bara and Ansongo each show a short radius across seasons, indicating a relatively small marketshed for these cereals.

Lastly, the hypothesis that average wild fonio distances decrease as greater supplies become available by the rainy season such that market transactions drop off, holds for Temera and Bourem as well as Bara (skipping the hot dry season). This hypothesis is difficult to measure. Average distances may reflect the erratic nature of localized rainfall more than unstable marketsheds. Further, there are fewer observations available for wild fonio.

In summary, supplier distances (not shown) usually exceed consumer distances considerably, as expected for a net deficit region. Some of the supplier and consumer

[26]Even the *direction* of marketshed expansion from Djebok can be surmised from these average distances for millet, which approach the distance to Gao-City (38 km to the west). As consumers would not logically travel from Gao-City to Djebok to procure their millet if they could buy it locally (assuming transfer costs exceeded any price savings), it appears that Djebok's millet clientele resides within an average 30+ km radius to the east.

distances for some markets are statistically greater than for others.[27] These will have implications for measures of market integration (section 7.4.).

Repeating this exercise may produce more conclusive results in the "bad year" case than this "good year" case (Table 7.3). The implication is that policy makers (and to a lesser extent traders) cannot predict the expansion or contraction of rural marketsheds in the Northeast — hence supply and demand patterns — with certainty in a year of good rainfall and harvests.

7.3.2. Coordination as a Process

The role of countless anonymous and diverse market participants in coordinating the transfer of cereals from surplus areas in southern Mali to deficit areas in the Northeast, as well as within the Northeast, has been documented before (BECIS, 1981 and 1982; Steffen and Koné; Maïga and Rutten; Lindland; and Harts-Broekhuis and de Jong, 1990a).

Less research was conducted on coordination as a process for rural markets than for urban wholesale markets (Chapter 8). No sample of rural traders was constructed. The assessment which follows is largely based on informal interviews with rural market participants, rather than systematic investigation. Based on the picture that emerges, it is astonishing that market coordination occurs as well as it does.

7.3.2.1. Planning for Long Distance Trade

Planning by traders as a method for vertical coordination is haphazard, fragmented or passive at best. Coase's argument that spatial distribution of transactions increases *internal*

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[27]Distances to market for suppliers and consumers can be just as long in the Tombouctou Region. The walk from Lake Horo to Tonka, the closest weekly market town, takes three days (personal interview, August 1988). The weekly market in Gossi continues two days to accommodate travellers from great distances (personal interview, July 1988). See also BECIS (1981 and 1982).

organizational costs (Chapter 6) seems to apply as well to the costs of long distance trade between *independent* firms.

As one example, upstream and downstream relations seem to be loosely structured. Formal contracts between traders do not exist. A trader/transporter in Tombouctou Region delivers cereals occasionally to "certain Arab wholesalers" in Gao City, but claims not to know their names. Even procurement plans are subject to deviation. One transporter from the Tombouctou Region told of having bought a load of cereals in San (Ségou Region), only to end up selling it along the way before reaching home, requiring that he return to San for another load. This has occurred several times.

Another example is that the apparent absence of planning reduces possibilities for preference articulation by consumers. A trader selling maize in Djebok acknowledges that millet would sell faster, but he could only afford to buy maize to sell. A trader in Douentza (Tombouctou Region) says he takes whatever cereal that his supplier in Mopti delivers, whether the cereal of choice or not. If cereals arrive unexpectedly (before his current supplies have run out), he has to store them outside or make arrangements for storage in a friend's house. Yet, he is not particularly concerned because "everything will sell". While the first trader is unable to buy the millet he wants because he can get no credit, the second is willing to accept the unwanted cereals because he is offered credit terms; he repays according to the rhythm of his sales.

This last anecdote exemplifies the critique sometimes heard of developing country markets that "supply drives demand." This criticism may be more valid for the Northeast with fewer negative consequences than elsewhere. Even unplanned deliveries boost local supplies, thereby lowering prices and increasing real incomes for consumers. Elasticity measures in Table 5.16 (Chapter 5) show that cereal purchases are highly elastic with respect to expenditures (a proxy for income) for the lowest expenditure tercile households. A number of informants cited the "deficit zones argument" as sufficient reason why even the less-preferred cereals always sell.[28]

In all these examples, personal trust between traders is crucial, whether transactions are planned or not. The high search costs of finding a different partner in a complex environment may implicitly protect either party against the worst abuses or opportunism by the other, despite frequent information asymmetries between the parties.

7.3.2.2. Interstage Cooperation

Efforts to influence interstage cooperation and conflict are not well known, but two examples suggest areas for better coordination. At the most basic level, another small trader returns to her home in Gao-City after each weekly market in Djebok with the unsold millet remaining in her partly filled sack. Alternative arrangements might include consigning her millet to another trader for sale or safekeeping, pawning her millet with a shopkeeper or forming a small trader clearinghouse for managing temporary excess supplies.

When the riverboat arrives in Bamba (Gao Region) and Bourem from southern Mali, local traders complain of losing clientele to retailers from the boat. Yet, opportunities exist for direct and regular contractual relations between travelling traders and local traders. Regular orders for grain deliveries could lower risks and reduce transactions costs to the benefit of both parties. A more competitive market structure would ensure that reduced marketing margins are passed along in the form of lower consumer prices.

Both examples reflect the lack of trust and credible guarantees among traders or, in agency terms, distrust due to differing objectives between the principal and agent. With

[28]The argument in this paragraph appears to reject the hypothesis stated in Chapter 1 that markets are demand-driven.

pervasive distrust, little complex or impersonal exchange occurs to capture potential economic grains from trade. According to North (pp. 120-121), a major impediment to the development of long-distance trade is due to agency costs and the costs of measurement and enforcement of contract performance in "alien" localities. Innovations that lower transaction costs and spread risks are largely absent.

7.3.2.3. Standard Operating Procedures

As discussed in Chapter 6, standard operating procedures allow firms to facilitate decision making in the face of uncertainty and limited facilities for assimilating and processing information. These SOPs reduce transaction costs in the form of operational short-cuts for dealing with recurring situations.

Among the myriad of SOPs that rural market participants employ, two SOPs seem preeminent. The first is that even SOPs for contingencies require contingencies of their own. Any unexpected event might have a positive or negative impact on relatively thin markets. Yet, the ability to take preventive or corrective measures is constrained by imperfect information, difficult transportation and/or inaccessibility and poor telecommunication links. Rural market participants in the Northeast, like firms, must maintain a considerable amount of organizational slack (Hirshman) just to cope.

The second SOP derives in part from the first. Uncertainty and a limited capability to respond immediately require that cereals turn over as rapidly as possible, a theme expressed by many informants. Cereals are like the proverbial hot potato. Unless passed along, one's fingers get burned: Terms of trade may suddenly worsen. Denying credit to poor consumers is difficult. Social obligations require giving some cereals. Returns to storage are low, if positive at all — and so on.[29] One effect of this SOP on coordination is that rapid transfer of ownership accelerates the circulation of cereals through the market. A second effect is that the storage function is deflected away from the rural market.

7.4. Evaluation of the Performance of Rural Cereal Markets

This section evaluates performance on the basis of spatial integration between rural markets and between rural markets and urban wholesale markets in Gao-City and regression analysis of rural market-urban wholesaler marketing margins. Both performance indicators are the outcome of coordination activities, the extent to which supplies match demand preferences with respect to timing and location. Both indicators measure static efficiency performance.

The working hypothesis of this section is that market performance is better in habitually (year round) deficit localities and worse in localities where recourse to the market is highly seasonal in years of favorable harvests. Such a hypothesis is difficult to test.

7.4.1. Spatial Integration of Markets

Measurement of spatial market integration is basic to the understanding of market performance, particularly price differentials for identical cereals[30] on different markets. If trade takes place between markets (similar to that between exporting and importing regions),

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[29]This SOP may also be grounded in the recent past when cereals attracted the unwelcome attention of government price regulators and tax collectors. Cereals could be requisitioned as a penalty for alleged violations.

[30]Identical cereals refers to cereals at the same stage of transformation in the same measure of volume and measured in the same observation period. Ideally, the cereals will be of the same grade and age.

the price in the importing market will equal the price in the exporting region plus the unit cost of storage and transfer between the two. Under competitive conditions, spatial price arbitraging by grain traders will tend to keep a system of markets in equilibrium. Markets may thus be considered integrated on the basis of reasonably stable price differentials for the same cereal, subject to random variations.

7.4.1.1. Spatial Integration of Rural Cereal Markets

This section tests for the integration of rural survey markets in the Gao Region on the basis of bivariate correlation coefficients, the most common measure of spatial market integration, between time series of prices for the same cereal at different markets.[31] Based on the null hypothesis that a non-zero correlation coefficient signifies integration between two markets, a statistically significant non-zero correlation coefficient means that one fails to reject the null hypothesis.[32] The Pearson correlation coefficient, giving values between -1.00 and 1.00,[33] was used on the weekly price pairs for the main cereals, running from December 1988 to October 1989. A curious feature of these rural market prices is that *they remain*

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[31]Common criticisms of the bivariate correlation coefficients include coefficient bias due to common seasonality and/or inflation, violation of the assumption of constant price variance over time and the overt influence of public pricing policies (Delgado, 1986; Ravallion, 1986). Because of these shortcomings, bivariate correlation coefficients are best analyzed in conjunction with other relevant market information (Goetz and Weber).

[32]Ravallion (1986) points out that this formulation of the null hypothesis is more appropriate than testing for a non-zero result which almost invariably leads to rejection of the null hypothesis (that markets are segmented).

[33]The Pearson correlation coefficient, or R, is a scale-free measure of covariance between the two price series. Squaring the coefficient gives an estimate of the proportion of the variability in prices on one market that is associated with (or explained by) the variability of in prices on the second market.

constant for weeks at a time.[34] Price data were not deflated (for lack of a deflator) or detrended.

This chapter hypothesizes the possibility of thin markets and low-volume transactions in the Northeast, particularly *between* rural markets. Thus, it is not necessarily expected that cereals flow between all markets, especially given the large distances involved (Figure 7.3). Nonetheless, all rural market pairs were tested for price integration. All results are shown for discussion purposes.

Table 7.4 displays the pairwise price correlation coefficients between markets for millet, sorghum, maize, paddy and local rice. Most correlation coefficients are statistically significant and, where positive, may be taken as indication of spatial integration between the respective market pair. Generally, significant coefficients have higher absolute values. A negative sign, indicating a negative linear relationship, means that there was no price integration. Note that pairing with certain markets usually results in a non-significant coefficient (more later).

Interpretation of these coefficients is somewhat subjective, requiring cut-off levels to describe the degree of market integration. Following Barry, a correlation coefficient greater than 0.77 indicates "strong" market integration. Squaring a correlation coefficient of 0.77 means that approximately 60 percent of the price variation in one market can be explained by the variation in another market. Correlation coefficients less than 0.45 describe "weak" market integration, as only 20 percent of the variation in one market can be explained by variation in the other. Market integration is "medium" or "moderate" between 0.77 and 0.45.

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[34]To induce greater variation in the price series and remove the effect of missing observations, correlation coefficients were also calculated using monthly quantity-weighted sales prices. These coefficients were generally higher, but the numbers of significant coefficients are lower.

Markets that appear to be reasonably integrated (medium integration) in terms of one cereal (for example, Temera and Djebok for sorghum, a local crop) may be weakly integrated in terms of another (Temera and Djebok for millet, an outside crop). A higher proportion of millet pairwise coefficients are significant than sorghum coefficients, possibly because most millet is distributed via Gao-City. All paddy coefficients are significant although there are only ten pairwise comparisons, of which six are negative. With a full set of 21 pairwise comparisons, local rice has 18 significant correlation coefficients, the highest number of the five cereals, but ten are negative. The highest significant correlation coefficient reached 0.85 (Ansongo and Tessit for local rice) while the lowest significant coefficient was 0.23 (Bourem and Bara for millet).

There are several hazards in the interpretation of correlation coefficients which may explain the mixed results in Table 7.4. First, the correlation coefficient measures the presence of a linear relationship between the two price series. This can produce some odd or unexpectedly poor results, despite a large number of paired observations, even for adjacent markets.[35] These results might lead to rejection of the null hypothesis when other evidence

[35]Some of this is due to the Pearson correlation coefficient ***R*** itself, as defined below for two price series for markets X and Y:

$$R = \frac{\sum_{i=1}^{N} (X_i - \bar{X})(Y_i - \bar{Y})}{(N-1)\, S_X\, S_Y}$$

For example, two price series in which the price does not change in one market (or both) will produce a correlation coefficient of 0.00 as at least one parenthetical expression in the numerator equals zero, making the entire numerator zero. Alternatively, two price series in which the price in just one market does not change will produce no correlation coefficient at all as one of the standard deviations in the denominator is zero, making the entire denominator zero, division by which is undefined.

Table 7.4

Rural Market Integration:
Pairwise Weekly Price Correlation Coefficients (December 1988-October 1989)

1. Millet Prices

	Almou't	Temera	Bourem	Djebok	Bara	Ansongo	Tessit
Almoustarat	**1.00**	***45	***40	***45	**41	***45	35
Temera	.51	**1.00**	***41	***46	43	***47	***36
Bourem	.66	.81	**1.00**	**42	*39	***41	*32
Djebok	.75	.42	.26	**1.00**	43	***46	35
Bara	.26	.17	.23	.14	**1.00**	43	***33
Ansongo	-.48	-.67	-.60	-.41	.03	**1.00**	36
Tessit	-.00	-.42	-.29	-.01	-.41	.18	**1.00**

2. Sorghum Prices

	Almou't	Temera	Bourem	Djebok	Bara	Ansongo	Tessit
Almoustarat	.	.	.	.	.	.	.
Temera	.	**1.00**	***20	***18	20	***22	11
Bourem	.	.69	**1.00**	***34	35	***40	20
Djebok	.	.70	.41	**1.00**	32	***37	18
Bara	.	.11	-.05	-.04	**1.00**	41	19
Ansongo	.	-.77	-.68	-.41	-.00	**1.00**	*22
Tessit	.	.18	-.05	.11	.09	.31	**1.00**

3. Maize Prices

	Almou't	Temera	Bourem	Djebok	Bara	Ansongo	Tessit
Almoustarat	.	.	.	.	.	.	.
Temera	.	**1.00**	***37	a	.	a	.
Bourem	.	.70	**1.00**	.	.	a	.
Djebok	.	a	.	**1.00**	.	.	.
Bara	.	.	.	.	.	.	.
Ansongo	.	a	a	.	.	**1.00**	.
Tessit	.	.	.	.	.	.	**1.00**

Note: The number of pairwise observations appears above the diagonal. Asterisks refer to the significance of the respective correlation coefficient below the diagonal (where *** indicates significant at the 99 percent level; ** at 95 percent; and * at 90 percent). [a]Correlations not calculated for fewer than 10 weekly observations.

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Table 7.4 (continued)

4. Rice Paddy Prices

	Almou't	Temera	Bourem	Djebok	Bara	Ansongo	Tessit
Almoustarat	**1.00**	***10	**6	.	**12	**12	.
Temera	-.76	**1.00**	***20	.	**33	***34	.
Bourem	a	.76	**1.00**	.	***25	***25	.
Djebok	.	.	.	.	.	.	.
Bara	-.50	.30	.47	.	**1.00**	***45	.
Ansongo	.52	-.71	-.66	.	-.44	**1.00**	.
Tessit	.	.	.	.	.	.	.

5. Local Rice Prices

	Almou't	Temera	Bourem	Djebok	Bara	Ansongo	Tessit
Almoustarat	**1.00**	a	10	a	**10	**10	***11
Temera	a	**1.00**	38	**33	***41	***41	***34
Bourem	-.07	-.14	**1.00**	*35	***44	*44	*38
Djebok	a	.31	.24	**1.00**	***36	**37	**30
Bara	-.59	.64	-.39	.50	**1.00**	***46	***39
Ansongo	-.69	.50	-.24	.38	.72	**1.00**	***39
Tessit	-.90	.46	-.24	.33	.70	.85	**1.00**

Note: The number of pairwise observations appears above the diagonal. Asterisks refer to the significance of the respective correlation coefficient below the diagonal (where *** indicates significant at the 99 percent level; ** at 95 percent; and * at 90 percent). [a]Correlations not calculated for fewer than 10 weekly observations.

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suggests that the markets are linked and that participants in both markets act rationally and competitively.

This makes it necessary, second, to go beyond the mathematical properties of the correlation coefficient to discover why prices change or do not change. It is conceivable, for example, that a stable price is indeed the result of competitive supply and demand conditions and that this constant price persists for short periods. It is also conceivable that traders and customers both have the same *focal price* for the cereal from which they do not deviate under normal market conditions. Bargaining is simply out of the question.[36] Competitive conditions need not prevail in this second case as consumers simply get used to prices fixed by collusion between grain traders or other means.

According to the enumerator in Bourem, the village council set the post-harvest paddy price at 300 CFAF per *markassou*.[37] Price data show that nominal prices remained at 300 francs from December through April. Paddy prices in Ansongo, the other major assembly market, remained constant at 500 CFAF per *tasse* through the entire survey period, raising suspicions of price-fixing there, too. Even the sales venue may influence the degree of market competition. It is possible that the process of price determination in the confines of a shop in Almoustarat differs qualitatively from that occurring anywhere else in an open, central marketplace under more transparent conditions.

In this respect, third, it is clear that pairwise correlation coefficients, of themselves, reveal little about the underlying structure of markets or the process by which they transmit price signals. A correlation coefficient of 1.00, implying perfectly integrated markets, may result from fiercely competitive markets. In contrast, it may result from monopolist control of both markets in which prices are manipulated in tandem.

Lastly, correlation coefficients are most informative based on a pairing of nearby markets in a relatively homogenous geographic region. Distances between rural markets in

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[36]It is possible, of course, that local measure volumes vary while nominal prices remain constant (causing a "price illusion" effect on the part of consumers), such that real prices do indeed change. However, enumerators detected no systematic change in unit volumes.

[37]Three individuals designated by the council patrol the market, carrying standard sized *markassoux* for use in all paddy transactions. These individuals are not paid but can expect "tips" in paddy from either buyer or seller.

the Northeast may be too great or markets too seasonally inaccessible to expect high correlation coefficients.[38] For the most part, only lower-volume smaller traders using animal or river transport are able to service these hard-to-reach markets, slowing the effect of spatial price arbitraging.

Goetz and Weber caution that correlation coefficients should be considered only relative indicators of spatial integration and efficiency, not proof. They maintain that spatial correlation coefficients that are less than 0.90 are "suspect." Further investigation is required, on the basis of transport linkages and trading patterns, to see whether certain markets should be logically paired in the first place. If not, correlation coefficients may be spurious.

7.4.1.2. Spatial Integration of Rural Markets with the Gao-City Wholesale Market

The largest wholesale cereals market in the Gao Region operates in Gao-City. Linked to southern Mali by a paved road, Gao-City is the principal all-season distributor of cereals produced outside the Gao Region (mainly millet and to a lesser extent, 40 percent brokens rice, *RM40*). To a smaller degree, it is the main source of urban demand for regional cereals (mainly local rice). This two-way flow between the Gao-City market and outlying rural markets is therefore expected to be reflected in high measures of market integration.

Timmer proposes an "index of market connection" for measuring the spatial integration of prices where a central market ultimately determines market prices elsewhere.[39] His model regresses the first difference in logarithms of monthly prices in local or rural markets on four explanatory variables, as follows:

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[38]Figure 7.2 indicates that the longest distance between paired markets is greater than 200 miles, roughly the distance between East Lansing and Cleveland.

[39]This discussion is summarized from Goetz and Weber, Appendix 4.

$$P_t - P_{t-1} = a + b\,(P_{t-1} - R_{t-1}) + c\,(R_t - R_{t-1}) + d\,R_{t-1} + e\,X_{t-1}$$

where

P_t = the logarithm of the rural market price in time *t*,
R_t = the logarithm of the central market price in time *t*, and
X_t = a vector of other variables influencing local price formation, independently of central market prices, lagged appropriately.

Rearranging the model as follows aids interpretation:

$$P_t = a + (1 + b)\,(P_{t-1}) + c\,(R_t - R_{t-1}) + (d - b)\,R_{t-1} + e\,X_{t-1}$$

The time series effects of rural market prices and central market prices on current rural market price formation are represented by the coefficients $(1 + b)$ and $(d - b)$, respectively. Coefficient c measures how well price changes in urban markets influence rural market prices.

Based on the coefficients above, Timmer calculates his index of market connection as $(1 + b)/(d - b)$. *Small* values of the IMC indicates that markets are well connected, as lagged urban prices are relatively more important than lagged rural prices in determining current rural market prices.

This dissertation attempted to measure Timmer's index for integration between the Gao-City wholesale market and the seven survey rural markets for those crops supplied from Gao-City — logically, millet, maize and the most common industrially milled rice from southern Mali, *RM40*. To overcome the problem of limited degrees of freedom using monthly data, Gao-City wholesaler transactions were disaggregated by week to calculate quantity-weighted weekly wholesale prices. Because of frequently constant rural market prices from week to week, meaning that $P_t - P_{t-1} = 0$, the log of which is undefined, price data were not transformed into logarithms.

Regression estimates for millet are reproduced in Table 7.5.[40] Most regressions yielded disappointing and non-significant results. This could be due to the nature of the rural prices themselves which were constant for weeks at a time. Bourem had the smallest IMC, hence the strongest market connection with Gao-City for millet, although the coefficient on *d* was not significant. Djebok registered the best results in terms of a relatively low and plausible IMC, adjusted R^2 and significant coefficients (99 percent) on *b* and *d*. Ansongo and Tessit also had strongly significant coefficients on *b* and *d*, but their IMCs were negative.

Table 7.5. Index of Market Connection (IMC) for Millet Gao Region, Mali

December 1988-October 1989

	Almou't	Temera	Bourem	Djebok	Bara	Ansongo	Tessit
IMC with Gao-City	1.11	2.71	0.79	1.72	1.04	-8.64	-2.61
Adjusted R^2	0.380	0.096	0.277	0.443	0.300	0.157	0.372
N	43	46	39	46	40	46	31

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This leaves the measure of urban-rural market integration to price correlation coefficients.

[40]Regressions were not run for maize because only Temera and Bourem reported weekly prices for maize, believed to have been supplied from up-river sources, and because only three weekly price observations were available for Gao-City. Regressions were not run for RM40 due to few weekly price observations in the rural markets and only four in Gao-City.

Table 7.6 shows pairwise correlation coefficients based on weekly Gao-City wholesaler sales prices (*prix de vente grossiste*) and weekly rural market retail prices for millet and sorghum, the only crops for which many paired prices are available.[41] Since the question of price lags has been raised, correlation coefficients are shown twice — first, for same-week price pairs and second, for paired prices where Gao-City prices are lagged by one week.

Pairwise correlation coefficients for millet are reasonably good, indicating medium integration, and significant in six of the seven rural markets. However, one correlation coefficient is negative (the coefficient for Tessit is negative, but not significant), indicating the absence of price integration with Gao-City. Lagging the Gao-City price by one week improves results, compared to the same-week paired prices, in terms of correlation coefficients for all markets (except Tessit which remains about the same) and significance (Djebok and Bara). The link between Gao-City and Almoustarat goes from medium integration to strong integration. The improved lagged-price correlation coefficients appear to confirm the direction of millet flows from Gao-City to rural markets and corroborate the good IMC between Gao-City and Djebok.

Each of the same-week correlation coefficients between Gao-City and the rural markets for sorghum is higher than the respective lagged coefficient for millet for Temera and Bourem, and about the same for Djebok. Only the Bara—Gao-City correlation coefficient improves absolute value, from 0.24 to 0.40, and significance, when Gao-City prices are lagged, possibly due to Bara's preponderant production (and consumption) of paddy causing it

[41]Local rice is seldom traded by Gao-City wholesalers in the sample and maize even less often. Paddy is not traded at the wholesale level.

The distinction between wholesalers (*grossistes*) and semi-wholesalers (*demi-grossistes*) will be made in Chapter 8.

Table 7.6. Urban-Rural Market Integration, Gao Region, Mali: Pairwise Weekly Price Correlation Coefficients

December 1988-October 1989

Millet	Almou't	Temera	Bourem	Djebok	Bara	Ansongo	Tessit
Gao-City	.75	.60	.65	.52	.18	-.53	-.16
same week	***45	***47	***42	**47	44	***47	36
Gao-City	.86	.65	.69	.73	.35	-.43	-.13
lagged price	***45	***46	***42	***47	**43	***46	35
Sorghum	Almou't	Temera	Bourem	Djebok	Bara	Ansongo	Tessit
Gao-City	.	.70	.68	.30	.24	-.54	-.03
same week	.	***22	***40	**36	*42	***46	22
Gao-City	.	.46	.60	.32	.40	-.52	-.07
lagged price	.	**21	***40	**36	***40	***45	21

Note: The number of pairwise observations appears below the correlation coefficient (where *** indicates significance at the 99 percent level; ** at 95 percent; and * at 90 percent).

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to meet its lower sorghum demand from Gao-City. Correlation coefficients between Gao-City and Tessit are negative and not significant in either case for several possible reasons: higher rainfall in Tessit and good prospects for recession agriculture; Tessit's access to supplies from nearby Burkina Faso and Niger (section 7.3.1.1.); some degree of local self-sufficiency in Tessit; or simply a poor *R* due to little movement of millet prices and virtually none whatever for sorghum in Tessit.

On balance, there is evidence of moderate (medium) cereal market integration in the Region for millet and sorghum between Gao-City and rural markets *other than* Ansongo and

Tessit, 100 km or more to the south. Measurement for other cereals is hampered by too few price observations, itself an indicator of little trade between markets.[42]

There are several implications of these results from a food security perspective for OPAM and the government. For OPAM, the acceptable measures of medium market integration of some rural markets with Gao-City for millet and sorghum (except Bara, Ansongo and Tessit) mean that OPAM is in position to influence rural prices by increasing supplies in Gao-City through food aid deliveries and/or SNS destocking operations. When there is normal effective demand in rural market towns, OPAM does not necessarily have to arrange for the physical delivery of cereals to these towns. Traders will take care of this at no cost or little cost to OPAM. The fact that prices for both an outside cereal, millet, and a regional cereal, sorghum, are correlated with Gao-City prices increases the significance of these results. The exceptions are Bara, which is weakly integrated with Gao-City, Ansongo and Tessit, which are either locally autarkic in production or supplied from neighboring sources/countries, for which direct deliveries from OPAM may be necessary if market intelligence indicates sharp declines in supply and/or effective demand. In turn, this also places a greater onus on the SIM to monitor these two markets.

For the government generally, these results, however reasonable, point to the need to reduce *physical* handling costs between Gao-City and outlying markets, especially Ansongo and Tessit, as a means to strengthen market integration. Barring costly improvements in road infrastructure due to semi-desert conditions, improvements in marketing services (such as

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[42]Survey data indicate that little RM40 rice is sold in rural markets, where local rice dominates, and that the volume of local rice sold in Gao-City is small (one-eighth) relative to RM40. On the basis that the two types of rice are close substitutes, monthly Gao-City RM40 prices were correlated with rural market local rice prices. Nevertheless, results suggest that the Gao Region rice market is weakly integrated at best, due to a combination of local production sources, strong product differentiation and tastes and preferences.

information, credits, contract enforcement and streamlining regulations) are required to reduce exchange or *coordination* costs.

If peripheral areas in the Gao Region are indeed supplied by neighboring countries — Niger and Burkina Faso to the south and Algeria to the north (Steffen and Koné) — the government has to monitor conditions and trading patterns with those countries as well. Easing cross-border trade restrictions would also facilitate greater fluidity in the cereals market.

7.4.2. Rural Market-Urban Wholesaler Marketing Margins

7.4.2.1. Marketing Margin Analysis

Marketing margins are defined as "the price of a collection of marketing services which is the outcome of the demand for and supply of such services" (Tomek and Robinson).[43] These marketing services may include assembly, transformation or processing, storage, transportation and retailing. Marketing margins differ among cereals because their marketing services differ.

Gross marketing margins based on average monthly rural market prices minus average monthly Gao-City wholesaler sales prices are shown in Table 7.7 for millet and Table 7.8 for

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[43]A marketing margin is also defined as the difference between the consumer price (based on primary demand and derived supply) and the farmer price (based on derived demand and primary supply) (Tomek and Robinson). Use of this definition would be more appropriate for cereals supplied by rural markets to Gao-City, rather than the reverse where cereals located in Gao-City are already produced.

sorghum, the only cereals traded by wholesalers each month.[44] These tables illustrate several points.

First, a large absolute value does not necessarily mean greater profits. It may reflect a higher value of marketing service, especially transportation. With the exception of margins between Gao-City and Ansongo (for millet) and Gao-City and Tessit (for millet and sorghum), absolute margins roughly correspond to relative physical difficulties of transporting from Gao-City. Expressed as a percent of the rural market sales price, absolute gross margins for millet are lowest on average in Djebok, the rural market closest to Gao-City. Although absolute gross margins for millet are about the highest on average in Bourem, absolute gross margins for sorghum are lowest on average in Bourem.[45]

Next, margins are least stable between Gao-City and Ansongo for both millet and sorghum, due to a reversal of cereal flows during the year (because of which no CV is calculated). From December through February, the gross marketing margin on millet is negative, meaning that Ansongo has its own supply source for millet. A less likely scenario is that Ansongo sends millet to Gao-City. For the rest of the year, margins are positive, suggesting that the Gao-City marketshed expands to include Ansongo and that Ansongo receives millet from Gao-City. In this case, Ansongo prices exceed Gao-City prices by a margin which exceeds transfer costs. A similar apparent reversal of flow occurs for sorghum, although not until July when gross margins turn positive.[46]

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[44]These prices were put on a monthly average to avoid the same week versus lagged week issue raised in Table 7.6.

[45]The low absolute gross margins for millet and sorghum in Ansongo are not considered here because of the suspected reversal of cereal trading patterns (see the following paragraph).

[46]See Timmer, Falcon and Pearson for a further discussion and graphical presentation rural-urban price margins and product flow reversals, pp. 177-180.

Table 7.7.

Gross Margins (CFA Francs/kg) on Millet between Average Monthly Rural Market Prices and Average Monthly Gao-City Wholesaler Sales Price and as Percent of Wholesaler Sales Price

	Almoustarat		Temera		Bourem		Djebok		Bara		Ansongo		Tessit	
Millet	Margin	Pct	Margin	Pct	Margin	Pct	Margin	Pct	Margin	Pct	Margin	Pct	Margin	Pct
December 1988	30.6	28.5	21.6	21.9	.	.	18.3	19.3	11.4	12.9	-15.4	-25.0	-22.7	-42.0
January 1989	15.2	17.7	36.6	34.3	25.8	26.8	8.8	11.1	13.7	16.3	-9.7	-16.0	-23.4	-49.7
February	14.1	16.6	32.5	31.5	24.4	25.7	5.2	6.8	16.9	19.3	-6.7	-10.4	-19.0	-31.9
March	17.9	21.1	18.2	21.3	23.2	25.7	11.2	14.3	22.4	24.9	2.0	2.9	-15.3	-29.4
April	18.3	21.5	15.1	18.4	21.1	24.1	12.9	16.2	22.4	25.1	1.8	2.7	-7.2	-12.0
May	21.3	25.1	17.4	21.4	16.3	20.4	16.1	20.2	23.2	26.7	0.3	0.4	-9.6	-17.7
June	23.5	28.7	22.8	28.1	24.3	29.4	21.5	27.0	18.6	24.1	5.7	8.8	-4.2	-7.8
July	7.7	11.1	19.2	23.7	17.6	22.1	13.8	18.3	17.3	21.9	2.7	4.2	-5.5	-9.7
August	11.1	15.8	21.6	26.9	19.9	25.2	16.8	22.2	26.1	30.7	11.1	15.9	-6.2	-11.8
September	15.6	22.2	24.6	31.1	23.7	30.4	21.3	28.1	25.2	31.6	16.1	22.9	-0.3	-0.6
October	4.6	6.5	10.7	14.0	12.7	16.3	12.0	15.5	13.8	17.4	3.3	4.8	-11.2	-20.7
Monthly Average	16.4	19.5	21.8	24.8	20.9	24.6	14.4	18.1	19.2	22.8	1.0	1.0	-11.3	-21.7
C. V.	0.447		0.340		0.203		0.353		0.261		a		-0.686	

Note: Oneway ANOVA indicates three subsets whose rural market-Gao City gross margins on millet are significantly different from other subsets at the 95 percent level ($F = 36.33$ with $DF = 6, 69$). These subsets are 1) Tessit; 2) Ansongo; and 3) all other rural markets. [a]A CV is not calculated for Ansongo due to the reversal of millet flow during the year.

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Table 7.8.

Gross Margins (CFA F/kg) on Sorghum between Average Monthly Rural Market Prices and Average Monthly Gao-City Wholesaler Sales Price and as Percent of Wholesaler Sales Price

	Almoustarat		Temera		Bourem		Djebok		Bara		Ansongo		Tessit	
Sorghum	Margin	Pct	Margin	Pct	Margin	Pct	Margin	Pct	Margin	Pct	Margin	Pct	Margin	Pct
December 1988	.	.	18.1	18.7	.	.	-8.7	-12.5	8.0	9.3	-16.7	-27.0	-22.5	-40.1
January 1989	.	.	20.2	20.9	17.6	18.7	-11.0	-16.8	1.2	1.6	-20.1	-35.7	-20.4	-36.4
February	.	.	17.9	19.3	12.1	13.9	-19.2	-34.6	7.6	9.2	-7.1	-10.4	-18.6	-33.4
March	.	.	11.7	13.5	9.0	10.8	-19.4	-34.9	19.2	20.4	-1.6	-2.2	-18.7	-33.1
April	.	.	7.2	9.0	11.1	13.2	-16.1	-28.1	19.2	20.7	-1.6	-2.3	-17.2	-30.7
May	.	.	.	.	13.4	16.0	-11.8	-20.4	16.2	18.8	-3.4	-5.2	-13.8	-24.5
June	.	.	11.5	14.2	12.4	15.2	-11.2	-19.3	9.5	12.0	-1.3	-1.9	-13.0	-23.2
July	.	.	13.2	16.3	11.2	14.2	-10.6	-18.5	15.2	18.4	3.3	4.6	-11.3	-20.2
August	.	.	10.7	13.2	8.8	11.1	-8.9	-14.6	13.3	16.0	6.8	8.8	-10.9	-18.5
September	.	.	15.6	19.7	8.6	11.9	-8.3	-15.0	17.1	21.2	15.5	19.6	-7.3	-13.0
October	.	.	17.0	20.2	1.6	2.3	-20.5	-44.2	18.7	21.9	7.9	10.5	-10.7	-19.01
Monthly Average			14.3	16.5	10.6	12.7	-13.2	-23.5	13.2	15.4	-1.7	-3.7	-15.0	-26.5
C. V.			0.286		0.392		-0.352		0.445		a		-0.321	

Note: Sorghum is not marketed in Almoustarat. One-way ANOVA indicates four subsets whose rural market-Gao City gross margins on sorghum are significantly different from other subsets at the 95 percent level (F = 29.79 with DF = 5, 46). These subsets are 1) Tessit and Djebok; 2) Djebok and Ansongo; 3) Ansongo and Bourem; and 4) Bourem, Bara and Temera. [a]A CV is not calculated for Ansongo due to the reversal of sorghum flow during the year.

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Third, gross margins between Gao-City and Tessit for millet and sorghum are always negative. This seems to be consistent with the negative and insignificant market integration correlation coefficients between Gao-City and Tessit (Table 7.6) and seems to confirm suspicions that Tessit lies in the marketshed of another supply source — possibly itself, but not Gao-City.

Gross margins between Gao-City and Djebok for sorghum are also consistently negative, indicating that Djebok sorghum prices are not functionally related to Gao-City prices. Supplies from pond recession sorghum appear to meet local demand entirely. These negative margins are all the more striking, given that Djebok is only 38 km from Gao, the shortest distance of any survey rural market. This indicates that the boundary for the Djebok and Gao-City sorghum marketshed lies somewhere between the two.

Generally, the functional dependence of rural markets on Gao-City for regionally-grown sorghum supplies may be weak *in good crop years*, such as 1988/89, because much is consumed within rural production localities. Although records show that regional sorghum is traded with Gao-City, particularly from Bara and Ansongo, it is possible that the Gao-City market for sorghum is dominated by supplies from outside the region.

Lastly, analysis of variance (ANOVA) tests whether some rural markets have statistically different gross margins from other rural markets, *not* explained by variability due to random price sampling. ANOVA results indicate that gross margins between Gao-City and Tessit and Ansongo, respectively, are statistically different both from each other and from the rest of the markets, which form their own group (whose gross margins are not statistically different). This presents additional evidence that Tessit and Ansongo (for at least part of the year) have characteristically different market links to the Gao-City market than other regional rural markets.

7.4.2.2. Regression Analysis of Rural Market-Urban Wholesaler Marketing Margins

Without a complete breakdown of costs going into the gross marketing margin, the net profit level of rural market traders cannot be measured. As an alternative, it may be possible to test whether rural traders are price takers or price setters. Goetz and Weber propose the use of econometric modelling to test whether rural traders influence their sales prices or simply add a unit mark-up to the price they pay their suppliers. The following regression models are formulated for millet and sorghum as:

$$\mathrm{RMPMIL} = a + b\,\mathrm{PVWMIL}_{t-1}$$
$$\mathrm{RMPSOR} = a + b\,\mathrm{PVWSOR},$$

where

RMPMIL	=	rural market sales price of millet
PVWMIL_{t-1}	=	lagged urban wholesaler (*grossiste*) sales price of millet
RMPSOR	=	rural market sales price of sorghum
PVWSOR	=	urban wholesaler (*grossiste*) sales price of sorghum.

The model implies that rural market sales prices are functionally dependent on Gao-City wholesaler sales prices. If the coefficient *b* on wholesaler prices is *not* significantly different from 1.0, it may be inferred that rural traders simply add a constant mark-up to urban supplier prices and that rural prices change only as urban prices change. Rural traders are price takers.[47]

If, on the other hand, the coefficient *b* is significantly different from 1.0, a one-unit change in urban wholesaler prices does not lead to a one-unit change in rural market prices,

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[47]A key assumption in this model is that cost elements within the margin are competitive and reasonably constant.

but may vary or lead to some other constant change in rural market prices. Rural traders in this case are price setters, making profits or absorbing losses as urban prices fluctuate.

For a two-tailed test at the 95 percent significance level, the null hypothesis that the coefficient b is equal to 1.0 is:

$$H_o: b = b' \text{ (where } b' = 1.0)$$

and the appropriate test t statistic is:

$$t_{(\alpha/2,\ d.\ f.)} = \frac{b - b'}{\text{S. E. of } b}$$

The null hypothesis is rejected if the observed t statistic is greater than the positive test t statistic or less than the negative test t statistic, for the given degrees of freedom.

Table 7.9 shows the result of regression analysis of weekly urban wholesaler-rural trader gross marketing margins, where the appropriate degrees of freedom (d. f.) in each case are N-2. Gao-City millet prices have been *lagged* by one week due to the known functional dependence of the rural markets on Gao-City as a millet supply source. Gao-City sorghum prices were *not lagged* because of the uncertain supply relationship between Gao-City and the rural markets. Millet prices were not regressed in the case of Tessit (due to the consistently negative gross marketing margins in Table 7.7)[48] or Ansongo (because of the millet flow reversal, Table 7.7).[49] Sorghum prices were not regressed in the case of Almoustarat

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[48]Given the negative marketing margins between Tessit and Gao-City (Table 7.7), the equation is either misspecified (the two variables should switch sides of the equation) or there is no functional relationship at all since Tessit and Gao-City are not spatially integrated.

[49]Regression analysis of marketing margins is no longer appropriate where there is an apparent product flow reversal because the functional price relationship between Ansongo and Gao-City is unknown (Goetz and Weber, pp. 61-62.).

Table 7.9

Regression Analysis of Weekly Gross Marketing Margins (CFA Francs/kg) between Gao Region Rural Markets and Gao-City Wholesalers

MILLET Rural Market Price (RMPMIL)	Constant	Gao-City Wholesaler Sales Price ($PVWMIL_{t-1}$)	Adjusted R^2 (F Statistic)	Test *t* Statistic, 95 percent significance	Observed *t* Statistic
Almoustarat	**2.419**	**1.213**	**0.729**	± 2.003	1.919
(N = 45)	(7.122)	(0.111)	(119.566)		
Temera	**24.060**	**0.979**	**0.409**	± 2.004	-0.121
(N = 46)	(11.104)	(0.173)	(32.097)		
Bourem	**17.497**	**1.076**	**0.463**	± 2.021	0.427
(N = 42)	(11.198)	(0.178)	(36.312)		
Djebok	**42.171**	**0.578**	**0.524**	± 2.005	**-5.275**
(N = 47)	(5.166)	(0.080)	(51.719)		
Bara	**61.683**	**0.354**	**0.101**	± 2.003	**-4.365**
(N = 45)	(9.461)	(0.148)	(5.704)		
Ansongo	a	a	a	a	a
Tessit	b	b	b	b	b

SORGHUM Rural Market Price (RMPSOR)	Constant	Gao-City Wholesaler Sales Price (PVWSOR)	Adjusted R^2 (F Statistic)	Test *t* Statistic, 95 percent significance	Observed *t* Statistic
Almoustarat	c	c	c	c	c
Temera	**10.265**	**1.044**	**0.461**	± 2.086	0.105
(N = 22)	(16.844)	(0.240)	(18.982)		
Bourem	**-27.638**	**1.560**	**0.449**	± 2.038	**2.051**
(N = 40)	(19.218)	(0.273)	(32.730)		
Djebok	b	b	b	b	b
Bara	**60.279**	**0.349**	**0.035**	± 2.024	**-2.932**
(N = 42)	(15.684)	(0.222)	(2.470)		
Ansongo	a	a	a	a	a
Tessit	b	b	b	b	b

Standard errors in parentheses.

[a]Regression for Ansongo is not calculated due to product flow reversals. [b]Regression not calculated due to negative gross marketing margins with Gao-City. [c]Sorghum is not traded in Almoustarat.

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(because sorghum is not traded there), Djebok[50] and Tessit (due to the negative gross marketing margins in Table 7.8), or Ansongo (because of the sorghum flow reversal, Table 7.8).

Looking at both millet and sorghum, regression equations are generally better in terms of adjusted R^2s and F statistics for North markets than South markets. However, the observed *t* statistics for Almoustarat, Temera and Bourem in the North are low, so the null hypothesis is not rejected. This implies that rural traders do not adjust their prices upward by other than one-unit given a one-unit increase in Gao-City prices. In the case of Almoustarat, for example, the coefficient *b* for the Gao-City sales price is not significantly different from 1.0, so the effective equation for Almoustarat rural market prices becomes RMPMIL = 2.419 CFAF constant mark-up per kilogram above the Gao-City price.

For the other two markets, the constant terms are significant. Both equations show a *b* coefficient on the Gao-City sales price which is significantly different from 1.0 at the 95 percent level. This implies that Djebok and Bara traders adjust their prices upward by less than one unit (absorbing a profit), given a one-unit increase in Gao-City prices. The regression also predicts that these rural traders drop their prices by less than one unit (making a loss) when the urban price drops by one unit. These econometric results make intuitive sense, especially for Djebok — there may be room for price setting as one moves away from other markets and population concentrations along the Niger. However, there may not be a functional relationship between Gao-City and Bara prices for millet, as suggested by the low correlation coefficients in Table 7.6 — whether Gao-City prices are lagged or not. Moreover, the adjusted R^2 in the Bara equation is weak.

[50]As in the case of Tessit, the negative marketing margins between Djebok and Gao-City (Table 7.8) mean that Djebok prices may influence Gao-City prices or that the equation should not be considered.

Some of the same patterns hold also for the sorghum regressions. The observed *t*-statistic in Bourem (2.051) slightly exceeds the two-tailed test t-statistic (2.038) at 95 percent significance, thereby rejecting the null hypothesis, indicating that Bourem traders are price takers. Since the Bara regression is very poor statistically in terms of adjusted R^2 and F-statistics, the results that Bara traders are price takers should not be accepted.[51]

While these results are a bit murky, they suggest that rural market traders are price takers for the most part, allowing only a constant mark-up from Gao-City supply sources. It appears to corroborate evidence that at least part of the year, rural markets are contestable and thus competitive. This analysis continues to raise questions about the functional relation between Gao-City and some rural market prices.

7.4.3. A Final Observation on Performance

There is little doubt that cereals on some rural markets are thinly traded and attract few buyers, although the number of farmer-sellers may be quite large seasonally. Some observers see the large number of farmer-sellers in a positive light. Ateng says that the possibility of crop sales in small lots to assemblers or directly to consumers offers considerable flexibility to farmer households in terms of timing, place and quantity in smoothing income. For Harts-Broekhuis and de Jong (1990b), petty trade in the market represents employment for those with low opportunity costs. Moreover, factors which give individual utility, such as socializing and diversion from day to day tasks, cannot be discounted.

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[51]Once again, regression analysis of marketing margins for Ansongo is not appropriate because of the apparent reversal of product flow (Table 7.8) during the survey period.

Others consider the highly fragmented, unspecialized and low productivity market structure which may be "efficient but poor" as undesirable. Shaffer and colleagues (1983) believe that the search for improvement in market performance should exploit opportunities for reduced unit costs through investments in larger scale operations, specialization and lower transaction costs.

The merits of each argument must be put in the context of the Northeast. Certainly, local harvests and prices (and hence, household incomes) which fluctuate from one year to the next are chief factors inhibiting the emergence of a full-time class of traders and reducing incentives for storage and transport for both upstream (assembly) and downstream (sales) operations.[52] Second, rural markets which become too highly concentrated reduce alternative marketing channels, lead to collusion between traders and other opportunistic behavior. Third, opportunity costs for small-scale transactions may be lower in deficit production zones than in surplus ones.

7.5. Conclusion and Summary of the Main Points

This summary of the structure, conduct and performance of rural markets in the Northeast is applicable following a year of good harvests.

7.5.1. Rural Market Structure

- The number of participants on rural markets appears amorphous and seasonally fluid, but follows an identifiable cycle. When farmers converge on the market during the harvest/post-harvest season to sell their supplies, traders

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[52] This observation applies equally to the marketing of crop production inputs.

and consumers compete with each other for purchases. The middleman is effectively bypassed. Market transactions are largely transparent and tend toward one equilibrium price. The number of traders drops during the remainder of the year when markets are more thinly traded.

- Poor access to credit restricts the scale of trader operations. The majority of recorded transactions are carried out in small lots in the absence of standard grades and measures. Informal information channels, supplemented recently by the government's Market Information System, keep market participants reasonably informed.
- The state of herder and consumer cooperatives is in disarray. Their rehabilitation as useful risk-sharing institutions and alternative to the market is impeded by past debts and financial mismanagement and inadequate training of membership. Unattractive costs keep consumer cooperatives from obtaining supplies from farmer cooperatives. Cooperatives are not yet viable competitors with the market following a good harvest year in which prices are stable or decline.

7.5.2. Rural Market Conduct

- Rural marketsheds expand and contract to meet seasonal shifts in supply and demand patterns. Average distances from supply source to market for coarse grains are several times greater than average distances from market to destination of the client. Two Off-River markets, Almoustarat and Djebok, obtain most of their cereals from Gao-City while other markets procure a good part of their cereals locally. Off-River and Northern markets generally serve a more widely dispersed clientele for coarse grains.

- Long-distance market coordination, although enlisting a broad diversity of participants, is achieved haphazardly. Poor or non-existent telecommunications severely hamper planning. Use of contracts as a coordinating device is virtually unknown. Cereals often arrive from suppliers unexpectedly. An occasionally limited choice of cereals constrains preference articulation by consumers.
- Repeated transactions between the same trading partners lowers search costs and may reduce opportunism, but is likely to inhibit more fluid and transparent marketing.
- Mechanisms for interstage cooperation are weak. Interstage conflicts are resolved in an *ad hoc*, personal way, not systematically.
- The most prevalent standard operating procedure of professional rural traders emphasizes rapid turnover of grain stocks, having the effect of accelerating cereal flows within the system and deflecting the storage function elsewhere. Another common SOP is flexibility in the face of uncertainty, requiring any number of contingencies.

7.5.3. Rural Market Performance

- The degree of spatial price integration between *adjacent* survey rural markets is rarely strong (price correlation coefficients greater than 0.77). Spatial price integration is handicapped by low production volumes in most locations, in the case of regional crops, as well as a poor and inadequate transportation network.

- Integration between the Gao-City wholesale market and most rural markets is better, reflecting active trade links. Lagging Gao-City wholesale prices yields reasonably good correlation coefficients for Almoustarat, Temera, Bourem and Djebok for millet, an outside crop. Unlagged Gao-City prices are reasonably good only for Temera and Bourem for sorghum, a regional crop. Tessit in the South falls outside the influence of the Gao-City market for coarse grains.
- Millet and sorghum marketing margins between Gao-City and Tessit are consistently negative, apparently confirming that Tessit does not rely on Gao-City for supplies. Similarly, sorghum marketing margins between Gao-City and Djebok are always negative, indicating that even a nearby Off-River market is not necessary supplied by a central market. Marketing margin analysis reveals product flow reversals between Ansongo and Gao-City for millet and sorghum, where Ansongo appears to be supplied from Gao-City only during the second part of the survey year.
- Simple regression analysis of weekly urban-rural price margins for millet and sorghum over the entire year indicates that rural market traders are more likely to be price takers, adding a constant margin to their delivered prices from Gao-City.
- Interannual variability of local and regional cereal production and its uncertain effect on market conditions are critical factors in slowing the emergence of full-time professional traders capable of specialization and innovation to lower unit costs.

- The high costs of transacting between markets presents another obstacle to specialization and innovation. Transaction costs dampen entrepreneurship and adaptability to exogenous change factors.
- Public sector marketing services to foster competition and innovation are largely lacking at the rural market level.

Chapter 8. The Structure, Conduct and Performance of Urban Wholesale Cereal Markets in the Northeast

This chapter assesses the structure, conduct and performance of urban wholesale cereals markets in the Northeast, in contrast with urban markets elsewhere in Mali. After a review of the grain trader sampling methodology in Section 8.1, the chapter evaluates the structure of urban wholesale markets in Section 8.2 and their conduct in Section 8.3. Market performance is assessed in Section 8.4, including discussion of factors which are likely to influence future performance. Section 8.5 concludes the chapter.

8.1. Grain Trader and Transporter Sampling Methodology

The grain trader sample for this dissertation is built on the sample established in October 1985 during the first phase of the CESA-MSU Food Security Project, when four wholesale markets were selected based on a preliminary analysis of national marketing channels: Koutiala and Sikasso, constituting the main supplier markets from the CMDT zone in southern Mali; Bamako as national capital and largest source of urban demand; and Mopti for its strategic location as grain dispatcher to the Northeast (Dioné, 1989b). The Food Security Project identified 21 traders in Koutiala, 21 traders in Sikasso; 33 traders in Mopti and 37 traders in Bamako (Dioné, Dembélé and Mariko).[1] All traders were retained in

[1] In addition, the Food Security Project identified 5 transporters in Koutiala, 12 in Sikasso, 16 in Mopti and 15 in Bamako.

Koutiala, Sikasso and Mopti while a sample of 30 traders was selected for Bamako (Dioné, 1989b). Initially, the surveys covered only coarse grain transactions. When the surveys were expanded to include rice transactions in April 1988, Ségou as added as a fifth survey market due to its proximity to irrigated rice production and as headquarters for the *Office du Niger* zone.

The trader sampling methodology for the Northeast during the second phase of the Food Security Project was identical to that of the first phase. The regional capitals of Tombouctou and Gao were selected as the main urban markets and redistribution centers. In addition, two District seats in the Gao Region, Ansongo and Bourem, were selected for their dual roles as secondary urban markets and rural assembly markets (Chapter 7). Project enumerators asked known traders and key informants to identify all the traders and transporters in each city who were then formally surveyed for a baseline census. Rather than selecting a random sample from the relatively smaller number of traders and transporters in the Northeast, it was decided to maintain a complete enumeration. The trader respondents dating from the first phase were retained, both to continue the time series on trader grain transactions during a period of structural change in the market (Annex 2.1) and to serve informally as a control group, against which key structure, conduct and performance variables from the Northeast could be contrasted. See Figure 8.1., which shows urban survey markets.

Trader participation in the Food Security Project surveys was optional. Attrition was not a serious problem in the Northeast.[2] However, respondent fatigue in Koutiala, Sikasso

[2]One trader in Gao dropped out after eight months of participation.

Figure 8.1 Map of Urban Wholesale Market Survey Sites

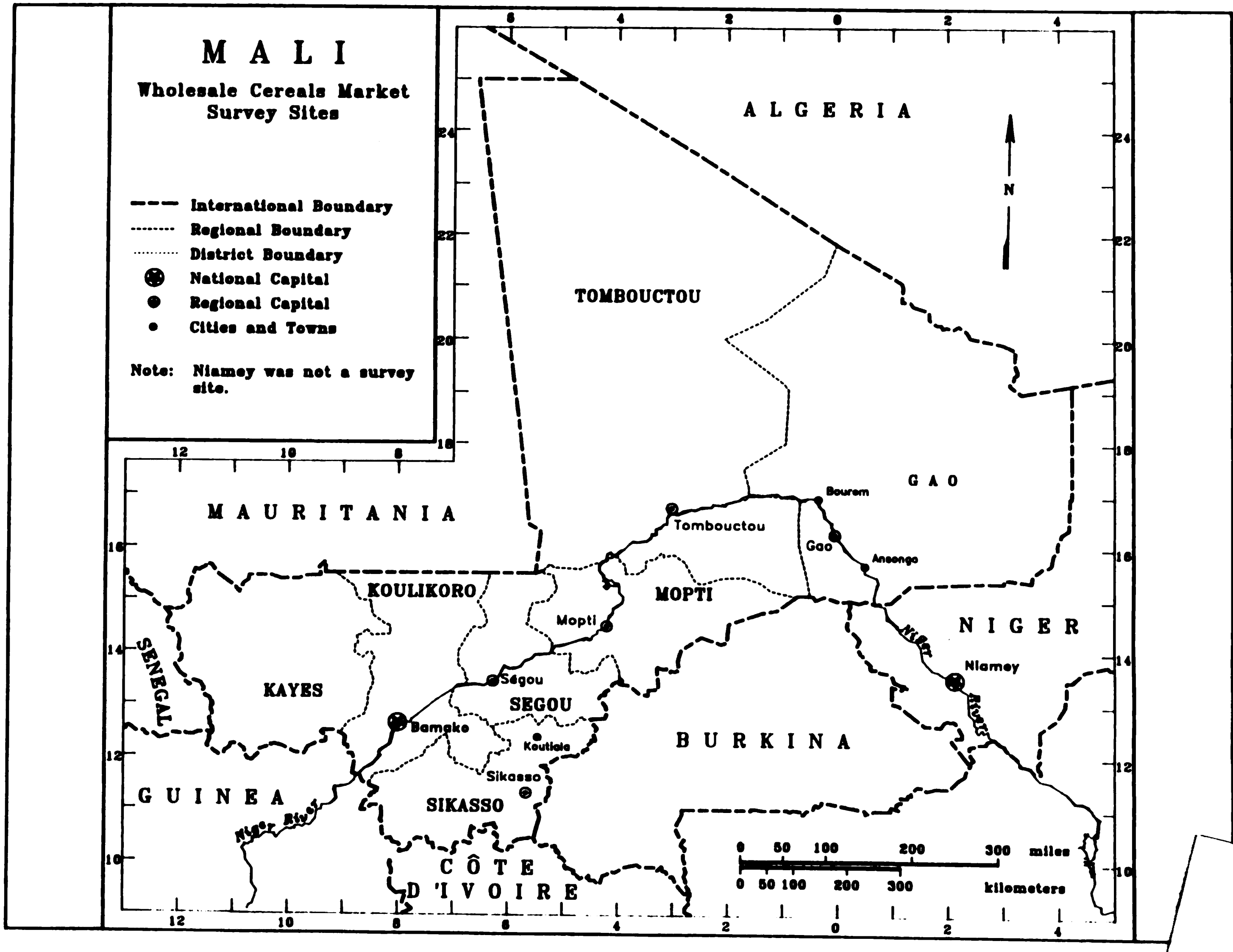
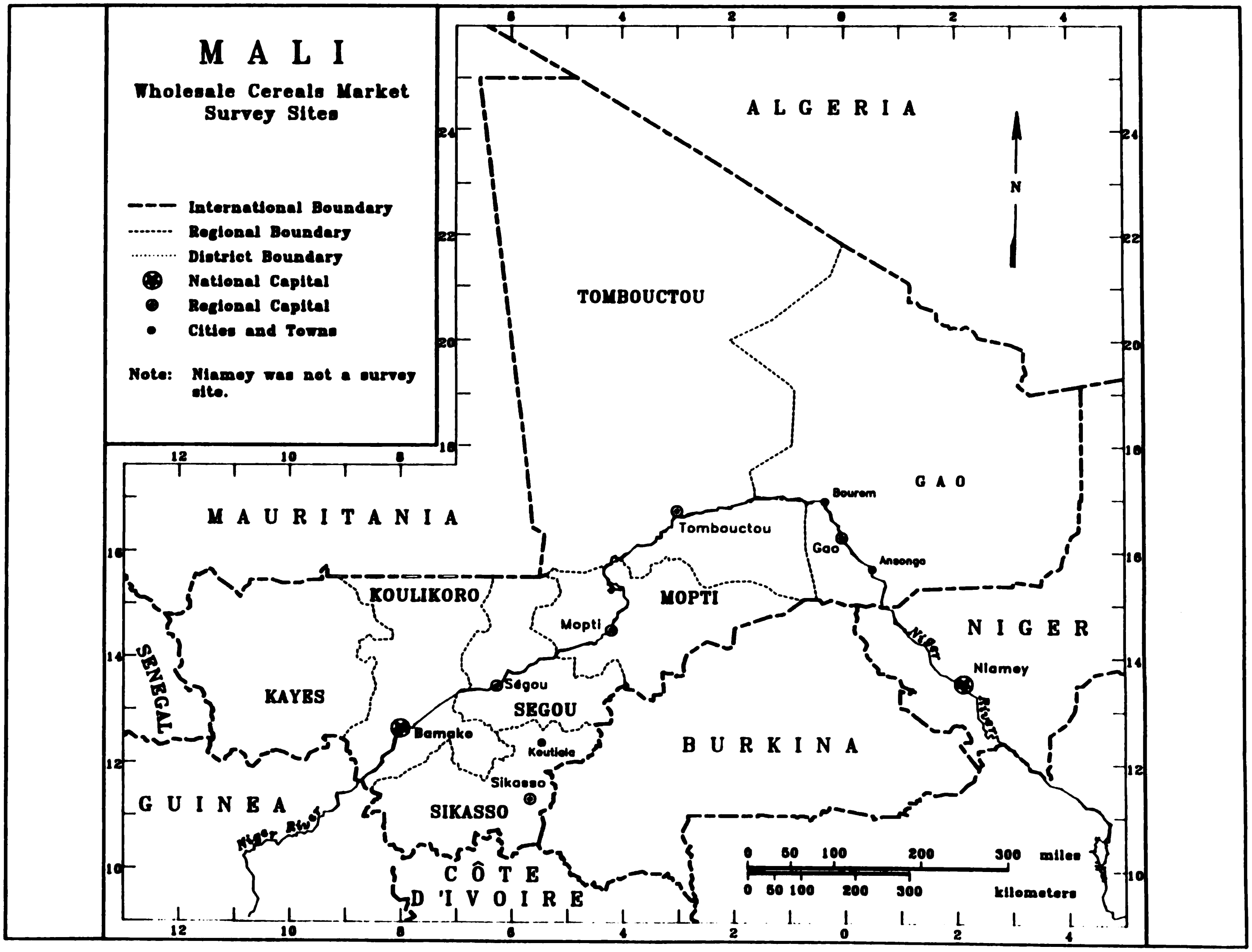


Figure 8.1 Map of Urban Wholesale Market Survey Sites



and Mopti, into their fourth year of continuous surveys, prompted a number of traders to drop out.[3]

Evolution of the trader sample in each city can be seen in Figure 8.2 showing the numbers of survey participants and non-participants as of September 1989.[4] Figure 8.2 also indicates that survey coverage in the Northeast was not as comprehensive as initially thought. Nonetheless, nearly two-thirds of all known traders participated in the Northeast. Of all cities, the non-participation rate dipped below half only in Ansongo. Nearly three-fourths of known traders participated in the surveys overall.

The number of participating traders surveyed in each urban market was limited to those willing to respond. Since participants were not randomly selected initially (except those in Bamako), this raises the related statistical problems of self-selection and non-response.

Non-response may be broken down into *total* non-response (based on refusal to be interviewed at all, non-contact or unavailability, or incapacity to respond) and *item* non-response (where the respondent does not know the answers to certain questions or refuses to answer certain questions). Within total non-response, refusals are considered more serious than cases of non-contact or incapacity because the latter are likely to be randomly distributed, whereas refusals are not. Refusal is similar to self-selection where target individuals choose to participate — or not — on the basis of some anticipated return. The

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[3]This decrease in numbers surveyed may be somewhat overstated to the extent that baseline data from the 1985/86 census picked up large numbers of "temporary traders" (*commerçants occasionnels*) who had entered the market under extraordinary conditions to profit from sales to OPAM at fixed official prices which were higher than market prices (Dioné and Dembélé). Temporary wholesalers trade in other commodities as well, but enter the cereals market to honor a contract to supply the National Security Stock, or seasonally, after the harvest (Mehta).

[4]Cereal transactions data were solicited from non-participating traders in order to measure market concentration (Section 8.2.3.).

Figure 8.2.

Participating and Non-Participating Grain Traders by Wholesale Market

	Participating Traders	**Non-Participating Traders**	**Participating Traders as Percent of All Traders**
Tombouctou	11	6	64.7
Gao[5]	13	7	65.0
Ansongo	3	4	42.9
Bourem	6	1	85.7
Mopti	16	6	72.7
Ségou	14	5	73.7
Koutiala	9	7	56.3
Sikasso	8	4	66.7
Bamako	32	17	65.3
Total/Average	112	40	73.7
Northeast Total/Average	33	18	64.7

CESA-MSU Food Security Surveys, 1988/89

chief risk with either self-selection or non-response is that survey estimates based on actual respondents alone will be biased estimates of overall trader population parameters. Further, differential rates of self-selection or non-response may be concentrated among subgroups (or particularly sensitive questions, in the case of item non-response) (Kalton).[6]

[5]This figure is valid through June 1989.

[6]Several techniques are available for handling item non-responses, including the option used in this dissertation of proceeding on the basis of available responses alone (Kalton, Chapter 9).

While the risk of self-selection and/or non-response bias cannot be ignored, it is expected that the favorable overall participation rate has resulted in relatively robust estimates of most variables. Where given, opinions of participating traders are taken as a very representative order of magnitude of the opinions of all traders.[7]

Figure 8.3.

Participating Grain Transporters by Base of Operations

Tombouctou	6
Gao	6
Ansongo	1
Bourem	1
Mopti	5
Ségou	7
Koutiala	8
Sikasso	4
Dioila	3
Bamako	7
Total	48

CESA-MSU Food Security Surveys, 1988/89

In general, the same selection methodology was applied to grain road transporters. Without an overall census, however, the true number of transporters based in a particular city remains unknown, making it impossible to indicate what percentage of transporters from a

[7]Considering the possible margins of error where the absolute number of respondents in a given city is small, some caution is nonetheless required in accepting results uncritically.

given city participated in the survey. Figure 8.3 shows the number and distribution of road transporters.[8]

8.2. Wholesale Market Structure

This section focuses on the stratification of urban grain traders into wholesalers and semi-wholesalers, key demographic and economic characteristics of urban grain traders, entry conditions, access to market information and two measures of market concentration. In the interest of editorial flow, other structural variables will be introduced in Section 8.3 to facilitate analysis of conduct.

8.2.1. Stratification of Grain Traders into Wholesalers and Semi-Wholesalers

Grain traders in Mali are distinguished as "wholesalers" (*grossistes*) or "semi-wholesalers" (*demi-grossistes*). Informally, semi-wholesalers appear to be characterized by lower volumes and a higher portion of direct sales of cereals to consumers than wholesalers.

Formally, however, this distinction is less precise. Scrutiny of the Malian Business Code (*Code de Commerce du Mali*) and other relevant legislation did not uncover legal definitions for either semi-wholesalers or wholesalers. This was verified by the National Tax Authority (*Direction nationale des impôts*), according to whom there are no "rational,

[8]Note that transporters are grouped according to their principal base of operations (not according to survey location), accounting for the appearance of Dioila even though it was not a Project survey site. The Ségou transporter sample includes one transporter from Bla; Dioila includes one transporter from Beleco; and Tombouctou includes the neighboring port towns of Kabara and Korioumé.

objective criteria" by which a wholesaler can be distinguished from a semi-wholesaler.[9] The lack of clear and unambiguous criteria represents a major gap in commercial legislation and a source of confusion, as eligibility for certain credit programs, among others, depends on the trader's status as wholesaler or semi-wholesaler.

In order to stratify trader respondents, traders were asked to define themselves as wholesalers or semi-wholesalers. In the case of a missing self-definition, Project enumerators evaluated the status of the given trader as either wholesaler or semi-wholesaler according to the standard Project definition: A wholesaler sells cereals almost exclusively *at wholesale* to other wholesalers or semi-wholesalers while a semi-wholesaler sells cereals *at wholesale* (to other semi-wholesalers or retailers) *or at retail* (directly to consumers).[10] By coincidence, the number of wholesalers in the survey roughly equals the number of semi-wholesalers.

8.2.2. Presentation of Grain Traders

Table 8.1 sketches a profile of grain traders in Tombouctou, Gao, Ansongo and Bourem. To protect the confidentiality of the small sample of wholesalers in Ansongo and Bourem, only one in each town, information from Ansongo and Bourem is designated jointly as Ansongo-Bourem. Traders in Mopti and Bamako are also shown for contrast with the Northeast.[11]

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[9]Personal interview with the Chief Tax Inspector, National Tax Authority, District of Bamako, November 1989.

[10]This definition initially appeared in Nango Dembélé, Josué Dioné and John Staatz, 1986a, p. 16.

[11]Most information in Table 8.1 is based on the census questionnaire of February 1989 for all cities except Bamako. Bamako information for average age, ethnicity and specialization is based on the census questionnaire of February 1988, although results are reported only for CESA-MSU survey participants active during 1988/89. Other Bamako data were collected at the same time as data for other cities.

Table 8.1

Key Demographic and Structural Indicators of Urban Grain Traders in the Northeast, Mopti and Bamako, 1988/89

	Tombouctou	Gao	Ansongo-Bourem	Mopti	Bamako
Average Age					
Wholesalers	40.8 4	44.3 6	33.0 2	44.8 6	55.1 13
Semi-Wholesalers	39.0 7	42.5 4	39.3 7	55.8 5	47.7 14
All Traders	39.6 11	43.6 10	37.9 9	49.8 11	51.6 27
Average Number of Years as Grain Trader					
Wholesalers	14.8 4	7.5 6	10.5 2	9.0 5	10.1 17
Semi-Wholesalers	7.1 7	16.3 4	5.5 7	9.3 4	7.9 13
All Traders	9.9 11	11.0 10	6.6 9	9.1 9	9.2 30
Ethnicity (Percent)					
Arab	27.3 3	10.0 1	22.2 2	.	.
Bambara	.	20.0 2	.	27.3 3	42.9 12
Bozo	.	.	.	27.3 3	.
Dogon	.	10.0 1	.	9.1 1	.
Malinké	9.1 1	.	.	9.1 1	14.3 4
Marka	.	10.0 1	.	.	.
Maure	18.2 2	10.0 1	11.1 1	.	.
Peuhl	9.1 1	.	.	.	14.3 4
Saracollé	.	.	.	.	14.3 4
Senoufo	.	.	.	.	7.2 2
Somono	.	.	.	27.3 3	.
Songhraï	36.4 4	40.0 4	44.4 4	.	.
Others	.	.	22.2 2	.	7.2 2
Percent Specializing in the Grain Trade					
Wholesalers	0.0 4	66.7 6	100.0 2	100.0 6	61.1 18
Semi-Wholesalers	28.6 7	100.0 4	28.6 7	100.0 3	92.9 14
All Traders	18.2 11	80.0 10	44.4 9	100.0 9	78.1 32
Average Number of Permanent Employees					
Wholesalers	8.1 4	6.0 6	1.5 2	1.8 5	a
Semi-Wholesalers	4.4 7	3.3 4	3.0 7	2.8 4	
All Traders	5.8 11	4.9 10	2.7 9	2.2 9	
Mean Monthly Sales (MT)					
Wholesalers	41.2 4	17.3 8	1.1 2	66.8 7	248.2 17
Semi-wholesalers	8.2 7	29.5 5	1.9 7	24.6 9	54.6 14
All Traders	20.2 11	22.0 13	1.7 9	43.1 16	160.7 31

Fine type in each cell indicates the number of respondents.

[a]Unavailable. Bamako data for average age, ethnicity and specialization from census of February 1988.

CESA-MSU Food Security Project Surveys, 1988/89

Expected differences between wholesalers and semi-wholesalers are weak in terms of age and experience. Only wholesalers in the Bamako sample are distinctly older, on average, than their semi-wholesaler counterparts. Elsewhere, semi-wholesalers in Mopti and Ansongo-Bourem are older than their wholesalers counterparts. Wholesalers in Tombouctou and Ansongo-Bourem have roughly twice as much experience in the grain trade as their semi-wholesaler counterparts. This ratio is reversed in Gao. When average length of experience is subtracted from average age, it appears that wholesalers in Tombouctou, Ansongo-Bourem and Mopti started trading cereals at an earlier age than semi-wholesalers in the same cities, possibly indicating that they benefitted from easier entry conditions in terms of access to capital and family business connections.

Ethnic diversity within the trader sample indicates that the urban grain trade is not dominated by a particular group, but generally reflects the regional ethnic composition. Notably absent in the Northeast, however, are Tuaregs and Bellas, the main minorities.

Most wholesalers claim to specialize in the cereal trade except in Tombouctou, probably due to that city's seasonal inaccessibility which requires that traders diversify their activities. Mehta found an increase in specialization among Bamako wholesalers between the CESA-MSU census surveys of 1985/86 and 1988, but such a benchmark is unavailable for the other cities. The average number of permanent employees (excluding the trader himself) appears to be inversely related to the percentage of traders in any city specializing in the grain trade.

Lastly, average monthly sales figures show that wholesalers sell several times more cereals than semi-wholesalers. The exception in Gao is due to large unsold stocks held by several wholesalers. Average volumes sold also point to relative market size. Average sales by all traders in Tombouctou and Gao are comparable, but only about half of average sales in Mopti.

8.2.3. Entry Conditions into the Grain Trade

The number and size of buyers and sellers — the number of parallel channels — depends on entry and exit conditions. Entry into the grain trade is relatively unrestricted in a legal sense. The two main requirements are that all professional traders be listed on the Business Register (*Régistre du commerce*) and possess a valid operating license in order to engage in business during the fiscal year.

This is not to suggest that entry is always easy. Barriers to entry, as identified by traders in Table 8.2,[12] chiefly concern insufficient capital and knowledge of the grain trade itself. One-third of all respondents (33.3 percent) cited lack of finances as the principal barrier, the same rate of responses in the Northeast. Whereas lack of market-specific knowledge and information was cited by one-fourth of all traders (26.9 percent), 40.0 percent in the Northeast listed this barrier first. Somewhat unexpectedly, about one trader in six overall (17.2 percent) claimed not to have run up against any barriers. When barriers concerning multiple administrative requirements, lack of connections and poor understanding of marketing regulations are grouped together, these barriers account for 11.8 percent of responses.

Differences between wholesalers and semi-wholesalers are most pronounced concerning insufficient capital and knowledge of the grain trade. These two barriers accounted for nearly three-fourths (72.9 percent) of semi-wholesaler responses, but less than

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[12]Responses by traders in Tombouctou, Gao, Ansongo and Bourem have been aggregated and labelled as "Northeast." Responses by traders in Koutiala, Sikasso and Ségou have been aggregated and labelled as "South." Mopti and Bamako have been left as distinct markets.

Table 8.2. The Most Important Barrier to Entry into the Cereals Market, according to Urban Grain Traders in Mali

	Northeast		Mopti		South		Bamako		Row Totals		Whole-salers		Semi-wholesalers		Row Totals	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
1. Poor knowledge of the cereals market and/or the profession.	12	40.0	1	7.7	1	4.8	11	37.9	25	26.9	8	17.8	17	35.4	25	26.9
2. Lack of sufficient capital.	10	33.3	7	53.8	3	14.3	11	37.9	31	33.3	13	28.9	18	37.5	31	33.3
3. Inability to read, write and keep accounts.	1	3.3			2	9.5			3	3.2	3	6.7			3	3.2
4. Lack of adequate cereal storage capacity.					1	4.8			1	1.1	1	2.2			1	1.1
5. No means of transport.	2	6.7							2	2.2	1	2.2	1	2.1	2	2.2
6. Too many complicated administrative conditions to meet.					3	14.3			3	3.2	2	4.4	1	2.1	3	3.2
7. Lack of contacts in the bureaucracy to explain things or ease administrative requirements.					3	14.3			5	5.4	2	4.4	3	6.3	5	5.4
8. Poor understanding of grain trade regulations.	1	3.3	2	15.4	2	9.5			3	2.2	2	4.4	1	2.1	3	3.2
9. High cost of the annual operating license.					1	4.8	2	6.9	3	3.2	1	2.2	2	4.2	3	3.2
10. There were no barriers in my case.	4	13.3	3	23.1	4	19.0	5	17.2	16	17.2	12	26.7	4	8.3	16	17.2
11. I don't know.					1	4.8			1	1.1			1	2.1	1	1.1
Column Totals	30	100.0	13	100.0	21	100.0	29	100.0	93	100.0	45	100.0	48	100.0	93	100.0

CESA-MSU Food Security Surveys, 1988/89

half (46.7 percent) of wholesaler responses. Three times as many wholesalers in the sample encountered no obstacles as semi-wholesalers. These results imply that semi-wholesalers are at a disadvantage when entering the grain trade compared to wholesalers or that these disadvantages prevent semi-wholesalers from expanding operations, once having entered. An alternative explanation is that many traders work their way up from semi-wholesaler to wholesaler status. Capital and lack of knowledge may initially constrain the entry of semi-wholesalers in the trade, but after several years, they gradually accumulate capital[13] and experience.

Table 8.3 summarizes open-ended explanations as to how traders were able to overcome the barriers they encountered. While these summaries are not linked to a particular barrier to entry, they show that about one-fourth (24.4 percent) got established by collaborating with more experienced traders and "learning on the job". Business counsel and financial support from family and associates was also cited by nearly one-fourth (22.2 percent) of the traders, some of whom indicated that they got started by inheriting the family business.[14] This latter response was most often cited by traders in the Northeast (26.7 percent). Ten percent of traders overall claimed that they had not yet succeeded in overcoming all obstacles.

Both wholesalers and semi-wholesalers relied most on collaboration with other traders to get established. Based on the first two responses, it appears that semi-wholesalers had to

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[13]This appears to be born out by Table 8.10 where, almost without exception, a higher proportion of wholesalers than semi-wholesalers buy cereals on credit, can find sufficient credit on short notice, have bank accounts and/or have borrowed from banks and sell on credit.

[14]The 1985/86 census of traders in Bamako, Koutiala, Sikasso and Mopti by Dembélé, Dioné and Staatz (1986a) found that around 90 percent of the traders surveyed inherited their family's business, either as grain traders, traders of other items or transporters. A precise count is unavailable for the 1989 survey.

Table 8.3. Overcoming Barriers to Entry into the Cereals Market, according to Urban Grain Traders in Mali

	Northeast		Mopti		South		Bamako		Row Totals		Wholesalers		Semi-wholesalers		Row Totals	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
1. Rigorous and austere management helped me to cope.	2	6.7					3	12.5	5	5.6	1	2.5	4	8.0	5	5.6
2. I asked others for information.	3	10.0			1	4.2	4	16.7	8	8.9	2	5.0	6	12.0	8	8.9
3. Family and friends offered sound business advice and financial support.	8	26.7			6	25.0	6	25.0	20	22.2	8	20.0	12	24.0	20	22.2
4. I was able to obtain a bank loan.							1	4.2	1	1.1	1	2.5			1	1.1
5. I took advantage of contacts inside the bureaucracy to get started.			2	16.7	5	20.8			7	7.8	4	10.0	3	6.0	7	7.8
6. Other traders collaborated with me and instructed me.	5	16.7	7	58.3	5	20.8	5	20.8	22	24.4	10	25.0	12	24.0	22	24.4
7. I managed with God's help and good luck.	1	3.3							1	1.1	1	2.5			1	1.1
8. I used my own resources to get started.	3	10.0			5	20.8	2	8.3	10	11.1	5	12.5	5	10.0	10	11.1
9. I'm still trying to overcome obstacles.	5	16.7	2	16.7			2	8.3	9	10.0	4	10.0	5	10.0	9	10.0
10. There were no barriers in my case.	2	6.7	1	8.3	1	4.2	1	4.2	5	5.6	3	7.5	2	4.0	5	5.6
11. I don't know.					1	4.2			1	1.1			1	2.0	1	1.1
12. Others.	1	3.3							1	1.1	1	2.5			1	1.1
Column Totals	30	100.0	12	100.0	24	100.0	24	100.0	90	100.0	40	100.0	50	100.0	90	100.0

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be more self-reliant and self-motivated. Only one wholesaler obtained a bank loan to get started. For the rest, access to credit came from informal channels, pointing out the advantage of contacts with others in business. In contrast, only a few traders were able to call on contacts in the bureaucracy to sort out their problems.

Of course, these explanations are from traders who succeeded. Table 8.3 does not show responses from traders who did not. The image emerging from these responses is that while some traders enjoyed a head-start by taking over established family businesses and benefitting from social contacts, most others succeeded by muddling through, with access to neither formal training nor formal sector credit.

8.2.4. Access to Market Information

Table 8.4 summarizes indicators of access to cereals market information. On the whole, five of six traders (84.4 percent) claim to be well informed about the grain market for running their personal business. Traders in Bamako are more modest in their declarations. Being well informed is correlated to seniority as a grain trader. About one-fourth of those in the Northeast and Bamako with less than ten years of experience in the market do not consider themselves well informed (Steffen, 1990).

Traders in the Northeast, those farthest from the main production zones, have the best access to telephones (71.0 percent). In contrast, just more than half of Bamako traders have easy access to a telephone. Virtually everyone with access to a phone uses it to conduct cereals market business.

Only a few issues of the Market Information System (SIM) *Quarterly Bulletin* had appeared when traders were interviewed, accounting in part for the low numbers who had

Table 8.4

Indicators of Access to Grain Market Information, according to Urban Grain Traders

	Northeast	Mopti	South	Bamako	Total
Percent who consider themselves well informed about the grain market					
Wholesalers	91.7 12	100.0 6	100.0 12	70.6 17	87.2 47
Semi-Wholesalers	84.2 19	100.0 6	100.0 11	53.8 13	81.6 49
All Traders	87.1 31	100.0 12	100.0 22	63.3 30	84.4 96
Percent with a telephone or easy access to a telephone					
Wholesalers	91.7 12	33.3 6	33.3 12	88.9 18	68.8 48
Semi-Wholesalers	57.9 19	16.7 6	8.3 12	7.7 13	26.0 50
All Traders	71.0 31	25.0 12	20.8 22	54.8 31	48.0 98
Percent of those with access to a telephone who use it for their grain trade					
Wholesalers	100.0 11	100.0 2	100.0 4	100.0 16	100.0 33
Semi-Wholesalers	90.9 11	0.0 0	100.0 1	100.0 1	92.3 13
All Traders	95.5 22	100.0 2	100.0 5	100.0 17	97.8 46
Percent who have read the SIM *Quarterly Bulletin*					
Wholesalers	15.4 13	33.3 6	0.0 12	27.8 18	18.4 49
Semi-Wholesalers	5.3 19	0.0 6	0.0 12	0.0 13	2.0 50
All Traders	9.4 32	15.4 12	0.0 24	16.1 31	10.0 99
Percent who have listened to the SIM market radio broadcast					
Wholesalers	84.6 13	83.3 6	100.0 12	94.4 18	91.8 49
Semi-Wholesalers	78.9 19	100.0 6	100.0 12	100.0 13	92.2 49
All Traders	81.3 32	91.7 12	100.0 24	96.8 31	92.0 98

The fine type in each cell indicates the number of respondents.
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read it, only 10.0 percent overall. The other reason explaining low readership was that distribution was largely concentrated in Bamako.

Most all traders in all regions/cities reported having listened to the weekly cereals market broadcast on the radio about rural producer prices, urban consumer prices and special news of interest. Traders have expressed their general satisfaction with the content, frequency and market coverage of these broadcasts (Steffen, 1990). The slightly lower listening audience among Northeast traders probably reflected the initial focus on the main producing zones. The appropriateness of certain media over others for rapid diffusion of information is apparent in the South, where no trader had read the *Bulletin* but every trader had listened to the radio broadcasts.

Until the recent past, wholesalers enjoyed tremendous advantages over semi-wholesalers in terms of access to information based on international contacts (especially importers), their own networks of buyers in the field and insider information from the Chamber of Commerce, the Economic Affairs Agency and local administration, such that the system was characterized as two separate systems: Wholesalers were better informed than semi-wholesalers, but semi-wholesalers in Bamako working for Bamako wholesalers were better informed than their countryside counterparts (Amselle and Bagayogo). Inauguration of the SIM radio broadcasts, enthusiastically received, has helped to level the information playing field between wholesalers and semi-wholesalers.

8.2.5 Urban Market Concentration

One common index of the number of channels in the cereals market is the market concentration ratio, the percent of market sales held by the largest firms in the market (Marion, 1986). Concentration ratios are conventionally expressed in terms of the largest 2, 4 and 8 firms or traders (abbreviated as CR_2, CR_4 and CR_8, respectively). A high CR_2 or CR_4 may signal an underlying oligopolistic market structure where a relatively few traders are able to influence prices by colluding to manipulate supply and demand. Alternatively, low concentration ratios may reflect easy entry and hence, a more competitive structure.

To calculate concentration ratios for urban cereal markets as accurately as possible, enumerators made a considerable effort to identify and survey non-participating traders regarding their cereal sales from January 1 through August 31, 1989. These volumes were added to aggregated sales data of participating CESA-MSU sample traders over the same period to arrive at a total sales figure for all cereals for each city.[15] The resulting concentration ratios are shown in Table 8.5.

Based on concentration ratios, urban cereals markets in the Northeast are more concentrated, on balance, than markets elsewhere. Only Sikasso in southern Mali shows a comparable level of concentration.[16] Although an interpretation of these concentration ratios is somewhat normative, these levels are probably high.[17] However, one drawback to the use of concentration ratios is the failure to account for alternative supply sources. For example, the particularly high CRs in Ansongo and Bourem, due to the smaller number of wholesalers

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[15]No attempt was made to distinguish between wholesalers and semi-wholesalers in the calculation of CRs because the status of non-sample traders is unavailable. Double-counting of some cereals based on transactions *between* traders (tending to reduce the calculated concentration ratios) may have been offset by the effect of missing sales observations for non-surveyed traders (tending to increase calculated concentration ratios).

[16]Concentration ratios in Bamako are overstated to the extent that nine traders, participating in PRMC credit programs, had not sold their stocks within the observation period. Sales by these traders would have had the effect of reducing concentration ratios, all things equal, by adding to the total volume sold.

[17]Bain (1968) maintains that in *industries* with differentiated products, the critical level at which profits are positively correlated with economic profits occurs for a CR_8 of about 50 percent, and that a high degree of concentration is found at 70 percent or above and medium concentration between 33 and 69 percent.

Table 8.5

Cereals Market Concentration Ratios and Herfindahl Indices for the Northeast and Other Cities: All Cereals, January 1 - August 31, 1989

	CR_2	CR_4	CR_8	N	1/N	Herfindahl Index
Tombouctou	56.1	68.9	84.1	17	0.059	0.184
Gao	43.4	60.4	79.6	20	0.050	0.148
Ansongo	61.0	83.4	a	7	0.143	0.282
Bourem	73.7	91.3	a	7	0.143	0.330
Mopti	28.7	46.5	71.8	22	0.046	0.089
Ségou	35.3	55.0	79.5	19	0.053	0.107
Koutiala	24.3	45.0	70.8	16	0.063	0.081
Sikasso	46.5	66.2	91.3	12	0.083	0.158
Bamako	33.0	52.1	67.5	49	0.020	0.090

[a]Not applicable.

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and semi-wholesalers, do not incorporate market sales by farmers and gatherers directly to consumers, especially during the harvest/post-harvest season (Chapter 7).

The Herfindahl Index (Scherer) offers an alternative measure of market concentration, $(CV^2 + 1)/N$, where CV is the coefficient of variation of firm size, defined as the volume of market sales of individual traders or firms, and where N is the number of traders or firms. If all traders in the same market sold equal volumes, the CV would be zero and the Herfindahl Index reduces to 1/N, or the reciprocal of the number of traders. A single trader in the market also would result in an Index of 1/N, or one. Whereas the concentration ratio is an *absolute* measure, the Herfindahl Index is a *relative* measure to 1/N, the value signifying equal market shares among traders.

Table 8.5 shows that the Herfindahl Indices parallel their respective market concentration ratios, but may be several factors greater than 1/N. On this basis, Ansongo and Bourem are less concentrated than either Tombouctou or Gao. Overall, the Koutiala market is relatively least concentrated while Bamako is most concentrated.[18]

These two measures, the concentration ratio and Herfindahl Index, may produce contradictory results, but both are useful. Both measures show that the Tombouctou and Gao markets are more concentrated than markets in Mopti, Ségou and Koutiala, suggesting that these two markets in the Northeast represent low-grade oligopolies.

8.3. Urban Wholesale Market Conduct

This section looks primarily at elements of coordination to describe urban market conduct: sources of information and the process of price discovery, financing arrangements for cereal transactions, grain storage practices and conflict and cooperation.

8.3.1. Information Needs and Price Discovery

As noted in Chapter 6, marketing strategies depend on access to reliable information in order to make rational decisions to the extent possible, both for short immediate price discovery and longer term investment planning.

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[18]Notice that Bamako, with the lowest CR_8 and hence the least concentrated in absolute terms, has the highest Herfindahl Index relative to the expected value of equal market shares, 4.5 times greater, making the Bamako market relatively most concentrated.

8.3.1.1. Trader Sources of Market Information

Tables 8.6 and 8.7 break down trader sources of price information and market conditions by usual supply sources and sales locations, respectively. According to Table 8.6, most traders obtain supply-source market information by word of mouth from their own suppliers (91.9 percent) or other traders (86.0 percent), followed by family or personal friends (71.1 percent). This pattern holds across cities and regions and between wholesalers and semi-wholesalers. Only traders in the South get information from field agents and contacts in equally high terms (95.7 percent).

Supply-market sources of information are somewhat more diversified in the Northeast. Of the entire national sample, only two traders from Tombouctou pay someone (other than hired staff and apart from any usual reciprocal arrangements with field contacts) for the express purpose of reporting market price information to them. Use of field agents is unexpectedly low (28.1 percent), in view of the significant paddy production along the Niger. Reliance on transporters is decidedly lower in the Northeast than in the rest of the country.

As for sources of price information and market conditions at usual sales locations, Table 8.7 indicates that most information is obtained informally, again from other traders (87.9 percent), own retailers (87.9 percent, with retailers replacing suppliers) and family and social contacts (66.3 percent). Traders in the South depend strongly on information from their own agents and field contacts (95.8 percent). Transporters continue to represent a major source of information in the South and Mopti. Only one trader, from Gao, pays someone to report market price information at usual sales locations.

In all likelihood, the diversity of market information sources signals differences in the importance of particular information. Moreover, comparison of trader views about the importance of a particular item of information and their degree of being informed about it

Table 8.6

Sources of Price Information and Market Conditions for Usual *Supply Sources*, according to Urban Grain Traders in Mali

	Northeast (N=32)		Mopti (N=13)		South (N=24)		Bamako (N=31)		Row Totals (N=100)		Whole-salers (N=49)		Semi-wholesalers (N=51)		Row Totals (N=100)	
	n	Pct	n	Pct	n	Pct	n	Pct	n	Pct	n	Pct	n	Pct	n	Pct
1. The newspaper, *L'Essor*	1	3.1	0	0.0	0	0.0	2	6.5	3	3.0	3	6.3	0	0.0	3	3.0
2. The Chamber of Commerce	5	15.6	1	7.7	3	13.0	7	22.6	16	16.2	14	29.2	2	3.9	16	16.2
3. Other grain traders	24	75.0	13	100.0	24	100.0	25	80.6	86	86.0	41	83.7	45	88.2	86	86.0
4. My suppliers themselves	26	81.3	12	92.3	24	100.0	29	96.7	91	91.9	46	95.8	45	88.2	91	91.9
5. My agents or contacts in the countryside	9	28.1	4	30.8	22	95.7	15	48.4	50	50.5	26	54.2	24	47.1	50	50.5
6. Transporters	9	28.1	9	69.2	16	69.6	24	77.4	58	58.6	31	63.3	27	54.0	58	58.6
7. Family and personal friends	23	71.9	11	84.6	18	81.8	17	56.7	69	71.1	33	70.2	36	72.0	69	71.1
8. Economic Affairs Agents	0	0.0	0	0.0	1	4.3	1	3.3	2	2.0	2	4.3	0	0.0	2	2.0
9. The local administration	1	3.1	0	0.0	0	0.0	0	0.0	1	1.0	1	2.1	0	0.0	1	1.0
10. The SIM *Quarterly Bulletin*	2	6.3	0	0.0	0	0.0	8	26.7	10	10.2	9	19.1	1	2.0	10	10.2
11. SIM weekly radio broadcasts	13	40.6	0	0.0	19	90.5	12	40.0	44	45.8	20	42.6	24	49.0	44	45.8
12. Producers	.	.	.	.	1	50.0	1	100.0	2	66.7	1	100.0	1	50.0	2	66.7
13. Other sources	6	19.4	0	0.0	0	0.0	3	12.0	9	11.1	2	5.3	7	16.3	9	11.1

Note: N refers to sample size; **n** refers to the number of traders selecting the given source of information; and **Pct** refers to percent of valid responses.
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Table 8.7

Sources of Price Information and Market Conditions for Usual *Sales Locations*, according to Urban Grain Traders in Mali

	Northeast (N=32)		Mopti (N=13)		South (N=24)		Bamako (N=31)		Row Totals (N=100)		Whole-salers (N=49)		Semi-wholesalers (N=51)		Row Totals (N=100)	
	n	**Pct**	**n**	**Pct**	**n**	**Pct**	**n**	**Pct**	**n**	**Pct**	**n**	**Pct**	**n**	**Pct**	**n**	**Pct**
1. The newspaper, *L'Essor*	1	3.1	0	0.0	0	0.0	0	0.0	1	1.0	1	2.0	0	0.0	1	1.0
2. The Chamber of Commerce	2	6.3	0	0.0	1	4.5	5	16.7	8	8.2	7	14.6	1	2.0	8	8.2
3. Other grain traders	25	78.1	13	100.0	24	100.0	25	83.3	87	87.9	43	87.8	44	88.0	87	87.9
4. My retailers themselves	26	81.3	13	100.0	23	95.8	25	83.3	87	87.9	44	89.8	43	86.0	87	87.9
5. My agents or contacts in the countryside	9	28.1	3	23.1	23	95.8	17	56.7	52	52.5	31	63.3	21	42.0	52	52.5
6. Transporters	12	37.5	9	69.2	18	78.3	10	33.3	49	50.0	24	49.0	25	51.0	49	50.0
7. Family and personal friends	18	56.3	11	84.6	20	87.0	16	53.3	65	66.3	31	64.6	34	68.0	65	66.3
8. Economic Affairs Agents	0	0.0	0	0.0	1	4.2	0	0.0	1	1.0	1	2.1	0	0.0	1	1.0
9. The local administration	2	6.3	0	0.0	0	0.0	0	0.0	2	2.0	2	4.1	0	0.0	2	2.0
10. The SIM *Quarterly Bulletin*	3	9.4	0	0.0	0	0.0	8	26.7	11	11.1	9	18.4	2	4.0	11	11.1
11. SIM weekly radio broadcasts	9	29.0	0	0.0	20	87.0	10	33.3	39	40.2	20	41.7	19	38.8	39	40.2
12. Other sources	6	20.0	0	0.0	0	0.0	2	8.7	8	9.8	1	2.6	7	15.9	8	9.8

Note: **N** refers to sample size; **n** refers to the number of traders selecting the given source of information; and **Pct** refers to percent of valid responses.
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shows sharp regional contrasts in what traders believe to be key information. It also shows the logic that when certain traders don't consider something critical, they don't bother informing themselves about it. For example, most traders in the Northeast (75.0 percent) believe that information concerning the distribution and sale of food aid is either "crucially important" or simply "important" to know for their business, whereas only one in six traders in the South (16.7 percent) thinks so. Further, traders in the South show little interest in weather information nor consider themselves well informed, possibly because the impact of rainfall fluctuations on the cereals trade in the highest rainfall region of the country is relatively less pronounced. In contrast, more than 80 percent of the traders in the Northeast consider weather information "crucially important" or "important" because their commerce is sensitive to changes in rainfall levels and Niger River flooding through cereal price movements (Steffen, 1990).

8.3.1.2. Cereal Price Discovery

Price discovery is the process by which buyers and sellers arrive at specific prices. The outcome of this process depends on access to reliable market information. Table 8.8 shows the first three cumulative factors that urban traders take into account when negotiating the purchase price of cereals.[19] Responses of traders in the Northeast closely follow those of traders elsewhere. The market purchase price of the day was cited most often during the first round, taking more than 80 percent of the combined responses in all four regions/cities, and most often cited after three consecutive rounds (34.2 percent), followed by market supply and demand conditions (24.7 percent). Effectively, there is little difference between these first two factors. Under competitive market conditions, each factor expresses the other.

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[19]Not all traders chose to identify three factors, explaining why the column totals are not exact multiples of three times the sample size.

Table 8.8
Purchase Price Discovery: First Three Cumulative Factors taken into account by Urban Grain Traders in Mali

	Northeast		Mopti		South		Bamako		Row Totals	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
1. Market purchase price of the day	28	33.3	13	34.2	23	37.7	30	32.6	94	34.2
2. Expected purchase price in one month	3	3.6	.	.	.	.	13	14.1	16	5.8
3. Expected purchase price in six months	3	3.6	.	.	.	.	.	.	3	1.1
4. Expected purchase price in one year	2	2.4	.	.	.	.	.	.	2	0.7
5. Expected profit at sales location	11	13.1	2	5.3	16	26.2	16	17.4	45	16.4
6. Expected profit on the day of sale	6	7.1	3	7.9	.	.	7	7.6	16	5.8
7. Market purchase price of the day for substitute cereals	2	2.4	3	7.9	1	1.6	1	1.1	7	2.5
8. Expected market purchase price of substitute cereals in six months	.	.	.	.	1	1.6	.	.	1	0.4
9. Market supply and demand conditions	16	19.0	13	34.2	18	29.5	21	22.8	68	24.7
10. Market supply and demand conditions for substitute cereals	1	1.2	.	.	1	1.6	1	1.1	3	1.1
11. Availability of transportation	7	8.3	4	10.5	1	1.6	.	.	12	4.4
12. Availability of storage	2	2.4	.	.	.	.	2	2.2	4	1.5
13. Availability of sacks	1	1.2	.	.	.	.	.	.	1	0.4
14. Offsetting expected profits on non-cereal trade which allow flexibility in bargaining, even buying high	2	2.4	.	.	.	.	.	.	2	0.7
15. Other factors	.	.	.	.	.	.	1	1.1	1	0.4
Column Totals	84	100.0	38	100.0	61	100.0	92	100.0	275	100.0

Note: Multiple responses were possible. Percent refers to percent of responses.
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As with factors taken into account for purchase prices, traders identified the market sales price as the most critical factor they consider when striking agreement on the sales price (33.3 percent), as shown in Table 8.9, followed again by market supply and demand conditions (21.2 percent).

Traders thus conceptualize all transactions in terms of *margins*, taking market prices and conditions as givens. It appears that more traders are accustomed to constant profit margins under stable market conditions, such as those prevailing in 1988/89, than variable margins, a phenomenon noted in previous research (Dembélé, Dioné and Staatz, 1986b; Phélinas, 1989a)[20]. Taken together, the constant and variable profit motives account for about one-third of total responses (32.6 percent). In the Northeast and Bamako, these considerations are foremost in trader strategies.

According to traders in the producing zones, rural purchase prices are functionally dependent on the sales price in the nearest urban center, regardless of final destination. Similarly, urban purchase prices also depend on urban sales prices. Such observations are consistent with models of marketing margins where primary demand is determined by the response of the ultimate consumers (Tomek and Robinson). Only during the late rainy season or early harvest season, when the level of primary supply is yet uncertain, do rural prices influence urban prices. These patterns are likely to hold in the Northeast, although only for local rice in the case of regional production.

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[20]According to traders in the producing zones, the determining factor whether to buy is the short term difference between purchase price and sales price, not absolute price levels. Because traders there store as little as possible (Section 8.3.3.), their sales are not timed as a function of seasonal price movements. When prices are relatively stable, price spreads and hence profits also tend to be stable. A difference of 5 CFAF per kilogram between purchase price and sales price, over period between three days to one week, is generally considered satisfactory (Phélinas, 1989a).

Table 8.9

Sales Price Discovery: First Three Cumulative Factors taken into account by Urban Grain Traders in Mali

	Northeast		Mopti		South		Bamako		Row Totals	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
1. Market sales price of the day	27	31.0	12	35.3	24	38.7	28	31.1	91	33.3
2. Expected sales price in one month	6	6.9	.	.	.	.	8	8.9	14	5.1
3. Expected sales price in six months	2	2.3	.	.	.	.	.	.	2	0.7
4. Expected sales price in one year	1	1.1	.	.	.	.	.	.	1	0.4
5. My usual (or constant) profit margin after deducting costs	16	18.4	1	2.9	17	27.4	22	24.4	56	20.5
6. A variable profit margin, after deducting costs	13	14.9	3	8.8	5	8.1	12	13.3	33	12.1
7. Market sales price of the day for substitute cereals	.	.	3	8.8	.	.	2	2.2	5	1.8
8. Market supply and demand conditions	12	13.8	13	38.2	15	24.2	18	20.0	58	21.2
9. Market supply and demand conditions for substitute cereals	.	.	2	5.9	1	1.6	.	.	3	1.1
10. Availability of transportation	3	3.4	.	.	.	.	.	.	3	1.1
12. Offsetting expected profits on non-cereal trade which allow flexibility in bargaining, even selling low	4	4.6	.	.	.	.	.	.	4	1.5
13. My immediate needs for liquidity, even if I lose money selling low	2	2.3	.	.	.	.	.	.	2	0.7
14. Other factors	1	1.1	.	.	.	.	.	.	1	0.4
Column Totals	87	100.0	34	100.0	62	100.0	90	100.0	273	100.0

Note: Multiple responses were possible. Percent refers to percent of responses.
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In response to further questions (data not shown), a surprising minority of all traders (19 percent) indicated that traders collude in effort to set purchase prices, but more than half of the Mopti sample (61.5 percent) and about one-third of the Northeast sample (34.4 percent). Several larger wholesalers in Mopti allegedly lowered their sales prices in concert, forcing others to realign their sales prices (Phélinas, 1989a). Some traders allowed that purchase prices could be set tacitly, through price leadership without explicit agreement, or that under supply scarcity, suppliers were in a position to dictate the purchase price by others. Traders acknowledge the ability of large traders to influence market prices up or down as a function of larger volumes transacted or rebates offered.

Yet, the large majority of traders claimed that price-fixing was impossible, first, because information circulates so rapidly that the purchase price is already known. Second, differences in quality and origin among cereals lead to price differentials.[21] Third, competition among traders undermines any attempts to set prices, because someone was bound to "cheat" by offering more. Similar explanations were given in response to the question whether traders colluded to fix their sales prices.

Departures from the *equilibrium* price for the same cereal are rare or small (Phélinas, 1989a), although in abundant supplies or market gluts, liquidity constraints often force smaller traders to reduce their margins. In well provisioned markets, buyers are aware of their bargaining power to negotiate lower prices. Indeed, prices become more variable, depending in part on credit repayment deadlines (section 8.3.2.) which compel traders to sell even at a loss. In periods of shorter supplies, bargaining power shifts to the sellers.

[21]It is not clear how these first two reasons necessarily preclude price fixing, particularly if barriers to entry exist (Table 8.2).

8.3.2. Financial Needs and Use of Credit by Grain Traders

The task of financing the marketing of Malian cereals falls on coarse grain traders in southern producing zones, who are obliged to pay cash to producers or advance cash to their assemblers. These producing-zone traders often sell their cereals on short-term credit to traders in other cities. Repayment is expected within several weeks or when the initial delivery is completely sold (Dembélé, Dioné and Staatz, 1986; Mehta; Phélinas, 1989a). As the financial resources of producing-zone traders are not necessarily greater than traders elsewhere, this raises the question of *their* source of finances. Amselle and Bagayogo conclude that the initial finances lubricating the entire system flow from the half-dozen Bamako-based rice importers, whose links with international grain merchants offer them access to 90-day credits on favorable terms. In years of large-scale rice imports, commercial relations between Bamako importers and producing zone traders "prefinance" the purchase of domestic cereals: village rice sellers also function as coarse grain assemblers, advancing rice on credit for repayment in kind in coarse grains after the harvest, with producing zone grain traders as intermediaries (Amselle and Bagayogo).

The advent of PRMC credit programs (Annex 2.1) has spread some of the financial burden and risk of cereals marketing. As of 1988/89, however, no trader in the Northeast had benefitted from these programs. Four traders (three in Tombouctou and one in Gao) received a total of 97 million CFAF in credits for the purchase of regional cereals through OPAM as supervising public agency.[22] Late approval of the loans in June 1989 in the case

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[22]According to regulations of the West African Monetary Union (WAMU), of which Mali is a member, subsidized credit was authorized for the purchase of agricultural crops or production inputs only. Such credit was to be extended and supervised by a public agency, in this case, OPAM (see Steffen and Dembélé, 1987, for discussion of these regulations). The requirement for public-sector supervision ended when the WAMU prohibited subsidized-interest loans in late 1989.

of Tombouctou traders effectively eliminated the possibility of purchasing regional crops. Delivery of crops purchased in Mopti was further delayed until near the end of the rainy season in September-October. Thus, formal sector credit had little impact on the Tombouctou market during the survey year. The loan beneficiary in Gao was able to buy cereals with his funds, but, like his counterparts in Tombouctou, was faced with the likelihood of financial loss due to declining prices on a saturated market (Gueymard *et al.*).

For all practical purposes, financing and credit in the Northeast has relied on the same relations built on mutual trust, characteristic of informal sector loans in the rest of Mali. This section investigates how and under what terms traders in the Northeast finance their transactions.

8.3.2.1. Experience in the Use of Credit

Several preliminary indicators of the use of credit for cereals marketing by traders in the Northeast are shown in Table 8.10, with responses from Mopti traders for contrast. Just half of all traders in the Northeast (50.0 percent) buy cereals on credit (and only one-third in Gao), compared to about five of six traders (84.6 percent) in Mopti. Nearly two-thirds of the traders in the Northeast (63.3 percent) and all of the Mopti traders claim that they are able to find sufficient short-term credit on short notice, implying that credit does not pose a constraint for a specific transaction.[23] This is a critical point because credit purchases do not typically involve a transfer of funds, but a request for (or acceptance of) cereals on consignment for repayment when sold (in part, for the reason below).

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[23]Half of those unable to find credit on moment's notice cited the lack of a bank account and relations with a bank as the main reason.

When asked whether money or access to credit to buy cereals was the binding constraint in the short term, rather than adequate storage space, traders in the Northeast were evenly divided. Eighty percent of Tombouctou traders identified access to credit, compared to 20 percent of Gao traders.

Table 8.10. Use of Credit and Access to Credit for Cereals Marketing by Urban Grain Traders in the Northeast and Mopti, 1988/89

	Tombouctou	Gao	Ansongo-Bourem	Northeast	Mopti
Percent who buy cereals on credit					
Wholesalers	50.0 4	28.6 7	100.0 2	46.2 13	100.0 6
Semi-Wholesalers	42.9 7	40.0 5	71.4 7	52.6 19	71.4 7
All Traders	45.5 11	33.3 12	77.8 9	50.0 32	84.6 13
Percent who can find sufficient credit for cereals marketing on short notice					
Wholesalers	100.0 4	66.7 6	100.0 2	83.3 12	100.0 5
Semi-Wholesalers	42.9 7	25.0 4	71.4 7	50.0 18	100.0 4
All Traders	63.6 11	50.0 10	77.8 9	63.3 30	100.0 9
Percent with a bank account					
Wholesalers	100.0 4	66.7 6	0.0 2	66.7 12	0.0 5
Semi-Wholesalers	57.1 7	50.0 4	0.0 7	33.3 18	25.0 4
All Traders	72.7 11	60.0 10	0.0 9	46.7 30	11.1 9
Percent who have borrowed from a bank for any purpose					
Wholesalers	75.0 4	33.3 6	0.0 2	41.7 12	0.0 5
Semi-Wholesalers	28.6 7	25.0 4	14.3 7	28.6 18	25.0 4
All Traders	45.5 11	30.0 10	11.1 9	30.0 30	11.1 9
Percent willing to borrow on commercial terms (repayment with interest) for marketing cereals					
Wholesalers	100.0 4	33.3 6	50.0 2	58.3 12	100.0 5
Semi-wholesalers	71.4 7	50.0 4	57.1 7	61.1 18	75.0 4
All Traders	81.8 11	40.0 10	55.6 9	60.0 30	88.9 9
Percent who sell cereals on credit					
Wholesalers	100.0 4	85.7 7	100.0 2	92.3 13	66.7 6
Semi-Wholesalers	100.0 7	60.0 5	85.7 7	84.2 19	42.9 7
All Traders	100.0 11	75.0 12	88.9 9	87.5 32	53.8 13

The fine type in each cell indicates the number of respondents.
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Experience with formal-sector loans among traders is limited, in part due to the absence of banks. The four private banks in Mali operated few branches outside of Bamako. None had branches in the Northeast in 1988/89. The government bank, *Banque de développement du Mali* (BDM), had branches around the country, but was undergoing reorganization after near collapse from bankruptcy following years of poor lending practices. BDM branches in Tombouctou and Gao reopened in 1989 for deposits and withdrawals only. All loan requests were transferred to Bamako headquarters for decision. Against this backdrop, it is unclear how many trader bank accounts in Table 8.10 remained active or solvent. While not quite half of the traders in the Northeast had bank accounts (46.7 percent), but none in Ansongo-Bourem, only one in the Mopti sample did. Even fewer in the Northeast had borrowed from a bank, reflecting perhaps the distrust of banks by traders documented elsewhere (Amselle and Bagayogo).

Even so, a majority of traders in each city, except Gao, would be willing to borrow on commercial terms, including reimbursement with interest. Of those unwilling to borrow from a bank, one-third expressed fears and suspicions of banks. Only one trader expressed lack of interest based on Islamic sanctions against usury.

On this basis, PRMC credit programs may not be addressing the most binding constraint, given banking arrangements for established traders. More programs targeted to *new* traders may be useful in easing market entry (Table 8.2) and reducing market concentration (Table 8.5).

8.3.2.2. Use of Informal Credit for Cereal Purchases

As just mentioned, use of credit for cereals purchases more often means accepting cereals on consignment from another trader, where acceptance entails an implicit contract for future payment. Of the traders who "buy" on credit, Mopti traders buy a larger portion of their cereals on credit (more than half for each major crop) than traders in the Northeast who buy about half of their cereals on credit only for rice and paddy. The source of credit differs according to the cereal for Mopti traders while most Northeast traders (62.5 percent) turn to the same source, suggesting either that they deal in fewer cereals or that they have a usual supplier of all cereals.

Credit sources differ between Mopti and the Northeast. Mopti traders buy millet, sorghum and maize on credit first from rural assemblers and secondly from travelling wholesalers or transporters. In contrast, traders in the Northeast rely on established wholesalers as their primary source of credit for all cereals with the exception of a few traders who buy on credit from farmers.[24]

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[24]This somewhat unusual phenomenon for a good production year is potentially insightful from a food security perspective. Cases of traders buying cereals on credit from farmers could signal distress sales by farmers. Nonetheless, these cases are rare, limited to two traders in Tombouctou and two in Ansongo-Bourem. (Gao traders buy only millet and sorghum on credit and then, only from permanent and occasional wholesalers).

Two traders in Tombouctou buy millet from farmers on credit. One trader buys sorghum and another buys paddy from farmers on credit. Terms of repayment are six months or longer in the case of millet and paddy (terms are not known for sorghum).

This suggests a longer-term production or other contractual relationship — perhaps crop purchases on credit in exchange for production inputs and/or cash for the next crop. This was the case of one large, diversified Tombouctou trader (one of the two buying on credit), with family connections in the Goundam-Diré delta area, 100 kms up-River.

Given Tombouctou's relatively enclave status part of the year, it is not surprising that some Tombouctou traders seek better backward linkages with production sources. This contrasts with the case of Ansongo-Bourem. Both River towns are situated in and near irrigated and recession paddy perimeters where contact with farmers is frequent and, presumably, more casual since credit is paid within one week or less. Only one trader in Ansongo-Bourem buys paddy and two buy local rice from farmers on credit.

Trader purchases of cereals from farmers on credit, unfortunately, cannot be cross-checked using rural household or rural market data. First, no household surveys were conducted in the Tombouctou region. Second, the sources of household income questionnaire (Chapter 4) asked the value of cereal sales in terms of cash payment or estimated value of payment in kind or trades, not sales on credit (unlike the household expenditures questionnaire which registered household *purchases* on credit).

Third, the rural trader purchases questionnaire (Chapter 7) focused on price per unit and distance from supply source, rather than purchases on credit.

The reimbursement period is also shorter for Mopti traders, one week being most frequently cited, followed by 2-3 days. In the Northeast, reimbursement extends from 2-4 weeks, although this can be variable in the case of paddy.

Traders reimburse with neither interest nor gifts. The value of the loan to be reimbursed is usually the relevant market price of the day of delivery. In attempt to remove the possible influence of the 1988/89 marketing year, those traders having bought cereals on credit were asked whether reimbursement terms varied under conditions of abundant supplies or scarce supplies. According to Mopti traders and most traders in the Northeast, there is no difference between cash purchase price and credit purchase price when supplies are abundant. A constant minority of traders in the Northeast, usually 10-30 percent, stated that the credit price is higher than the cash price. When supplies are scarce, the credit purchase price is higher for millet and sorghum (three-fourths of the Mopti traders) and for maize and 40 percent brokens rice (all Mopti traders) whereas a majority of the Northeast traders still claimed that the credit price was the same as the cash price. As discussed in section 8.3.2., Mopti traders are particularly adverse to tying up capital for long periods, preferring to recover liquidity by taking a loss, if necessary, over the prospect of higher profits later.

When asked whether reimbursement terms varied according to volume, or wholesale and retail, more than half of Mopti traders said that the cash wholesale purchase price and the credit purchase price were the same for millet and sorghum, similar to responses given for credit and cash purchases at the retail level. Responses from traders in the Northeast indicated the same pattern, except that the credit purchase price for paddy and local rice was more expensive than the cash price at the retail level.

More empirically, review of the terms of each trader's most recent cereals purchase on credit at time of survey (some 25 credit purchases) shows the repayment price to be identical to the initial purchase price in each instance. This implies that their trading partners forgo interest income in favor of rapid turnover of stocks. Alternatively, transaction costs in recovering interest payments may be too high to bother with. Either case points to a relatively high ratio of outstanding loans (represented by cereal transfers in kind) to reserves, regardless of initial source, as scarce capital is quickly recycled.

8.3.2.3. Sales of Cereals on Credit

The last entry in Table 8.10 shows that the large majority of traders in the Northeast (and all traders in Tombouctou) sells cereals on credit (87.5 percent), compared to just over half in Mopti (53.8 percent). This is roughly the inverse relation for purchases on credit and follows logically: If Mopti is the principal supply source for cereals from southern Mali and if about half of traders sell on credit, about half of the traders in the Northeast are able to buy on credit.

Mopti traders sell about 10 percent of their millet, sorghum and maize on credit. Traders in the Northeast sell a little more on credit, 10-30 percent. Overwhelmingly, traders in Mopti and the Northeast sell cereals on credit to anyone capable of repayment, rather than limiting their credit sales to a particular clientele. Mopti traders sell most on credit to retailers, followed by transporters, while traders in the Northeast sell most on credit to retailers and then consumers. As with purchases on credit, the usual reimbursement period for sales is one week for Mopti traders and 2-4 weeks for traders in the Northeast.

According to those who sold on credit, the cash sales price does not differ from the credit sales price in Mopti or the Northeast when supplies are abundant, although a minority in the Northeast (about 10 percent, depending on the cereal) claimed that the credit price was higher. During scarcity, three-quarters of the Mopti traders reported that the credit prices was higher, compared to only about one-fourth of traders in the Northeast.

About 80 percent of traders in Mopti and 75 percent in the Northeast sell *retail* cereals on credit for the same price as for cash. Fewer traders are willing to sell on credit at the wholesale level for the same price as cash transactions. The credit wholesale sales price of millet and sorghum is more expensive than the cash wholesale sales price, according to half of the Mopti traders and nearly half of the Northeast traders, slightly higher proportions than for purchases. Traders in Tombouctou stand out from the others, about nine of ten insisting on a higher price for credit sales than cash sales at the wholesale level. The implication is that large volume sales on credit do not sufficiently offset the need for liquidity to enable the Tombouctou trader to sell at the lower cash price. This reflects an appreciation of the time value of money seldom seen in other instances. In practical terms, however, any higher credit prices are passed along by retailers or rural traders who get their supplies from Tombouctou.

Only two traders of 36 who sell on credit (5.6 percent) require repayment with interest. A review of the most recent sale on credit shows that only two traders (both in Tombouctou) charged more for repayment than the cash price, while four traders (all in Tombouctou) took a deliberate loss by selling for less on credit in order to liquidate their stocks.

The foregoing discussion shows that traders use variable credit terms as one more marketing device, along with prices, to ration supplies.

8.3.2.4. Financial Needs and Investment Planning

A final look at financial needs considers investment planning by traders as an indicator of future market coordination. Traders in Mopti and the Northeast were asked to identify their needs for short-term credit, defined as credit to be reimbursed within one year.

Table 8.11 shows the cumulative criteria, after up to three responses, by which traders evaluated short-term credit requirements. Traders in Mopti think in terms of usual purchase and sales volumes by period (36.8 percent), closely followed by whatever credit the creditor can provide (31.6 percent), as if credit needs are never fully satisfied and more credit could be put to productive use. The most prevalent criterion cited by traders in the Northeast concerns credit for the immediate next purchase (30.4 percent), followed distantly by market supply and demand conditions (which call for buying on credit and/or selling on credit which ties up cash, 13.0 percent). For wholesalers and semi-wholesalers alike, credit for the next purchase ranked first (31.0 percent and 30.0 percent, respectively). Few traders in the Northeast and none in Mopti offer evidence that their short term credit needs are based on a planned strategy.

When evaluating their needs for long-term credit, to be reimbursed in installments over two to ten years, traders in Mopti and the Northeast want to invest to protect market shares (31.6 percent and 20.8 percent, respectively) and to expand scale of operations (26.3 percent and 25.0 percent, respectively), as shown in Table 8.12. Both strategies require planning and forethought. Several traders, one in the Northeast and three in Mopti, have not evaluated their long-term credit needs. Two others in the Northeast want to diversify into other areas, although not necessarily out of cereals. Foremost in the long-term needs of *wholesalers* in the Northeast is protection of market shares — such as, through investments in transport, storage and more outlets. Growth in operating scale is cited more frequently by *semi-wholesalers* than wholesalers. There may be some overlap in these responses as growth in scale and protection of market shares are not mutually exclusive.

Table 8.11
Evaluation of Short-Term Credit Needs: First Three Cumulative Factors considered by Urban Grain Traders in the Northeast and Mopti

	Northeast		Mopti		Row Totals		Wholesalers (Northeast)		Semi-wholesalers (Northeast)		Row Totals	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
1. Next anticipated purchase of cereals.	21	30.4	1	5.3	22	25.0	9	31.0	12	30.0	21	30.4
2. Next anticipated sale of cereals.	8	11.6	2	10.5	10	11.4	4	13.8	4	10.0	8	11.6
3. Usual volume of purchases and sales.	5	7.2	7	36.8	12	13.6	2	6.9	3	7.5	5	7.2
4. My present storage capacity.	8	11.6	2	10.5	10	11.4	3	10.3	5	12.5	8	11.6
5. My present transport capacity.	4	5.8	.	.	4	4.5	3	10.3	1	2.5	4	5.8
6. Last year's operating expenses.	2	2.9	.	.	2	2.3	1	3.4	1	2.5	2	2.9
7. Estimated operating expenses and sales strategy for this year.	5	7.2	.	.	5	5.7	2	6.9	3	7.5	5	7.2
8. Whatever my creditors can lend me.	4	5.8	6	31.6	10	11.4	.	.	4	10.0	4	5.8
9. Market supply and demand conditions.	9	13.0	.	.	9	10.2	4	13.8	5	12.5	9	13.0
10. I don't need short-term credit.	1	1.4	.	.	2	2.3	.	.	.	.	1	1.4
11. I don't know.	1	1.4	.	.	1	1.1	1	3.4	1	2.5	1	1.4
12. Other.	1	1.4	1	5.3	1	1.1	.	.	1	2.5	1	1.4
Column Totals	69	100.0	19	100.0	88	100.0	29	100.0	40	100.0	69	100.0

Note: Multiple responses were possible. Percent refers to percent of responses.
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Perhaps most insightful into the immediate course of grain trader activities is the approximate percent of profits from cereals marketing that traders reinvest in their businesses at present. Nearly half of the traders in the Northeast (46.9 percent) "do not think about it, but give priority to day-to-day problems," a figure about equally divided among wholesalers and semi-wholesalers. Investments, if any, are made haphazardly, not according to some strategic blueprint.

The cumulative message of this section is that credit may be sufficient for most traders at their present scale of operations because credit is received in kind. While most traders state their willingness to take out commercial loans if made available, a good number would not know where to invest it. Conceivably, access to credit may represent such a distant probability to some traders that they do not think about investment strategies or multi-year planning. The danger is that expanded credit availabilities, like improvements in physical infrastructure, could result in the proliferation of many traditional scale operations, rather than gains in specialization, scale economies and modern management methods (Harrison *et al.*).[25]

[25]Pooling of capital by traders, such as through the PRMC-fostered economic interest groups (*groupements d'intérêt économiques, GIEs*) is a substitute for credit. Thus, alternatives to credit programs are programs which facilitate pooling of capital and regulations for its use.

Table 8.12
Evaluation of Long-Term Credit Needs: First Three Cumulative Factors considered by Urban Grain Traders in the Northeast and Mopti

	Northeast		Mopti		Row Totals		Wholesalers (Northeast)		Semi-wholesalers (Northeast)		Row Totals	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
1. Any necessary investment to protect my market share.	15	20.8	6	31.6	21	23.1	8	25.8	7	17.1	15	20.8
2. My planned investments for cereals transport.	8	11.1	1	5.3	9	9.9	6	19.4	2	4.9	8	11.1
3. My planned investments for cereals storage.	12	16.7	2	10.5	14	15.4	5	16.1	7	17.1	12	16.7
4. My multi-year marketing strategy.	10	13.9	.	.	10	11.0	4	12.9	6	14.6	10	13.9
5. Increase in my marketing scale.	18	25.0	5	26.3	23	25.3	6	19.4	12	29.3	18	25.0
6. Whatever my creditors can lend me.	4	5.6	1	5.3	5	5.5	.	.	4	9.8	4	5.6
7. I haven't evaluated my long-term credits.	1	1.4	3	15.8	4	4.4	.	.	1	2.4	1	1.4
8. I don't need long-term credit.	1	1.4	.	.	1	1.1	.	.	1	2.4	1	1.4
9. I don't like long-term credit.	1	1.4	1	5.3	2	2.2	1	3.2	.	.	1	1.4
10. I would like to invest in other, more profitable activities.	2	2.8	.	.	2	2.2	1	3.2	1	2.4	2	2.8
Column Totals	72	100.0	19	100.0	91	100.0	31	100.0	41	100.0	72	100.0

Note: Multiple responses were possible. Percent refers to percent of responses.
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8.3.3. Urban Trader Grain Storage Practices

8.3.3.1. Basic Indicators

Table 8.13 presents some basic indicators of cereal storage capacity, ownership and sufficiency of traders in the Northeast and Mopti. Traders in Tombouctou have the largest average storage capacity, 717.3 metric tons (MT), about four times greater than that in Gao and seven times greater than that in Ansongo-Bourem. Compared to traders in Mopti, who were reticent to give storage capacity figures, traders in the Northeast have spacious storage capacity.

Except for semi-wholesalers in Gao, traders in the Northeast own most of their storage capacity for cereals, the rest being rented. All traders in Tombouctou as well as wholesalers in Ansongo-Bourem own some storage capacity, while not all traders in Gao or all semi-wholesalers in Ansongo-Bourem are owners. The most frequently cited source of financing for the acquisition of warehouses was the trader's own funds. Some traders in Tombouctou and Ansongo-Bourem reported inheriting their warehouses, but none in Gao. A few traders bought their warehouses with a family loan, but none borrowed from the bank.

Only about one-fourth of traders in the Northeast store exclusively cereals in their warehouses. Storing other products in the same warehouse, unless well partitioned, may preclude fumigation or other stock protection practices. It may also imply that few traders specialize in cereals, as reported by traders in Tombouctou in Table 8.1.

Table 8.13

Average Cereal Storage Capacity, Ownership and Sufficiency: Urban Grain Traders in the Northeast and Mopti

	Tombouctou	Gao	Ansongo-Bourem	Mopti
Available storage capacity for cereals (MT)				
Wholesalers	847.5 4	245.0 6	115.0 2	65.0 2
Semi-Wholesalers	642.9 7	72.5 4	93.7 7	51.7 3
All Traders	717.3 11	176.0 10	98.6 9	57.0 5
Of which owned storage capacity (MT)				
Wholesalers	737.5 4	168.3 6	115.0 2	0.0 2
Semi-Wholesalers	542.0 7	17.5 4	78.2 7	0.0 4
All Traders	618.2 11	108.0 10	86.3 9	0.0 6
Percent who own storage capacity				
Wholesalers	100.0 4	83.3 6	100.0 2	0.0 3
Semi-Wholesalers	100.0 7	25.0 4	57.1 7	33.3 3
All Traders	100.0 11	60.0 10	66.7 9	16.7 6
Percent who store only cereals in their warehouses				
Wholesalers	25.0 4	83.3 6	50.0 2	50.0 6
Semi-Wholesalers	28.6 7	25.0 4	14.3 7	66.7 3
All Traders	27.3 11	60.0 10	22.2 9	55.6 9
Percent who claim that present storage capacity is sufficient				
Wholesalers	25.0 4	66.7 6	100.0 2	16.7 6
Semi-Wholesalers	71.4 7	50.0 4	42.9 7	50.0 2
All Traders	55.5 11	60.0 10	55.6 9	25.0 8

The fine type in each cell indicates the number of respondents.
CESA-MSU Food Security Project Surveys, 1988/89

Just over half of traders in the Northeast claim that their present storage capacity is sufficient. Inadequate capacity was twice as likely to be felt during the rainy season than the harvest/post-harvest season, possibly due to planned inventory build-up while roads are still passable. The period most often cited by Mopti traders was right after harvest. When asked how they deal with the problem of insufficient storage, half of the traders in the Northeast said that they store cereals in their own home or the home of a friend (Mopti traders did not respond). About one-third rent storage space with another trader. No one claimed to store cereals outdoors or engage in discount sales due to lack of space.

8.3.3.2. Length of Storage and the Ratio of Stocks to Sales

Previous research using this same data set has shown that about two-thirds (64.3 percent) of the traders in the Northeast would favor a requirement to maintain a minimum volume of cereals in storage. Those in favor cited benefits of stable supplies and avoidance of total drawdown of stocks. A small number indicated their willingness to store the required tonnage, provided they were given purchase, transport and storage credits (Steffen and Dembélé, 1990).[26]

One means to empirically evaluate trader perceptions about supply uncertainties and risk of supply ruptures is to measure the ratio of total grain in storage to average total monthly grain sales for a given period, chosen here as from January to August 1989. Multiplying the ratio by 100 gives stocks as a percentage of sales. This ratio also represents an implicit indicator of the length of storage.

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[26]This series of questions was not totally hypothetical, but based on a draft directive of the Economic Affairs Agency which had recently been withdrawn.

Table 8.14 shows that grain inventories relative to average monthly sales are smaller in the southern producing zones and Mopti than anywhere else in Mali.[27] The current storage practice is one of rapid turn-over of stocks and near symmetry between grain purchases and grain sales.[28] This is shown by the low ratio of stocks on hand as of September 1, 1989 to average monthly cereals turnover for the period January 1 - August 31, 1989.

One possible explanation is that this low rate of storage is analogous to the "just in time" inventory management technique pioneered by Japanese manufacturers in which the buyer takes delivery within a tightly controlled period, allowing very little tolerance for missed deadlines. This method of stock management, rapid purchases and sales, implies a high degree of confidence in market stability and performance and consistent cereals quality standards. Traders in Ségou and Mopti, having the lowest stocks/sales ratio, exemplify this "just in time" stock management technique best.[29] This rapid turnover effectively shifts the incidence and of longer term storage costs — and risks — to farmers, "importing zone" traders and the government (SNS) and away from traders, as has been widely observed (see, for example, Dembélé and Steffen, 1988b). An alternative explanation is that traders in the

[27]Wholesalers in Koutiala, Sikasso, Mopti and particularly Ségou store relatively little (see also Mehta, Gabre-Madhin). Curiously, both wholesalers and semi-wholesalers in Ségou claim to store virtually no stocks, negligible stocks in the case of wholesalers and none at all for semi-wholesalers (Steffen and Dembélé, 1990). Phélinas (1989a) characterizes storage by traders in Koutiala, Mopti and Ségou as "involuntary," caused by poor sales. Traders would rather sell, even at a loss, in order to refinance another transaction, than store to sell at a more favorable price.

[28]This is most apparent for millet, sorghum, maize and local rice, as seen in Annex 8.2.

[29]Notice that while average wholesaler sales in Bamako are three times greater than wholesalers in Mopti, average wholesaler stocks in Bamako are more than 23 times greater those in Mopti. The average semi-wholesaler in Mopti sells about half per month as the average semi-wholesaler in Bamako, but stores only a fraction of what his Bamako counterpart stores.

Table 8.14

Stocks as of September 1, 1989/Average monthly sales volumes from January-August 1989

Wholesalers	Average Stocks on September 1, 1989	Average monthly sales from January 1 to August 31, 1989	Ratio: Stocks/Sales	Stocks as Percent of Sales	N
Tombouctou	273.4 T	36.6 T	7.47	747.4	4
Gao	160.7 T	17.9 T	8.99	899.0	6
Mopti	23.6 T	92.2 T	0.26	25.6	5
Ségou	0.2 T	118.4 T	0.00	0.2	6
Koutiala	30.1 T	65.8 T	0.46	45.7	4
Sikasso	14.3 T	19.3 T	0.74	74.1	2
Bamako	553.9 T	308.4 T	1.80	179.6	13

Semi-Wholesalers	Average Stocks on September 1, 1989	Average monthly sales from January 1 to August 31, 1989	Ratio: Stocks/Sales	Stocks as Percent of Sales	N
Tombouctou	74.7 T	6.3 T	11.83	1182.6	6
Gao	125.8 T	40.7 T	3.09	309.0	3
Mopti	0.7 T	32.9 T	0.02	2.2	6
Ségou	0.0 T	16.7 T	0.00	0.0	8
Koutiala	4.0 T	18.0 T	0.18	18.1	5
Sikasso	5.2 T	8.3 T	0.62	61.9	6
Bamako	134.9 T	60.0 T	2.25	224.7	11

All Traders	Average Stocks on September 1, 1989	Average monthly sales from January 1 to August 31, 1989	Ratio: Stocks/Sales	Stocks as Percent of Sales	N
Tombouctou	1,542.0 T	184.2 T	8.37	837.1	10
Gao	1,341.5 T	229.4 T	5.85	584.8	9
Mopti	122.5 T	658.6 T	0.19	18.6	11
Ségou	1.3 T	843.7 T	0.00	0.2	14
Koutiala	140.5 T	352.9 T	0.40	39.8	9
Sikasso	59.6 T	88.6 T	0.67	67.2	8
Bamako	8,683.9 T	4,669.9 T	1.86	186.0	24

Note: In order to calculate the stock/sales ratio for the semi-wholesalers in Ségou, a stock of 1 kg was assumed. One-way ANOVA indicates no statistical difference between **wholesaler** stocks/sales ratios at the 95 percent or 90 percent levels of confidence (F = 2.27, DF = 6, 33 in each case). One-way ANOVA indicates that **semi-wholesaler** stocks/sales ratios in Tombouctou are statistically different from semi-wholesaler ratios in Koutiala, Sikasso, Ségou and Mopti at the 95 percent level of confidence (F = 6.24, DF = 6, 38). One-way ANOVA indicates that **all-trader** stocks/sales ratios in Tombouctou are statistically different from all-trader ratios in Koutiala, Sikasso, Ségou and Mopti at the 95 percent level of confidence (F = 5.89, DF = 6, 78). **All-trader** stocks/sales ratios in Tombouctou and Gao are statistically different from all-trader ratios in Koutiala, Sikasso, Ségou and Mopti at the 90 percent level (F = 5.89, DF = 6, 78). CESA-MSU Food Security Project Surveys, 1988/89.

producing zones find it difficult to locate and assemble cereals in great quantities from many dispersed sources in the countryside. Initially low stocks which are then shipped out immediately perpetuate low stocks at the trader level.

Traders in the importing zones hold higher stocks, resulting in a higher stocks/turnover ratio. On average, all traders combined from Tombouctou and Gao hold stocks which are about seven times greater than their monthly sales. These traders practice a more conservative "just in case" stock management technique in which stocks are built up in anticipation of ruptures in the supply pipeline. These traders share the risks of storing larger grain quantities with the government (SNS). This storage practice reflects uncertainty and less confidence in the functioning of the market to supply cereals exactly when needed. One-way analysis of variance shows that the stocks/sales ratios of semi-wholesalers in Tombouctou and all traders in Tombouctou are statistically different from those in Koutiala, Sikasso, Ségou and Mopti, respectively (see Note for Table 8.14).

As expected, stocks/sales ratios are highest, the greater the distance from producing zones. Based on the particular observation period used for these calculations, the size of reserves and length of storage practices among traders in the Northeast are not fundamentally different from those in Bamako, but a matter of degree, influenced by the seasonal inaccessibility of parts of the Northeast.[30]

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[30]It is likely that trader stock levels in some cities were high in September 1989 because prices were depressed, reflecting the record harvest of 1988/89, and because reimbursement of PRMC and OPAM credit for grain purchases was not due until September 30. (For example, consumer millet prices during September 1989 were lower than consumer prices in January 1989 in all cities in Table 8.14, except for Tombouctou [see OPAM. *Bulletin d'Information sur le marché céréalier en République du Mali. N°. 5*, (July-August-September-October 1989), p. 30].

According to the optimal storage rule, the expected price increase for an additional volume put into storage must equal the expected cost of storage for the period (D. Gale Johnson). It thus appears that many traders were waiting until the last possible moment, hoping for a price rise before selling their stocks in order to recoup at least part of their

8.3.4. Interstage Cooperation and Conflict

Aspects of transaction costs presented thus far in this chapter can be summarized as follows: Some high degree of bounded rationality exists, particularly concerning barriers to entry (Table 8.2), such as poor initial knowledge of the market, made worse for a few traders by illiteracy, poor understanding of market regulations and no contacts in the bureaucracy to facilitate things. However, a good number of traders claim to have overcome their early difficulties through cooperation with other, experienced traders (Table 8.3), implying that opportunism on the part of experienced traders was held to manageable levels. Table 8.4 suggests that access to information in the Northeast is becoming less asymmetric, as indicated by the high access of traders to telephones and their high use in the cereals trade. Listening to the SIM price broadcasts, moreover, should "broaden" rationality and thereby reduce the worst kinds of opportunism. Reliable information about conditions in distant markets is likely to mitigate the agency problem, a factor usually restricting the development of long distance trade (North), where wholesalers are misled by their agents who report lower sales prices than they actually were in order to pocket the difference (Staatz, Dembélé and Aldridge). Chapter 6 has already pointed out that as asset-specificity is not a compelling problem in the Northeast, neither is hold-up.

Yet, this still leaves uncertainty as a major cost of transacting. Aside from perennial concerns about rainfall and national and local production levels, uncertainty includes all aspects of Williamson's (1985) *ex post* and *ex ante* transaction costs. The *ex ante* costs of monitoring performance and resolving disputes — among traders themselves and between

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storage costs.

traders and regulatory agencies — may be the more troublesome of the two, possibly discouraging traders from entering into long-standing business partnerships in the first place.

8.3.4.1. Cooperation and Conflict among Traders

How traders arrange to obtain their cereals reveals a great deal about efforts to influence interstage cooperation — and the costs of transacting. One direct indicator may be seen in the number of contractual relations to share risk between traders in the same city or different cities. Looking at the first phase Food Security trader sample (Koutiala, Sikasso, Bamako and Mopti), researchers found little evidence of explicit contracts between traders or willingness to enter into them (Dembélé, Dioné and Staatz, 1986b; Phélinas, 1989a). A more recent development in the Bamako market, uncovered by the trader census of 1988, was the entry of several new companies and partnerships comprised of wholesalers pooling expertise and finances (Mehta), although these may be considered single firms.

During the second phase, traders in the Northeast and Mopti were asked whether they entered into contractual relations with one or more of their suppliers. Although "contract" was not defined, responses to related questions put this into context. Table 8.15 shows first, that fewer traders in the Northeast have the same regular supplier on average than traders in Mopti, and that a higher proportion of wholesalers has a regular supplier than semi-wholesalers. For Tombouctou and Gao, traders with a regular supplier average about 30 percent, compared to 70 percent in Mopti.

The contrast between the Northeast and Mopti sharpens in terms of the percentage of traders who buy fixed quantities of cereals at regular intervals, implicitly a standing order for delivery — eight of ten in Mopti, but only 6 of 28 in the Northeast.[31] In the case of Mopti

[31]In Mopti, fixed quantity purchases averaged 10 tons per week, the period cited by all but one trader. Ansongo traders bought an average fixed quantity of 13 tons each week while traders in Bourem bought less over a longer period, an average of 4 tons each quarter.

Table 8.15
Supplier Relations of Urban Grain Traders in the Northeast and Mopti, 1988/89

	Tombouctou	Gao	Ansongo-Bourem	Northeast	Mopti
Percent who have regular suppliers of cereals					
Wholesalers	50.0 (4)	40.0 (5)	100.0 (2)	54.5 (11)	83.3 (6)
Semi-Wholesalers	14.3 (7)	25.0 (4)	50.0 (6)	29.4 (17)	50.0 (4)
All Traders	27.3 (11)	33.3 (9)	62.5 (8)	39.3 (28)	70.0 (10)
Percent who buy a fixed quantity of cereals from a given supplier per period					
Wholesalers	0.0 (4)	0.0 (5)	100.0 (2)	22.2 (11)	83.3 (6)
Semi-Wholesalers	14.3 (7)	0.0 (4)	50.0 (6)	23.5 (17)	75.0 (4)
All Traders	9.1 (11)	0.0 (9)	62.5 (8)	21.4 (28)	80.0 (10)
Percent who have cereal purchase contracts with a supplier in another city					
Wholesalers	75.0 (4)	0.0 (5)	100.0 (2)	45.5 (11)	16.7 (6)
Semi-Wholesalers	28.6 (7)	0.0 (4)	66.7 (6)	35.3 (17)	0.0 (3)
All Traders	45.5 (11)	0.0 (9)	75.0 (8)	39.3 (28)	11.1 (9)
Preferred supply source					
Directly from farmers	9.1 (1)	. .	33.3 (3)	12.1 (4)	83.3 (10)
Independent assemblers	54.5 (6)	7.7 (1)	. .	21.2 (7)	. .
Own agents	9.1 (1)	. .	. .	3.0 (1)	. .
Other permanent wholesalers	. .	23.1 (3)	22.2 (2)	15.2 (5)	. .
Occasional wholesalers or transporters	27.3 (3)	7.7 (1)	. .	12.1 (4)	. .
Direct imports	. .	. .	. .		. .
No particular preference	. .	61.5 (8)	33.3 (3)	33.3 (11)	. .
Other	. .	. .	11.1 (1)	3.0 (1)	16.7 (2)
Total	100.0 (11)	100.0 (13)	100.0 (9)	100.0 (33)	100.0 (12)

The fine type in each cell indicates the number of respondents.
CESA-MSU Food Security Project Surveys, 1988/89

traders, this "standing order" may occur by default. Standard operating procedures require that the Mopti wholesaler buy whatever his supplier offers, even if he cannot pay immediately; the Mopti wholesaler does not risk losing his supplier, who offers credit terms, by refusing to accept delivery (Phélinas, 1989a).[32] Despite regular transactions with suppliers and fixed quantity purchases, Mopti traders evidently hesitate to formalize these supplier relationships through contracts. Only 11 of 28 traders in the Northeast have contracts with suppliers.[33]

Traders in Gao stand apart from the others in that not one buys a fixed quantity periodically nor has a contract with suppliers, long-distance or otherwise. The most plausible explanation is that Gao's all-weather road link with southern Mali offers supply security and flexibility of marketing operations, an option not afforded to traders in Tombouctou, Ansongo and Bourem. Compared with Mopti wholesalers (above), this also offers Gao traders greater control over cereal types and delivery scheduling. These advantages of flexibility and control seem to be confirmed by trader identification of *preferred* supply source (as distinct from habitual supply source, for which firm data are not available). Table 8.15 shows that most Gao traders have no particular preference. Flexibility to buy from diverse suppliers reduces their need for long-standing contractual relations.[34] To a lesser extent, the preference of

[32]As pointed out in Chapter 7, these "unordered" deliveries show up on rural markets in the Northeast.

[33]In her study of marketing strategies of 43 traders in Koutiala, Mopti and Ségou, Phélinas (1989a) found that as a rule, traders buy cereals as a function of general demand conditions, not to fill a specific order from a downstream trader.

[34]These more numerous parallel exchange channels may explain Gao's relatively lower concentration ratio and Herfindahl Index (Table 8.5), compared with Tombouctou, Ansongo and Bourem.

This diversity of suppliers also corroborates the low percentage (33.3 percent) of cereal purchases on credit (Table 8.10). Without steady supplier-buyer relations, buying cereals on credit is less feasible.

Tombouctou traders to buy from independent assemblers and the preference of Mopti traders to buy directly from farmers have a similar effect.[35] These responses, particularly those from Gao, may be partly conditioned on abundant supplies during 1988/89.

Turning to coordination with buyers, the same pattern of few contractual relations repeats itself, as indicated in Table 8.16. Overall, even fewer traders have regular client-buyers, sell fixed quantities to other traders on a periodic basis,[36] or enter into contracts. Gao traders seem to avoid client relationships as much as supplier relationships.[37] More Gao traders claim no preference of client than no preference of supplier.[38]

The slightly stronger preference for steady supplier relations may signify deeper concerns on the part of traders about lack of supplies or supply instability than lack of client demand. Nonetheless, use of buyer-contracts with grain traders may expand in urban areas as wholesalers supply OPAM's former institutional customers (the civil service, military and

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[35]Explanation of supplier preference was given as "higher profitability" in a majority of cases for each market in the Northeast and in Mopti (figures not shown). Other explanations are also based on economic considerations. Note that very few traders prefer their own agents as principal supply source, a situation existing where firms attempt to internalize repeated operations under conditions of uncertainty (Williamson, 1981; asset specificity for traders in the Northeast would pose less of a problem). Possibly, few traders can afford to mount large buying teams.

[36]Two traders in Mopti declared average weekly fixed sales of 10 tons. One trader in Ansongo sells 3 tons to the same buyer every week.

[37]Very few instances of downstream vertical integration were found, where a central market trader has permanent rural outlets (see also Table 7.1 in Chapter 7, showing that only small volumes of cereals are sold by trader agents in weekly rural markets). Further research is required whether this lack of downstream integration is due to the high cost of monitoring performance by agents, poorly capitalized central market traders, or both.

[38]Nearly half of the Mopti traders explained its preference as certainty of rapid, large-quantity sales. As a group, traders in the Northeast offered related explanations of certainty of immediate cash payment (23.3 percent); no discrimination between solvent clients (16.7 percent); and the possibility of making greater profits by having clients come to them, rather than actively seeking clients (16.7 percent).

Table 8.16
Client-Buyer Relations of Urban Grain Traders in the Northeast and Mopti, 1988/89

	Tombouctou	Gao	Ansongo-Bourem	Northeast	Mopti
Percent who have regular client-buyers of cereals					
Wholesalers	25.0 4	33.3 6	50.0 2	33.3 12	40.0 5
Semi-Wholesalers	0.0 7	0.0 4	33.3 6	11.8 17	75.0 4
All Traders	9.1 11	20.0 10	37.5 8	20.7 29	55.6 9
Percent who sell a fixed quantity of cereals to a given client per period					
Wholesalers	25.0 4	0.0 6	0.0 2	8.3 12	50.0 4
Semi-Wholesalers	0.0 7	0.0 4	16.7 6	5.9 17	75.0 4
All Traders	9.1 11	0.0 10	12.5 8	7.4 29	62.5 8
Percent who have cereal sales contracts with a client in another city					
Wholesalers	75.0 4	0.0 6	100.0 2	41.7 12	0.0 4
Semi-Wholesalers	0.0 7	0.0 4	66.7 6	11.7 17	25.0 4
All Traders	27.3 11	0.0 10	50.0 8	24.1 29	12.5 8
Preferred client					
Other permanent wholesalers	. .		33.3 3	9.1 3	83.3 10
Occasional wholesalers or transporters	9.1 1	. .	. .	3.0 1	. .
Retailers	63.6 7	7.7 1	11.1 1	27.3 9	. .
Consumer cooperatives	9.1 1	. .	. .	3.0 1	. .
National Security Stock					8.3 1
PVOs	9.1 1	7.7 1	. .	6.1 2	. .
Individual consumers	9.1 1	7.7 1	33.3 3	15.2 5	. .
No particular preference	. .	76.9 10	22.2 2	36.4 12	8.3 1
Total	100.0 11	100.0 13	100.0 9	100.0 33	100.0 12

The fine type in each cell indicates the number of respondents.
CESA-MSU Food Security Project Surveys, 1988/89

consumer cooperatives), although traders will be hard pressed to sell on credit to clients who go months on end without pay. The transition from "soft" term to commercial term buyer-contracts has already proven difficult (Nango Dembélé, personal communication).
Conflict resolution between traders was not investigated formally. Informally, traders show a strong predilection to settle disputes out of court. Insecurity of contracts, for example, is probably caused more by high *ex-post* transaction costs, mainly in monitoring performance and resolving disputes, than to the *ex-ante* costs of gathering and processing information and reaching a decision.[39] The cumbersome administrative apparatus does not allow speedy resolution of disputes between traders, leading them to try to resolve disputes among themselves, although not always successfully. It is also the uncertainty of outcome through the courts (due to the influence of bribes, personal relations and other aspects of opportunistic behavior on the part of at least one party to the dispute) that makes the courts unattractive to traders (see Dembélé).

8.3.4.2. Cooperation and Conflict between Traders and Regulatory Agencies

Much more is known about conflict between traders and market regulatory authorities.[40] During the survey year, traders expressed hesitancy in entering into contracts with the government, fearing that in case of dispute, prospects for a successful outcome were dim. Two areas are particularly troublesome, as identified by traders: inconsistent rules enforcement and discrimination against grain traders.[41]

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[39]Insecurity of contracts or other transactions reduces exchange efficiency because the expectations of one or more parties are insecure.

[40]See Steffen and Dembélé, 1990, for example.

[41]The sample of 48 grain transporters (Section 8.1) identified the excessive number of road checkpoints run by regulatory agencies as the "most unnecessary and bothersome" regulation in the transport sector (Steffen and Dembélé, 1990).

Inconsistency of rule-enforcement reflects the conflict between national and local ideas about economic liberalization. This inconsistency may occur between localities (as different officials interpret regulations differently or accord different priorities to them) or between individuals and groups (as some less articulate or less powerful groups are victims of discrimination). Table 8.17 indicates that twice as many traders interviewed stated that marketing regulations were enforced arbitrarily (41.1 percent) rather than uniformly (18.8 percent). The remainder were uncertain (40.0 percent). Traders outside Bamako thought rules were enforced arbitrarily rather than uniformly by a ratio of more than 4 to 1. Astoundingly, not a single trader in Mopti or the South felt that regulations were enforced uniformly.[42]

The issue is one of fairness. Some inconsistencies may occur inadvertently (an agency problem for the public sector where abuses occur), and some degree of decentralization appears necessary (devolution of powers and responsibilities to regional authorities with the autonomy to bend the law in the interests of "social peace and tranquility"). Still, adherence to regulations and the time devoted to understanding the regulations represents a substantial opportunity cost for traders and transporters, especially if it doesn't seem to matter.[43] The perception of unequal enforcement of equal violations diminishes respect for the enforcement mechanisms and future willingness to comply.

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[42]The question of consistency in the enforcement of grain transport regulations was also asked of the grain transporter sample. Of 48 respondents, only 5 (10.4 percent) believed that grain transport regulations were enforced uniformly. More than half (25, or 52.1 percent) believed that grain transport regulations were enforced arbitrarily (Steffen and Dembélé, 1990, Annex 2).

[43]For example, Newman, Sow and N'doye found that in Senegal in 1984/85, possession of a wholesaler card offered little protection to traders from arbitrary fines by regulatory agents.

Table 8.17. Consistency in the Enforcement of Marketing Regulations, according to Urban Grain Traders

	Northeast	Mopti	South	Bamako	Total
Percent who find that the regulatory agencies enforce the principal rules uniformly					
Wholesalers	18.2 11	. .	. .	52.9 17	23.9 46
Semi-Wholesalers	21.1 19	. .	. .	27.3 11	14.3 49
All Traders	20.0 30	. .	. .	42.9 28	18.9 95
Percent who find that the regulatory agencies enforce the principal rules arbitrarily					
Wholesalers	36.4 11	83.3 6	50.0 12	41.2 17	47.8 46
Semi-Wholesalers	26.3 19	71.4 7	16.7 12	45.5 11	34.7 49
All Traders	30.0 30	76.9 13	33.3 24	42.9 28	41.1 95
Percent who don't know					
Wholesalers	45.3 11	16.7 6	50.0 12	5.9 17	28.3 46
Semi-Wholesalers	52.6 19	28.6 7	83.3 12	27.3 11	51.0 49
All Traders	50.0 30	23.1 13	66.7 24	14.3 28	40.0 95

The fine type in each cell indicates the number of respondents.
CESA-MSU Food Security Project Surveys, 1988/89

The second arena of conflict lies in the perception of discrimination against traders by regulatory agencies in the settlement of regulatory disputes, especially assessment of fines for infractions (or alleged infractions).[44] Fair and impartial adjudication remains a problem.

[44]Some of this is due to the self-financing operations of regulatory agencies. The statutes of agencies such as the Economic Affairs Agency, Customs, the Water and Forest Service allow them to keep part of the value of fines and confiscations to self-finance their operating and equipment costs and to offer bonuses to agency officials and arresting agents. These regulations create institutional incentives to find fault in order to procure financing by filling

Those near Bamako complain that they stand little chance of challenging a penalty or winning a dispute against a regulatory agency. Those outside of Bamako have even less access to the regulatory system which may be poorly informed of recent developments in any case. The perception that "the state always wins" discourages traders from using the system to seek redress of grievance.[45]

Settling the matter "off-record" becomes the manner of least-resistance for resolving disputes. Of 96 grain traders, 45 (46.9 percent) said that it was not possible to defend themselves in the case of litigation against the government regulatory services; another 23 (24.0 percent) said that while it was legally or theoretically possible to defend themselves, this was unrealistic in practice. When asked whether it was worth it to contest a regulatory penalty, even if it was possible to defend oneself and win, 55 of 96 traders (57.3 percent) said it was not worth the trouble and 16 traders (16.7 percent) said it was worthwhile only if a big

national and regional quotas. The sharing in fines by agents also creates individual incentives to find fault, such as invoking obsolete marketing regulations against uninformed traders and transporters. The possibility of buying off agents to avoid fines (whether justified or not) reduces operating revenues of the regulatory agencies.

For example, more than one-fourth of the grain traders sampled (26 of 95, or 27.4 percent) and two-thirds of the transporter sample (31 of 47, or 66.0 percent) said that they had bribed regulatory agents at least once by mid-1989 to avoid a fine since the start of the 1987/88 marketing year, the last bribe averaging 15,125 CFAF for traders and 8,865 CFAF for transporters.

As for the incidence of a paying a fine (or bribe to avoid a fine), two-thirds of the traders (66.7 percent) said that payment represented an unrecoverable loss which cannot be passed along to the consumer in terms of higher prices, the other traders saying they would deduct these fines and arrangements from their income taxes (19.8 percent) or reduce operating costs elsewhere in order to maintain the same profit margin (12.5 percent). In contrast, nearly one-fourth of the grain transporter sample (23.4 percent) said that all fines (and bribes) were already anticipated and factored into the agreed transport charges, meaning that the client — and ultimately, the consumer — absorbed some of this loss (Steffen and Dembélé, 1990). Depending on demand elasticities, however, transporters and traders will not be able to pass the full cost on to consumers under competitive conditions.

[45]Undoubtedly, this perception taints the value of formal contracts between traders if resolution of contractual disputes are also vulnerable to abuse (Section 8.3.4.1. above).

fine was involved; otherwise it was best not to contest (Steffen and Dembélé, 1990, Annex 2).[46]

It would be misleading and inaccurate to end on this bleak note of conflict. Since the CESA-MSU surveys in 1988/89, new avenues for cooperation and coordination between traders and the government have opened. A business-like relationship is cautiously evolving as OPAM increasingly relies on grain traders for carrying out its objectives. Traders fill all of OPAM's buying orders through competitive bids. OPAM sells food aid cereals or old SNS stocks to traders in auction (Section 8.4.4.). Several credit programs for purchase of cereals are available to traders operating at different scales. Market transparency has been incontestably enhanced for traders by two OPAM programs: the Market Information System (SIM) and the Training and Information Center (CEFODOC), where traders can receive advice about regulatory changes, among other items. A new Business Court, comprised of one judge and two neutral traders, was set up in 1988 for swift adjudication of business disputes. The Economic Affairs Agency (*Direction nationale des affaires économiques*), the long-time nemesis of traders, now deals with macroeconomic policy analysis, rather than enforcement of fixed prices and routine harassment of grain traders. Despite the remarkable changes in its objectives, however, its poor image among traders will linger for some time.

[46]Of 47 grain transporters, 21 (44.7 percent) said that it was not possible to defend themselves in the case of litigation against the government regulatory services; another 16 (34.0 percent) said that while it was legally or theoretically possible to defend themselves, this was unrealistic in practice. When asked whether it was worth it to contest a regulatory penalty, even if it was possible to defend oneself and win, 25 of 48 transporters (52.1 percent) said it was not worth the trouble and 15 traders (31.2 percent) said it was worthwhile only if a large fine was involved (Steffen and Dembélé, 1990, Annex 2).

8.4. Urban Grain Market Performance

Chapter 6 outlines static and dynamic efficiency criteria, as well as institutional and government policies criteria, for evaluating cereals market performance. This section will look at one criterion from each category in Figure 6.7 (Chapter 6, based on Holtzman, *et al.*, 1993), drawing reference to related criteria discussed previously.

8.4.1. Static Efficiency Performance Indicators

8.4.1.1. Static Efficiency: Degree of Urban Wholesale Market Integration

This section tests for the integration of urban markets in the Northeast with other urban markets in Mali on the basis of up to 40 pairwise price observations for the main cereals, using the Pearson correlation coefficient as in the previous chapter. Based on the null hypothesis that a non-zero correlation coefficient signifies integration between two markets, a statistically significant positive correlation coefficient means that one fails to reject the null hypothesis. Monthly retail prices (*prix à la consommation*) from OPAM are used, rather than monthly wholesale sales prices (*prix de vente*) displayed in Annex 8.1, to take advantage of a longer price series extending beyond the dissertation survey period. Prices run from October 1988 to January 1992.

Pairwise price correlation coefficients are shown in Table 8.18. Looking first at millet, all correlation coefficients are significant at the 99 percent level. Correlation coefficients are very strong. None fall below 0.85 and two-thirds are equal to or greater than 0.90. Pairwise coefficients between Gao and Mopti, principal supply source from the south and gateway to the Northeast reached 0.97, the highest coefficient (along with Mopti and

Ségou).[47] Pairwise coefficient between Gao and other markets appear slightly higher than those between Tombouctou and the same markets. The correlation coefficient between the two markets in the Northeast are also high. In view of these coefficients, and based on other research presented in this chapter, it is reasonable to assume that Tombouctou and Gao are no less integrated into the system of urban retail millet markets than other cities.

All monthly sorghum prices were significantly correlated, like millet prices, at the 99 percent level. All but one correlation coefficient was equal to or greater than 0.86. The highest coefficient, 0.97, was again shared between Mopti and Gao and Mopti and Ségou. The weakest coefficient, 0.62, was recorded between Tombouctou and Sikasso, likely due to the influence of locally grown sorghum around Tombouctou. This time, Gao's better links with the rest of Mali, compared to those of Tombouctou, are more pronounced.

Tombouctou maize prices were significantly correlated, curiously, only with those of Bamako. The negative correlation coefficients between Tombouctou and Gao and between Tombouctou and Mopti indicate no integration between maize markets there, although this may reflect the low number of observations. In contrast, Gao maize price coefficients were much stronger, no less than 0.87, and significantly correlated at the 99 percent level with Mopti, Ségou, Sikasso and Bamako. Indeed, there appears little difference between Gao's correlation coefficients with other markets and correlation coefficients between markets in the south, where most maize is produced and more widely traded and consumed.

Only four of the 80 percent brokens rice correlation coefficients were significant (many were not calculated), whereas all but two of the 40 percent brokens rice correlation

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[47]Other millet price correlation coefficients between Gao and Mopti have been estimated at 0.96, based on monthly retail prices between November 1986 and September 1988 (Steffen and Koné), and at 0.89, based on monthly retail prices from July 1986 and October 1989 (Henry de Frahan). Estimates for Tombouctou and Mopti were 0.76 and 0.70, respectively.

Table 8.18.

Urban Retail Market Integration:
Pairwise Monthly Price Correlation Coefficients (October 1988-January 1992)

1. Millet Prices

	Tombouctou	Gao	Mopti	Ségou	Sikasso	Bamako
Tombouctou	**1.00**	***40	***40	***40	***40	***40
Gao	.93	**1.00**	***40	***40	***40	***40
Mopti	.90	.97	**1.00**	***40	***40	***40
Ségou	.91	.96	.97	**1.00**	***40	***40
Sikasso	.88	.88	.85	.89	**1.00**	***40
Bamako	.91	.92	.89	.93	.96	**1.00**

2. Sorghum Prices

	Tombouctou	Gao	Mopti	Ségou	Sikasso	Bamako
Tombouctou	**1.00**	***28	***28	***28	***28	***28
Gao	.91	**1.00**	***40	***40	***40	***40
Mopti	.91	.97	**1.00**	***40	***40	***40
Ségou	.87	.97	.97	**1.00**	***40	***40
Sikasso	.62	.87	.89	.88	**1.00**	***40
Bamako	.86	.96	.95	.96	.96	**1.00**

3. Maize Prices

	Tombouctou	Gao	Mopti	Ségou	Sikasso	Bamako
Tombouctou	**1.00**	a	a	11	12	**12
Gao	a	**1.00**	***16	***26	***27	***27
Mopti	a	.89	**1.00**	***25	***28	***28
Ségou	.27	.95	.94	**1.00**	***37	***37
Sikasso	.27	.87	.87	.90	**1.00**	***40
Bamako	.66	.92	.90	.95	.93	**1.00**

Note: The number of pairwise observations appears above the diagonal. Asterisks refer to the significance of the respective correlation coefficient below the diagonal (where *** indicates significance at the 99 percent level; ** at 95 percent; and * at 90 percent). [a]Correlations not calculated for less than ten paired observations.

OPAM, *Système d'information sur les marchés*

Table 8.18. (continued)

4. 80 Percent Brokens Rice *(Riz BB)* Prices

	Tombouctou	Gao	Mopti	Ségou	Sikasso	Bamako
Tombouctou	**1.00**	a	a	a	a	a
Gao	.	**1.00**	a	a	a	a
Mopti	.	a	**1.00**	**14	**8	***18
Ségou	.	a	.56	**1.00**	15	***29
Sikasso	.	a	.73	.23	**1.00**	19
Bamako	.	a	.79	.70	-.06	**1.00**

5. 40 Percent Brokens Rice *(Riz RM40)* Prices

	Tombouctou	Gao	Mopti	Ségou	Sikasso	Bamako
Tombouctou	**1.00**	***40	***40	***40	40	***40
Gao	.62	**1.00**	***40	***40	*40	*40
Mopti	.63	.47	**1.00**	***40	40	***40
Ségou	.47	.56	.52	**1.00**	***40	***40
Sikasso	.21	.29	.21	.63	**1.00**	***40
Bamako	.42	.27	.72	.75	.61	**1.00**

Note: The number of pairwise observations appears above the diagonal. Asterisks refer to the significance of the respective correlation coefficient below the diagonal (where *** indicates significance at the 99 percent level; ** at 95 percent; and * at 90 percent). [a]Correlations not calculated for less than ten paired observations. Price series for 80 percent brokens rice began in April 1989.

OPAM, *Système d'information sur les marchés*

coefficients were significant, including all those in the Northeast except Tombouctou and Sikasso.[48]

These results demonstrate that for coarse grains, price differentials were relatively stable between retail markets in the Northeast and key supplier markets elsewhere in Mali.

[48]Retail prices are unavailable for "local rice" or paddy. Hence, no correlation coefficients could be calculated.

This implies that price changes, signalling excess supply or demand conditions in the Northeast, are readily transmitted via wholesalers to other markets.[49] Based on the competitive nature of wholesale markets (workable competition, contestable markets and no unreasonable barriers to entry), moreover, these retail price correlation coefficients can be taken as indicators of cereals market integration and good performance.

Rice correlation coefficients are lower than those for coarse grains, probably due to the seasonal availability of "local rice." As defined in Annex 8.1, locally grown and milled rice is distinct from the rice grown in the large irrigated perimeters, such as *Office du Niger* and *Opération Riz Ségou*. Local rice is not separated into standard grades based on the maximum content of broken grains, such as the industrially milled RM40 and RM80 rice. Thus, local rice may be a "wild card" as concerns the national rice market. Physical attributes of "local" rice vary by locality so tastes and preferences are likely to vary by locality. Hence, local rice is rarely traded across regions (CESA-MSU enumerators). But, local rice gives consumers a cheaper alternative than industrially milled rice. Annex 8.1 shows that local rice cost less on average in 1988/89 than RM40 rice in the five urban wholesale markets where data are available. Annex 8.2 shows non-negligible quantities of local rice sold by wholesalers (recorded average monthly sales of local rice in Sikasso and Ségou exceeded average monthly sales of RM40 rice). Lastly, it is likely that a sizable portion of local rice is not marketed at all, but consumed on farm, unlike the industrially milled rice which, by definition, is sold *ex-usine*.

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[49]It was intended to include cereal prices from Niamey, capital of Niger, in the calculation of correlation coefficients, given the cereal trade flows between Niger and the Gao Region described in Chapter 7. Monthly wholesale price series were not found. However, quarterly retail prices in Niamey during 1988 and 1989 for millet, sorghum, and "rice" are similar to Gao-City wholesale prices (Annex 8.1) when a retail mark-up is added. See *Direction de la Statistique et de la Démographie.* *__Bulletin Statistique__, N°. 125, Année 1990, 1er Trimestre, (République du Niger/Ministère du Plan/DSD: Niger), Tableau 27.*

8.4.1.2. Static Efficiency: Gross Marketing Margins between Wholesalers and Semi-Wholesalers

An evaluation was made on gross margins between average semi-wholesaler sales prices and average wholesaler sales prices in Tombouctou and Gao as well as Mopti and Bamako, all net importing cities. Necessary assumptions are that a) semi-wholesalers buy their cereals exclusively from wholesalers; b) the effects of retail sales by both wholesalers and semi-wholesalers (whose effects cannot be removed) offset each other; c) prices reflect current supply and demand conditions, including build-up of storage (Section 8.3.3.); and d) cereals purchased by semi-wholesalers in one month (sales by wholesalers) are sold during the same month (prices are not lagged).

Gross monthly margins between semi-wholesaler and wholesaler prices and margins as a percent of semi-wholesaler sales prices are shown in Table 8.19. The margins indicate two apparent anomalies. The first is that average gross margins and percent mark-ups are lower than the previous margins and mark-ups for either wholesalers or semi-wholesalers alone. Average margins are not statistically different across cities. While some margins might be expected to be negative, the second anomaly is that nearly all monthly margins are negative for Gao.

Table 8.19

Difference between Semi-Wholesaler and Wholesaler Sales Prices (CFA Francs/kg) and Percent of Average Semi-Wholesaler Sales Price: Urban Wholesale Markets in the Northeast and Other Cities in Mali

	Tombouctou		Gao		Mopti		Bamako	
	Margin	Pct	Margin	Pct	Margin	Pct	Margin	Pct
Millet								
November 1988	10.54	11.57	.	.	.	.	0.36	0.56
December	-2.31	-2.97	-10.12	-15.16	-0.57	-1.21	3.21	4.92
January 1989	0.40	0.57	-2.75	-4.06	0.92	1.81	4.25	7.02
February	.	.	-2.73	-4.03	2.83	5.72	-9.26	-14.54
March	0.00	0.00	-2.53	-3.91	1.16	2.43	2.60	4.10
April	-1.16	-1.71	-1.58	-2.43	-0.57	-1.18	3.14	5.29
May	-0.70	-1.00	-0.46	-0.73	1.13	2.35	-3.73	-6.57
June	-3.98	-6.03	-2.44	-4.37	-0.07	-0.17	-0.14	-0.23
July	.	.	-4.71	-8.25	10.69	22.96	5.01	7.85
August	0.00	0.00	-1.40	-2.44	-1.77	-4.16	1.44	2.39
September	-3.79	-6.74	-1.50	-2.84	-1.13	-2.57	-9.62	-15.98
October	-2.52	-4.20	0.34	0.51	3.99	7.52	3.78	7.29
Monthly Average	-0.35	-1.05	-2.72	-4.34	1.51	3.05	0.09	0.18
C. V.	-11.800	-4.619	-1.026	-0.975	2.311	2.446	55.889	45.830
Sorghum								
November 1988								
December	5.65	6.88	.	.	.	.	0.03	0.06
January 1989	-3.48	-4.91	-15.36	-24.26	-8.40	-17.18	2.32	3.67
February	4.91	7.55	-4.84	-6.74	7.48	12.73	2.06	3.50
March	7.33	10.48	.	.	6.71	11.26	-7.82	-12.06
April	.	.	-0.78	-1.06	-4.73	-8.55	5.40	8.64
May	0.00	0.00	1.36	1.82	2.02	3.47	1.79	3.18
June	-1.00	-1.83	-1.02	-1.48	5.11	10.16	0.86	1.43
July	-1.00	-1.70	-2.92	-4.41	.	.	0.91	1.51
August	.	.	-2.50	-3.85	7.35	11.92	0.87	1.34
September	0.00	0.00	.	.	0.42	0.77	1.11	1.81
October	.	.	-3.46	-5.76	2.65	5.15	-4.46	-7.04
	.	.	-2.58	-4.01	0.49	0.89	6.05	11.03
Monthly Average								
C. V.	1.55	2.06	-3.57	-5.53	1.91	3.06	0.76	1.42
	2.497	2.660	-1.337	-1.354	2.754	3.173	4.960	4.308

Note: One-way ANOVA indicates that gross margins on millet do not differ significantly among cities at the 95 percent level ($F = 2.20$ with $DF = 3, 41$). One-way ANOVA indicates that gross margins on sorghum do not differ significantly among cities at the 95 percent level ($F = 2.96$ with $DF = 3, 35$).

CESA-MSU Food Security Project Surveys, 1988/89

To further test the gross margin relation between wholesalers and semi-wholesalers, average monthly semi-wholesaler sales prices were regressed against average monthly wholesaler sales prices, according to the following models for millet and sorghum:

$$\text{PVSWMIL} = a + b\,\text{PVWMIL}$$
$$\text{PVSWSOR} = a + b\,\text{PVWSOR},$$

where

PVSWMIL = semi-wholesaler sales price of millet
PVWMIL = wholesaler sales price of millet
PVSWSOR = semi-wholesaler sales price of sorghum
PVWSOR = wholesaler sales price of sorghum.

These models are analogous to those used in Chapter 7 testing whether rural traders are price takers or price setters. In this instance, the models test whether semi-wholesalers influence their sales prices or simply add a unit mark-up to the price they pay their wholesaler suppliers.[50]

For a two-tailed test at the 95 percent significance level, the null hypothesis that the coefficient b is equal to 1.0 is:

$$H_o\!: b = b' \text{ (where } b' = 1.0)$$

and the appropriate test t statistic is:

$$t_{(\alpha/2,\ d.\ f.)} = \frac{b - b'}{\text{S. E. of } b}$$

The null hypothesis is rejected if the observed t statistic is greater than the positive test t statistic or less than the negative test t statistic, for the given degrees of freedom.

[50]This model is also based on Goetz and Weber, pp. 55-57.

The model implies that semi-wholesaler sales prices are functionally dependent on wholesaler sales prices. If the coefficient *b* on wholesaler prices is not significantly different from 1.0, it may be inferred that semi-wholesalers add a constant mark-up to wholesaler supply prices (the regression "constant" term) and that semi-wholesaler prices change only as wholesaler prices change. Semi-wholesalers are price takers.[51]

If, on the other hand, the coefficient *b* is significantly different from 1.0, a one-unit change in wholesaler sales prices does not lead to a one-unit change in semi-wholesaler sales prices. Semi-wholesalers in this case are price setters. They act as a shock absorber when *b* is less than 1.0, reducing their margins (possibly absorbing losses). If *b* is greater than 1.0, they amplify wholesale price changes (possibly making profits).

Table 8.20 shows the regression results, where the appropriate degrees of freedom (d. f.) in each case are N-2. Looking first at millet, regression equations are decidedly better in terms of adjusted R^2s and F statistics for the Northeast than either Mopti or Bamako. The coefficients *b* on the wholesaler price are not significantly different from 1.0 in the case of the Northeast, although the Tombouctou observed statistic comes very close to the test statistic at the 95 percent level. This implies that both Tombouctou and Gao semi-wholesalers are price-takers who add only a constant mark-up reflecting costs to their sales prices. By comparison, the *b* coefficients are significantly different from 1.0 in the case of Mopti and Bamako, implying that semi-wholesalers in those two markets adjust their prices upward by less than one-unit, given a one-unit increase in wholesaler prices, taking a loss. By not passing on all variations in wholesale prices to their clientele but in effect stabilizing prices, semi-wholesalers may hope to maintain their clientele, not unexpected behavior in bigger markets, such as Bamako, where consumers have more alternative cereals and sellers to choose from.

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[51]This model assumes that cost elements within the margin are competitively determined.

Table 8.20

Regression Analysis of Monthly Gross Marketing Margins (CFA Francs/kg) between Wholesalers and Semi-Wholesalers in the Northeast and Other Cities

MILLET Semi-Wholesaler Sales Price (PVSWMIL)	**Constant**	**Wholesaler Sales Price (PVWMIL)**	**Adjusted R^2 (F Statistic)**	**Test *t* Statistic, 95 percent significance**	**Observed *t* Statistic**
Tombouctou	**-27.824**	**1.385**	**0.869**	± 2.306	2.292
(N = 10)	(11.809)	(0.168)	(67.623)		
Gao	**13.492**	**0.750**	**0.798**	± 2.262	-2.119
(N = 11)	(7.688)	(0.118)	(40.568)		
Mopti	**29.249**	**0.398**	**0.172**	± 2.262	**-2.652**
(N = 11)	(10.472)	(0.227)	(3.075)		
Bamako	**38.173**	**0.374**	**0.332**	± 2.228	**-4.230**
(N = 12)	(8.997)	(0.148)	(6.472)		

SORGHUM Semi-Wholesaler Sales Price (PVSWSOR)	**Constant**	**Wholesaler Sales Price (PVWSOR)**	**Adjusted R^2 (F Statistic)**	**Test *t* Statistic, 95 percent significance**	**Observed *t* Statistic**
Tombouctou	**-0.758**	**1.036**	**0.760**	± 2.447	0.167
(N = 8)	(13.905)	(0.215)	(23.224)		
Gao	**27.345**	**0.566**	**0.210**	± 2.365	-1.361
(N = 9)	(22.789)	(0.319)	(3.135)		
Mopti	**43.116**	**0.230**	**-0.064**	± 2.306	-2.258
(N = 10)	(18.282)	(0.341)	(0.457)		
Bamako	**33.337**	**0.442**	**0.719**	± 2.228	**-6.805**
(N = 12)	(4.940)	(0.082)	(29.204)		

Standard errors in parentheses.

CESA-MSU Food Security Project Surveys, 1988/89

As before, the regressions equally predict that semi-wholesalers make profits when a one-unit decrease in wholesaler prices causes a less than unitary drop in semi-wholesaler prices. The Mopti results are nonetheless suspect due to the low adjusted R^2.

Looking next at sorghum, only the coefficient *b* on wholesaler prices for Bamako is significantly different from 1.0, indicating that semi-wholesalers may be able to influence their sales prices. Again, the extremely poor explanatory power of the Mopti equation leaves raises doubts about the results. Both sets of millet and sorghum equations suffer from low degrees of freedom.

A look at the gross margin between average semi-wholesaler sales price and average wholesaler sales price (Table 8.19) suggests that the assumption above (for Table 8.20), that semi-wholesalers get their cereals supplies only from wholesalers, may not hold and that wholesalers and semi-wholesalers alike, but particularly in Gao for millet, have independent supply sources and may not trade much between categories.[52] In other words, semi-wholesalers operate in separate market channels from wholesalers. Just as significantly from the viewpoint of urban market structure, it may mean that there is no functional relationship between wholesalers and semi-wholesalers. If so, regulatory distinctions between semi-wholesalers and wholesalers — based on to whom they sell — are less meaningful. At the least, these terms are not meaningful, as they imply some vague subordinate or tutelage relationship that may not exist.[53]

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[52]To check whether the semi-wholesaler/wholesaler marketing margins decrease as a function of quantity, the marketing margin was regressed against semi-wholesaler quantities sold. The signs on the quantity coefficient were negative, as expected, in all but once case, but the regressions failed to meet goodness-of-fit and statistical significance criteria.

[53]The new distinction between wholesalers and semi-wholesalers by the PRMC appears to be misleading in this regard: Semi-wholesalers play an active and fundamental role in assembling and selling cereals, and in supplying urban centers and deficit regions. Semi-wholesalers are subordinate to wholesalers who may finance their operations (PRMC, 1990).

8.4.1.3. Urban Retail Price Stability

Price stability is a major aspect of performance that gives insights into the risks that consumers face in relying on the market for food. This section compares intra-annual and inter-annual price stability for millet, sorghum and RM40 rice, based on coefficients of variation of retail prices as shown in Table 8.21, between urban markets in the Northeast and markets in southern Mali.[54] Retail prices may be considered a reasonable proxy for wholesale prices, especially for millet and RM40 rice which are not produced in the Northeast. Prices have not been deflated or detrended.

Intra-annual prices, covering three years, were less stable than inter-annual prices, as expected. Retail prices were most stable for all three crops for Sikasso. Somewhat unexpectedly, millet and sorghum prices were least stable in Ségou, on the crossroads between southern production zones and the major consumption center of Bamako. Although Gao and Tombouctou CVs fell within the range of national CVs for millet and sorghum, prices of industrially-milled RM40 rice were least stable in Tombouctou.

The next column shows CVs for 1988/89, corresponding to the year of field surveys for this dissertation (for which production characteristics were described in Chapter 2). Rather unexpectedly, the producing zone market of Sikasso shows greatest price instability for millet and sorghum. The millet CV for Sikasso was twice that of Tombouctou. Also unexpectedly, Gao registered the lowest CV for retail millet prices. In both instances, the large ratio of cereal stocks held by wholesalers and semi-wholesalers to sales (Table 8.14) — the "just in case inventory" strategy — may have insulated retail markets in the Northeast

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[54]These are average retail prices collected by OPAM/SIM, where each split year corresponds to the production year, running from November to October.

Table 8.21

Comparison of Retail Price Stability in Selected Urban Markets, 1988/89-1990/91

Coefficients of Variation

	1988/89 - 1990/91	1988/89	1989/90	1990/91
Millet				
Sikasso	0.243	0.158	0.215	0.085
Bamako	0.284	0.156	0.239	0.100
Ségou	0.393	0.068	0.337	0.165
Mopti	0.378	0.076	0.258	0.158
Tombouctou	0.334	0.077	0.251	0.098
Gao	0.284	0.043	0.214	0.081
Sorghum				
Sikasso	0.275	0.147	0.206	0.147
Bamako	0.283	0.069	0.239	0.114
Ségou	0.366	0.084	0.323	0.164
Mopti	0.344	0.066	0.232	0.152
Tombouctou	0.348	0.111	0.306	0.144
Gao	0.297	0.115	0.240	0.101
RM40 Rice				
Sikasso	0.037	0.049	0.026	0.032
Bamako	0.055	0.039	0.063	0.052
Ségou	0.069	0.078	0.080	0.050
Mopti	0.108	0.065	0.129	0.049
Tombouctou	0.166	0.081	0.189	0.100
Gao	0.083	0.054	0.107	0.015

Note: Split years correspond to November through October.

OPAM/SIM

from abrupt breaks in long supply lines, thereby helping to smooth price fluctuations — although at higher average prices (Tables A8.1.1. and A8.1.2.).

RM40 faces strong competition in Tombouctou and Gao from local rice. Seasonally variable demand for RM40 (Table A8.2.7.) could result in relatively more price variability in the Northeast. Yet, it is curious that retail prices in Gao were more stable than those in Mopti and Ségou, the area straddling the main milling locations for RM40. Prices in Tombouctou were least stable, in addition owing to seasonally difficult deliveries, but very similar to the CV in Ségou.[55]

On balance, Tombouctou retail prices for millet and sorghum and Gao retail prices for sorghum and RM40 fell with the ranges of CVs for these crops: Retail prices in the Northeast in 1988/89 were not unusually stable or unstable compared with the other markets in Mali. The exceptions were Gao, lowest CV for millet, and Tombouctou, highest CV for RM40.

As for millet in 1989/90 and 1990/91, retail millet prices were most stable in Gao, followed closely by Sikasso (Table A8.2.1. shows that Gao monthly wholesaler sales were more stable in 1988/89 than the other four markets except in Mopti, many of whose sales are directed to the Northeast).

The stability of Tombouctou and Gao sorghum prices in 1989/90 fell within the overall range of CVs, a recurrence for Tombouctou in 1990/91. Gao retail prices were the most stable of the six markets in 1990/91.

Tombouctou retail RM40 prices were least stable (though not extremely so) in 1989/90 and 1990/91, likely for the same reasons cited above, seasonally difficult access and

[55]Any destabilizing impact of subsidized sales of rice from OPAM stocks on local retail prices in the Northeast (1,500 tons in Gao in April 1989 and 1,000 tons in Tombouctou in July) can be largely dismissed as the successful bidders shipped about 95 percent of this rice out of the Northeast (section 8.4.3.2.).

consumer preferences for local rice. Gao retail prices in 1990/91 were remarkably stable, where the highest average monthly price exceeded the lowest price by only 10 CFAF per kilogram.

Putting aside the possibility of enumerator error, prices were not markedly or consistently more volatile in the Northeast than the other four markets in Mali, despite the longer distance involved (millet, RM40, and to a lesser extent, sorghum) and despite seasonality of demand (wholesale quantities bought and sold in Tables A8.2.1., A8.2.2. and A8.2.7., and rural market demand, Chapter 7, for 1988/89). Indeed, Table 8.21 shows that Gao retail prices were the most stable for each of the three crops in 1990/91. This three-year look at retail price stability suggests that consumers in the Northeast, especially Gao, can reasonably count on cereal price stability when planning their household expenditures.

8.4.2. Dynamic Efficiency Performance Indicators

This next section evaluates two dynamic efficiency criteria, progressive institutional arrangements in the cereals market and the extent to which the cereals market generates and uses market information to improve market decisions.

8.4.2.1. Dynamic Efficiency: A Summary of Progressive Institutional Arrangements

Mali has inaugurated a number of new institutional arrangements since first embarking on its phased liberalization of the cereals market over a decade ago. These arrangements concern drought management, market facilitating services, marketing credit for farmers and traders and government-donor consultations. Despite the diversity of these arrangements, they serve common objectives intended to increase marketing efficiency, productivity and transparency — or to prevent disruptions of markets. Some arrangements, set up in the South on a pilot basis, have since been extended to the Northeast. Other arrangements started in the Northeast at the same time as elsewhere. The effect of these institutional arrangements has been to improve market coordination over long distances, of particular benefit to the Northeast.

These new arrangements have been mentioned elsewhere in the dissertation. They are briefly summarized here.

8.4.2.1.1. Market Information System. The SIM (*Système d'information sur les marchés céréaliers*) has overcome initial scepticisms that a market information system managed by OPAM could be objective and effective in gathering, processing and disseminating market prices and other information (see section 2.3.2.5. in Chapter 2 and section A2.1.3.3.2. in Annex 2.1.). Radio, television and newspaper articles inform the public. The SIM's prices and other market analyses through its *Bulletins* have already proved useful to Malian policy makers (see section 8.4.2.2. below).

8.4.2.1.2. Strategic Grain Reserve. While the SNS (*Stock national de sécurité*) is not a new institution as such (see section 2.3.2.1. in Chapter 2), rules for grain procurement and grain release have been overhauled through PRMC III. These rules pay greater attention to impact on the market (see section A2.1.3.3.1. in Annex 2.1.). OPAM procures grain for the SNS through competitive tenders. Routine out-rotation of old grain is carried out by competitive bids (see section 8.4.3.1. below). In both instances, OPAM refers to SIM prices and SAP recommendations to guide its SNS stocking-destocking decisions, such as releasing SNS grain when markets are poorly supplied but effective household demand is secure.

8.4.2.1.3. Early Warning System. The SAP (*Système d'alerte précoce*) continually monitors the food security status of households in traditionally "at risk" zones in the Northeast and elsewhere, based on market supplies, household resources and other indicators with respect to usual seasonal consumption habits (see section 2.3.2.3. in Chapter 2). On this basis, the SAP recommends the quantity and timing of food aid for emergency distribution in specific locations. Preliminary recommendations are made in November each year and final recommendations in March.

8.4.2.1.4. Public Agency for Drought Assistance. The CNAUR (*Comité national d'actions d'urgence et de réhabilitation des zones à risque*) coordinates with food donors to implement SAP recommendations to mobilize emergency relief and rehabilitation operations (see section 2.3.2.2. in Chapter 2. and section A2.1.3.2.1. in Annex 2.1.). Timing of operations is critical both to respond to food security needs and to minimize disruption to local markets caused by large grain deliveries or releases (see section 8.4.3.1. below).

8.4.2.1.5. Farmer Credit Programs. Annual crop purchase and storage credit for farmers is channelled through village associations (see section A2.1.3.3.4. in Annex 2.1.). Credit, provided by PRMC loan guarantees to banks at unsubsidized interest rates, lets village associations buy from their member farmers, injecting needed post-harvest liquidity into rural areas, and sell later in the year. Credit program design questions remain, however. For example, tempering normal seasonal price rises, by increasing post-harvest demand and hungry-season supplies, may reduce returns to storage and threaten loan repayment (see D'Agostino, Staatz and Weber).

8.4.2.1.6. Trader Credit Programs. Annual cereals marketing credit is available for wholesalers and semi-wholesalers through PRMC loan guarantees at unsubsidized interest rates (see section A2.1.3.3.4. in Annex 2.1.). For smaller traders, otherwise ineligible for bank loans due to insufficient collateral, the semi-wholesaler credit program has strengthened a previously little-used institution known as economic interest group (*groupement d'intérêt économique*, or GIE) by requiring individual traders to form their own GIEs with legal corporate status. By pooling their capital through the GIE, smaller traders become eligible for marketing credit.

8.4.2.1.7. Trader Training Programs. OPAM has established a trader training programs through its CEFODOC (*Centre de formation et de documentation*) for technical instructions in storage and marketing, interpretation of SIM prices and awareness campaigns of market regulatory changes (see section 8.3.4.2.). Initially Bamako-based, the CEFODOC intends to expand its training to regional capitals.

8.4.2.1.8. Liberalized Import/Export Schemes. The former system of cereal import (export) licensing was subject to delays, rent-seeking behavior by license-granting officials and, in 1986/87, costly suspensions. A streamlined system was introduced in 1989 requiring the importer (exporter) to simply record his intentions to import (export) with the Economic Affairs Agency (see section A2.1.3.3.3. and Steffen and Dembélé, 1990). With efforts to harmonize marketing policies among CILSS and West African countries as part of a "regional economic space", these simplified import (export) procedures are expected to improve cereals market stability, possibly even reducing the need for direct market intervention, in terms of volumes handled, by OPAM and the SNS.

8.4.2.1.9. New Business Courts. New courts for swift and fair adjudication of business disputes have been set up, effectively bypassing the more cumbersome and intimidating criminal court system (see section 8.4.3.2.). A three-person panel, on which two traders sit, helps ensure judgement by peers and acceptance of court decisions.

8.4.2.1.10. Institutionalized Government-Donor Coordination and Consultations. Parallel consultations between Malian government officials and donor representatives through the COC and PRMC have been a key ingredient in the liberalization of the cereals market. These consultations provide a forum for the regular exchange of views and appreciation of the other side's sensitivities, resulting in gradual but workable reforms. This institutional arrangement has been cited as one of the rare examples of successful donor-recipient collaboration in Africa in an area of priority reform (Coelo; see also Humphreys; Steffen, 1994).

Where complementary institutional arrangements — and reforms — need to be made is in the highway transport sector. Transporters have not benefitted from the decade-long attention paid to marketing problems of farmers and cereal traders, or only inadvertently where a transporter is also a trader. Steffen and Dembélé (1990, Annex 4) point out the striking divergence between trader and transporter views concerning the advantages of — and enthusiasm for — market liberalization. Transporter complaints effectively define the agenda for the next round of institutional reforms.

8.4.2.2. Growing Demand for Market Information to Improve Marketing Decisions

Tables 8.6 and 8.7 showed trader sources of price information and market conditions by supply sources and sales locations, respectively. It is striking that traders in the South, and particularly Mopti, rely so little on institutional sources of information, evidence that quick turnover marketing strategies cannot afford to wait for slow arriving information from the public sector. It should be recalled, however, that these tables report results of a survey taken in the very early days of the SIM when the only a few issues of the *Quarterly Bulletin* had been published and the radio broadcasts were still a novelty.

By disseminating timely market information, the SIM helps to lower marketing costs, thereby improving market efficiency. Widely diffused market information can reduce marketing margins due to risk and monopoly power, reduce the cost of transacting by aiding price discovery, smooth marketed supplies by facilitating spatial and temporal arbitrage, encourage long distance trade, alleviate farmer and trader uncertainties for planning medium term marketing strategies and give policy makers a better picture of how the marketing system operates (Staatz, Dembélé and Aldridge). Publicly provided market information also makes sense from a "public good" perspective. Due to high exclusion costs (Chapter 6), the private sector cannot recover the full costs of providing information; it will supply socially suboptimal levels. Therefore, the social benefit of broadening access to market information is considered greater than the social cost in terms of reducing uncertainties, information asymmetries and opportunism.

There is a continuing debate whether the importance of public market information systems is overrated, based on faulty premises that private traders are ill-informed about market developments, that lack of timely information about prices and market supply and demand conditions is a barrier to entry, and that providing market information will improve competition and market efficiency. Davies (1992) argues that large-scale, diversified traders in the Mopti region are "amongst the best informed about local demand, local and national supply and price differences between markets," due to their expansive network of agents and smaller trading partners. These large traders are so well informed, according to Davies, that they move in and out of the cereals market at will, depending on the year in question. Following a good harvest, most traders leave cereals to smaller, local traders (and withdraw funding for crop purchases) such that the cereals market in Mopti City is far more concentrated in a *good* year than in a bad one.[56] Further, SIM prices on the radio, according to Davies' research, do not facilitate rural market competition because buying and selling strategies depend instead on the specific circumstances of the transaction, such as the commercial relationship between trader and farmer, proximity of markets and means of

[56]Unfortunately, Table 8.5, comparing cereals market concentration between cities for the survey year, does not shed light on Davies' hypothesis about market concentration in Mopti. The appropriate comparison is concentration levels in Mopti between years.

transport to get to them, and farmer household level of market participation (Chapter 6). On this basis, Davies contends that access to credit and transportation are binding constraints to market development among smaller traders, not lack of market intelligence.

Research findings from the Mopti region are not necessarily applicable to the Northeast, in view of the differences in basic market conditions between regions. For one, steadier market demand for cereals in the Northeast likely reduces year-by-year entry and exit by traders. Table 8.2 also shows that poor knowledge of the cereals market — presumably including knowledge of market prices — was cited as the foremost barrier to entry in the Northeast, in contrast to Mopti where poor knowledge was cited just once.

Nonetheless, public sector users of the SIM may find it more useful than private users in the short term.[57] One of the first instances of successful use of the SIM data by public policy makers occurred in April 1991, following the *coup d'état* of March. Concerns about imminent grain shortages in Bamako due to looting of OPAM and trader warehouses prompted the COC to recommend that OPAM release of 5,000 tons of cereals onto the market. As any supply shortfalls would be reflected in price levels, however, this recommendation was amended to review SIM price data in two weeks' time before considering the release of stocks. Market monitoring by the SIM found satisfactory supply

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[57]The first survey of "institutional" users of the SIM (mainly government ministries, parastatals and donors) was conducted in August 1989, shortly after the CESA-MSU survey of market information needs of traders. The poor level of response (52 of 154 questionnaires were returned) casts doubts about the representativeness of results, but the SIM was found to be "incontestably useful". All but one respondent in each case considered the SIM *Bulletin* and SIM price broadcast useful. More than half found the *Bulletin* and radio format "satisfactory" (54 percent and 57 percent, respectively). *Bulletin* readers asked for more details about price collection methodology, a reduction in the number of tables and graphs, a bigger sampling of markets, quantity information and more analysis and commentary of the factors underlying market developments. Views diverged among those who were not satisfied with the radio broadcast, some wanting a longer broadcast and some shorter (Phélinas, 1989b).

levels, no expectations of a rupture in supply lines and a trend toward *lower* prices as looters tried to unload their cereals quickly. This reliance on SIM data convinced policy makers not to release OPAM stocks unnecessarily (Coelo; Staatz, Dembélé and Aldridge).

Mali has also made strides in exploiting complementarities between the market information system and the famine early warning system (SAP) for food security decisions. SIM prices reveal much about market supply levels, marketing margins and trader behavior, such as hoarding or dumping. Price ratios, such as the market price of a goat in terms of the market price of millet, are robust indicators of terms of trade between herders and farmers — hence, exchange entitlements for food security. Institutional complementarities in Mali's case have been strengthened by a common source of funding (the PRMC) and oversight body (the COC) (Coelo).[58]

The real question for market performance is one of the relative usefulness of the SIM to whom and whether that usefulness will evolve over time. Most indications point to a growing usefulness of the SIM for farmers and traders and a greater balance between the private and public sector clientele of the SIM.

First, market information needs will become more complex and sophisticated, particularly as the public and private sectors settle into a new, complementary relationship. Second, this need for complex information places a growing reliance on public sources of information, such as the SIM,[59] which possesses greater capacity than all individual farmers and traders to collect and systematically analyze diverse market information and disseminate

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[58]See COMAC, Technical Debates *Report No. 2* for a series of articles from Mali and West Africa regarding the potential contributions of market information systems to short term food security information.

[59]Other institutions might include OPAM/CEFODOC, OPAM/SNS, the Economic Affairs Agency (DNAE), the Chamber of Commerce (CCIM) and the commercial banks.

the results. A third indication is that, following the expansion of the SIM's market coverage, SIM prices will likely function as the principal reference prices, to which all other observations will be compared. The government's desire to transfer more of the medium-term grain storage function to traders, fourth, requires that traders be well informed about medium-term production and price trends as well as cereals marketing (and other) policies, such as publication of OPAM's Marketing Action Plan (*Plan de ravitaillement*) or advance notification of tenders for the purchase of cereals to reconstitute the SNS (section 8.4.3.1.).

Meeting this growing demand in terms of desired frequency of dissemination of prices and other information requires coordination between institutional suppliers of information and a rapid turn-around time by the SIM for data collection, computer compilation and analysis, and dissemination (Steffen, 1990; Staatz and Aldridge).

An effective Market Information System thus requires a long-term commitment of support by OPAM and the Malian government.[60] It also requires the right mix of institutional incentives, management autonomy and sense of responsibility to the clientele.

Institutional sources of market information represent one planning tool for the *private* sector provided in the *public* interest. It is nonetheless important that farmers, traders and their agents recognize the limits to this information. Like satellite imagery from outer space, institutional information needs to be complemented by "ground truthing" based on personal observation and experienced judgement.

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[60]This does not exclude the possibility of private sector support (through radio advertising revenues) and alternative self-financing possibilities (user fees and other charges) for services provided by the SIM.

8.4.3. Government Policy Indicators of Market Performance: Integration of Public-Good Services and the Cereals Market

Next, this section considers two government policies as indicators of market performance in the Northeast, the integration of public food aid and periodic auctions of OPAM stocks into the cereals market. Although categorical statements cannot be made on the success of these policies at this relatively early stage, these policies are identified for further monitoring.

8.4.3.1. The Impact of Public Food Aid

Food aid is no less controversial in the Northeast than elsewhere. While there may be no fundamental difference between distribution of cereals as alms for the poor (Section 8.4.4.) and distribution of free food aid by the CNAUR, at least traders are able to control volume and timing of their own alms. With food aid, they cannot.

As indicated by Table 8.22, only about one-fourth of the trader sample in the Northeast has traded in food aid intended for sale during the few years immediately preceding the CESA-MSU surveys (Mopti is shown for contrast). The volumes handled by the one or two traders in Tombouctou reached as high as 500 tons of maize and 300 tons of rice. The few traders in Gao and Ansongo-Bourem handled substantially smaller volumes. Most food aid was bought through OPAM.

Table 8.22 shows that only one trader in Tombouctou and in Gao,. but four in Ansongo-Bourem, bought and sold food aid for direct distribution. Secondary food aid markets often develop following large or untargeted distributions,[61] as recipients exchange some of their cereals to meet pressing cash needs, including purchase of other food items.

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[61]Where all residents receive the same quantity per household regardless of effective demand or nutritional status.

Table 8.22

Purchase and Sale of Food Aid by Urban Grain Traders in the Northeast and Mopti, 1988/89

	Tombouctou	Gao	Ansongo-Bourem	Mopti
Percent who buy and sell food aid intended for sale				
Wholesalers	25.0 4	0.0 6	50.0 2	0.0 4
Semi-Wholesalers	28.6 7	75.0 4	14.3 7	0.0 5
All Traders	27.3 11	30.0 10	22.2 9	0.0 9
Percent who buy and sell food aid intended for free distribution				
Wholesalers	25.0 4	0.0 8	50.0 2	0.0 4
Semi-Wholesalers	0.0 7	20.0 5	42.9 7	0.0 5
All Traders	9.1 11	7.7 13	44.4 9	0.0 9
Percent who believe that food aid disrupts the cereals market				
Wholesalers	100.0 4	100.0 5	50.0 2	33.3 3
Semi-Wholesalers	71.4 7	.100.0 1	85.7 7	100.0 3
All Traders	81.8 11	100.0 6	77.8 9	66.7 6
Percent who find that buying and selling food aid is lucrative				
Wholesalers	75.0 4	0.0 7	50.0 2	0.0 2
Semi-Wholesalers	42.9 7	25.0 4	42.9 7	0.0 3
All Traders	54.5 11	9.1 11	44.4 9	0.0 5

The fine type in each cell indicates the number of respondents.
CESA-MSU Food Security Project Surveys, 1988/89

Although all traders admitted paying less than the prevailing market price, they clearly saw this arrangement as mutually advantageous to themselves and food aid beneficiaries.

Most traders claim to be pleased that the needy receive free food. However, the majority of all traders in each city agrees that the sale or distribution of food aid disrupts normal market operations. A more divisive issue among traders is whether dealing in food aid is lucrative, a typical example of a social trap where an action that is profitable for the individual in the short run is detrimental to the group in the long run.

Table 8.23 summarizes trader attitudes about the lures and hazards of dealing in food aid. Nearly all who find food aid lucrative say that food aid sales offer quick liquidity (50.0 percent) and high returns (35.7 percent), opinions held in about the same proportions by wholesalers and semi-wholesalers.

These views are not universally shared. About two-thirds of the complaints against "profiteering" from food aid are moralistic in tone: that the intended purpose of food aid as a source of consumption for the poor should be respected (25.9 percent) and that trading in food aid is undignified and disrespectable (22.2 percent) or dishonest and unscrupulous (18.5 percent). These responses suggest that traders do not always distinguish between food aid authorized for sale and food aid for direct distribution. This confusion about the alternative uses of food aid may discourage some traders from participating in food aid auctions run by OPAM (following section).

The remaining criticisms, mainly by those who don't deal in food aid, are more economic in nature and concern the price depressing effects of additional food aid supplies on the market, the slowdown of commercial sales and implied impact on credit repayments. Instability of expectations due to the uncertain timing of the appearance of food aid is a final factor which disrupts trader marketing strategies and may cause investments to be scaled back. Indeed, the majority of traders sampled in Tombouctou, Gao and Ansongo-Bourem declared

Table 8.23. Reasons why the Buying and Selling of Food Aid is/is not Lucrative, according to Urban Grain Traders in the Northeast

	Tombouctou		Gao		Ansongo-Bourem		Row Totals		Whole-salers		Semi-wholesalers		Row Totals	
	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct	N	Pct
Lucrative														
1. Profits are substantial.	2	25.0	1	100.0	2	40.0	5	35.7	2	40.0	3	33.3	5	35.7
2. Food aid sells quickly because it's cheaper; food aid brings in liquidity in short order.	4	50.0			3	60.0	7	50.0	2	40.0	5	55.6	7	50.0
3. Buying by bid from OPAM is especially profitable for wholesalers.	1	12.5					1	7.1	1	20.0			1	7.1
4. Other.	1	12.5					1	7.1			1	11.1	1	7.1
Column Totals	**8**	**100.0**	**1**	**100.0**	**5**	**100.0**	**14**	**100.0**	**5**	**100.0**	**9**	**100.0**	**14**	**100.0**
Not Lucrative														
1. Sale of food aid undercuts the bargaining power of traders and depresses normal market prices.	2	40.0					2	7.4			2	13.3	2	7.4
2. Food aid slows the sale of commercial cereals.	1	20.0					1	3.7			1	6.7	1	3.7
3. Food aid is a source of annoyance, bringing nothing but trouble.	2	40.0					2	7.4			2	13.3	2	7.4
4. Food aid is intended for consumption by the malnourished, not for sales by traders.			5	31.3	2	33.3	7	25.9	4	33.3	3	20.0	7	25.9
5. Trading in food aid is disliked, the object of scorn and rumors.			4	25.0	2	33.3	6	22.2	4	33.3	2	13.3	6	22.2
6. Trading in food aid should be condemned on moral and religious grounds.			5	31.3			5	18.5	3	25.0	2	13.3	5	18.5
7. Availability of food aid is uncertain, no basis for planning a long-term marketing strategy.					1	16.7	1	3.7			1	6.7	1	3.7
8. I don't know.			2	12.5	1	16.7	3	11.1	1	8.3	2	13.3	3	11.1
Column Totals	**5**	**100.0**	**16**	**100.0**	**6**	**100.0**	**27**	**100.0**	**12**	**100.0**	**15**	**100.0**	**27**	**100.0**

Multiple responses were possible. CESA-MSU Food Security Surveys, 1988/89 themselves "poorly" or "not at all" informed about the distribution or sales of food aid operations (Steffen, 1990).

8.4.3.2. The Impact of OPAM Cereal Auctions

The switch to the new auction-based system of grain sales by OPAM suffered from lack of experience and understanding of normal auction procedures.[62] This produced some unusual results for market performance.

In Gao, sales contracts in the first auction of 1,500 tons of rice in April 1989 were awarded to the highest bidders (150 CFAF/kg), traders from Bamako and Ségou who shipped their rice back south to Mopti and Bamako. Five hundred tons of rice were put up for the second auction in May 1989, divided between 250 tons of American rice and 250 tons of Malian 40 percent brokens (*RM40*) purchased as food aid by the World Food Program. This time, sales were awarded to traders from Gao, but in order to sell the less preferred American rice, the bid price was negotiated in advance between OPAM and bidders, through the good offices of the regional governor, at the intermediate price of 140 CFAF/kg. In exchange, the winning traders agreed to take equal lots of Malian and American rice.[63]

In Tombouctou, 1,000 tons of American and Malian 40 percent brokens rice went up for auction in July 1989. Unlike the experience in Gao, tied purchases of American and Malian rice were not required and separate bid prices were accepted, reflecting the market margin between American and Malian rice. Only 150 tons were purchased by a trader from

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[62]This section is based on separate interviews with OPAM Regional Delegates in Gao and Tombouctou in September 1989 and Gueymard *et al.*, pp. 15-17.

[63]The impact of these purchases on the average Gao wholesaler purchase price of 40 percent brokens rice can be seen in Table A8.1.7 (Annex 8.1). Auction purchases caused the price to drop from 183 CFAF/kg in April 1989 to 143 CFAF/kg in May. This price rebounded to 177 CFAF/kg in June.

Tombouctou, but the remaining 850 tons were bought by a trader from Mopti for delivery to Mopti.

One external evaluation found this initial experience with auctions "disappointing," faulting OPAM for having accepted bids below market value. It was recommended that OPAM rely more closely on the SIM for determining optimal timing of auctions and minimum acceptable bids to obtain better margins and reduce price distortions (Thènevin and Waddell). While no restrictions were placed on the transfer of OPAM cereals by buyers, minimum bids would also put an end to price arbitraging based on implicitly subsidized prices and avoid the perverse result where cereals were exported from the "deficit zones" for sale in southern Mali (Gueymard *et al.*). Complementary efforts to expand the number of bidders through training and credits were deemed necessary to avoid collusion by traders (Thènevin and Waddell) who are aware that OPAM must sell one-third of the SNS each year, barring emergency drawdowns.

Another review of the OPAM experience with auctions identified similar problems: poor transparency, poor timing of sales, limited participation, and lack of bidder qualification safeguards. Possible solutions for improving auctions were to reduce minimum lot sizes to attract more smaller bidders, hold smaller but more frequent auctions, establish clear procedures for all stages of the auction process, clarify the pricing procedure, minimize negotiation after award of the bid, screen out non-serious bidders, and pay greater attention to grain quality (Bremer-Fox *et al.*).

Presumably, these and other required adjustments have been made in the intervening period. If not, unequal participation of traders in OPAM auctions, reflecting unequal access to credit and financial markets, and/or below market-price sales would lead to segmented markets at the cost of suboptimal market performance.

8.4.4. A Final Influence on Market Performance in the Northeast: Distribution of Cereals by Traders

Cereal market performance in the Northeast is also influenced by distribution of free cereals by traders. This influence is identified for further investigation.

Islam directs its adherents to give alms to the poor. There is evidence that traders in the Northeast take this directive to heart (Steffen and Koné).

Alms-giving under Islam is broken down into compulsory tithing (*zakat*) and voluntary charity (*sadaka*). Along with data on trader purchases and sales, data were collected on trader charity alms in the form of free cereals to the needy.[64] These data are shown in Table 8.24 by month for Tombouctou and Gao and, for comparison, by monthly average for Mopti and Bamako.

Evidently, traders in Tombouctou practice the tradition of voluntary charity for which that city has been renowned historically (Iliffe). Tombouctou traders distributed nearly 7 tons of cereals per month, about five times more than traders in Gao, even though the Tombouctou sample had one fewer than the Gao sample. These distributions (all cereals) were more stable in Tombouctou (CV = 0.29) than those in other cities.

Free distributions expressed as a percentage of market sales of surveyed traders shows that Tombouctou traders proportionally gave away about six times as many cereals as traders in Gao (3.02 percent versus 0.51 percent) and about seven times as many cereals as traders in Bamako (3.02 percent versus 0.43 percent). By contrast, Mopti traders appear unabashedly tight-fisted, having given cereal alms equivalent to a minute fraction of one percent of their sales.

[64]Alms are best given in secret, according to the Koran, but no trader objected to disclosing this information. Some traders declared having given charity other than cereals which was not recorded.

Table 8.24
Total Free Distribution of Cereals by Urban Traders
(Kilograms)

	Millet	Sorghum	Rice Paddy	All Cereals
Tombouctou (N = 11)				
November 1988	2,355	480	0	3,320
December	1,865	580	0	8,495
January 1989	765	75	0	6,020
February	1,615	145	180	7,150
March	1,590	15	525	7,615
April	1,825	75	710	8,180
May	1,625	50	300	7,350
June	3,580	725	4,800	10,035
July	2,540	85	4,700	7,515
August	2,565	165	200	7,730
September	2,296	0	357	7,328
October	2,410	135	100	2,805
Monthly Average	2,086	211	989	6,962
C. V.	0.34	1.15	1.79	0.29
Percent of Market	3.33	0.68	2.67	3.02
Gao (N = 13)				
November 1988	.	.	.	.
December	678	133	0	817
January 1989	50	2,250	0	2,300
February	1,650	2,950	0	4,600
March	21	0	0	21
April	4,526	0	0	4,526
May	554	60	0	614
June	34	0	0	484
July	227	500	0	1,227
August	220	0	0	320
September	18	0	0	18
October	27	0	0	177
Monthly Average	728	536	0	1,373
C. V.	1.86	1.95	.	1.24
Percent of Market	0.39	1.30	.	0.51
Mopti (N = 13)				
Monthly Average	84	31	0	140
C. V.	1.24	1.75	.	1.28
Percent of Market	0.02	0.04	.	0.02
Bamako (N = 33)				
Monthly Average	7,975	7,679	0	20,759
C. V.	1.97	1.91	.	1.31
Percent of Market	1.30	0.99	.	0.43

CESA-MSU Food Security Project Surveys, 1988/89

This high level of free distribution of cereals in Tombouctou may have several impacts on performance, depending on underlying supply and demand relationships. If a *one-time* distribution of cereal alms displaces effective demand for cereals which would otherwise be met on the market, all things equal, this would cause a shift in the market demand curve downward and to the left. However, if the distribution of cereals does not displace effective demand (because distribution is successfully targeted to those without effective demand), the demand curve would not shift.

The impact on the supply side depends on assumptions about the supply source. If cereals for a *one-time* distribution of alms are procured locally on Tombouctou markets, thereby reducing available local supplies for those with effective demand, the supply curve shifts upward and to the left. However, if alms for distribution are procured outside of Tombouctou (for example, in distant rural villages), the Tombouctou supply curve might not be affected. Under these alternatives and depending on supply and demand elasticities, market prices for cereals might increase or stay the same.

If the distribution of cereals by traders occurs regularly, however, as appears to be the case, and supply and demand conditions are relatively constant, price changes will move along the supply and demand curves.

8.5. Conclusion and Summary of Main Points

8.5.1. Structural Variables

- For the most part, grain traders in the Northeast exhibit the expected patterns whereby wholesalers have more experience, sell higher average monthly volumes and are more likely to specialize in trading cereals than semi-wholesalers. The grain trade is not dominated by any single ethnic group.

- Barriers to entry are the same in the Northeast as elsewhere: poor knowledge about the grain market and insufficient capital. A minority of traders claimed to have encountered no particular barriers.
- Most traders in the Northeast consider themselves well informed about developments in the grain trade as concern them personally. Few had read the SIM *Bulletin* as of mid-1989, although most had listened to the weekly SIM radio broadcast. There is compelling evidence that trader information needs differ by region of the country.
- Based on market concentration ratios and Herfindahl Indices of market concentration, urban cereal markets in the Northeast are more concentrated, on balance, than other markets in Mali.

8.5.2. Conduct Variables

- Price discovery depends foremost on information from other traders and suppliers, in the case of purchases, and from other traders and clients, in the case of sales, rather than institutional sources. The market price of the day is the most critical factor taken into account. While price leadership occurs, collusion to fix prices is difficult to achieve due to price transparency and competition, according to traders.
- Apprehension about ruptures in cereal supply-lines causes traders in the Northeast to pay greater concern to temporal price arbitrage, as seen by their "just in case" cereal storage strategies, whereas traders elsewhere in Mali

mainly pay attention to spatial price arbitrage, as seen by their "just in time" storage practices.

- Although fewer traders in the Northeast buy cereals on credit than sell on credit, most wholesalers say that they can find sufficient credit on short notice; semi-wholesalers are less able to find credit readily. Reimbursement periods are longer in the Northeast than in the South, usually two to four weeks, without payment of interest. When cereals are abundant, as in 1988/89, only Tombouctou traders appear to charge a higher price for sales on credit than for sales for cash; elsewhere, there is no difference between cash prices and credit prices.
- Credit relations between traders are built on mutual trust. Long-standing supplier-creditor and consignee-debtor relationships, where credit is received in kind, function as formal contracts in disguise. Fears of biased and unfair adjudication of contractual disputes by the court system block wider use of formal contracts between traders.
- Thanks to all-weather road links with southern Mali which expand trading options, traders in Gao are less likely than traders in Tombouctou to enter into steady partnerships or contracts with suppliers. Transaction costs, including the agency problem, are likely to be less for Gao traders.

8.5.3. Performance Variables

- Concerning static market efficiency, pairwise price correlation coefficients show that price differentials for the main cereals were relatively strong and stable between wholesale markets in the Northeast and key supplier markets in

Mali, particularly for millet and sorghum. Price changes, signalling excess supply and demand conditions in the Northeast, are readily transmitted to other markets, indicating a high degree of market integration.

- Gross marketing margins between wholesaler sales prices and semi-wholesaler sales prices are often negative, especially in Gao, suggesting that the functional supply relationship between wholesalers and semi-wholesalers is weak and that the two types of traders operate in different marketing channels. Regression analysis of gross marketing margins between wholesalers and semi-wholesalers for millet and sorghum implies that both Tombouctou and Gao semi-wholesalers are price-takers who add only a constant mark-up reflecting costs to their sales prices — unlike Mopti and Bamako (millet) and Bamako (sorghum), where semi-wholesalers adjust their prices upward by less than one-unit, given a one-unit increase in wholesaler prices (and adjust their prices downward by less than one-unit, given a one-unit decrease in wholesaler prices).
- Concerning dynamic market efficiency, a panoply of new or reformed market-facilitating institutions and services augur favorably for the continued development and strengthening of Mali's cereal market. As well functioning markets are the first line of defense for food security, this is of special importance for the Northeast.
- These improvements in the cereals market are generating demand for accurate and reliable market information and analysis through the SIM. Although policy makers may find this information more useful in the immediate term that the farmers and traders, demand for institutional sources of market

information can be expected to grow more evenly between the public and private sectors.

- Concerning institutional and government indicators of performance, strides have been made in more closely integrating distribution of public food aid and periodic auctions of OPAM stocks within market mechanisms and to rely on market prices to guide food aid distribution (SAP, SIM, CNAUR and OPAM) and buying and selling operations (SNS, SIM and OPAM).
- Market performance in the Northeast is subject to the additional influences of free distribution of cereals by traders, notably in Tombouctou, the direction and magnitude of which need to be investigated.

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THE ROLES AND LIMITS OF THE GRAIN MARKET IN ASSURING HOUSEHOLD FOOD SECURITY IN NORTHEASTERN MALI: IMPLICATIONS FOR PUBLIC POLICY

Volume III

by

Philip Nathan Steffen

A DISSERTATION

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Part IV.

Chapter Nine. Summary and Implications for Public Policy in the Northeast

This concluding chapter begins by reviewing why cereal markets matter for household food security. Section 9.2 summarizes the limitations of the market, as filtered through pervasive uncertainty and discrepant seasonalities from the vantage of both traders and households. Section 9.3 distills implications for food security and marketing policies from the major conclusions. Section 9.4 makes specific recommendations for public sector intervention in the cereals market to improve market performance and household food security. Section 9.5 identifies areas for future research. Section 9.6 offers a closing comment.

9.1. Why Markets Matter for Food Security

Given the long lead time for economic growth in Mali and the Northeast, what steps can be taken in the short term to enhance food security? Many options point to improving the reliability of markets and prices as signals of relative scarcity and incentives.

The notions of markets and market prices are interlinked. Markets provide a setting for transforming agricultural commodities in time, place and form. Markets provide the means for transferring ownership between producers and consumers. Markets allow price discovery (Timmer, 1986).

In turn, prices express relative values. Prices influence the allocation of resources in production and consumption. Prices inform market participants about the structure of incentives and opportunities. Prices coordinate markets and markets coordinate the economy.

But actual market performance and its impact on welfare depend critically on just how efficiently marketing activities are carried out and thus, how efficiently markets generate and transmit price signals. The presence of market imperfections and structural constraints mean that market prices do not necessarily lead to an optimal pattern of resource allocation (FAO/Committee on World Food Security).

In the absence of domestic trade and storage, the short-term supply of cereals in the Northeast is subject to random drought, compounded by production technologies which are mostly static. A production shortfall will have largely offsetting price effects, although to the degree that demand for cereals as a staple is price inelastic, the change in price may be proportionately greater than the change in output.

The heart of the question is whether food insecurity in the Northeast is due to a lack of effective demand or to a lack of grain. Ultimately, of course, it is both. The physical presence of food is required to translate recovery and improvements in exchange entitlements into tangible improvements in food security. Without supplies, the notion of entitlements is meaningless. In a market economy, the bulk of the adjustment to reduced cereal supplies is made by low-income households (Mellor).

This is because cereals, above all other foods, are a wage good. Due to the critical relationship between food prices and income, the real price of cereals determines the adequacy of exchange entitlements — and whether poor households are able to maintain equilibrium consumption levels.

Even within the same marketing year, seasonal variability in food prices affects farmer incomes and consumption costs of net buyers. For farm households, holding production constant, the effect of a relative change in cereal prices on incomes depends on the quantity they produce, the quantity they market, and the quantity of purchased production inputs (Mellor), the latter which may be negligible in the Northeast. For wage earners, any relative change in cereal prices will affect their real incomes and possibly employment opportunities through secondary changes in the demand for other goods and services by upper-income households (particularly critical for wage-earning or salaried Off-River households). Real incomes decline as food prices increase over time after harvest, an effect possibly alleviated by rainy season access to wild cereals. However, to the extent that the pattern of seasonal price increases is unpredictable — due to variations in crop yields, total production, and availability of wild cereals, as well as releases from the National Security Stock and/or distribution of food aid — seasonal prices differ year by year *as expectations differ* (Sahn and Delgado).

Prices have important nutritional implications. Since the poor in the Northeast are more likely to be net buyers of cereals most of the year, they will be more sensitive to higher food prices as a result of their relatively inelastic demand (von Braun and Kennedy).[1] The full impact of higher prices also depends on the relative budget share allocated to cereals, the elasticity of supply with respect to higher prices and, as cereals are not a homogenous

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[1]Table 5.18 indicates that that price elasticities of demand for local rice (North stratum) and millet (Off-River stratum) are negative and less than unity (inelastic), while the price elasticity of demand for sorghum (On-River stratum) is negative and greater than unity (elastic).

commodity, cross-elasticities of demand among cereals. Generally, a change in real income of the poor will be reflected in the change of demand for food (Mellor).[2]

However, if prices decline, net buyers respond in two ways: They will be able to substitute cheaper cereals for more expensive ones (by moving along their indifference curve). Price declines will lead households to buy more through the income effect as real incomes rise in proportion to budget share spent on cereals (by moving to a higher indifference curve). In either case, the income and substitution effects tend to raise food consumption through increased purchases. Fortunately, households in the Northeast have the option of selecting among a range of cereals, including wild cereals in a good rainfall year. Moreover, even substitution of lower-priced cereals for higher-priced cereals allows similar quantities of consumption without necessarily a commensurate loss of nutritive value (Chapters 4 and 5, Annex 5.1).

These factors point again to the critical exchange function of markets and what might decrease their effectiveness. Seasonally thin rural markets limit the dual role of markets as supply source and outlet for local products. Poorly functioning markets, as a result of underdeveloped physical marketing infrastructure that hinders cereal flows between regions and seasons, mean that price risks are high. While high prices are not necessarily undesirable — they reflect storage and transfer costs, among others — they add to high marketing margins and costs borne by the ultimate consumer. Although the adverse effects of price controls on cereals marketing are no longer an issue in the Northeast, other risks and uncertainties keep costs high. In addition to poor roads and transportation facilities and thin markets, excessive

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[2]Table 5.16 shows that the lower income terciles have a positive and elastic expenditure elasticity of demand for food and (except for the North stratum) cereals, but positive and inelastic expenditure elasticities for cereal calories. Table 5.17 shows that aggregated households by strata have positive but inelastic income elasticities of demand for consumption of cereal calories.

costs arise from low volumes and lack of large scale economies, and ineffective public sector participation in markets.[3]

Markets can be made more reliable for the poor and food insecure, despite generally good performance by traders under a host of physical and institutional constraints. Price and supply fluctuations due to climatic variability can be moderated through improvements in the food distribution network — especially transport and storage arbitrage. Well-functioning markets can restore predictability to prices. By influencing distributional issues of entitlements and purchasing power, "effective and equitable operation of markets" can be considered a critical mainstay of a country's food security policies (World Bank, 1990a).

One objective is to strengthen market efficiency. Expansion of market facilitating services leading to greater competition and transparency will help to lower marketing costs. Lower marketing costs improves market efficiency. By reducing uncertainty and transaction costs, markets "behave" more rationally, modulating prices marketing costs between locations and seasons. Prices will seek their equilibrium as food staples move from surplus areas where prices are low — benefitting farmers — to deficit areas where prices are high — benefitting consumers.

Furthermore, by lowering costs, efficient markets push down the cost of food for the poor — with enormous implications for household cereals consumption and food security. Studies have shown that the greatest relative benefits from reductions in marketing margins accrue to the lowest income consumers via the price effect described previously (Harrison, Henley, Riley and Shaffer; A. Berg; Mellor). In Africa, the potential savings in food

[3]Sen (1985) makes the case for expanding food production in Africa where markets are unreliable so that rural households are less dependent on market exchange for acquiring food. However, Shaffer *et al.* caution against emphasizing food production to the neglect of investments in markets, as "...the marketing system can be a source of considerable development leverage or can be a barrier to development."

marketing costs are enormous (Pinstrup-Andersen, 1989). This situation appears little different in Northeastern Mali.

Stability of prices is another aspect of market performance which aids household expectations and planning for food security, especially intertemporal economic decisions regarding savings and dissavings and, where possible, participation in the labor market (Alderman and Sahn). Low income households are at particular disadvantage during excessive fluctuations in prices, often unable to cope with periods of high prices. Moreover, high food prices decrease real exchange entitlements of households that are net buyers or that do not derive their incomes from cereals production. The malnourished, who exist on the slimmest of margins, are the least able to absorb economic adversity (A. Berg) or carry over stocks and purchasing power from one season to the next (Pinstrup-Andersen, 1985).[4]

In short, there is ample scope for improved marketing services and infrastructure. This point has been made often. Reviewing the experience of World Bank-financed nutrition projects, A. Berg found that by increasing efficiencies in the food marketing system, it is possible to substantially reduce prices that poor families pay for food (A. Berg, 1987). Von Braun (1990) claims that overcoming market failures may be a feasible solution to mitigate food insecurity. Improving the efficiency of cereals marketing and price transmission may achieve simultaneously higher producer prices and lower consumer prices (Pinstrup-Andersen, 1985), and resolution of the food-price dilemma. Indeed, well-functioning markets are the front-lines defense in the battle for food security (Staatz, Dembélé and Aldridge).

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[4]Lipton claims that those near the margin between the poor and the very poor may be less equipped to withstand an unexpectedly bad season than households accustomed to generations of extreme poverty.

9.2. A Summary of the Limitations of the Market in the Northeast

This dissertation has recounted the long traditions of marketing in the Northeast which, in some ways, escaped the worst excesses of earlier government policies (such as forced sales to OPAM) but which still endured other forms of harmful government interference (such as segmented markets and indiscriminate distribution of food aid). The regional economic base — on which the cereals market relies as both a source of supplies and effective demand — remains fragile and narrow, precariously dependent on rainfall for agriculture and herding. On a more optimistic note, the former neglect of basic marketing services has reversed course. The impact of nascent marketing services and institutions to coordinate markets is starting to be felt.

Yet, two factors overarch all other considerations in limiting the effectiveness of the cereals market in the Northeast: pervasive uncertainty and discrepant seasonalities.

9.2.1. Pervasive Uncertainty

Markets in the Northeast are subject to pervasive uncertainty. Some of this uncertainty is systemic. Some is "natural," subject to vagaries of climate and rainfall. The specifics may vary between survey strata, terciles and years, but the following factors contribute to supply and demand uncertainty in the "good year" scenario, such as 1988/89:

9.2.1.1. Supply[5]

9.2.1.1.1. Weak physical infrastructure. Physical infrastructure is poorly developed. Transport infrastructure deteriorates during the rainy season (Chapter 2).

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[5]Identification of some factors as "supply" factors and others as "demand" factors is somewhat arbitrary as a "supply factor" may have an offsetting "demand factor," and vice versa.

Supplies cannot reach some localities which become isolated for weeks at a time — with little warning. Moreover, poor physical infrastructure generally increases transaction costs by impeding transmission of market signals and obstructing the private sector in effectively performing its role in facilitating trade and integrating competitive markets.

9.2.1.1.2. Expensive storage practices. Poor transport infrastructure requires traders to practice a "just in case" storage strategy, where supplies on hand are equivalent to several times monthly sales, as insurance against ruptures in the supply line (Table 8.14). This also requires higher storage capacity at a non-negligible opportunity cost (Table 8.13). However, a minority of traders stores *only* cereals in their warehouses, leaving room for the majority of traders to expand cereal storage.

9.2.1.1.3. Seasonally thin rural markets. The presence of thin markets, in both supply sources and demand centers, can easily upset purchase and delivery plans — and distort prices (Chapters 6 and 7). Moreover, economies of scale in transport are difficult to achieve given the widely dispersed population. Backhaul opportunities are few (Chapter 2).

9.2.1.1.4. Unexpected cereal deliveries. Poor planning or unexpected cereal deliveries on consignment, especially for rural markets, requires traders to operate with a full set of contingencies for storage facilities and alternative markets (Chapter 7).

9.2.1.1.5. High costs of long distance contracting. Contractual relations are difficult to achieve due to the higher costs of transacting long-distance business (Chapter 6). This is partly a function of poor infrastructure which prevents easy monitoring of far-away agents. This is also a function of the legal/regulatory system. Traders, historically, are reluctant to ask the courts to resolve contractual disputes because outcomes are uncertain (Table 8.17; Steffen and Dembélé), particularly when one party can influence these outcomes opportunistically. Nonetheless, there is some evidence that "contractual" consignment relations are taking hold, particularly in Tombouctou (Table 8.16).

9.2.1.1.6. Weakly integrated rural markets. Measures of market integration between *urban* wholesale markets in the Northeast and the rest of the country are strong for millet and sorghum (Table 8.18), although indices for less accessible Tombouctou are usually poorer than those for Gao. However, based on correlation coefficients and Timmer's index of market connection, measures of market integration among many *rural* markets in the Gao region are weak (Tables 7.4 - 7.6). Poor integration poses problems for price arbitraging opportunities, compounded by poor information about alternative markets.

9.2.1.1.7. Uncertain impact of wild cereals on market supply and demand. The availability of wild cereals decreases market demand for cereals (Tables 5.8 - 5.11), but supplies are very unpredictable due to localized rainfall patterns. This decrease in market demand could be offsetting in that the increase in real incomes, due to availabilities of wild cereals and foregone expenditures (the income effect), means that households want higher quality cereals or more convenient to prepare cereals, such as millet (the substitution effect).[6]

9.2.1.1.8. Low specialization in the cereals trade. The degree of urban wholesaler specialization in the cereals trade is relatively low in the Northeast (Table 8.1). No wholesaler in Tombouctou specializes in cereals, implying that traders must diversify because the cereals market alone is not sufficiently stable, remunerative, or both.

9.2.1.2. Demand

Effective rural demand for cereals is seasonally weak, volatile and unpredictable. Changes in demand patterns *between* years make medium- to long-term planning an uncertain

[6]Data do not allow a full measure or disaggregation of these effects.

exercise. Changes in demand *within* the year require continual adjustments in marketing strategies.

9.2.1.2.1. Uncertain, fluctuating household income. A sizeable part of household income in each strata is subject to random weather shocks in the case of own production of agricultural products (gathering of wild cereals) and own consumption of produced (gathered) cereals. Livestock production is equally rainfall-sensitive. A sizeable part of income depends on goodwill and support from others in the form of charity aid and remittances. These income sources often fluctuate sharply by season.

9.2.1.2.2. Unpredictable impact of charity and alms. Relatively significant charity income in rural areas may reduce effective market demand if given in kind (Tables 4.8 and 4.11). Likewise, alms-giving of cereals by traders, particularly in Tombouctou (Table 8.23), may reduce the market demand for cereals slightly, although to the extent that this is largely self-targeting (the poor identify themselves) or regulated (the trader knows who is poor), the impact on aggregate effective demand is not known.

9.2.1.2.3. Potentially disruptive food aid. Food aid distributions reduce market demand for cereals in the short run. Food aid arrival dates are usually unknown to traders. Local authorities may inflate needs. Food aid distributions may disrupt markets due to leakages from untargeted uniform distributions, depressing prices and reducing returns to storage. In some cases, this is offset by the profitability of food aid cereals dumped onto the market as household recipients seek quick cash for other pressing needs (Tables 8.21 and 8.22).

9.2.1.2.4. Perverse effects of OPAM auctions. Initial experiences with OPAM's auctions of cereals stored in the National Security Stock (food aid or domestic production) had perverse results, allowing below-market value cereals to be transported great distances to upset normal supply channels (section 8.4.3.2.).

9.2.1.2.5. Variable timing of cereal flow reversals. Cereal flow reversals can occur between rural markets (Tables 7.9 and 7.10). The exact timing of these reversals is variable, adding another factor of uncertainty for traders in planning their marketing strategies. This requires traders (and public marketing institutions) to monitor unlikely sources of supply and/or distant sources.

9.2.1.2.6. Difficulties in meeting the strong demand for millet. Over the year, rural households spend more on millet, a cereal grown outside the Northeast, than sorghum which is grown regionally (except paddy purchases by On-River middle income households; Tables 5.4 - 5.7). This requires wholesale traders to monitor supplies and prices in millet-growing regions of southern Mali and to enter into long distance trading relations with southern suppliers — perceived as risky ventures.

9.2.1.2.7. Uncertain local/rural market demand patterns for cereals. In the good year case, local traders buy cereals from South/On-River households which reenter the market later in the season as buyers (section 5.5.1). In poor years, there may be no local surplus for farmers to sell and hence, less household income for buying marketed cereals. The question remains whether cereals will flow into localities with negligible incomes and hence no effective demand.

9.2.2. Discrepant Seasonalities

The need for cereals and the capability of the market to meet those needs are subject to discrepant seasonalities, especially in the rainy season. Delivery of outside cereals *to* local/regional markets and delivery *between* local/regional markets are the most difficult.

Moreover, while cereals purchases from the market are proportionately greatest in the rainy season, household incomes to buy cereals are typically lowest during the rainy season. There are few options in the short run to reduce these discrepancies or improve synchronization.

9.2.2.1. Pro-cyclical marketing behavior and price movements. On-River (Table 4.10) and other surplus-producing households dispose of most of their cereals on the market during the harvest/post-harvest season when supplies are abundant from regional and national sources. This may cause a pro-cyclical decline in prices — advantageous for non-farming and poor households in driving down the cost of cereals, but not advantageous for farming households in terms of higher prices in later seasons. These households are unable to defer some consumption in the harvest/post-harvest to the rainy season due to insufficient volumes of home storage (assuming the expected gain in market prices over time is greater than cumulative storage costs).

9.2.2.2. Inverse seasonal relation between household incomes and absolute market demand for cereals. Seasonal household incomes are lowest in five strata terciles (of twelve) when seasonal absolute cereal expenditures are highest. This phenomenon is not limited to lower income households, but includes upper income South households in the rainy season, as well as middle income Off-River and On-River households during the hot dry season, and lower income South and Off-River households during the hot dry season (Tables 4.14 - 4.16). For these last four terciles, incomes rise and absolute expenditures on cereals fall during the rainy season, both due to home consumption of wild cereals (Tables 5.9 - 5.11).

9.2.2.3. Inverse seasonal relation between household expenditures and percentage expenditures on cereals. In aggregate terms, spending on cereals is the highest expenditure category for nearly all household strata and terciles, even in a good rainfall year. In seasonal terms, cereal expenditures may decrease absolutely as household incomes decrease, but increase relatively as a proportion of total expenditures. In the North and Off-River strata, *all terciles*, absolute total household expenditures decrease to their lowest levels by the rainy season, but percentages spent on cereals increase to their highest levels (Tables 4.13 and 4.15).[7] This relation also holds for middle income South and On-River households (Tables 4.14 and 4.16).

9.2.2.4. Highest proportion of cereal expenditures within total expenditures during the rainy season. Closely related to the point above, half or more of all household expenditures is allocated to cereals in each stratum[8] during the rainy season (except the South at about 46 percent; Tables 4.13 - 4.16). Cereals expenditures as a percentage of total expenditures are the highest during the rainy season in all strata and *all terciles* except South lower income households (Table 4.17).[9]

The North and On-River households are most dependent on the market for purchase of cereals in the rainy season. On-River markets are no less difficult to reach than North markets at that time. Even in the rainy season, the Niger River does not rise high enough for large river transport until near the end of the season.

9.2.2.5. High demand for non-regional cereals during the rainy season. The percent of cereal calories consumed from cereals grown outside the Gao Region during

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[7]Assuming that cereal expenditures of 40.5 percent by middle income Off-River households during the hot dry season is equivalent to cereal expenditures of 40.4 percent during the rainy season.

[8]Based on a weighted average of expenditures of all terciles.

[9]Again assuming that cereal expenditures of 40.5 percent by middle income Off-River households during the hot dry season is equivalent to cereal expenditures of 40.4 percent during the rainy season.

the rainy season is high when demand on the poor road network is greatest and rural roads are often impassable — as high as 70-80 percent in the North and around 50 percent Off-River strata, all terciles, and nearly 50 percent for lower tercile On-River households (Table 5.12).

Rural households consume about half their cereal calories from *millet* in the North and Off-River strata, an outside cereal — an increasing percentage by season in the North and a higher percentage in the rainy season than the harvest/post-harvest season in the Off-River stratum (Tables 5.4 and 5.6).[10]

9.2.2.6. High dependence on market cereal calories during the rainy season. North and Off-River households depend on market cereals for a high percentage of their cereal calories consumed in the rainy season — about two-thirds on average in the North and Off-River strata — when roads are poorly passable (Tables 5.8 and 5.10). Upper and middle tercile North and Off-River rural households purchased a higher percentage of their cereal calories from the market in the hot dry season than in the rainy season when they could gather wild cereals.

Whereas South households purchased an average of about 37 percent of their cereal calories from the market (Table 5.9), reliance on the market is greatest during the hot dry season, followed by the rainy season when wild cereals became available. On-River households purchase nearly 40 percent of their cereal calories (Table 5.11). Like South households, these purchases are greatest in the hot dry season, followed closely by the rainy season.

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[10]Less categorically, South and On-River rural households consume a high portion of their calories from paddy, a *local* crop (although millet contributes the largest share of calories for low income South households during the harvest/post-harvest season and upper income South households during the remaining two seasons and for lower income On-River households during the last two seasons).

9.2.2.7. Rainy season consumption of seed stock. Average North and On-River cereals producing households, *all terciles*, dipped into their seed reserves for cereal consumption during the rainy season — a dangerous depletion of productive assets during the season when these are most urgently required (Tables 5.9 and 5.11). Middle and lower tercile South households also consumed their seed reserves during the rainy season (Table 5.9).

9.2.2.8. Higher calorie consumption needs, but sharp declines in cereal calorie consumption during the rainy season. Cereal consumption needs — calories — are greatest for farming and pastoral households in the rainy season. Seasonally labor-intensive activities, such as rainy season farming and short migrations, call for additional consumption of between 500 and 1,000 calories per day (Annex 5.1).

Yet, cereal calorie consumption per adult-equivalent is generally lowest in the rainy season.[11] Average daily consumption of cereal calories declines by about half in North households, *all terciles*, between the harvest/post-harvest season and the rainy season (Table 5.4). Cereal calorie consumption also declines between the harvest/post-harvest period and the rainy season for households in the South and On-River strata, *all terciles* (Tables 5.5 and 5.7), by more than half in the case of middle and lower tercile On-River households.

9.2.2.9. Little difference in consumption with the elimination of post-harvest "forced" sales of cereals. Spreading the daily calorie equivalent of average household cereal sales during the harvest/post-harvest season among the hot dry season and rainy seasons does not greatly alter the discrepant seasonality in cereal consumption.

[11]This was the case for all North terciles and two of three On-River terciles (Tables 5.8 and 5.11). Cereals consumption, given a boost by access to wild cereals during the rainy season, was lowest in just one of three South and Off-River terciles (Tables 5.9 and 5.10). Cereals consumption is likely to deteriorate in years of poor rainfall, all factors equal, when wild cereals are not abundant.

Sensitivity analysis shows that households in only two terciles (middle terciles, South and On-River) would become consumption secure in the rainy season when calorie demands are at their peak (Table 5.13).

9.2.2.10. Growing numbers of consumption insecure households by the rainy season. The percentage of consumption insecure household adult-equivalents within each stratum climbs sharply between the harvest/post-harvest season and the rainy season. Consumption security is much more sensitive to *seasonal* changes than alternative calorie consumption thresholds (Table 5.14). Although the North stratum has the lowest percentage of consumption secure households in the rainy season, the percentage *drop* in consumption secure households between the harvest/post-harvest and rainy seasons is just as severe in the farming On-River stratum, about 60 percentage points.

9.2.2.11. Few consumption secure households, many chronically insecure households. As a corollary, when calories from cereals contribute 85 percent of all calorie intake, few households are consumption secure in the Northeast — ranging from less than one household in five in the South to none in the North. The number of transitorily insecure households increases in the North and Off-River strata. These households can expect to recover consumption security in a subsequent season(s). Yet, about 75 percent of North, Off-River and On-River households, and more than 60 percent of South households, are chronically insecure (Table 5.15) — and this is the good year case, based on a bumper harvest nationally and widespread availability of wild cereals in the Northeast.

Note that the "bad year" case might produce fewer seasonal extremes — downward trends in household income and cereal calorie consumption would be flatter — but households would be worse off in absolute terms, all things equal.

9.3. Some Implications for Policy

Pervasive uncertainty in cereal markets and discrepant seasonalities complicate marketing and food security policies in Northeastern Mali. To make policy planning easier, the following implications for the "good year" case can be drawn from evidence presented in this dissertation. These implications are shown in bullets following the major conclusions.

9.3.1. Household incomes — through agriculture and herding — remain dangerously dependent on rainfall levels and spacing.

Part II assessed household food security through the prism of exchange entitlements and access to food, rather than a focus on increases in food supplies alone. But, household food security status in the Northeast is closely correlated with the local cereals harvest. When farming households have a good harvest, they have higher real incomes through sales and own consumption. Local surpluses lower the real price of cereals for non-farming households as well. But when farming households experience a poor harvest or harvest failure, their real incomes suffer.

Short-term prospects do not look encouraging. In view of variable rainfall patterns, low-fertility of soils and the fragile resource base, Chapter 2 has all but ruled out agricultural and livestock sector-led growth in the Northeast.[12] Traditional practices to ensure low but sustainable crop yields are no longer effective, given population pressures (World Bank, 1989). Rare development projects to rehabilitate pastoral economies based on the voluntary return and socio-economic reintegration of destitute herders and on the promotion of

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[12]In the medium- to long term, increasing food supplies in *southern* Mali can come about through production increases based on research into drought-resistant local crops, yield stability and soils conservation which are both economically and ecologically sustainable.

environmentally-sound, low-intensity herding and pasture management practices justify themselves on the grounds that the "opportunity cost of doing nothing is high" in terms of the return to uncontrolled grazing habits (IFAD).

The combination of farm production and home consumption of produced (and gathered) cereals in the South and On-River households, all terciles, is the largest average source of annual household income (Tables 4.6 and 4.10). By generating demand for other local goods and services, this source of income strengthens the local economy through the multiplier effect — the multiple effect of each CFA franc of autonomous spending on the equilibrium level of income, where the simple multiplier is defined as $1 \div (1\text{-MPC})$.

An order of magnitude of the income multiplier can be calculated from the average marginal propensities to spend on (consume) all food from Table 5.16 for the middle income tercile of each of the four household strata (where the marginal propensity to spend on (consume) food is the highest available aggregate level of expenditure). These multipliers are substantial. They range between about 1.60 and 2.00, meaning that each CFA F 100 injected into the local economy through household spending will generate between CFA F 160 and CFA F 200 in additional demand.[13] Since the marginal propensity to consume *all* goods and services will be higher, the overall income multiplier will be higher arithmetically also. A multiplier of 2.50 is conceivable — or CFA F 250 per each CFA F 100 spent.

Salaries and wage income in North (upper income) and Off-River (upper and middle income) households are the largest average source of household income (Tables 4.5 and

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[13]These multipliers are 1.96 (North stratum), 1.98 (South), 1.83 (Off-River) and 1.64 (On-River). Multipliers taken from the entire stratum would be even higher, ranging between about 2.30 (South) and 2.80 (North).

4.9).[14] But, this implies a precarious indirect dependence on rainfall, via the income multiplier, as the engine of growth in the agricultural sector. Most likely, the contribution of salaries and wages would be much smaller in years of poor rainfall. Even charity and alms-giving income, the second highest average source for lower income North households, depends indirectly on rainfall levels. A critical question is the extent to which this source dries up in bad rainfall years.

Expansion of rural non-farm activities, a dynamic source of income and employment for rural households, thus requires strong forward and backward linkages with the agricultural sector as primary source of demand for non-farm goods and services (Chuta and Liedholm; Kilby and Liedholm). But, the impact of year-to-year volatility of this demand in the Northeast on intersectoral linkages is not clear.

Since any increases in income tend to be unequally distributed during the early stages of development (disparities in income distribution tend to broaden before they converge),[15] the large majority of poor people do not fully share in that growth of income or experience any immediate improvement in their energy intakes.[16]

Some policy implications are that:

- The search for new income growth and employment policies *delinked* from rainfall-dependent traditional income sources needs to continue unabated as a vital element of the government's food security strategy in the Northeast. In

[14]Average annual non-farm income was greater than farm and home consumption income combined for households in the North and Off-River strata and On-River lower income households (Tables 4.5, 4.9 and 4.10).

[15]This is the "inverted-U hypothesis" of Kuznets (1963), as reviewed in Meier (1989).

[16]Barring major changes in income distribution and changes in real food prices, chronic food insecurity is likely to diminish slowly in percentage terms of the population but increase in terms of numbers of people (World Bank, 1986b).

the absence of capital-intensive transport and extractive mineral sectors, and other than full control irrigated agriculture, these income and employment policies need to emphasize human resources development for labor-intensive manufactures and services.

- However, the same factors which hamper the cereals market — great distances from input and product supply sources, dispersed population, low economies of scale and seasonally difficult access — conspire against easy solutions. Thus, delinking employment and income from weather-dependent activities is a gradual and long-term prospect. This implies that many households in the Northeast will remain vulnerable in the medium term to transitory and chronic food insecurity.
- While a deliberate policy to depopulate the Northeast away from the Niger River would not be politically feasible,[17] subtle policies of more profitable investment and employment generation in other regions of Mali, allowing migrants to send remittances back to the Northeast, should not be discarded. This does not imply that Mali surrenders sovereignty over the expansive Northeast.

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[17]A deliberate policy would be unacceptable to Off-River communities, following settlement of several years of armed unrest aiming at greater autonomy for Tuaregs and economically related groups, among other objectives. However, if leaders in the Northeast were to lend their support to "quick-growth" investment strategies in southern Mali, attracting labor from the Northeast, as a means to preserve the culture and restore the "traditional way of life" *for the much fewer people remaining,* this population depletion policy might be less offensive.

9.3.2. The marginal propensity to consume food and cereals is high.

While the average marginal propensity to spend on food is about 0.60 in all strata, it is higher in the lower terciles. While average marginal propensities to spend on cereals fall around 0.25, they are up to twice as high in the lower terciles. MPCs for cereal calories are also relatively high for lower tercile households in the North and Off-River strata. Average expenditure elasticities for food and for cereals is also greater than one in all lower terciles and fairly high (though less than one) for calories in the North (Table 5.16). Unexpectedly, cereal expenditure elasticities are highest in the South.

- An injection of income or expansion of income-generating activities (such as food-for-work, cash-for-work or purchase of seasonal local cereal surpluses for food aid distribution/market sales elsewhere) is likely to dramatically increase food consumption and improve food security status in the short term, especially for lower-income households.
- While extra income will be wisely spent on cereals (and/or all food), additional supplies are required to match the increase in effective demand to avoid a surge in price inflation (Mellor; Reutlinger, 1986; Webb and Reardon).
- Market mechanisms should be relied on as much as possible, but unless grain traders are attracted to this enlarged effective demand, additional cereals may have to be supplied by the public sector.

9.3.3. Cereal calorie expenditure depends on total household expenditure and household size.

Table 5.16 indicates that adjusted household expenditures are significant explanatory variables at the 99 percent level (North and Off-River strata) and at the 90 percent level and above (South and On-River strata) for cereal calorie *purchases*. Household size is significant at the 99 percent level across all strata.

- Since cereal calories expenditures elasticities of demand are consistently lower than cereal cash expenditures of demand (tercile by tercile and strata by strata), poorer households are able to choose among lower-priced cereals with calorie values comparable to those of more expensive cereals. This heightens the importance of well-performing markets in the Northeast, both as exchange institutions and as supply sources, offering variably-priced cereal calories which correspond to the range of household budgets.
- The positive and inelastic household size variable indicates that economies of scale exist in the purchase of cereal calories.

9.3.4. Cereal calorie consumption largely depends positively on household income and diversity of household income, but negatively on household size.

Only household income, diversification of income and household size are significant explanatory variables (at the 99 percent level) for cereal calorie *consumption* in all four strata (Table 5.18). However, while household income and diversification of income elasticities are positive, the household size elasticity is negative.

- This puts considerable weight on income growth and diversification as elements of a food security strategy for the Northeast, allowing households to compensate for lack of credit markets and variable harvests (Reardon, Delgado and Matlon, 1992).
- Nonetheless, diversification of household income limits the cost-reducing gains from specialization and growth in real incomes. Income diversification is

therefore a useful temporary measure, but not a permanent solution for improving household exchange entitlements.

- One way to ensure diversity of household incomes, while furthering specialization, would be to encourage mobility of individual household members across sectors, ideally on a permanent or at least seasonal basis, rather than the same household member performing a diversity of unspecialized jobs.
- Households require adequate and stable incomes to be able to smooth consumption across seasons or need to pursue pro-cyclical incomes/prices strategies to avoid insufficient consumption. However, policies to help households achieve stable incomes or pro-cyclical incomes/prices are incomplete, poorly articulated or not yet conceived.
- The negative household size variable (section 9.3.4.) indicates that economies of scale do not exist in cereal calories *consumption*. The negative household size consumption elasticity can be interpreted from an incomes perspective as well. Large size, in terms of able-bodied and working-age members, does not help the household's ability to consume, leaving out-migration as a common coping mechanism. The public sector may not be able to easily manipulate household size locally as an element of its regional food security strategy.

9.3.5. Food insecurity is a seasonal phenonemon, especially in the rainy season.

At alternative cereal calorie consumption thresholds, fewer households were consumption secure in the last two seasons than in the harvest/post-harvest season. Within the last two seasons, fewer households were consumption secure in the rainy season (in percentage terms) than in the hot dry season, except in the South (Table 5.14) due to abundant wild cereals. The seasonality index of cereal calorie consumption (Table 5.19) confirms that consumption falls off during the rainy season from the average monthly index in the North, South and On-River strata.

- These results implicitly indicate the seasons when households need to augment their incomes.
- These are the seasons, especially the rainy season, to heighten monitoring from a food security policy viewpoint.
- These are target seasons for direct food security interventions, if necessary. If interventions take the form of increasing market supplies and/or distributing food aid, physical stocks must be positioned before the onset of the rainy season.

9.3.6. The food security status of scattered and hard-to-reach Off-River households gives cause for both concern and comfort.

Of *concern* to food security planners is the dependence on charity and alms[18] as a major source of household incomes (Table 4.12); high expenditure rates (over 50 percent) on millet, an outside cereal, within total cereal expenditures (Table 4.20); considerable reliance on wild fonio within the cereals consumption basket (Table 5.6); significant resort to the market as the first source of cereals consumed (Table 5.10); but low rates of consumption security (Table 5.15).[19]

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[18]As distinct from remittances.

[19]These results from the Gao Region might apply to other parts of the Northeast, such as the lower stretches of the Tombouctou Region.

- Since the source of charity and alms tends to be local and the source of remittances distant, an incomes-growth policy must be *locally* focused with strong inter-sectoral linkages if ample charity and alms-giving is to continue.
- Strong demand for and high consumption of millet *and* first resort to the market put the marketing network to a major test in these hard-to-reach locations. Thus, marketing policies will need to emphasize market coordination and facilitating services to keep millet and other cereals affordable.
- High consumption of wild cereals cannot be counted on every year. This again challenges policies to improve market performance in outlying areas in drought years.
- Moreover, the availability of wild fonio is a localized phenonomen, which is difficult for the market to predict and adjust to. This calls for continual monitoring of wild fonio availabilities, especially by the SAP. These availabilities need to factor into any market intervention policies.
- Skillful coping strategies of Off-River households, while good, may not be good enough. Low rates of consumption security in a good rainfall year means that the food security status in Off-River communities deserves no less attention than other elsewhere in the Northeast.

Of *comfort* to policy makers is the remarkable seasonal stability and equality in Off-River household income and cereal calorie consumption. Average annual Off-River household incomes vary by only ± CFAF 304 per AE per season (Table A4.2.5.), easily the lowest variation of the four strata (Annex 4.2.). Average Off-River household incomes are about as stable as On-River incomes (CVs of 0.72 and 0.70, respectively) and about as equally distributed (Gini coefficients of 0.36 and 0.37, respectively; Tables A4.2.5. and A4.2.7.). Seasonal average daily calorie consumption varies least by $\pm$ 51 calories from the annual mean (or about $\pm$ 2.3 percent of the consumption security threshold of 2250 calories). Seasonal average daily calorie consumption is reasonably stable with a CV of 0.41, and is equitably distributed with a Gini coefficient of 0.23 (Table A5.2.5.). The seasonality index (Table 5.19) shows that cereal calories consumption varies the least between months, in contrast to the pronounced seasonality in cereal consumption of households in other strata.

- A relatively equal distribution of household income and significant private charity and alms-giving among Off-River households in effect relieve much of the public sector imperative to redistribute income through taxes and grants/subsidies.
- Stable and equal seasonal consumption of cereals by Off-River households reduces the need for direct food distribution and negates political impulses to "do something".
- Strong reliance on the market *and* steady seasonal consumption of cereals by hard-to-reach Off-River households suggest that regional cereal markets are performing adequately. If so, this argues for investment policies favoring physical market infrastructure development along the Niger River and/or highway network *where consumption disparities are much greater*, rather in than the vast low-populated hinterland. Such a policy implies strengthening a hierarchy of more accessible — hence, more cost-effective — cereal assembly, transit and redistribution markets to which Off-River traders and consumers

come, rather than the more expensive option of developing physical infrastructure far from the main transport links.[20]

9.3.7. A high portion of cereal calories are purchased from the market, increasing after the harvest season (Tables 5.8 - 5.11).

By extension, since cereals represent a high portion of all food calories consumed (about 85 percent, Annex 5.1.), a high portion of *all* calories are purchased from the market.

- Public policy needs to recognize the non-negligible role of the market in distributing food within a broader national food security policy. Since the market can be enlisted as a vehicle to serve the public purpose, it removes the much of the burden of direct intervention by the government.
- Recognition of the importance of the market in supplying a major portion of calories needs should put an end, if it has not already, to misguided notions of regional food self-sufficiency, regardless of cost.
- It is counterproductive to distort market signals and weaken the critical function played by markets in the Northeast by poorly considered public sector market interventions. Instead, the function of markets needs to be reinforced through pro-market policies and facilitating services.

[20]This policy might not be politically palatable to the Off-River population. Some physical infrastructure development away from the Niger River may be part of the peace bargain between the government and former rebels and/or a perceived need for the new administrative region of Kidal.

9.3.8. Cereals from outside the Northeast contribute a high portion of calories consumed.

Well over half of cereal calories consumed in the North and Off-River strata originate outside the Northeast. The portion of non-regional cereals rises significantly in the South and On-River strata after the harvest/post-harvest season (except lower tercile South households, Table 5.12).

- Food security policy needs to approach the cereals market from a national perspective in order to fully appreciate the comparative advantage in cereals production of southern Mali and north-south trade links — integral factors in the food security equation for the Northeast.
- In addition, domestic trade links underscore the need for further development of transport and communications infrastructure and broad-based credit facilities which ensure that supplies move quickly.[21]
- In years of poor rainfall and cereal deficits, well-established trade networks will already be in place for transporting cereal imports to the Northeast.

9.3.9. Cereals market price instability in the Northeast stems from domestic sources.

The usual source of cereals market price instability in Mali is variation in domestic production due to weather shocks, especially variations in rainfall patterns for coarse grains. Supply-side price instability in Northeastern Mali is exacerbated by fluctuating deficit production locally and difficult access from southern supplies and international ports.

- Thus, the physical buffer stock option (SNS) for the Northeast to reduce the gap between seasonal supply and demand makes sense in terms of immediate

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[21]These policy implications need to be read in conjunction with section 9.3.13.

availability of supplies, no foreign exchange requirements and independence from world markets. The relatively small volumes in the Northeast ease the frequently cited drawbacks of high management costs (procurement, interest, storage and quantity/quality losses), inflexible institutional capacity and poorly trained personnel to respond quickly to expected seasonal shortages through well-timed procurement and sales operations (Pearson; Timmer, Falcon and Pearson; Sahn and Delgado). These operations presume the availability of accurate market prices for analyzing market conditions.

Where direct interventions are made they should be of limited, but well-defined scope, high priority and location-specific (Sahn and Delgado). It is essential that direct public sector market interventions — or the threat of interventions — be credible to market participants, particularly traders.

- This requires first, that public interventions be limited in scope and frequency except under extraordinary fluctuations in supply and demand. The OPAM Contract-Plan allows the OPAM Director-General to set prices for a minor portion of OPAM sales in the Northeast. Setting a wide price intervention band between floor price and ceiling price gives more play for market forces.
- Secondly, market interventions should be price-based rather than quantity-based in order to eliminate opportunities for speculative excesses by traders once quantity targets have been met (Pearson; Sahn and Delgado).[22] This implies that the OPAM/SNS have a open line of credit to purchase as much

[22]These speculative actions are buying at low prices once the SNS has released known target volumes onto the market or selling own stocks at high prices once the SNS has purchased known target volumes.

cereals as required, possibly destabilizing financial markets or disrupting the government budget.[23]

9.3.10. Traders in the Northeast face a volatile and uncertain market environment.

As seen in section 9.2.1., uncertainty is due in part to variability in supply and demand linked to rainfall and in part to lack of transparency in government actions which influence the market. For example, few traders are aware of impending food aid distributions (Steffen and Koné; Steffen, 1990). About six of seven traders believe that food aid disrupts the cereals market (Table 8.22).

- While marketing policy cannot control rainfall patterns, it can remove the other source of uncertainty by defining in advance the appropriate role of the public sector, distinguishing between direct interventions to foster and regulate competitive markets and indirect services to make private sector participation more effective.
- Clear and frequent restatements of public cereals marketing policies and scopes of action (especially OPAM's marketing action plan, including food aid distributions) also help to distinguish the more *macro* public role from more *micro* private functions.
- The public sector generally needs to make its actions more transparent. Progress to date with the Market Information System is encouraging although competitive bid auctions of the National Security Stock require greater transparency and clarity of rules.

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[23]The proposed revolving fund *(fonds de roulement)* for OPAM, up to CFAF 500 million, will help greatly (PRMC, 1990).

9.3.11. Traders in the Northeast face an incomplete set of marketing facilitating services, particularly credit.

Only a minority specialize in cereals (Table 8.1). Lack of capital was cited second as the most difficult barrier to entry (Table 8.2). The professed willingness to make long-term investments in the cereals trade (Table 8.12) may be considerably less due to the lure of profits elsewhere, perhaps lower but more certain. However, if traders in the Northeast quit, cereals markets there may become even more concentrated (Table 8.5). Only half of traders in the Northeast buy on credit (Table 8.10), suggesting that many unexpected market opportunities are lost due to lack of liquidity or collateral. Far fewer traders in the Northeast enter into regular purchase contracts or fixed-quantity sales contracts than Mopti traders (Table 8.16).

- In general, these points imply that access to credit remains a marketing constraint from both short-term and long-term perspectives. They call for marketing policies to expand short-term seasonal credit (not necessarily limited to PRMC credits) and longer-term investment credit through the commercial banking network.
- Traders in the Northeast have largely missed out on PRMC credit programs for traders. The planned expansion to the Northeast, including the significant first-time expansion into domestically grown paddy/rice (PRMC, 1990), bodes well. This expansion will enlarge alternative sources of credit and increase competition.
- These points also call for training sessions in the use of credit facilities for traders who may not be completely familiar with the formal credit system.

- Greater transparency in public marketing policies and operations (section 9.3.10. above) will reduce the risks of transacting loans and encourage better informed investment planning by cereal traders.

Two-thirds of the traders in the Northeast (section 8.3.2.1.) say credit is not a constraint for short-term transactions. Supplier credit in kind may partly substitute for missing financial markets. But Table 8.10 shows that *semi-wholesalers* have problems in getting credit. Moreover, section 8.4.1.2. (including Tables 8.19 and 8.20) suggests that semi-wholesalers are not necessarily supplied or financed by wholesalers and that the functional relationship between semi-wholesalers and wholesalers in the Northeast is weak. Therefore, expansion of credit mechanisms and institutions to semi-wholesalers may reduce market concentration.

- Access to credit and credit needs vary between wholesalers and semi-wholesalers. There is a need to target financial mechanisms better.
- The PRMC decision to differentiate among semi-wholesaler partnerships ("economic interest groups" or GIEs) based on the size of their capital base and crops marketed, either coarse grains or domestically grown paddy/rice, also helps to redress imbalances in access to credit and experience with credit.
- Credit programs need to reach new traders to help ease market entry. Any net exit of grain traders from the market as a result of credit/investment capital constraints would increase market concentration, undesirable in itself for the development of transparent and workably competitive markets, and possibly lead to increased direct public sector participation in markets by default.

- A related policy implication is that without prompt and fair decisions of the new business courts (section 8.4.3.2.), many traders will hesitate before entering into high transaction cost formal or semi-formal contractual relations with distant counterparts, particularly if formal sector credits are involved.

9.3.12. **Rural markets in the Gao Region are poorly linked with each other, but reasonably linked with Gao City** (Tables 7.5 and 7.7).

Some rural markets are seasonally inaccessible (Chapter 2) and therefore unreliable. This argues for twin policies of maintaining public cereal stocks in Gao City for periodic sale and for promoting of local agriculture, especially full-control irrigated agriculture delinked from irregular rainfall. Both actions aim at reinforcing or shortening cereal supply lines in the short term until other market-facilitating services improve market coordination and services. This conclusion is likely to hold for the Tombouctou Region, but rural market-Tombouctou City links need to be measured.

- Such policies appear to go against conventional economic prescriptions to rely foremost on domestic market flows and international trade. Yet, these prescriptions are less viable in the Northeast in the short to medium term — at least during the rainy season.
- The present geographic distribution of National Security Stocks, of which nearly half is stored in the Northeast, should be maintained. The present role of Gao City (and Tombouctou City) as regional supply/distribution hubs should also be maintained. However, this does not rule out periodic review and/or modification of the location and volume of grain reserves within the Northeast.

- The government can regulate rural markets in Gao Region from Gao City (those that show medium to strong integration with Gao City — and other rural markets from the other regional capitals in the Northeast) through selected indirect interventions in "normal" production and rainfall years. Use of spatial equilibrium models can simulate the price impact of SNS stock releases or local purchases on the major rural markets.
- SNS grain purchase and sales procedures need to be transparent, understood and open to various sized lots and types of traders if the use of the SNS is to complement, not obstruct, market development in the Northeast.
- Greater assurance of available supplies may reduce marketing risks and transaction costs for local traders and improve their willingness to invest in the trade and pursue more innovative trading practices. Expanded trader credit facilities could capitalize on this new perception of lower risks.
- There is little that public marketing policy can do to improve marketed cereal supplies for rural markets which are not spatially linked with Gao City, short of costly road improvements. However, even these improvements might be insufficient without complementary services and coordinating mechanisms (section 9.3.13.).

9.3.13. Strengthening market-facilitating services and coordinating mechanisms may be more cost-effective in the short run than developing road infrastructure.

Market development in the Northeast can advance more quickly *in the short run* by strengthening market-facilitating services and coordinating mechanisms than by constructing large-scale, capital-intensive road infrastructure. This is conclusion is perhaps the most controversial one, in light of the conclusion above (section 9.3.12.) that some rural markets are not linked with Gao City, but it does not exclude infrastructural development as such. The need for physical infrastructure, including highways, is not in dispute.[24] The question for the Northeast is what kind of physical infrastructure and at what cost and whether alternatives are available. For example, all-weather highways in shifting desert terrains (especially in the Tombouctou *haoussa*) would be expensive, technically difficult to engineer and slow to build.[25]

Until such time as poor physical infrastructure becomes *the* constraining factor, rapid improvement of market performance in the Northeast needs to rely foremost on public support for marketing services and an enabling environment (Chapter 6). Such an approach may reduce long distance transaction costs and risks while generating private investments in the market. Furthermore, such an approach is "consistent with state resources," the first objective of PRMC III, and presumably, therefore, a sustainable one.

- Only *capital*-intensive physical infrastructure with high internal rates of return (for example, telecommunications and selected road spurs) should be developed.
- Market-facilitating services such as enforcement of market regulations and contracts, and credit and market information dissemination can partly

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[24]The World Bank experience in agricultural marketing projects shows that "...where the government has provided the infrastructure needed for markets to work, such as roads, and has relied on the private sector to handle marketing, the project has generally been successful" (World Bank, 1990). Lele (1977) points out that wide marketing margins indicate inadequate development of physical infrastructure — bottlenecks in transport and storage and poor handling facilities — in addition to uncertainties and imbalances in supply and demand. Loveridge shows how spatial price integration improved dramatically after highways were paved between major markets in Rwanda.

[25]Traders in Tombouctou compensate for poor transport links by greater use of the telephone and holding large inventories (Chapter 8).

substitute for underdeveloped infrastructure (Jones, 1984).[26] Innovations which lower transaction costs for long distance trade (those that increase the mobility of capital, lower information costs and spread risks) may mitigate the effects of poor infrastructure in the short term (North).

However, infrastructure improvement and maintenance are inescapable.

- *Labor*-intensive physical infrastructure can be developed as a matter of on-going policy. It should especially feature as part of temporary employment programs to maintain household incomes and prop up effective market demand for cereals.
- Existing physical infrastructure, such as SNS warehouses and the all-weather road between Mopti (Sevaré) and Gao City, needs to be maintained.

9.3.14. Occasional seasonal surpluses of paddy may depress local rural market prices.

On-River households produce occasional seasonal surpluses of paddy (Chapters 2, 4 and 5) which may depress local rural market prices. The impact on household food security status is somewhat indeterminate: seasonal surpluses allow increased harvest/post-harvest consumption (Table 5.7) and income via the imputed value of home consumption (Table 4.10), but market purchases of cereal calories climb during the hot dry and rainy seasons (Table 5.11) when incomes drop (Table 4.10).

- Under the "right circumstances" (to be defined by national food security policy), purchases of paddy grown in the Northeast by the SNS could boost

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[26]The dilemma is that while development of physical infrastructure is controversial because of high costs, many of the expected returns to improved production technologies and market services are predicated on infrastructural development. The availability of infrastructure improves the productivity of other resources.

rural market demand. This paddy could be stored temporarily in the SNS for sale at a profit and/or distribution as food aid. By agreement, this paddy would not be transferred out of the Northeast by the SNS.

- Multilateral and bilateral food aid donors as well as regional PVOs might consider local cereal procurement under suitable circumstances.
- Present rules prohibiting purchase and storage of paddy/rice for the SNS need to be relaxed when conditions warrant.
- Milling SNS paddy at production sources would further inject value-added income into local economies with expected multiplier effects. Milling, like purchases, could take place later in the crop year.
- Like other SNS operations, procedures for the purchase of local paddy/rice need to be clearly understood, announced shortly after harvest and open to various amounts offered in order to fully inform and guide multi-period farming household food security strategies — the sequence of producing, consuming, buying and selling.

9.3.15. Food security responses necessarily differ according to the dimension of the problem, circumstances or scenario.

Responses first require a conceptual framework for diagnosing the source of food insecurity problems and the appropriate policy instruments to alleviate them. This additionally requires a comprehensive approach to food security monitoring. In the Gao region, monitoring should focus on the lower-rainfall North and the less accessible Off-River households during years of good rainfall and abundant cereal harvests. During years of poor rainfall and deficit harvests, *all* of the Northeast should be monitored.

- Diagnosis of food security problems calls for developing a taxonomy of scenarios and list of short-term food security responses, increasing in urgency and/or comprehensiveness.[27]
- Such a taxonomy can build on the government's current distinctions between grain deficit zones, zones at risk and zones with no effective demand.
- The poor are especially vulnerable to food insecurity if their terms of trade (food exchange entitlements) suddenly tilt against them. Thus, the category of "zones with no effective demand," wrongly implies uniform needs within a geographic area.[28] A more functional category would be "households with no effective demand" to take into account the variability of food exchange entitlements among households. Such a new category also acknowledges that households with no effective demand can be found everywhere.

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[27]Gueymard (1989) offers an analytical starting place. First, Gueymard identifies the types of public sector food security interventions by increasing urgency and severity. These are a) supplying food to deficit zones; b) supplying food and/or protecting zones at risk from food insecurity (presumably transitory food insecurity); and c) protecting population groups without effective demand from food insecurity (presumably either transitory or chronic food insecurity).

Next, Gueymard takes into consideration the type of harvest/rainfall year, based on the three benchmark production years: a) a surplus year (such as 1988/89 for the Sahel generally); b) a normal year (such as 1985/86 for the Sahel); and c) a deficit year (such as 1984/85 for the Sahel).

Thus, for each of the three types of food security interventions there are three corresponding production/climatic years, resulting in nine different scenarios — each requiring a distinctive set of responses. For each scenario, Gueymard spells out the possible sources of food supplies and/or income-augmenting activity, the constraints to overcome, a set of goals and purposes for intervention, the steps for carrying these out and identification of the actors (traders, OPAM, PVOs), and complementary measures.

The following policy implications in this section and section 9.4.2.1. build from, but modify Gueymard's approach.

[28]Webb and Reardon offer an significant caveat in section 9.4.2.1.

- The category "households with no effective demand" is the broadest geographically. It automatically encompasses zones at risk and deficit zones — the entire Northeast. This requires continual improvements in measures to identify and target the food insecure.
- The last and most tightly targeted category, "*individuals* requiring urgent medical attention and/or nutritional rehabilitation," continues to be valid. Early warning and detection of these individuals can reduce the incidence of this costly type of direct intervention.

9.4. Public Sector Interventions to Facilitate Market Performance

Recommended public sector interventions follow from the preceding implications. They can be grouped by national cereals market policy, regional markets in the Northeast and local households. These interventions are primarily based on the "good year" case, such as 1988/89, which witnessed little market price instability (Annex 8.3), but considerable household demand instability. Attention is also drawn to the "bad year" case where discussion of the "good year" case alone would otherwise lead to an incomplete set of interventions.

9.4.1. National Cereals Marketing Policy

Concepts presented in Chapter 6 — transaction costs, thin markets, market failure, public goods and market institutions — provide a theoretical basis for government intervention in the cereals market. None contest the responsibility of public sector as the final guarantor of food security in the Northeast. The crucial point, though, is that the role of government is an enabling one, not an "either-or" situation in which market forces or the government tackles the job alone. Experience shows that institutional pluralism is necessary to foster competition in agricultural marketing (Lele and Christiansen).

A national cereals marketing policy is an essential component of a national food security policy. Well-performing markets require mutual confidence building measures that regulatory fair play and market-facilitating services can bring. Market-facilitating services and programs can compensate for inherent instabilities and *pervasive uncertainty* in deficit zone markets to the benefit of consumers, producers and traders alike. By improving market coordination and performance to lower the real cost of cereals throughout the year, market facilitating programs can help address the *discrepant seasonalities* problem of mismatched supplies, incomes and consumption. Indirect market-facilitating services provided by the public sector may prove more cost-effective (and less disruptive for markets) than direct government intervention running the risk of government failure.

9.4.1.1. Continue the Cereals Market Restructuring Program

The overarching recommendation is that as a poor country of limited means, Mali should maintain its commitment to the broad thrust of cereals market reforms through the PRMC (Chapter 2).[29] Problems in the Northeast are too complex and some policy instruments too blunt for the government to approach the complex web of markets and food security in an unsystematic manner. At this stage, Mali probably cannot go it alone. Some recourse to external aid is inevitable. Approached in partnership with committed donors, problems will seem less intractable.

[29]Based on PRMC III in effect for the three-year period starting in November 1990. See PRMC. *Programme de restructuration du marché céréalier: Documents de stratégie phase III.*, 1990.

The "common platform" of the PRMC prescribes a set of pragmatic steps to reform and strengthen the market and marketing institutions. The goal of the PRMC is to "assure food security through regular supplies of [food aid] cereals...thanks to a restructured cereals market making maximum use of local resources." While this goal can be faulted for stressing the supply side of the market to the detriment of demand-side considerations, the PRMC acknowledges that some households have insufficient effective demand to meet all of their cereal needs from the market for which non-market transfer mechanisms are required. The PRMC also recognizes that the level of *non*-effective demand can be significantly reduced by well-functioning and regularly-supplied markets which lower prices.[30] It makes progress by distinguishing various causes of supply shortfalls and advocating flexible and variable supply responses. Moreover, the three-year PRMC plan is fairly comprehensive in its attention to needs of various market participants and in continuing to define the respective roles of the public and private sectors. Just as importantly, the PRMC provides a national forum for debating marketing and food security issues and a contractual approach for problem-solving with donor agencies who have demonstrated their willingness to stand by with aid and technical advice.

It is recommended that:

- the government of Mali continue its cereals market reform and development through the PRMC in order to benefit from its long-standing association with the PRMC donors in terms of physical and financial resources and technical advice.

[30]Use of food aid pledges helps to relax the food constraint (Singer). Developing countries such as Mali can proceed with market-strengthening policies and services with a reasonable assurance that cereals needs are covered.

9.4.1.2. Set Limited Objectives in Keeping with Limited Resources

A second recommendation, endorsed by the PRMC but worth reiterating, is that policy objectives need to be consistent with government financial and managerial resources available to achieve them. This argues for policies grounded on more limited price stabilization methods. Fortunately, both the government and the donors have moved up the learning curve on how to intervene in the market selectively. Accordingly, it is recommended that:

- national marketing policies set more limited price stabilization objectives, in line with modest government resources in a poor region.

Setting more limited objectives is closely tied to an indirect approach to market stabilization (below), making effective use of markets and marketing institutions to achieve those objectives (including the SNS and other institutional mechanisms for which recommendations are made in the following sections).

9.4.1.3. Use an Indirect Approach to Market Stabilization

Recognition that there are market-disrupting actions which the government should *not* take in effort to stabilize markets argues in favor of the indirect approach advocated by the PRMC through a package of measures to improve market performance. These measures seek to remedy market imperfections, reduce uncertainty, expand competition, improve the reliability of prices, lower risks and transaction costs which, according to Jones (1984), "reduce lags and restrain over-reaction to changing market conditions." The PRMC spells out actions for an array of support institutions to take. It is recommended that:

- the government make effective use of market participants and institutional mechanisms as part of an indirect approach to carry out its limited market stabilization objectives. It is understood that maintaining markets in the "bad year" case will require more direct forms of public sector intervention (some of which are discussed below).

Indirect methods for strengthening and promoting markets require the government and public sector marketing institutions to announce their intentions and intervention benchmarks in advance, leaving broad scope for the private sector to plan and carry out marketing strategies with rational expectations. This requires maximum transparency on the part of the public sector, including announcements of *adjustments* of intentions based on updated analysis. It also requires public sector follow-through with stated intentions to maintain credibility of actions or threats of actions. In effect, the public sector sets the rules and guidelines within which the private sector plays, but then becomes a referee until or unless those rules are transcended — when it enters the game directly. It is therefore recommended that:

- the government make conscious efforts to widely announce the main elements of its cereals market policies and operations in order to improve market transparency and the reliability of prices as signals for market adjustment.
- the government and its marketing institutions consistently adhere to announced cereals market policies and operations in order to maintain the credibility of public sector actions.[31]

Indirect methods for stabilizing markets in a landlocked country can employ a variety of instruments, like trade, food aid, and publicly-held stocks.[32] The difficult management

[31]This implies a hierarchy of public sector instruments where OPAM's market action plan (section 9.4.2.2.) is subordinate to the cereals marketing policy. In turn, operations of the SNS are subordinate to the market action plan (section 9.4.2.3.).

[32]Approaching the supply dimension of food security from the macro perspective, Pearson (1992) argues for creation of a food security reserve fund to finance grain imports for coastal countries with occasional food deficits, rather than maintaining more expensive physical grain

issue is to blend adjustments in trade, food aid and stocks to provide adequate aggregate supplies at an acceptable costs (Pearson), especially for potentially tradable crops such as millet and sorghum.[33] Even with indirect means of replenishing the SNS through competitive tenders and releasing stocks through competitive bids — or "free" donor food aid — incurs costs.[34]

The indirect approach even encourages use of markets and the private sector in carrying out relief operations. It is desirable, nonetheless, that direct market intervention by the government take place as a last resort, triggered by previously set and transparent — yet flexible — market and food security thresholds.[35] Experts advise that market stabilization programs plan with the extreme years in mind — which in the Northeast is more likely to

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stocks. Use of a reserve fund allows the country to import only as needed, transferring the costs and risks of physical storage to the world market. However, Pearson does not reject physical grain reserves entirely, noting that landlocked countries — such as Mali and the Northeast — may be less capable of meeting urgent needs from the world market. In such cases, he finds that a mix of physical stocks and reserve fund might be appropriate. Maintaining a reserve fund, however, requires enormous fiscal discipline.

[33]Crops such as millet and sorghum are "potentially tradable" because domestic prices usually fall between import and export parity prices, and are thus not affected by world market prices. These crops become "tradable" only when imports are required in years of extremely bad weather where production shortfalls push domestic prices above the import parity price, *or* in exceptionally favorable years when high production pushes domestic prices below export parity prices, creating export surpluses. Pearson (1992) demonstrates how stabilizing markets at a target price (falling between import and parity prices) through use of a buffer stock would be very costly for potentially tradables in terms of import and export subsidies in years of supply contractions or expansions.

[34]Access to the deep pockets of the donors is another argument for Mali to continue collaboration with the PRMC. Food aid guarantees in poor years ease some of the financial management burden for Mali. If food aid is not needed in any given year, donors have pledged financial support (up to CFAF 150 million) to defray operating expenses of the SNS, or other expenses.

[35]Lele and Christiansen point out that a limited amount of market intervention will be necessary as part of an overall agricultural strategy, not to mention a food security strategy under stress.

mean the extremely poor years rather than extremely good years. In such case, the public sector will have to intervene in the market directly, with site-specific priority interventions. It is therefore recommended that:

- direct market interventions by the government in the Northeast be largely limited to the "bad year" case and location-specific, where possible.
- direct market interventions be price-based rather than quantity-based to maintain the credibility of the public sector cereals policy. It is further recommended that OPAM/SNS have access to the OPAM revolving fund to carry out these interventions, subject to strict COC and PRMC oversight.
- such interventions be limited in scope, based on articulate objectives and transparent benchmarks, which can be "renewed" as necessary. It is further recommended that an element of flexibility be factored into these direct interventions in the form of periodic, but frequent, assessment of impact (see section 9.4.1.4. below).

9.4.1.4. Develop a Professional Market Analysis Capacity

An indirect approach to market stabilization and market development requires both a conceptual framework and the capacity to analyze which policy instruments and institutions are best equipped to correct market imbalances or imperfections.

For example, analysis of market price instability — or cereals consumption instability — in the Northeast needs to first determine the source of instability and then use an appropriate mix of policy instruments to mitigate it. Furthermore, policy makers and market analysts need to make an informed judgement on the incidence of policy changes, using basic data on consumption patterns and market behavior of households and traders — such as provided by this dissertation.

It is recommended that:

- the government and PRMC continue to improve their collaborative analysis of market conditions and means to correct market imperfections, as well as analysis of household food insecurity and means to reestablish food security, with particular emphasis on the Northeast.
- the government and PRMC donors identify and fund promising Malians for in-service or advanced training to develop a critical mass of analytical capability in such relevant fields as marketing (economics, agricultural economics, finance, international trade), agriculture (agronomy, animal science), food security (public health and nutrition, human resources development) and infrastructure (engineering, telecommunications). It is further recommended, to retain new capacity, that priority be given to in-country training through technical assistance (perhaps a donor project under PRMC auspices) and/or regional training.

Ideally, each major public institution should have its own in-house analytical capacity to guide its operations. The operations of OPAM, through the National Security Stock (SNS) and Market Information System (SIM), and the Early Warning System (SAP) are potentially most universal in their impact on markets and food security in the Northeast. Accordingly, it is recommended that:

- in an initial phase of analytical capacity building, efforts should be focused on OPAM, through the SNS and SIM, and the SAP.

And, related to the indirect approach advocated in section 9.4.1.3. which requires consistency in public marketing operations, it is further recommended that:

- the public sector carefully analyze the expected impact and incidence of rules and guidelines governing cereals market policies and operations before their announcement, thereby enabling the public sector to follow through with its operations with reasonable confidence and avoid embarrassing policy reversals which would undermine the credibility of those actions.

9.4.1.5. Coordinate Cereals Marketing Policies within the West Africa Region

Lastly, as Mali participates in several regional institutions (such as CILSS and BCEAO) and has important trade links with neighboring countries within the West African "economic space," Mali cannot make its cereals marketing policies in isolation.

Even though instability of coarse grain supplies in Mali is mostly due to domestic causes, as discussed in Chapter 2, the cereals that matter most, millet and sorghum, may be considered potentially tradables because Mali is self-sufficient in normal rainfall years, where prices reflect domestic supply and demand, and because there is a world market for these crops, although a thin one. In the event of a supply shortage in Mali, the most convenient source might be imports from neighboring countries (assuming their production patterns differ from that of Mali). Similarly, in the event of coarse grain surpluses in Mali, neighboring countries may offer the most convenient export market.[36] The problem with potentially tradables, almost by definition, is that the machinery of trade may be poorly lubricated, given irregular cereal flows. Moreover, coarse grains bear the disadvantage of being lower-value crops, making trading margins slimmer. It is recommended that:

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[36]As millet and sorghum are potentially tradables, nearby border prices will usually be more relevant than distant world market prices for establishing import and export parity prices.

- Mali continue its liberalized cereal import-export regime (Steffen and Dembélé) as a means to facilitate regional cereals trade, particularly for millet and sorghum. It is further recommended that Mali resist the temptation of price controls on staple food items, unlike some of Mali's neighbors following the 100 percent devaluation of the CFA franc in January 1994, in order to limit trade distortion.

Another factor in favor of regional coordination is that some markets and households in the Northeast may be more accessible from Burkina Faso, Niger or even Mauritania and Algeria, either seasonally or during food crises. Thus, it is recommended that:

- Mali coordinate its cereal marketing policies and operations with those of its regional neighbors, for market flows both east-west and north-south.
- Mali actively exchange and make public cereals production, marketing and food security intelligence with its neighbors.

9.4.2. Market Performance-Oriented Measures

The challenge for the public sector is to reduce marketing uncertainty with countervailing measures which preserve the private sector incentive to buy, store and transport grain. Alternatively, the challenge is to guard against moral hazard by the private sector, whereby traders forego their own market-equilibrating operations and investments in order to deflect grain storage and handling risks to the public sector.

Uncertainty in an uncertain environment cannot be removed entirely, but it can be reduced. Within the broad implications for national cereals market policy (above), and based on the evaluation of urban and rural markets in Part III and the principal conclusions and implications in sections 9.2 and 9.3, respectively, this section recommends market-facilitating measures that public sector institutions can take to mitigate uncertainty, improve transparency and reduce transaction costs.

Most recommendations are directed towards the urban grain trade, about which more is known, on the finding by Harrison *et al.* that dynamic reforms at the retail level are only possible if reforms are managed at the wholesale level. These recommendations bear in mind the full range of constraints faced by Malian policy makers. Recommendations are couched in general terms, allowing for specific changes which may have occurred after the end of field research. These recommendations, divided for organizational purposes, are simultaneous, recursive and sometimes deliberately overlapping as there is not necessarily a one-to-one correspondence between implications and recommendations.

9.4.2.1. Cereals Market Information System (SIM)

This dissertation has previously signalled the increasingly vital role of the SIM in the Northeast and the rest of Mali for both improving market efficiency and strengthening food security. Dissemination of reliable and accurate market information improves market efficiency by lowering marketing costs. Monitoring the food security situation, such as market prices to gauge the affordability of food, will help to guide government actions by identifying food crises that may call for special relief actions. A third function of the SIM is to contribute to analysis to explain how markets behave and why (Staatz, Dembélé and Aldridge), such as through the subsector studies approach described in Chapter 6. For example, Mellor advises using movements in market prices as indicators of marketing and production bottlenecks that might be dealt with through other policies.

An indirect approach to market price stabilization may still require localized market interventions. Such interventions are predicated on the expanded access to accurate and timely local market intelligence which determines the nature of the intervention. The question arises where the SIM should expand.

As the SIM is still in its "developmental stage," Aldridge and Staatz argue that the SIM should emphasize data collection, transmission and diffusion — the "market news" aspect — with some basic data analysis to verify data quality.[37] Assuming that market data collection mainly means market price collection, this argument accords with the principal factor taken into account by wholesalers when buying and selling — market prices (Tables 8.8 and 8.9) and the most critical information need of traders after sources of credit (Steffen, 1990). Jones (1984) also advocates focusing on market price collection over other indicators like crop acreage, crop conditions, size of harvest and size of stocks "which tend to be costly and unreliable whereas the general level of prices is easy to learn." Indeed, market prices embody numerous bits of complex information in a single index which meets many of market information needs of most buyers and sellers.

The SIM needs to master its market data collection procedures to have confidence in the data that it intends to analyze. Market analysis based on poor-quality data might lead to the wrong policy prescriptions. Moreover, analysis should not overwhelm the necessary care and attention required for data collection techniques, verification and data base management at this stage. Thus, it is recommended that:

- the SIM continue to emphasize basic market price data collection.

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[37]Aldridge and Staatz contend that in the early stages of development of a market information system, such as the SIM, a vertically integrated structure in the same organization, from data collection through data dissemination, offers the desirable level of coordination and broad experience to staff in all functional areas. Only later, the authors argue, might the SIM consider spinning off market analysis to outsiders (individuals and/or agencies), or ultimately separate the data collection function from the data analysis function, provided there is sufficient coordination and feed-back between the two.

This does not preclude the SIM from carrying out periodic analysis. Yet, data collection issues are sufficiently complex in terms of basic understandings of market conditions, interviewing and price observation/recording techniques, rules of price averaging, verification and quality control by field supervisors, transmission of prices, computer entry and cleaning of prices and computer data file management. These operational issues demand the exclusive attention of a full-time data collection manager at headquarters. On this basis, it is recommended that:

- the functions of market data collection/data base management and market data analysis should be managed independently within the SIM.

Accurate and reliable prices for a few key reference crops are more useful than unreliable prices covering a broad number of products. Quality matters more than quantity. Nonetheless, other market data are equally important in the Northeast. From a food security viewpoint, these include market prices relative to other key products that households exchange for food, such as livestock and/or livestock products (hides and skins and seasonally available milk and butter). Quantity data are also useful for analyzing the seasonality of market flows as well as estimating price (and income) elasticities of household demand.

The SIM's market prices are perceived as credible and reliable. The critical point is that the SIM not succumb to the "paradox of success" — wholesale expansion of data collection to more products on the basis of successful mastery of a few — by broadening its market data collection activities hastily or in a poorly conceived manner. Accordingly, it is recommended that:

- the SIM establish a plan of expansion in the Northeast which prioritizes market information needs in terms of quantity data and price data for other, non-cereal products, as identified by target groups and market analysts. It is further recommended that the SIM give full consideration to methodological and other issues when establishing this expansion timetable (such as live animal prices versus meat prices or animal quantities versus meat volumes). It is further recommended that this expansion plan take personnel and training needs into account.

- the SIM enumerators collect cereal market data exclusively at this stage. If it is decided to collect animal/meat prices and/or quantities, it is further recommended that the SIM work with the Ministry of Livestock to develop reliable market data collection techniques for use by Ministry enumerators for dissemination by the SIM on behalf of the Ministry.

Where the SIM might expand operations fairly quickly is in the coverage of the same cereal crops in more rural markets in the Northeast. One methodological issue concerns conversion of non-standard units of measure prevailing on most rural markets into kilograms, an issue that can be resolved by weighing unit samples each season to obtain reliable conversion factors. Another methodological issue concerns how — or whether — to collect prices from seasonally thin markets. It is recommended that:

- the SIM collect cereal crop data from all rural markets in the Northeast which are considered essential, based on knowledge of market flows and measures of market integration, functions and hierarchies — which markets serve as reference markets. It is further recommended that any expansion of market coverage be integrated into the market information plan for the Northeast (above).

- the SIM resolve the two methodological issues of market price collection related to non-standard units of measure and seasonally thin markets before embarking on an expansion of market coverage.

Traders in the major urban centers in Mali express different needs for market information by region. Critical information needs particular to the Northeast differ from those in the rest of Mali (Steffen, 1990). Market coverage by the SIM is presently divided into four main axis or marketsheds for price collection and analysis, but the SIM can be more responsive to its regional clientele.

It is recommended that:

- the SIM address the regional market information needs of producers, consumers and traders, in addition to centralized price data collection activities. It is further recommended that regionally-organized divisions within SIM be authorized the necessary autonomy to conduct their own regionalized market information services as defined by target group needs.
- the SIM broadcast urban and rural market prices in the Northeast on the radio from Gao-City (as well as other regional capitals if booster stations are operating there), at a special time, as part of efforts to regionalize certain SIM functions and mitigate opportunism and information asymmetries among market participants.

Lastly, to alleviate some of the uncertainty experienced by grain traders and households, it is recommended that:

- the SIM issue clear and frequent restatements of public cereals marketing policies and scopes of action (especially OPAM's market action plan) to inform and educate all market participants about their respective roles and functions as well as to reduce marketing risks and encourage better informed marketing strategies by the private sector.

9.4.2.2. Market Action Plan of OPAM

OPAM must take into account the strengths and limitations of the market in storing and distributing cereals when developing and updating its market action plan (*plan de ravitaillement*, Chapter 2). In preparation, OPAM should consult the periodic working papers on cereals market performance by PRMC donors and affiliated researchers. OPAM's market action plan should factor in PRMC credit programs in the Northeast for village associations (AVs) and federations of rural groupings (FGRs) to buy cereals, build or improve storage facilities and buy equipment, especially locations and cereal quantities bought. Full use of market traders and/or village associations as partners within the framework of the market action plan eases OPAM's direct actions considerably. Accordingly, it is recommended that:

- OPAM's market action plan approach the cereals market from a national perspective in order to take advantage of regional comparative advantage in production and national trade links in supplying the Northeast.

Sahn and Delgado conclude that *expectations* of supply and demand conditions have a major impact on storage behavior by traders and households — and hence, marketing behavior and seasonal price variations. But, incorrect expectations lead to erratic market behavior. To aid formation of market expectations, it is essential that OPAM's market action plan be clear and coherent, against which others make their private marketing decisions. It is recommended that:

- OPAM disseminate widely the key features of its market action plan (through the SIM *Bulletin*, newspapers, radio and television) in the interest of greater transparency so that it is clearly understood by market participants on whom OPAM must rely.

A previous recommendation (section 9.4.1.) is reiterated here: Indirect market intervention by the public sector is preferable in many "good year" scenarios, leaving as the exception priority interventions in specific locations. In that context, the market action plan charges OPAM with supplying cereals on a priority basis to districts in the Northeast about to become seasonally inaccessible and to districts with documented food emergencies, where households are classified "at nutritional risk" based on SAP criteria (section 9.4.2.4. below), as endorsed by the CNAUR and PRMC donors. It is first recommended that:

- OPAM employ market mechanisms as far as possible when supplying cereals to these districts. It is further recommended that OPAM's market action plan set a policy of supplying cereals through the market first, through targeted employment schemes second, and untargeted food aid distributions as a third resort (see sections 9.4.3.1 and 9.4.3.2.).

In order not to possibly jeopardize cereal market performance when conditions change, it is recommended that:

- the scheduled *quarterly* review and update of the market action plan be rigorously maintained, supported by information and analysis from the SIM, SAP and other agencies. It is also recommended that under extraordinary circumstances, the market action plan should be updated more frequently, such as biweekly.
- quarterly modifications of the market action plan, in addition to the original plan, be disseminated widely to allow market participants to revise their marketing strategies.

- OPAM's market action plan closely adhere to the taxonomy of scenarios and short-term food security responses and associated decision rules for all the Northeast (as recommended in 9.4.2.4.), on which the SAP will take the lead, building on the distinctions between grain deficit zones, zones at risk and households with inadequate effective demand.
- OPAM take into account availabilities and prices of wild cereals (as analyzed and supplied by SAP) as part of any market intervention activity.

OPAM is also charged by its contract-plan to reduce the distribution of food aid to the minimum necessary (Article 16), based on marketing and nutritional considerations. In the event of prolonged delays in delivery of food aid due to impassable roads or insufficient funding, it is recommended that:

- the validity of food aid deliveries scheduled for prior months be reviewed to determine whether deliveries are still warranted *or* whether, under improved market conditions and/or household exchange entitlements, the missing deliveries constitute a case of consumption forgone (or consumption made up by other means), in which case the recommended delivery can be canceled to avoid disrupting the market.

In addition, OPAM is charged with supplying cereals to districts where cereals are totally absent or extremely rare (*zones en rupture d'approvisionnement*) through sales, requiring the same degree of justification as distribution of food aid. This allows OPAM to intervene on a temporary basis by selling cereals in the absence of private sector activity or where markets are insufficiently or irregularly supplied.[38] In effect, OPAM cereal supplies

[38]This paragraph is based on Yves Gueymard (1990).

are intended to "jump-start" markets which have temporarily failed to attract private traders. It is recommended that:

- justification for such intervention by OPAM be based on local market conditions, not the nutritional status of the local population, in order to respond to those with unmet effective demand, not those with no effective demand whose needs will be met differently (section 9.4.3.1.; see also section 9.4.3.2.).

To be effective, it is further recommended that:

- OPAM sell its cereals on the nearest *sub-district* market, anticipating that additional supplies will attract traders to service the target market and/or consumers from the target market — all in effort to restore functioning markets.

As these market activities require a convincing institutional capacity to respond quickly to expected and unexpected market shortages and/or ineffective market demand for cereals, OPAM needs skilled market analysts and financial flexibility for timely responses. In this light, it is recommended that:

- OPAM assemble a corps of skilled market analysts to implement the market action plan by proposing promising staff for skills-intensive training (section 9.4.1.4.) and/or participation in in-service training seminars to better understand seasonal influences on domestic markets and appropriate use of countervailing measures.
- OPAM take full advantage of its proposed revolving fund to carry out necessary steps as soon as they can be analytically justified.

9.4.2.3. National Security Stock (SNS)

The indirect approach to improving cereal market performance places considerable emphasis in the Northeast on seasonal stabilization of cereal supplies. Supply stabilization calls for a mix of instruments — purchase and sale of domestic cereals, managing trade and food aid, and storage. Whereas commercial imports can be handled by the private sector, other operations involve the public sector. International food aid agreements require governments to take official delivery of food aid. Limited purchase and sales of domestic cereals for the SNS also require the public sector to handle and store cereals. The upshot is that the public sector is inescapably involved in the storage and handling function.[39] As a principal conclusion, it is recommended that:

- the National Security Stock function primarily as a supply store in the Northeast and secondarily as a market price regulator through indirect buying and selling operations

In that context, it is recommended that:

- the SNS continue to use domestic crop purchases, food aid and storage to reduce the gap between seasonal supply and demand in the Northeast.
- the SNS continue to limit the role of Gao City (and Tombouctou City) to that of regional supply/distribution hubs. It is also recommended that the SNS periodically review, and modify if necessary, the location and volume of grain reserves within the Northeast.
- the SNS continue to regulate rural markets in Gao Region from Gao City (and other rural markets from the other regional capitals in the Northeast) through

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[39]Sahn (1989) recommends that governments should use indirect means to improve market performance, "even if it is deemed necessary for governments to retain a complementary role as procurer and storer of grain."

selected and limited market purchases and sales (except for rare, well-justified sales on sub-district markets where cereals are absent, section 9.4.2.2). It is also recommended that the SNS develop regional spatial equilibrium models to estimate the price impact of SNS stock releases or local purchases on major rural markets prior to taking any actions.

- the SNS coordinate the timing of cereal inflows to the SNS, including the coordinated shift of domestic cereals to the Northeast in the event of non-routine drawdowns of SNS stocks, and outflows from the SNS through cereal sales to traders and/or village associations.

In bad years, nonetheless, some market price intervention is necessary through managed buying and selling operations (along with more targeted interventions recommended by the SAP and CNAUR). Such interventions succeed where OPAM and the SNS have accurate market information, carry out well-timed purchases and sales, are perceived as credible operators, and have adequate access to credit to carry out price stabilizing interventions (Sahn and Delgado). It is therefore recommended that:

- OPAM authorize the SNS unlimited (but supervised) access to credit or use of its new revolving fund to carry out well-timed buying and selling operations based on frequently updated price benchmarks.
- OPAM tightly coordinate market data collection and transmission functions of the SIM (section 9.4.2.1.) with those of the SNS, to assure that SIM prices meet SNS needs.

To avoid problems of seasonal inaccessibility of some markets, it is recommended that:

- the SNS position additional physical stocks in regional capitals — up to four months of average demand from the SNS — before the onset of the rainy season as a matter of course, in anticipation of possible market interventions, including distribution of food aid.

Traders and transporters in the Northeast complain of being poorly informed about operations of the National Security Stock as to grain releases for periodic sale and procedures for bidding. Traders and transporters claim to be poorly informed, or informed on short notice only, about the distribution of food aid. The following recommendations aim at shortening the period in which traders adjust their expectations about market conditions. It is recommended that:

- the SNS better coordinate its standard operating procedures and make its decision rules more transparent and better understood, especially the announcement of grain releases and sales by competitive auctions, so that the SNS becomes a reliable and predictable supply source for market participants in the Northeast.[40]
- the SNS use the newspapers and radio to notify market participants of food aid distributions as far in advance as possible, within the bounds of meeting the urgent cereal demands of at-risk groups, so that traders and transporters can adjust their marketing strategies and/or contract with the SNS for the physical delivery of food aid.[41]

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[40]The detailed operational recommendations by Bremer-Fox and colleagues would be a good place to start.

[41]A precedent for such announcements was set during the survey year. As a condition of receiving food aid for free distribution in the Bankass district in the Mopti region, USAID/Mali required the Malian government to announce distribution plans on the radio. In addition to alerting traders, this publicity put pressure on local authorities to distribute the

Sudden increases in purchasing power as a result of income-enhancement programs and projects of the CNAUR and PVOs can be equally destabilizing on poorly supplied markets, previously abandoned by traders due to weak effective demand for cereals. The public sector may need to step in temporarily with additional supplies or arrange to have additional supplies sold on target markets. It is recommended that:

- the SNS match the increase in effective demand for cereals from local income-enhancement programs and projects, where necessary, with sales of additional supplies to avoid demand-pull inflation until trader-suppliers are attracted to these markets (Mellor; Webb and Reardon; World Bank, 1986a). It is further recommended that the SNS coordinate the supplying of additional cereals with the CNAUR and PVOs.

Managing SNS stocks as part of the OPAM market action plan requires analytical capabilities and managerial agility and a trained workforce (section 9.4.1.4. above). It is recommended that:

- OPAM upgrade the market analytical skills of its regional SNS managers through training in price analysis, trade and storage techniques as part of its institutional capacity-strengthening efforts.

Public storage is also costly in terms of budgets. Fortunately, PRMC donors have pledged to reconstitute the SNS on a ton-per-ton basis, following out-rotations of old stocks in poor production years and distribution of free food aid, and to pay the transport costs of free distributions. These implicit savings allow the SNS to pay the physical costs of storage more easily. This donor pledge, however reassuring from a food security viewpoint, could give rise to moral hazard from an operational viewpoint, if SNS managers feel they have the

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food aid to the intended beneficiaries (Staatz, Rubey, Steffen and Sundberg).

license to take risky actions or avoid taking risk-reducing actions. Accordingly, it is recommended that:

- the COC and PRMC donors, particularly donors giving financial and technical support to the SNS, closely supervise SNS operations in the context of its decision rules and the broader market action plan, in order to monitor and prevent unnecessary risky operations.
- donors link their food aid and financial pledges to performance indicators specified for the SNS as part of OPAM's contract-plan as an enforcement mechanism to avert risky actions.

However, SNS managers should not feel compelled to wait for donor pledges to replenish stocks before releasing urgently needed cereals. It is therefore recommended that:

- the SNS release required cereal quantities to meet emergency needs, as soon as authorized by the CNAUR, without waiting for donor pledges to reconstitute the SNS for each drawdown of stocks.

The PRMC plans to explore the purchase and use of small mechanical rice mills by individuals or collectives for the purpose of rapid transformation of "considerable volumes of paddy in short time for the market". The PRMC is wise to approach this question with caution, given that manually pounded local rice is highly prized by consumers, manual pounding and subsequent sale is a source of income for women, and that mechanization of milling paddy might shift the incidence of income-earning opportunities between genders within households and thus, control of household expenditure patterns. Harvest/post-harvest home consumption of local rice (household disappearance of paddy) is, moreover, particularly high for On-River households, a recovery from low levels of cereal consumption after the rainy season. Nonetheless, possibilities of increasing post-harvest market demand for paddy and/or local rice, and hence prices, would offer higher incomes and liquidity for selling households. It is recommended that:

- the National Security Stock consider purchase of paddy produced in the Northeast, as a means to boost rural market demand, for seasonal storage in the SNS, for for-profit sale and/or distribution *within the Northeast only* as food aid under suitable circumstances. It is also recommended that the SNS consider purchase of locally milled rice.
- current rules prohibiting purchase and storage of paddy/rice for the SNS be amended to allow such purchases and storage.
- SNS procedures for the purchase of local paddy/rice be clearly understood, announced shortly after harvest and open to various amounts offered in order to fully inform and guide multi-period farming household food security strategies.[42]

Lastly, to attract and acquaint all grain traders with SNS operations, it is recommended that:

- the SNS open its grain purchase and sales procedures to various sized lots and types of traders in order to help foster the development of competitive markets in the Northeast.

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[42]As part of a development strategy for developing countries, Bromley and Chavas advocate greater use of "contingent contracts," conditional on the uncertain states of the world such as prospects for the next harvest, to expand the nature and scope of economic transactions by lowering transaction costs and strategic uncertainty (Chapter 6). The announced intention by the SNS to buy surplus local rice, under well-defined conditions, would be one example of a contingent contract, assuming that use of the local rice by SNS would help to stabilize market prices in the Northeast, thereby also reducing exogenous uncertainty.

9.4.2.4. Early Warning System (SAP)

Strides made in recent years to make use of objective criteria for classifying the populations of deficit zones as "under surveillance" or "at nutritional risk" should continue. From a market performance perspective, however, it is urgent to develop more closely focused assessments of need *below* the sub-district level to avoid blanket distribution of food aid to those who may not need it. Targeting at the sub-district level is "too broad" (Autier, 1988b).[43]

This requires a fundamental modification in the hierarchy of official market/nutrition interventions. Taken together, the OPAM market action plan and the SAP/CNAUR operations are based on classification of *zones* as either a) deficit production zones under surveillance or, more ambiguously, b) zones at risk of rupture of market supplies and/or zones with nutritional needs and/or zones with no effective demand, the latter two incorrectly implying uniform needs within a geographic area.[44] This hierarchy then jumps directly to c) life-threatening, emergency feeding and medical rehabilitation programs for *individuals*.

A new classification needs to be inserted between b), zones, and c), individuals, which addresses non-emergency needs of food insecure *households* — presumably households with no/inadequate effective market demand for cereals. These households will require some type of food aid or other transfers.[45] This new category takes into account the variability of

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[43]This section should be read in conjunction with section 9.4.3.1. on targeting of non-market transfers.

[44]Webb and Reardon contend that targeted interventions on the basis of geographic regions can be justified where coping mechanisms among households are *similarly* constrained or have *similarly* collapsed — implying that similarities of risk exist (see section 9.4.3.1.).

[45]Consideration of cash transfers should not be excluded when households lack adequate effective demand, but where there are sufficient market supplies. The UNICEF experience in Ethiopia in 1984 points out the advantages and drawbacks of such transfers (World Bank, 1986b).

food exchange entitlements and drought impact among households, a category which implicitly acknowledges that households with no effective demand can be found as well in the first two categories, deficit zones and zones at risk — that is, the entire Northeast.[46]

Thus, it is recommended that:

- the SAP adopt a new hierarchy of market/nutrition interventions, increasing in intensity, as follows:

    1) cereal-production deficit *zones* under routine surveillance;
    2) deficit *zones* at risk of rupture of market supplies, probably leading to price hikes and food scarcities;
    3) food-insecure *households* and/or households with no effective demand; and
    4) emergency feeding and/or medical rehabilitation of *individuals*.

Routine surveillance means that no interventions are required in the first case. The main instrument for addressing the second case would consist of augmenting market supplies. The main instrument in the third case would be non-market transfers of food or income and/or paid employment. The fourth case requires medical attention. In some instances, a mix of instruments may prove necessary.

Although monitoring household status may be more costly than monitoring geographic zones — raising benefit/cost questions, it is recommended nonetheless that the SAP improve its methodologies for assessing vulnerable rural populations generally (AID, 1987). Autier (1988b) recommends that the SAP develop better standard operating procedures for use by headquarters and lay technicians in the districts (drawn from District Development Committees who report to headquarters) to help narrow analysis of the problem and focus responses (including non-food aid activities) and improve the usefulness of information.

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[46]Research shows evidence that considerable pockets of malnutrition exist outside SAP "at risk" arrondissements, even in the OHV and CMDT zones (Staatz, Dioné and Dembélé; Sundberg, 1989).

These procedures would deal with identifying useful information and strictly defining the terms used, modalities for collecting and transmitting information, and interpreting this information for taking actions (say, in the face of locust attacks, arrival of displaced persons or massive departures, or epidemics). More specifically, it is recommended that:

- the SAP continue to sharpen and refine its level of needs assessment, based on localized household coping strategies, enabling it to identify and target food insecure categories of *households* (short of emergency deployment of medical-nutritional teams).
- the SAP continually monitor the local availability and market prices of wild cereals in order to factor supplies into any market intervention policies.
- the SAP devote sufficient attention to the food security status of Off-River communities which, despite use of finely-tuned coping strategies, still show low rates of consumption security in a good rainfall year.

Yearly and seasonal variability in household incomes and cereals consumption and the geographically broad definition of "households with no effective demand" thus call for a comprehensive approach to food security monitoring. It is recommended that:

- within the Gao Region, the SAP focus particularly on the lower-rainfall North and the less accessible Off-River households during years of good rainfall and abundant cereal harvests.
- the SAP monitor *all* of the Gao Region — and Northeast — during years of poor rainfall and deficit harvests.
- the SAP develop a taxonomy of scenarios and list of short-term food security responses for all the Northeast, increasing in urgency and/or comprehensiveness, in close collaboration with other relevant parties such as

the CNAUR, OPAM, the local administration, PRMC donors and community representatives, building on distinctions between grain deficit zones, zones at risk and households with no effective demand (see footnote 27).

9.4.2.5. Meeting Training Needs of Traders

Dioné and Staatz (1989) point out that one of the basic assumptions of the initial phase of the PRMC was that private traders had sufficient business acumen and access to capital so that once market restrictions were removed, traders would expand their markets through investments and fill the void created when OPAM lost its marketing monopoly. This assumption proved incorrect. Removing marketing restrictions alone is not enough to ensure that traders can formulate and execute sound marketing strategies to make markets perform better. This issue — preparing and equipping traders with a host of supporting services — is still relevant as the PRMC expands its geographic focus to the Northeast, even though historically, traders there used to have wider latitude to operate.

Two related observations are pertinent, both from Harrison and colleagues. First, easy entry and exit conditions may simply result in a proliferation of grain traders using traditional methods, rather than improvements in scale economies and use of modern business practices. Next, easy entry and exit may signal instability in the grain trade, market conditions and other factors equal. This highlights the importance of one of OPAM's secondary missions (Chapters 2 and 8), that of training grain traders in the skills of entrepreneurship through its Training and Information Center (CEFODOC), for which donor funding may be necessary.

Accordingly, it is recommended that:

- CEFODOC steadily gear up to offer a full range of training programs for urban traders based on trader-identified needs, but also including basic accounting, inventory management techniques and periodic briefings on changes in marketing policies and regulations.

Such programs should not be limited to Bamako traders. As CEFODOC gears up, it is recommended that:

- CEFODOC take its training program to all regional capitals and other major trading centers, including those in the Northeast, so that regional traders benefit. It is further recommended that, with experience, CEFODOC expand training programs to smaller-scale and rural trading sectors in the Northeast.

With respect to improving trader understanding of routine operations of the National Security Stock (section 9.4.2.3.) and raising the competence of traders in playing a necessary partnership role with the SNS, it is recommended that:

- CEFODOC offer and publicize special sessions, in collaboration with SNS, for instructing traders on how to submit bids for the purchase of SNS stocks and tenders for the sale of cereals to the SNS in order to develop OPAM's bid system of purchases and sales.

9.4.2.6. Meeting Financial and Credit Needs of Traders

Chapters 7 and 8 have evaluated trader financial needs and the prevalence of supplier credit in kind as a substitute for missing financial markets. Yet, promoting efficient financial markets is indispensable for speeding market response and boosting productivity (World Bank, 1989). Access to credit allows own buy-sell decisions for which timing is critical for profitability. Access to credit averts passive receipt of another trader's unexpected consignment and possible storage constraints. Even if credit appears to be not needed, credit availabilities expand trader capacities to take advantage of unexpected market opportunities — subject to training in the use of credit.

The position of the government and PRMC is that the responsibility of financing cereals marketing needs to be transferred to the banking sector. Specific lines of credit need to be abolished in favor of general short-term seasonal marketing credits *(crédit de campagne)* as traders grow increasingly accustomed to borrowing within the rules of formal sector banking (PRMC, 1990).

These policy directions are valid in the long term, but more pertinent to southern Mali in the short term where grain traders have benefitted since the first PRMC credit programs. These directions are less valid immediately for the Northeast where the presence of commercial banks is weak and trader experience with banks negligible (Chapters 2 and 8) and where some traders declare their aversion to use of bank credits due to repayment with interest. A menu of credit programs targeted to various levels of trader capitalization, moreover, ensures greater competition, leading to lower marketing costs as a result of expanded use of other marketing services and smoothing seasonal price instability.

In the absence of a commercial banking network, cereals traders in the Northeast operate at a disadvantage with respect to their counterparts in other regions in terms of both short-term credit requirements and long-term investments. Until commercial banks establish branches in the Northeast or until the government's development bank, BDM, reopens there, it is recommended that:

- the government and PRMC maintain their commitment to extend short-term seasonal credit programs to wholesalers and semi-wholesalers throughout Mali, especially those in the Northeast.
- the government and PRMC investigate the feasibility of modifying PRMC credit terms to accommodate Islamic banking principles, based on profit-sharing rather than explicit interest charges. Alternatively, if private banks

emerge in the Northeast founded on Islamic banking principles, it is recommended that the PRMC investigate channeling cereals marketing credit through such banks (also see section 9.5.5.1.).

- other marketing policies promote longer-term investment credit through the commercial banking network, including coverage in the Northeast, to encourage the more innovative and entrepreneurial traders to expand marketing investments.

As financial needs of semi-wholesalers differ from those of wholesalers, as well as among different classes of semi-wholesalers, it is recommended that:

- the PRMC redesign credit lines to better reach the target clients, especially the semi-wholesalers gathered in "economic interest groups" (GIEs), based on different levels of capitalization and different crops marketed.

Exposure to the requirements of formal sector banking is limited, particularly among semi-wholesalers in GIEs in the Northeast. It is further recommended that:

- the PRMC continue use of technical training teams to guide these GIEs in their bank loan requests, monitor implementation of the various credit programs, suggest corrective actions where necessary, and evaluate private sector capacities to supply isolated areas or areas far from production sources.[47]

Since interannual variability in market conditions may require special flexibility in loan conditions, it is recommended that:

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[47]As this last point also has relevance for the Northeast, especially for rice-growing zones along the Niger, successful operations of these GIEs might allow dropping the recommendation (section 9.4.2.3.) that the SNS consider buying paddy/rice for storage in the SNS.

- the banks, PRMC, OPAM/CEFODOC and/or OPAM/SNS jointly offer a short training workshop to wholesalers and retailers each year in the use of credit *whose terms may differ from year to year,* as a loan qualification requirement.

To complement the general training by CEFODOC (section 9.4.2.5. above), it is recommended that:

- this credit-use workshop discuss and update public marketing policies, operations and regulations to improve borrower understanding and confidence (reduce vulnerability to hold-up resulting from fixed asset investments) and to encourage better informed investment planning by cereal traders.

9.4.2.7. Improving Transport and Communications Infrastructure

There is near universal agreement on the importance of infrastructure for coordinating input and output markets and services. Transport linkages stimulate markets by facilitating efficient price arbitrage between markets and seasons. Better communications infrastructure reduces costs, risks and speculative gains and losses while improving market integration. The paved road between Gao and Mopti (Sevaré) has opened options to Gao traders and transporters in terms of fluid supplier and client relations, and possibly for other elements of conduct (Chapter 8).

Unfortunately, transport improvements between Tombouctou and other cities will be harder to achieve due to unaccommodating sand dunes and, to a lesser extent, heightened concerns about environmental fragilities. Improvements in river transport offer a partial solution, although low drafts during the dry season limit the scale of river transport.

Where feasible, continued improvements in transport and communications infrastructure will bring markets in the Northeast into closer commercial relations with the rest of the country. An indirect policy of market intervention will address those infrastructure constraints that hamper the ability of farmers, traders and transporters to respond to distant market signals (Sahn and Delgado). But in view of the not insignificant technical and financial constraints, it is recommended that:

- Mali limit *capital*-intensive infrastructure development to investments with high internal rates of return (above the cost of capital) which directly strengthen provision of market facilitating services in the Northeast. At the same time, it is imperative that Mali not neglect maintenance of existing capital-intensive infrastructure.
- such capital-intensive investment policies generally favor physical market infrastructure development along the more accessible and more densely populated Niger River valley and/or highway network, rather in than the vast low-populated hinterland where investment returns are likely to be lower.

In contrast, it is recommended that:

- Mali emphasize *labor*-intensive infrastructure development, making particular use of temporary employment programs (section 9.4.3.2.) seeking to maintain household incomes and support effective market demand for cereals.
- the rural engineering department (*génie rurale*) of the Ministry of Public Works identify and design a series of local, technically-sound and labor-intensive transport infrastructure projects, such as spot improvements on highways (digging culverts, planting windbreaks, graveling and paving steep gradients) for ready use by emergency employment schemes.

Since market-facilitating services and risk-reducing policies can compensate for missing physical infrastructure up to a point, it is recommended that:

- the critical function played by markets in the Northeast be reinforced through an enabling environment of pro-market policies, services and coordinating mechanisms (Chapter 6).[48]

9.4.2.8. Fair and Equitable Enforcement of Marketing Regulations

Chapter 8 recounted trader perceptions of the unfair and inequitable enforcement of marketing regulations. Selected recommendations from Steffen and Dembélé (1990) in this regard are still valid. In addition, this dissertation recommends that:

- the government revise obsolete legislation and adapt the judicial and administrative system to the new, liberalized economy in order to eliminate administrative obstacles and inconsistencies in marketing cereals.
- the government encourage greater transparency in public marketing policies and operations to reduce the perception of risks and stimulate marketing investments by cereal traders.
- the government streamline operations of the new business courts for timely, fair and equitable adjudication of business disputes between a) private parties and b) private parties and the public sector to promote use of contracts in the cereals market by reducing the risks of long-distance transactions, providing redress for principal-agency conflicts and encouraging use of marketing credit.
- the government put an end to harassment by regulatory agents during site inspections and highway checkpoints which often result in financial extortion.

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[48]Infrastructure investments without appropriate economic policies and incentives can be a "prescription for indebtedness rather than development" (Hopcraft).

- the government enforce grain trade and grain transportation regulations uniformly so that all traders and transporters are equally and fairly treated in the eyes of the law.
- the government publicize all grain trade and grain transportation regulations widely, in conjunction with the SIM and CEFODOC, so that market participants understand their rights and responsibilities.[49]

9.4.3. Household Food Security-Oriented Measures

While the market-oriented recommendations above are no less instrumental for household food security, this section deals with more direct measures which, in terms used by Pinstrup-Andersen (1989), maximize the real incomes of the poor. Recommendations to improve household food security follow.

9.4.3.1. Targeting of Non-Market Transfers

As a corollary to the recommendations concerning the Early Warning System (SAP, section 9.4.2.4. above), better efforts can made to direct food aid to those at nutritional risk to avoid leakages to those who are not in need. By definition, targeting transfers to target groups excludes non-target groups, seldom an easy operation.

A major concern with distribution of food aid is the "omnipresent danger" it poses to the market.[50] Free food aid disrupts normal market flows and reduces storage and transfer incentives for farmers, traders and transporters (Staatz *et al.*, 1989). Consumption of food

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[49]This measure was strongly supported by traders and transporters who described themselves "partially informed" or "poorly informed" (Steffen, 1990).

[50]This section concerns targeted non-market interventions. It is not a systematic review of food aid and its variations. See Singer for a rebuttal of the numerous criticisms of food aid.

aid often displaces other purchased food and/or own produced food, releasing new purchasing power, some of which will be spent on food or non-food items, altering market supply and demand patterns. Free food aid tends to attract "outsiders" to distribution sites, especially nomads, a problem acknowledged by sub-district officials (Steffen and Koné). While the needs of some households are undoubtedly genuine, distribution of free food aid must be reserved for exceptional circumstances (Autier, 1988b). Moreover, non-targeted food aid costs are high whereas targeting could be more economical. The question is whether there is a way of targeting the poor without disrupting private market incentives to supply those households who do have enough income to rely on the market.

9.4.3.1.1. When to Target. A first consideration is when to target. Targeted non-market interventions are justified when traditional coping mechanisms have failed. Targeted food security interventions can help households cope with seasonal variations in production, work, incomes and prices. Targeting can supplement seasonal consumption when physical workloads are greatest (Table 5.19). Targeted interventions are also justified when markets are distorted. Targeting corrects for market inefficiencies and market failures (Sahn, 1989).

9.4.3.1.2. Whom to Target. A second consideration is whom to target. Although there are some exceptions (more later), there is a strong consensus that the appropriate target for non-market interventions is the household. Pinstrup-Andersen points out that *individuals* within the household should be targeted only in cases of serious nutritional deficiencies or medical risks (as cited in A. Berg, p. 97). Otherwise, households should be targeted to receive subsidies or food-linked income transfers. From an administrative standpoint, moreover, targeting households is more practical and manageable.[51]

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[51]Focus on the household as a unit does not deny issues of intrahousehold distribution and budget control (Chapter 2). Intrahousehold budget control is a function of the source of income (which household members earn it) and/or whether income is pooled collectively

Ideally, household targeting should be based on income, adjusted for household size and composition (Pinstrup-Andersen, 1988), a positive and strongly significant explanatory variable for cereal consumption levels for all household strata in the Northeast (Table 5.18). A similar recommendation comes from Reardon, Delgado and Matlon (1992), based on their study in Burkina Faso, that non-market transfers be targeted to those with lowest purchasing power, not poorest harvests.

Wealth may be another good indicator of cereal consumption in good years in parts of the Northeast. Table 5.18 shows that the explanatory power of the combined value of household assets was low, but positive and strongly significant for Off-River and South households. This wealth effect may allow consumption at stable and adequate levels as some physical assets may function as income-earning resources. Moreover, wealth which serves as collateral is linked with credit — including the ability to borrow to buy food. Comparing household responses to drought in Burkina Faso and Ethiopia in the mid-1980s, Webb and Reardon found that lower income households were able to borrow less food or cash than upper income households, underlining the credit constraints on poor households that make it difficult for them to preserve assets during crises.[52]

Diversification of household income is a much stronger indicator of household consumption levels than household income itself (Table 5.18). Diversification, especially the liquidity aspect of diversification or non-agricultural income, is a valuable mechanism to

(which household members decide how it is spent) and different marginal propensities to consume food among different household members. Nonetheless, households are the appropriate level of targeting.

[52]Comparing household sale of assets, Webb and Reardon found that upper income tercile households fared better than lower tercile households because they had more assets to begin with, could wait until market conditions were more favorable before selling and, as most assets sold were cattle, upper tercile households could afford to sell some cattle without jeopardizing the reproductive capacity of the herd.

compensate for weak credit markets and poor harvests (Reardon *et al.*, 1992). But, not all households are able to diversify equally. Small household size and wealth constrain some households from diversifying their incomes, although Reardon *et al.* (1992) consider an out-migrant as an asset.

The overall dilemma is that estimates of household income may not always be reliable, especially estimates which are quickly made but not verified. Furthermore, some households move in and out of poverty and transitory food insecurity (Table 5.15). These households may only require seasonal support. Verifying purchasing power is no less difficult than estimating income — not to mention income diversification — although determining household size and composition may be slightly easier.

The main lesson is that household characteristics and ability to cope with drought are diverse (Chapter 3). Non-market transfer programs must not view households as "homogenous subsistence units or drought-prone areas as homogenous environments" (Webb and Reardon). There is an enormous difference in drought impact across households and regions. Thus, governments need to target their interventions more selectively by identifying different marketing, consumption, and income patterns, and coping strategies and the types of households pursuing each one (Autier, 1988a; Ellsworth and Shapiro; Reutlinger and Katona-Apte; Webb and Reardon).

Short of direct income measures, it is important to identify at-risk households who derive incomes from the same sources, who face the same relative prices, have the same consumption patterns, but who may not have the same basic needs. These households should then be classified into functional at-risk groups for the purpose of understanding how they would be affected by targeted interventions based on, in part, the levels of and fluctuations in incomes of these groups, the prices they must pay for food, and fluctuations in these prices (Pinstrup-Andersen, 1989).[53]

Geographic-focused targeting may be effective, according to Webb and Reardon, among poor households in regions where similar coping mechanisms — among similar ethnic groups or strata, as in the Northeast — have collapsed or are constrained. Such geographic targeting still requires a first-hand knowledge of household consumption and income patterns. It is therefore recommended that:

- the SAP make use of the information found in these chapters on household income, expenditure and consumption patterns to develop its household targeting indicators for the Northeast.

9.4.3.1.3. How to Target. A third consideration is how to target. Pinstrup-Andersen (1989) proposes a six-step approach for identifying target groups and recommending target mechanisms. These are: 1) identifying functional groups that are food insecure or at risk of becoming food insecure; 2) assessing the food acquisition and intrahousehold allocation behavior of these households; 3) assessing household resource availability and constraints; 4) assessing institutional and administrative capabilities for targeted interventions; 5) identifying sources of financing, including external food aid; and 6) selecting the most appropriate measures to compensate for food insecurity. This approach requires access to accurate and up to date information and continual monitoring of changes in the food security status of these groups based on key indicators.

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[53]Pinstrup-Andersen (1989) identifies these at-risk groups as agricultural households, subsistence and semi-subsistence households, the rural landless, households headed by women, and nomadic and semi-sedentary households. All of these overlapping groups are found in the Northeast.

There is broad agreement on how to make targeting approaches acceptable to beneficiaries. As a general rule, the most successful targeting approaches disrupt or contradict household behavior the least (Pinstrup-Andersen, 1989) or, similarly, limit the number of changes in the normal habits of target populations (A. Berg). Sahn (1989) urges that targeting build on existing or indigenous strategies to cope with seasonal food insecurity. Moris concludes, however, that indigenous strategies are not always available to those who want to use them because these requires access to common property resources (such as wild cereals) which suffer from overuse due to increasing population and environmental stress. Fortunately, this is less a problem in the Northeast in the short term with net decreases in human and livestock populations over the past decade (Chapter 2).

There is also agreement on how to make targeting approaches acceptable — or at least less offensive — to non-beneficiaries. On one hand, targeted programs need to watch out for non-target households who try to circumvent the restrictions of targeting. Particularly troublesome are situations where local resident households do not receive rations when displaced households in nearby refugee camps do. Untied cash transfers seem less socially palatable than transfers linked to food, especially for non-target households, as the link between the transfer and reducing malnutrition is less apparent. On the other hand, targeting may result in a stigma on certain population groups, possibly leading to social and political instability, if target groups coincide with specific ethnic groups and exclude others.

Accordingly, it is recommended that:

- the SAP identify *now* those functional groups which pursue similar livelihoods with similar (seasonal) patterns of income, expenditure and consumption as well as coping strategies — and thus, which are vulnerable to similar risks of food insecurity and economic dislocation (the first three steps of Pinstrup-Andersen's approach).

- the SAP, together with the CNAUR and PRMC, develop alternative targeted intervention programs for dealing with each functional group, based on the taxonomy of drought/harvest scenarios proposed in section 9.3.14. (the last three steps of Pinstrup-Andersen's approach).

9.4.3.1.4. Selecting the Targeting Mechanism. The next consideration is selecting the targeting mechanism. There are three categories of targeted interventions, those that a) generate income through productive work; b) transfer income directly; and c) affect prices faced by consumers (Sahn, 1989). Each has its relative merits and drawbacks.

The most common type within the first category is labor-intensive food for work programs, where able-bodied workers are paid in food (or partially in food). The drawback of food for work programs is that they create a parallel market channel which possibly makes normal markets even thinner and hence more volatile (Staatz *et al.*, 1989). A variation is cash for work, similar to food for work except that workers are paid in cash. This type of intervention is most effective when target groups have no effective demand for food, when food is already available locally and when recovery is facilitated when the target group remains in place (for example, planting for the next crop cycle), rather than migrates to distant food distribution centers.[54] However, cash payments might have an inflationary impact on local market prices unless higher demand is offset by increased supplies. Note that external food aid can reduce the fiscal costs of food for work programs. External financial aid can reduce the fiscal costs of cash for work programs.

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[54]Food for work and/or cash for work have bearings on recommendations for labor-intensive infrastructure (section 9.4.2.7.), relief and rehabilitation programs (section 9.4.3.2.), and employment strategies for the Northeast (section 9.4.3.3.).

The second category includes a) transfers in kind, such as supplementary school feeding/preschool feeding or maternal-child feeding; b) any other direct feeding programs based on age and need to ward against seasonality of diseases, hunger and malnutrition and raise productivity, and c) use of alternative foods which are not themselves considered replacements for meals. For feeding programs, once nutritional or other health thresholds are reached, individuals within target groups are removed to reduce dependence. These transfers in kind reduce price increases that would occur with non-food transfers.

In contrast, food subsidies and targeted transfers reduce food prices relative to other prices, thus contributing to a substitution of food for non-foods which would not occur through direct income or cash transfers (Pinstrup-Andersen, 1988). Examples of this third category are more varied. They include: a) seasonal food subsidies when prices are highest (and real incomes lowest); b) subsidies on prices of inferior food commodities; c) targeted subsidized food coupons for households with children under five and pregnant or lactating women; d) wage supplements to compensate for higher food prices; and conceivably e) nutrition education when linked with primary health care (such as child growth monitoring, oral rehydration, nutrition education, breastfeeding weaning, home gardens, food storage, family planning, and clean water supplies) (A Berg; World Bank/World Food Programme). Dioné (1989b) and Sahn (1989) recommend that governments defer or spread out post-harvest tax payments. Sahn (1989) also recommends that governments and/or PVOs set up credit programs to prevent distress sales.

9.4.3.1.5. Managing Targeted Interventions. A fifth consideration is management demands of the targeted intervention. Administrative complexities and financial costs of targeted transfer programs are considerable, even when the food (cereals) are donated for free. Moreover, seasonally targeted programs are difficult to start and stop. Targeting itself, if properly done, is management-intensive as household food security status varies between households at any one moment and for the same households over time. Assessing food security status and targeting households may exceed the capabilities of the regional administration in the Northeast. Private voluntary organizations can be helpful here. Accordingly, it is recommended that:

- the CNAUR and Malian administrators in the Northeast, *as a matter of policy*, seek out and make full use of competent, committed and experienced PVOs with a demonstrated ability to relate to the local communities which they serve to manage (seasonally) targeted interventions — program content, identification of target households, commodity distribution and program termination.
- the SAP and CNAUR train PVO staff in the accepted criteria for identifying both the functional groups for intervention activities and the target households who benefit.
- the CNAUR and Malian administrators manage direct distribution programs themselves where PVOs are not active or not willing.

One means of reducing management costs of targeted programs is to rely on "self-targeting" programs. In one self-targeting model malnourished households receive inferior-good food aid commodities which better-off households disdain. A variation of the latter model is self-targeting food-for-work programs, based on the precept that certain activities, especially "undesirable" manual labor, will attract the food insecure but not the food secure. Self-targeting may be possible through food subsidies aimed at less desirable foods but it is not possible for cash transfers (Pinstrup-Andersen, 1988). Self-targeting mechanisms are typically less controversial to non-beneficiaries who themselves choose not to participate than direct targeting programs from which non-beneficiaries are deliberately excluded.

While self-targeted programs are desirable in terms of lower administrative costs and leakages of benefits to non-targeted households, there is little scope for self-targeting foods in Mali (Staatz *et al.*, 1989). For one, inferior foods are virtually unknown or unavailable most of the year. Tubers do not represent the cheap food substitute as in many other locations throughout West Africa (Reardon, Delgado and Thombiano; Ross). In Northeast, a cassava root is considered a "vegetable" and just as expensive as a tomato. Next, the poor eat much the same mix of foods as the rich over the year (Tables 5.4 - 5.7; Lowdermilk and Rogers). Even where there are seasonal variations in cereals consumption, the substitute cereal is not necessarily considered an inferior food, with the exception of wild fonio. Besides, the availability of wild fonio is too irregular — or unknown in advance — to be reliable as a self-targeted food in many cases. Lastly, nearly all households in the Northeast are poor by most objective measures. Self-selection may not be as effective where variations in poverty levels are less significant. It is recommended that:

- the CNAUR, SAP, PVOs and administrators in the Northeast nonetheless continue their search for workable self-targeting prototype food intervention programs and/or foods in order to reduce administrative costs and leakage of benefits to the non-needy.
- the CNAUR and SAP investigate use of maize meal as a self-targeting food, based on its perception a famine food in the Northeast.

Which targeting approach is appropriate? The most appropriate choice among various targeting approaches depends on the particular circumstances within which targeting is introduced. A case by case basis determines which is most cost effective.

9.4.3.1.6. Toleration for Some Leakages. Sixth, there is a limit to efforts for targeting households to achieve income transfers or nutrition goals at reduced fiscal costs. The design and implementation of programs to reach targeted households — and exclude non-targeted households — can be extremely costly and difficult in terms of political and logistical factors and lack of sufficient information (A. Berg; Pinstrup-Andersen, 1988). Therefore, "perfect targeting" should not be attempted. Pinstrup-Andersen (1988) warns that the increases in administrative costs (including identification of target households) at some point exceed the savings from avoiding fraud and further reducing benefit leakages to non-target households. In emergency programs, "perfect targeting" might quickly become counter-productive as there is a risk of excluding those that need help. Autier (1988b) also rejects "obsessively precise" targeting and the surveillance it requires. Nutrition interventions must not target individuals (meaning that the status of *all* individuals has to be observed or measured to be able to identify the needy ones) when targeting the household or even village will do.

It is recommended that:

- the CNAUR, SAP, PVOs and administrators in the Northeast do not aim at perfect targeting in food intervention programs, which costs valuable time and resources, but be prepared to accept some minor leakage to non-targeted households as long as requirements of the most needy can be met with reasonable assurance.

Invariably, beneficiary households might sell some of their food aid to meet undeniable cash needs or simply because they have no means of transporting large quantities home (for example, several bags of cereals). The worst impact on the market occurs where food aid is distributed to all comers, without distinction as to need, leading to a secondary market in food aid. If proper targeting has been done, however, food aid leakages onto the market will likely be small and less disruptive.[55] It is recommended that:

- the CNAUR, PVOs, donors and particularly local administrators in the Northeast not attempt to prevent households by force from selling some of their food aid onto the market.

Such attempts do not recognize the resource allocating functions of rational households or differences in household utility derived from transfers in kind or their cash equivalents. A show of force would be counterproductive and make a potentially volatile social situation worse, especially where disorderly crowds of recipients are involved. Instead, it is recommended that:

- the CNAUR, PVOs, donors and local administrators better control their food aid interventions by targeting recipient households, distributing smaller quantities on a more frequent basis, and distributing in less centralized locations when feasible, to avoid both transport problems for recipient households and massive flooding of markets with food aid.

This requires flexibility in food aid deliveries by donors or releases of security stocks by the SNS.

If self-targeting models are not chosen, it is recommended that:

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[55]Reutlinger and Katona-Apte urge donors to improve the cost-effectiveness of their food transfers by relating the value of take-home food aid to the recipient in terms of the supply cost to the donor — in other words, those food aid commodities which maximize the ratio of local market cost faced by the recipient to food aid acquisition and delivery costs paid by the donor. This implies that commodities with high values for the recipient may be most appropriate, regardless of specific nutrient content, provided that the marginal propensity to spend additional income on nutrition is positive. The impact of the food aid transfer is determined by its potential savings to the recipient household which frees its budget for other food (and non-food) purchases. A possible consequence of this approach is that carefully selected food aid commodities may be less likely to be leaked onto the market.

- the SAP make concerted efforts to develop seasonally robust, qualitative indicators of food need *at the household level* which are easily and objectively verifiable (thereby avoiding charges of favoritism or opportunism) and, which after testing for reliability, can be used to identify food insecure households for more tightly controlled targeting.[56] It is further recommended that specialists make continual improvements in these indicators to identify and target the food insecure (see also section 9.4.2.4.).
- household food aid need indicators pay particular attention to the rainy season and/or the hot dry season which precedes it — the discrepant seasons(s) in terms of incomes, consumption requirements and market access.
- the SAP and researchers delve deeper into food need indicators to analyze and predict the relationship between household income, other economic indicators and alms/charity, given the high dependence on charity as a source of household income in some strata in the Northeast.

Since household-based targeting is not restricted to any given district or sub-district, deficit or surplus, it is recommended that:

- the SAP designate and train a local, mobile agent(s) in each sub-district in the Northeast, answerable to SAP, to assess household needs using the qualitative indicators above.[57]

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[56]See Autier (1988a) for a discussion of the special behavioral, methodological, operational and political-economic problems of targeting aid to displaced persons in Mali.

[57]Use of qualitative indicators is emphasized mainly in the interest of speed and ease of verification, *not* necessarily to dismiss use of quantitative measures such as anthropometric measures, especially critical for direct medical-nutritional intervention which require more intensive, repeat professional monitoring and observation beyond the level of training envisaged for the sub-district SAP agent. Indeed, relatively simple quantitative indicators can usefully complement qualitative indicators (section 9.4.3.1.7.).

- the SAP regional headquarters closely monitor and verify calls for food aid by local administrators and/or SAP agents which exceed estimated needs or, in the less likely case, denials of need when food is actually required (both variants of the agency problem, with different motives) so that adequate supplies are distributed when needed, as needed.
- targeting for direct food security interventions take into account any need to position additional market supplies and/or food aid before the start of the rainy season when given locations in the Northeast are not accessible.

Identifying functional groups whose coping strategies differ can proceed from the analysis of incomes, expenditures and consumption of the four household strata used in this dissertation. It is recommended that:

- the SAP use and refine the four cross-cutting household strata used in this dissertation — North, South, On-River and Off-River — to define functional groups in the Northeast and to develop targeted intervention modalities *in advance,* varying by seriousness of the situation.

9.4.3.1.7. Targeting when Emergencies are Underway. What about emergencies which have not been averted but which are already underway? Thus, another consideration is how to target during emergencies. "Phase III" of the SAP kicks in *after* alarms have rung. In response, the SAP rushes medical-nutritional or socio-economic teams to the sites in question within two weeks to investigate and quantify the extent of threat or crisis. While the methodologies for these investigations are well-developed and hence replicable, Phase III investigations are too cumbersome, sophisticated and costly to be used routinely (Autier, 1988b).

Médecins Sans Frontières (Belgium) applied a rapid appraisal approach to identifying and comparing nutritional needs of different displaced groups during the food emergencies in Chad in 1984 and 1985 based on social, economic and nutritional risk indicators. Advantages of this "nutritional scoring system" are ease of sampling procedures, particularly when reliable sample frames are not available and/or when field staff are unaware of classical sampling procedures, and focus on the socio-economic situation of the household, not limited to nutritional status of children which might misrepresent that of all household members.[58] Five levels of targeted interventions were established based on the average range of per group surveyed, where the score of 30 was set as the threshold for taking direct action (as opposed to continued surveillance). These interventions extended from supplemental feeding programs and medical attention ("severe nutritional emergency") to no action recommended (nutritional situation considered "normal").

Disadvantages of this nutrition scoring system were some subjectivity in defining indicators and inter-observer variability in assigning scores, and non-transferability of the scoring system elsewhere *without* modification based on a good working knowledge of the new target groups. On the positive side, the nutritional scoring system was more readily

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[58]These risk indicators were cause of displacement; number of displaced people; type of displaced people; mortality rate; nutritional status of the population; homogeneity of families; type of food consumed; household food reserves (including household ability to buy food on the markets, if markets still functioned); and vitamin A deficiency. The predictive quality of these indicators was weighted according to their ability to detect a nutritional problem; degree of specificity in pinpointing cause; ease of measurement; and acceptability of the particular indicator by decision makers. A scoring method was devised which assigned a variable number of points for each indicator of risk (increasing in value as the situation worsened) and values from zero to five for each of the four predictive qualities per indicator (based on previous experience in Chad by MSF-Belgium), and then totalling the predictive values for each indicator to obtain the importance of each indicator within the score, and lastly, transforming this score to a scale of 100.

operational in terms of implementation by non-medical enumerators, speed due to simpler sampling procedures, and short-term predictability of some of the indicators (Autier, 1988a).

It is recommended that:

- the SAP in Mali adapt this approach, perhaps initially parallel to Phase III surveys, to better target and compare non-market interventions for meeting the nutritional needs of households and groups of households in exceptional circumstances.
- the SAP develop and test such indicators as need-criteria for Phase II surveillance to supplement, or possibly replace, the present monthly SAP questionnaires to district SAP technicians.

9.4.3.1.8. The Extreme Northeast: A Special Case. A final consideration is how to handle the extreme Northeast. Due to choice of survey sites, these dissertation strata exclude households living in the Saharan zone of the Northeast — less than 100 mm of annual rainfall, generally above 17-18^0 N, and probably including the northern three-fourths of Tombouctou region and all of the newly-created Kidal region. It is further recommended that:

- the SAP define a fifth functional group, based on various food security indicators, for households living in the Saharan zone of the Northeast.

Designing non-market interventions in this vast, far-away and low-populated zone pose formidable challenges for monitoring and targeting, not to mention difficulties in delivery of cereals to dispersed households.[59] For practical purposes (a fairly obvious instance where administrative costs far exceed the benefits from "perfect" targeting), direct interventions should be geared to truly exceptional circumstances, such as the formation of camps of

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[59]This entire expansive zone, about half the territory of Mali, may contain no more than 100,000 people.

displaced persons, unusual/unseasonal mass departures of households, changes in food consumption behavior, distress sales of animals and death from malnutrition. In less critical instances, it may be necessary to attract these widely dispersed households to outpost towns, such as Kidal, Tessalit and Arouane, or more easily accessible (from a food delivery standpoint) population centers along the Niger River.[60] Accordingly, it is recommended that:

- the SAP consider the enormous logistical difficulties in reaching widely dispersed households when determining response intervention scenarios for the Saharan zone.
- the SAP limit direct targeted interventions in the Saharan zone to extreme or exceptional conditions. Under less urgent circumstances, it is further recommended that the SAP make use of indirect market interventions to reach households in the Saharan zone and/or targeted interventions for Saharan households present in more accessible points in the Sahelo-Saharan or Sahelian zones to the south.

The preceding recommendation implies the migration of at least some Saharan households to southern food distribution and relief points. Gueymard (1989) reminds planners that there is a "natural socio-demographic flux" of population within and to and from the Northeast. Development projects, particularly nutrition intervention projects, neither keep people in the Northeast "artificially" nor stop those who want from leaving. The impact of these projects is "very marginal," according to Gueymard, although a minority of households does need help. As it is possible for most households to eke out a viable livelihood, the

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[60]Kidal's new status as a regional capital offers a *political* rationale for placing modest levels of grains there as part of the SNS, although delivery and stock management would be no less difficult in logistical terms.

government and donors should not feel a special obligation to maintain households in the Northeast through expensive food supply operations. While Gueymard overstates his case somewhat, his main argument as concerns the Sahara zone is sound.

9.4.3.2. Drought Relief and Rehabilitation

Planning drought relief and rehabilitation or responses to less severe crises which endanger household food security fall within the purview of CNAUR, supported by the SAP, PVOs and local administration. In fact, there need not be a sharp delineation between relief and rehabilitation. Viewed in terms of the "relief-development continuum," all well-conceived relief activities can be designed to lift drought victims, displaced people and the food insecure out of current economic distress and set them on the path to sustainable recovery. Evaluating the emergency assistance program in Mali in 1984-85, the Agency for International Development (1987) recommended that:

- economic recovery programs be carried out even during the relief phase of emergency food distributions, rather than the end of relief operations, in order to restore the exchange entitlements of vulnerable households as soon as possible.

This dissertation fully endorses that AID recommendation.

As with targeted food transfers, it is necessary to know the income source of food insecurity before designing rehabilitation programs. Webb and Reardon point out that "droughts pose a *cumulative* threat" and that "isolated occurrences are rarely dangerous." Thus, planners need to keep the sequence of droughts and poor harvests years in mind, whether households need help in recovering from a single poor year with few long-lasting harmful effects or whether households are suffering from consecutive droughts which severely strain their coping strategies.

9.4.3.2.1. Involvement of Target Community. Experience has taught there are several elements of successful rehabilitation projects. The first is that rehabilitation projects to raise employment levels and the income-generating capacity of poor people need to involve the target community to achieve community-based solutions. Ideally, such involvement is not passive, but calls for specific provisions to ensure the active, broad-based participation of the poor and food insecure in the rehabilitation process (FAO/Committee on World Food Security). Rehabilitation programs should empower communities to become self-reliant (A. Berg) — a concept for which there should be few cultural barriers in the Northeast. Sahn (1989) also urges rehabilitation programs to facilitate village initiatives for determining their own needs for assistance. All told, the range of possible schemes offers flexibility for communities, provided that there are positive payoffs for collaborative solutions.

9.4.3.2.2. Participation of the Poor. A second element is that rehabilitation programs need well-designed screening mechanisms to ensure that the poor participate and benefit. Effective targeting is no less critical for rehabilitation programs than for other non-market transfers. The impact of drought is more severe for lower tercile households with fewer options left in their coping strategies due to consecutive drought (Chapter 3) or for smaller households with fewer opportunities for income diversification (Chapter 5). Loss of productive assets and capital constraints also lead to destitution. Fortunately, community-based rehabilitation programs can help set criteria for selecting participating or beneficiary households (Sahn 1989).

It is recommended that:

- the CNAUR, PVOs, donors and local administrators design drought recovery and rehabilitation projects with the objective of offering opportunities and options to needy households to make them independent and economically viable units once more.

- the CNAUR, PVOs, donors and local administrators design drought recovery and rehabilitation projects with the full collaboration of target communities, encouraging them to propose their own ideas and choices which meet the test of workability in the given socio-economic and cultural context — so that the target communities invest in the success of rehabilitation.
- the CNAUR, PVOs, donors and local administrators rely on ideas from the target community for selecting rehabilitation program participants and beneficiaries.

9.4.3.2.3. Need for Support Resources. The third element is to link ideas for rehabilitation with tangible resources, such as food aid, financial aid and technical assistance. Without these resources, programs tend to be limited by the lack of administrative or technical capabilities. Technical assistance is necessary and would yield high returns (FAO/CWFS). Project sponsorship by donor organizations and PVOs to pay for the replacement of lost productive assets is indispensable for some households to reclaim their livelihoods. Use of food aid can alleviate the budget constraint on sustaining projects or good ideas for projects (in terms of income transfers, food consumption or support services) (World Bank/World Food Program). Linking food aid with rehabilitation projects may be complicated. Food aid must be used judiciously so that rehabilitation projects are not disrupted. Consequently, it is recommended that:

- the CNAUR, PVOs, and donors make provision for financial, technical and administrative support when planning drought recovery and rehabilitation programs with target communities. It is further recommended that these rehabilitation programs use and/or hire qualified members of the community, where possible, to help manage the rehabilitation programs and serve as ombudsmen for participant complaints and suggestions.

- the CNAUR, PVOs, donors and local communities carefully weigh the advantages and disadvantages of food aid resources in furthering program objectives *before* deciding whether to incorporate food aid in program design.

In addition, given the importance of additional income in view of high marginal propensities of lower income households to consume cereals and food, and as a means to stimulate effective demand, this dissertation recommends that:

- the CNAUR, PVOs and donors sponsor local labor-intensive infrastructure projects through food for work opportunities (and cash for work opportunities, where appropriate), especially those which facilitate market access (designed in conjunction with the Ministry of Public Works, section 9.4.2.7.), for persons not too debilitated to work, as a means of quickly restoring incomes to large numbers of households and hence, market demand for cereals.

To repeat the recommendation made in the previous section, it is recommended that:

- relief/food aid programs not restrict households from selling part of their food aid, if they want, to meet other cash needs such as buying other food complements; buying tools, seeds and animals to rebuild productive assets; and giving charity to other households. An alternative recommendation is that recovery programs distribute productive assets to distressed households directly, in addition to food aid, to facilitate economic recovery.

Another AID recommendation, also endorsed by this dissertation, is that:

- relief and rehabilitation programs be integrated with local and regional development plans and implemented through international and Malian PVOs (AID, 1987).

9.4.3.2.4. Avoiding Administrative Complexities. Fourth, it is advised to avoid administrative complexities in relief and rehabilitation programs. Successful projects will limit the complexity and numbers of components of administration (A. Berg). This suggests that programs attempt nothing grandiose or extraordinary. Close involvement of the target communities in the selection of activities will help to check complicated or ambitious programs. It is possible that activities which are "too new and innovative" may attract the unintended participation of the better-off and/or intellectually curious. It is recommended that:

- the CNAUR, PVOs, donors and local communities keep relief and rehabilitations reasonably simple so that they are understandable to participants and not administratively complex.

9.4.3.2.5. Matching Increased Food Demand with Increased Food Supplies. A fifth element is match increases in food demand with increases in food supplies. Mellor is very clear about this: "If increased demand for food accompanying the increased employment of low income people is not met by an increased food supply, the employment-based increase in real income will be substantially reduced by price increases. Therefore, an employment program or income transfer program will be inefficient unless provision is made for an enlarged supply of basic food commodities." Sahn (1989), who recommends that rehabilitation programs focus on the slack season in terms of labor demands, suggests that rehabilitation programs offer partial payment in kind if the food supply is inelastic in the short run to ease local market pressures. In cases where there are no cereals on local markets at all (due to former lack of purchasing power or inaccessibility for suppliers), it is necessary lubricate market flows with outside food supplies. It is recommended that:

- the CNAUR, PVOs and donors coordinate with the SNS to make additional food (cereals) available, where necessary, for rehabilitation project sites and/or nearby local markets in order to offset the increase in effective demand brought about by income-generating activities and avoid local inflationary price surges. It is further recommended (to reiterate from section 9.4.2.3.) that the SNS release emergency stocks for this purposes, without waiting for donor commitments to replenish the SNS on a one-to-one basis.
- relief programs consider purchase of seasonal local cereal surpluses, where available, for relief and rehabilitation projects elsewhere in the Northeast as another means of expanding income-generating activities and economic linkages in the Northeast.
- the SNS make maximum use of private traders and transporters, through auctions or contracts, to supply identified rehabilitation project sites and/or nearby local markets.

An alternative view, which does not necessarily dispute the arguments above, holds that traders will quickly find out about any increase in local purchasing power. This will attract additional supplies to offset increased demand. It is recommended that:

- the CNAUR coordinate radio broadcasts of the location of rehabilitation programs to voluntarily attract food suppliers in order to ease managed supplied through the SNS.

9.4.3.2.6. Improving the Reliability of Markets. Lastly, relief and rehabilitation programs will succeed by improving the reliability of the market as an exchange mechanism for the poor — both as a source of cereals supply and a source of demand for local products. For example, Staatz *et al.* (1989) suggest that one means to expand the physical availability of cereal supplies in the Northeast would be to subsidize storage costs for traders renting space from OPAM, an option for the CNAUR, PVOs and rehabilitation programs to consider, especially former OPAM storage space in outlying district and sub-district seats. Other options might also be effective, depending on local circumstances. At minimum, it is recommended that:

- the CNAUR, PVOs, donors and local communities consider and evaluate the consequences of their respective relief and rehabilitation programs on the longer-term reliability of cereals markets locally and throughout the Northeast, with a view towards strengthening — not weakening — the critical coordinating role of markets in keeping cereals prices affordable.

9.4.3.3. Employment and Incomes

At the *macro* level, the logical long-term means to reduce food insecurity, according to Sahn (1989) is to promote agricultural growth and market development. The route to *household* food security, according to Sen (1981), is through employment and incomes, or viable exchange entitlements. The two views are not unconnected. Food security is a seasonal problem in the Northeast, but addressing seasonal problems does not necessarily require seasonal solutions (Sahn, 1989). An employment and incomes policy can tackle the year-round structural constraints which accentuate the seasonality of food insecurity.

9.4.3.3.1. Agricultural Sector. Defining this policy will not be easy going. With the need to conserve increasingly threatened natural resources and stop environmental degradation, the agriculture and livestock sectors will not be able to employ the present population, much less absorb all newcomers. Nonetheless, since employment in new, non-traditional sectors is expected to grow gradually at best, an employment and incomes strategy for the Northeast cannot abandon the many households who still make their livelihoods from agriculture and livestock.[61]

A primary consideration is productivity gains through changes in agricultural technologies (Jayne *et al.*). Mellor calls for technological improvements in agriculture which allow an increased supply of wage goods without an increase in price, coupled with appropriate incentives to reduce risks and uncertainty, thereby inducing farmers to shift to the new technology.

The impact of technical change on labor demands varies according to the labor intensity of the agricultural crop mix, the labor intensity of agricultural technology, and the level and structure of non-agricultural employment (Mellor). Technological change can alleviate seasonal labor bottlenecks through diversified planting, inter-cropping, relay planting, recession agriculture (Sahn, 1989), as mentioned previously. Moris lauds farmer adaption of recession agriculture for intensification of farming, but warns that this technology cannot withstand severe drought.

Reardon *et al.* (1992) acknowledge that relying on technological improvements in agriculture is not suitable everywhere. They advocate promoting non-crop enterprises in the

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[61]Autier (1988b) makes the distinction between "rehabilitation" projects, which aim at returning people to their former economic activities before conditions deteriorated (such as partial restoration of animal herds), and "reinstallation" projects, which try to help people adapt to new living conditions and means of food production in the long term (such as the semi-sedentarization of nomads and introduction of desert pond recession agriculture). The IFAD project (section 9.3.1.) would be an example of a rehabilitation project, modified by sustainability concerns. Community development and new vocational skills projects sponsored by World Vision International in Ansongo and Ménaka districts exemplify reinstallation projects. Reinstallation projects are more likely to be necessary following consecutive years of devastation.

While this distinction is useful to planners, this section will use the term "rehabilitation project" in a generic sense to include both rehabilitation and reinstallation projects.

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low-potential zones (corresponding to northern and off-River areas in the Northeast) through project assistance. The assumption that the liquidity offered by wage labor will provide greater stability in household incomes and consumption may overstate the growth possibilities for non-crop enterprises in the Northeast. Reardon *et al.* (1992) advocate developing and intensifying agriculture in high-potential zones (corresponding to Niger River irrigated rice schemes in the Northeast) to boost more farm labor demand and lower grain prices.

Here, too, rapid improvements may be illusive. One factor is specific to irrigation. High investment costs and high costs of inputs mean that farmers cannot afford to grow low value crops. This leaves mainly rice. Moris claims that improvement of small-scale irrigation or minor organizational improvements in the poorly performing large systems would be far more cost-effective than investment in additional large schemes — particularly given the high opportunity costs of capital and skilled management and high recurrent costs. Improved water control, cultivation techniques, and credit programs may offer greater productivity gains in the short run.

A second factor has to do with taste. It may take considerable time to breed a new higher-yielding hybrid with the distinctive taste and appearance characteristics of local rice *(koroboro)*.

A third consideration has to do with the nature of cereals demand. Off-River households strongly prefer for millet (and or sorghum) which requires far less cooking time than rice. This means that the incidence of any benefits from expanded rice production would be largely restricted to On-River families who may gain from increased home-production and lower market prices. This may raise political objections about the equitable distribution of scarce investment funds from Off-River communities.

Thus, it is recommended that:

- agricultural employment and income strategies for the Northeast promote the widespread use of labor-intensive technologies to take advantage of the relative abundance of labor, compared with scarce capital and capital-intensive inputs.
- development strategies for the Northeast continue to promote seasonal diversity of income sources with strong inter-sectoral linkages and/or stability of income sources allowing multi-seasonal planning by households to ward off transitory and chronic food insecurity.
- agricultural development policies emphasize the rehabilitation of existing irrigation schemes along the Niger River, including internal organization and management, but also investigate investments in full control irrigated agriculture where economically feasible. It is further recommended that the decision-making role of farmer-tenants in these schemes be expanded to ensure that any new technological packages take farmer and labor constraints into account prior to adoption.
- the SNS buy occasional surpluses of paddy produced in the Northeast and/or locally mill paddy for temporary storage in the SNS, sale by auction and/or distribution as food aid to a) strengthen intersectoral linkages; b) inject value-added income into local economies with expected multiplier effects; and c) reinforce market development in the Northeast.

9.4.3.3.2. Regional Employment-Incomes Conference. A regional conference of community leaders and other representatives, government, donors and PVOs can provide a highly visible forum for discussion of these issues and options (as well as hasten the

reconciliation process), leading to a comprehensive employment-incomes-labor requirements strategy for the Northeast. It is recommended that:

- a regional conference be held to explore and debate these strategic employment and incomes options for the Northeast. It is further recommended that these strategies and options emphasize diversification of incomes across seasons to smooth consumption.
- this regional conference also determine the labor requirements to support the employment and incomes strategy and then formulate a human resources development strategy for the Northeast.
- the first objective of a diversified employment and incomes policy for households (section 9.3.1.) should encourage mobility of individual household members among economic sectors in order to capture cost-reducing gains from specialized skills from year-round permanent employment, if possible, rather than embody diverse skills in the same household member carrying out several simultaneous.
- the search for new sources of employment and income growth give first consideration to options which are independent of rainfall conditions and assess the viability of these options for broad-based development and food security in the Northeast.
- employment growth policies exploit the traditional vocation and vitality of Malians as traders and intermediaries, particularly as Mali contemplates closer links with neighboring West African countries as part of a regional integrated market.

- employment growth policies promote human resources development for labor-intensive manufactures and services, in view of the scarce capital and natural resources.[62]
- such a regional conference endorse growth and investment options elsewhere in Mali, only if rapid regional growth is unfeasible, as a means to maintain the vital flow of remittances to households in the Northeast.

Lastly, it is essential that expenditures for marketing and market facilitating services be seen as investments in the future productivity and economic growth of the country and the Northeast. The same investments and policies which foster development of the cereals market — an enabling policy environment for private initiative and reduction of the burden of inefficient public enterprises — are those which will spur entrepreneurship, business development and job creation.

9.5. Limitations of the Dissertation and Directions for Future Research

This dissertation has a "natural" limitation and several other limitations due to the research focus. These limitations offer topics for future research.

9.5.1. Limited Applicability of the Good Year Case

The first limitation relates to the impact of highly variable rainfall patterns on the design and conduct of household food security and rural grain marketing research. Through

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[62]According to the World Bank (1989), growth of a small business and services sector requires that far more be invested in people — human capital development — in three priority areas: primary education and technical training, affordable health services and proper nutrition. Well performing markets can contribute to this last priority area.

no planning on the part of this researcher, research results typify the good year case — the second year of very good rainfall and the fourth year after severe drought. Cereals production in the Northeast was expected to be near the production possibility frontier, given current technologies and institutional arrangements. Household incomes were into their fourth year of post-drought recovery, notwithstanding prior differential losses of productive assets between sedentary farming households and semi-sedentary pastoralist households. Household effective demand for cereals and (seasonal) reliance on the market for cereal supplies were expected to be at their post-drought peak, conditions presumably factored into trader marketing strategies. Moreover, there was little seasonal price instability on wholesale and retail markets in the Northeast during the year (Annex 8.1 and price regression analysis, results not shown), helping to dampen seasonal instability in real incomes.

It is precarious to draw conclusions about market performance and food security status on the basis of one year's data. The very context which lends insights to research results for the good scenario may weaken the applicability of results in a year of poor rainfall or drought years. Research of this kind in poor rainfall years, using stratified household panel data, would shed further light on the limits of the market, when effective demand is weak or lacking among certain groups, and on the effectiveness of alternative non-market interventions to maintain food security of individual households.

The dilemma is that the meteorological context of the research year cannot be predicted, certainly not for the Northeast of Mali. At best, one faltering rainy season is all the advance notice that can be expected. This virtually requires that a "shadow" research mechanism be in place based on preselected sites, with necessary funding, staffing and institutional supervision, to be fielded at moment's notice. Strengthened institutional links between the CESA, SIM and SAP, with contingent financing from donors if necessary, may be one means to plan for poor year research.[63]

9.5.2. Continuing Gaps in the Knowledge of Rural Markets

With the exception of rural market cereal transactions and associated variables, the lion's share of the primary data collection for this dissertation was conducted at the household and urban trader levels. Rural market traders were not systematically sampled and surveyed as were urban traders, in part due to finite resources and in part, due to the greater emphasis placed on urban traders to capitalize on comparisons and contrasts between urban traders in the Northeast and the existing CESA-MSU trader sample in the rest of Mali. As a result, relatively less is known about the structure, conduct and performance of rural markets in the Northeast than urban wholesale markets.

Seasonal concentrations of sellers in the Gao region (Table 7.2.) can lead to thin markets with undesirable results: unreliable price signals, a lack of market alternatives for consumers, seasonal shifts in market power and opportunistic behavior. Are these markets seasonally thin primarily because of non-marketed supply gluts in a good rainfall year or lack of effective demand which keeps traders away? To what extent is poor infrastructure (section 9.5.4. below) a cause of seasonally thin markets? In the absence of infrastructure development, how effectively can the SIM mitigate the effects of information asymmetries by more actively diffusing regional market information? How do thin markets influence

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[63]To illustrate the risks of research planning, the 1989/90 grain harvest following the 1988/89 research year, turned out to be the second best in Malian history (FEWS, 1991). If it had been decided to continue the CESA-MSU surveys one more year (that is, through 1989/90), second year results may have simply duplicated first year results, with few additional insights to justify the extra expense.

transaction costs? What is the impact of charity aid and remittances on rural household marketing behavior in the Northeast (section 9.5.5. below)?

In-depth investigation of rural markets as critical intermediaries between urban traders and rural households is a future research priority, particularly concerning the trader-level decision environment, and rural market conduct and performance.

9.5.3. The Nexus between Urban Trader Expectations, Contracts and Credit

Research cited in Part III suggests that the buy-sell operations of urban traders in the southern producing zones and Mopti are predicated on short-term liquidity considerations due to the relationship between lender-supplier and borrower-consignee, by which the latter takes possession of cereals whether market conditions are propitious or not, in order to maintain access to credit in kind from the former. These supplier-consignee relationships appear to be passed along to the Northeast. While such conduct (in the S-C-P sense) appears to compensate for missing financial markets, it relegates the role of prices and the accuracy of how price expectations are formed to the sidelines.

Further research should investigate the impact of the development of financial markets, including the extension of PRMC and other credit programs to the Northeast as temporary measures, on these implicit contractual relations between lender-supplier and borrower-consignee. Specifically, this research should investigate whether prices and price expectations assume greater importance in trader marketing strategies, given alternative credit sources — or whether trader profits and losses are simply the coincidence of the timing of purchases and sales.

Additional research might investigate whether an infusion of commercial credit with interest payments will increase marketing costs over the prevailing situation based on credit in kind (credit on consignment) or whether it will decrease marketing costs as a result of more rapid buying and selling operations made possible by greater liquidity.

A related research topic is whether contractual relations between traders are becoming more explicit in terms of prices, quantities and delivery dates, instead of their *ad hoc* nature at present. Such results have implications both for future storage practices and the viability of the SIM.

9.5.4. Transport Costs and Physical Infrastructure

Evidence shows that transport costs comprise a major element of the gross margins, to and within the Northeast (Steffen and Koné). Improvements in transport infrastructure can be expected to reduce gross margins, but these improvements are likely to be years off. Scale economies in transport can achieve cost reductions as well, but the choice of scale is often dictated by road conditions, widely dispersed and seasonally mobile consumers, and possibly storage availabilities. Even variability in local cereals production constrains the choice of scale economies.

There is the uncertain impact of the 100 percent devaluation of the CFA franc in January 1994, raising costs of imports from outside the CFA zone. The immediate effect may be felt in fuel prices, depending how the government adjusts its uniform pricing policy through the OSRP. How the government ultimately responds in terms of medium-term policy is a test of confidence in its decade-long transition to a market-oriented price policy. Nonetheless, a doubling of the fuel component of cereals delivery costs to the distant Northeast may have a detrimental impact on the real incomes and entitlements of the poor.

These interconnected and simultaneous issues require investigation. Cost-route data can explore the various scale economy options based on alternative delivery schedules and market demand scenarios for the principal markets in the Northeast.

9.5.5. Other Topics

The importance of other topics for cereals markets in the Northeast may not be known until they are investigated in depth. These other topics include the link between trader understanding of opportunity cost and value-added concepts for storage and transport and the influence of Islamic teachings on trader pricing behavior, use of credit and attitudes towards interest-based loans. What do these attitudes portend for larger investments by traders in their businesses? Traders profess to uphold religious ideals, but their marketing behavior may differ in practice (Steffen and Koné).

A second topic concerns trader donations of cereals and inter-household transfers and/or charity (section 9.2.1.2.2.), believed again to be influenced by religious teachings. Such transfers are essential in the transition to market economies when a broad range of social distribution networks and traditional practices are still required. Will these transfers become a thing of the past as households rely increasingly on the market, or are these deeply ingrained cultural and religious practices which will remain? To what extent do family, clan and other relationships determine the size, timing, direction and predictability of these transfers?

A third topic pertains to food aid disincentives about much has been written in terms of local production and markets. No food aid from public sources was distributed during the survey year, although market informants interviewed during the rapid reconnaissance before the start of formal surveys recounted the impact of untargeted food aid on rural markets several months earlier (Steffen and Koné). Availability of food aid on *seasonally thin* markets in

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in deficit production zones may represent a special two-edged dilemma for traders whose marketing strategies are already buffeted by uncertainty: a sudden influx of outside supplies depresses prices and incentives for long-distance transport but increases real household incomes and demand, thereby attracting more trader-suppliers — with a time lag. Timing of food aid is thus a key factor determining trader profits and losses. The search for viable food aid uses along the relief-development continuum needs to preserve the dual role of markets as supply source and exchange mechanism for local products *and* counter the effect of thin markets.

9.6. A Closing Comment

This dissertation makes a strong case for a continuing role for the public sector in the Northeast to promote markets and food security. Determining the mix of government policies and interventions requires a comparison of those tasks most suitable for the public sector and those most suitable for the private sector.

Public sector confidence in markets is growing. The Malian government recognizes the market as an important and critical institution through which food production and consumption policies can be transmitted. The government appears content to manage the *macro*-levers of food policy, including food security, and to foster an environment which enables the private sector to handle the *micro*-details of matching supply and demand at the lowest possible cost.[64] This is a workable division of labor which has proved reasonably successful in other countries — *provided* that market conditions are right.

The foremost function of the public sector, therefore, is to provide an environment which enables markets to function properly. This will facilitate the search for market-oriented policies to assure household food security.

The public sector must turn toward the task of further strengthening the efficiency, transparency and competitiveness of markets — countrywide, as well as in the Northeast — within a broad framework of investments in market-facilitating services and public goods. The expected reduction in marketing costs and margins will likely to have will likely benefit the poor most. In the shorter term, the public sector can improve food security of the poor through targeted programs that do not seriously distort market price signals.

Government-donor collaboration in reorganizing the market through the PRMC and other channels needs to continue to emphasize market facilitating services. Moreover, this collaboration provides the government assurances of a safety-net in the unlikely event that this widely acclaimed economic experiment goes wrong and food security is threatened.

The unavoidable burden of ultimate guarantor of national food security falls on the public sector. Guaranteeing food security in the Northeast, while a daunting task, is made easier when markets are enlisted as the first line of defense.

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[64]Timmer (1987) makes this point succinctly. "The task for government policy, especially that policy aimed at solutions to poverty and hunger in the long-run, is to place the food sector in its macroeconomic context and find an appropriate balance of policies that lead to self-sustained growth."

ANNEXES

Annex 2.1. A Summary of Cereals Market Liberalization in Mali

This annex briefly recounts the policies and events leading to the gradual liberalization of the cereals market in Mali. Section A2.1 puts the performance of the market during the monopoly period (1965-81) into historical perspective by juxtaposing the implementation of official marketing policies in the south from that in the Northeast. Section A2.2 describes the first phase of market liberalization (1981-87) and Section A2.3 describes the second phase (1987-90).

A2.1. Historical Variations in the Northeast: Cereals Marketing Policy during the Monopoly Period (1965-81)

In several respects, the cereals market in the Northeast was immune from the restrictive and heavyhanded policies that characterized the cereals market in the rest of the country during the 1960s and 1970s, both as a matter of policy and practice.

This "immunity by omission" may have stemmed from the preoccupation of government planners with forcing the official marketing system to work in the south. It may have resulted from a realistic assessment of the limitations of the official system in the distant Northeast and the belief that the cereals market there was more autarkic in terms of lower levels of supply and demand.[1] To be sure, the relative inaccessibility of the Northeast afforded it a measure of natural protection from strict adherence to central government policies. Historical variations from these policies concerned cereals procurement, the role of

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[1]See Chapter 5.

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the private sector, consumer sales prices and limited access to subsidized cereals through OPAM.

A2.1.1. No Local Cereals Procurement

The government's cereals marketing policy was broadly shaped by three seemingly incompatible objectives: increasing rural incomes, keeping cereals prices affordable for consumers, and extracting a surplus from agriculture to finance industrial development. In the absence of rapid growth in agricultural productivity, these objectives came into conflict as pressures to keep grain prices cheap in order to protect the real wages of urban salaried consumers dominated concerns for remunerative producer prices (Humphreys; Dioné and Staatz, 1987). As a result, farmer prices were held low.[2]

Most parameters of each year's cereals "buying campaign" (*campagne agricole*) were set by the government, even cereals procurement quotas for OPAM down to the village level.

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[2]Evidence of this implicit taxation of agriculture is clearly seen by comparing estimated average production costs of millet and sorghum by the Institute of Rural Economy within the Ministry of Agriculture with official producer prices, as shown below (MF/kg):

	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
Production Cost	74	84	115	125	125	125
Official Producer Price	50	70	85	90	100	100

Source: USAID, 1984, Tables 2.1, 2.5; Humphreys, Table 3.

If these cost of production figures were accurate and official prices effective, no grain would be produced. However, official prices were not effective and cost of production estimates were based on official labor rates which overvalued household labor. The difference between official producer prices and official costs of production thus indicates the government's *intent* to tax agriculture by driving labor returns in agriculture below the level used in its own cost of production estimates.

All cereals prices, from the farmer price to the retail consumer price, were fixed by decree after interdepartmental negotiation and political bargaining.

OPAM's procurement monopoly broke down due to worsening terms of trade and other marketing disincentives facing farmers (Kébé). Official *consumer* prices in Mali dropped below official *producer* prices in neighboring countries and considerably below parallel market consumer prices in Mali (Humphreys). Under these unfavorable circumstances, farmers sold their grain for higher prices to traders, instead of OPAM, or engaged in clandestine exports. OPAM alienated farmers by resorting to forced deliveries.

To its credit, and unlike the situation in the south, the government did not attempt to procure cereals in the Northeast (BECIS, 1981),[3] even after irrigated production projects came on stream following the drought of 1972/73.[4] To have done so would have simply resulted in an internal transfer of cereals without addressing the overall deficit. Thus, the enmity that characterized relations between OPAM and farmers in the south largely bypassed the Northeast.

A2.1.2. Explicit Toleration of the Private Sector

Tight regulation of cereals marketing in the south reflected the anti-market bias of the government. Farmers were restricted from selling their crops to anyone other than farmer

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[3]The sole exception appears to be wheat bought by OPAM in Tombouctou for several years starting in 1978/79 (OSCE, 1988, Table 6).

[4]These were *Action Blé Diré, Action Iles de Paix-Plaine de Korioumé, Opération Lac Horo* and *Opération Zone Lacustre* in the Tombouctou region and *Action Riz-Sorgho* in the Gao region. It should be noted, however, that these production projects often accepted paddy, valued at official rates, as payment in kind for seeds and water service fees which were then sold directly on local rural markets outside of official marketing channels. In any event, quantities were relatively small (BECIS, 1981). See also USAID, 1987a, Annex 2, Table 10.

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cooperatives or government-approved traders. Wholesalers were required to keep detailed accounts of all transactions and inventories and to submit a monthly declaration of all transactions to the regional governor, the district commander and the cereals marketing agency. Cereals purchases by retailers were limited to two tons from farmer cooperatives, licensed wholesalers or the cereals marketing agency only. Delivery to retailers of all cereals not bought directly from the cereals marketing agency required a transfer permit from the subregion in which the crops were grown.

Parallel marketeering, trading without license or selling at other than official prices, was subject to strict penalties, including imprisonment. OPAM was ultimately granted a statutory monopoly in 1965 for the "purchase, transformation and sale of all cereals," thereby outlawing the private cereals trade altogether until its legalization at the end of 1981.

In practice, grain traders in southern Mali were alternatively tolerated or suppressed during the monopoly period, both as a consequence of OPAM's low market shares. In contrast, cereals marketing in the Northeast was "free and unrestricted," a situation which had "always prevailed" (BECIS, 1981). Thus, the position of private traders in the Northeast, while not legal, may have been somewhat more secure. Evidence to this effect is shown in official documents. For example, the five-year plan for 1974-78 acknowledged a *growing* role for the private sector (*circuit libre*) in the marketing of coarse grains and even rice in the Northeast in terms of both market shares and tonnage handled (*Direction Générale du Plan*, 1974). More generally, conceding a place for private traders reflected the schizophrenic policy of the government toward the free market which it could not replace through its own interventions.

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A2.1.3. Less Official Influence over Consumer Prices

Affordability of cereals became a fundamental element of the government's policy to hold down wages. Cereals remain the basic staple in Malian diets, representing a major share of the expenditures of households not growing their own crops. As such, cereals are viewed as a wage good, whereby relative cereals prices and wage rates constitute a crucial index of household welfare and consumer satisfaction.

Until the mid-1970s, OPAM price differentials tended to reflect transport costs from surplus producing to deficit regions.[5] The government modified its cereals pricing policy in reaction to the severity of the drought, in order that "all consumers be able to meet their cereals needs at reasonable and approximately identical prices, regardless of distance from producing regions" (*Direction Générale du Plan*, 1974). This policy of pan-territorial prices, by which OPAM's consumer prices in the Northeast did not differ from those elsewhere, remained in effect until 1987.[6]

This assumes, of course, that official prices mattered. Market price data for the Northeast are notoriously fragmentary and often aggregated. However, reliable price data that can be found show that market prices were consistently higher than official prices, with seasonal price variations nearly four times greater than official prices (BECIS, 1982, pp. 84,

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[5]In 1971/72, for example, official consumer prices per 100 kg sack of millet were set at 2850 MF in the southern producing areas, 3300 MF in Bamako, 4140 MF in the Northeast (Robbins and Garvey; see also *Ministère de la Coopération*, 1977).

[6]Regulation of domestic road transport rates also comprised an element of the cereals pricing policy. Domestic transport rates (in kilometer-tons) were generally set according to road classification, with higher rates paid as compensation for poorer quality roads. To encourage the transport and marketing of cereals in the deficit and hard to reach zones, a premium of 23 percent per kilometer-ton was added to transport rates. The paradox is that the more expensive official transport rates in the deficit zones simply added to the already relatively expensive cereals prices there (Steffen and Dembélé, 1990).

97). The question facing consumers was how to get access to subsidized cereals from OPAM outlets rather than paying higher prices on the market.

A2.1.4. Limited Access to Subsidized Cereals from OPAM

Since OPAM's market share of domestic production was exogenously determined by the amount and timing of funding available for crop purchases and by the relative price ratios between market and official prices over which it had no control, OPAM seldom met procurement targets, demonstrating that its legal marketing monopoly was a fiction.[7]

Conceding that it was unrealistic for OPAM to supply the entire country, the government scaled back OPAM's targets to supply 50 percent of the coarse grain needs in Bamako and the regions of Tombouctou and Gao and 30 percent of the needs in the rest of the country by 1978/79. For rice, the targets were 70 percent for Bamako and the regions of Tombouctou and Gao and 50 percent elsewhere (*Direction Générale du Plan*, 1974). Even including free distribution of food aid, these sales targets were not met through 1986/87.[8] However, Bamako was the biggest beneficiary of of OPAM's sales and distributions over the period 1976/77-1987/88, with volumes nearly five times the national average (see Table A2.1.1.).

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[7]Over the period, 1965/66-1980/81, OPAM's share of the market for coarse grains averaged about 27.3 percent. OPAM captured a higher share of marketed paddy, an estimated 38.5 percent, thanks in part to payment in kind for water and other user fees by farmers and more effective control of limited access irrigated perimeters by police patrols and roadblocks (Humphreys; Steffen, 1994).

[8]Based on calculations by the author, not shown. For OPAM sales and distributions, see OSCE, 1989, Table 6. For population estimates, see USAID, 1987, Annex 2, Table 2. Annual cereals needs were based on 165 kg per capita, of which 22 kg were rice (*Direction Générale du Plan*, 1974, p. 42).

Table A2.1. OPAM Sales and Distribution of Cereals Per Capita (kg) by Region: 1976/77-1987/88

	1st	2nd	3rd	4th	5th	6th	7th	Bko	Mali
1976/77	15.0	9.6	8.2	5.0	4.2	12.6	36.2	101.8	16.3
1977/78	12.5	8.9	7.9	11.2	5.6	7.5	13.4	77.8	13.9
1978/79	6.1	2.5	5.0	9.2	5.2	9.9	7.5	85.8	11.7
1979/80	4.4	4.3	5.8	11.7	9.1	10.0	19.4	73.8	12.9
1980/81	2.9	5.5	4.2	7.1	5.6	8.1	13.8	59.4	9.8
1981/82	5.9	4.1	3.2	4.0	3.9	10.8	27.0	47.6	9.1
1982/83	8.4	3.5	3.6	8.9	10.2	27.7	35.4	54.9	13.5
1983/84	12.3	6.2	4.1	8.8	11.3	40.4	36.6	76.1	17.3
1984/85	14.5	7.2	6.2	13.4	23.9	41.2	46.4	66.4	20.8
1985/86	2.8	1.6	3.3	4.7	5.1	11.4	11.3	19.5	5.8
1986/87	7.2	1.0	2.8	2.6	5.3	18.1	21.4	23.4	7.1
1987/88	3.9	3.7	2.7	9.9	7.0	19.6	27.1	16.5	8.4
Average (kg)	8.0	4.8	4.8	8.0	8.0	18.1	24.6	58.6	12.2
Coefficient of Variation	0.562	0.563	0.398	0.420	0.688	0.666	0.495	0.467	0.366

1st = Region of Kayes
2nd = Region of Koulikoro
3rd = Region of Sikasso
4th = Region of Ségou
5th = Region of Mopti
6th = Region of Tombouctou
7th = Region of Gao
Bko = District of Bamako

Data sources: OPAM cereals sales and free distributions by region from OSCE (1989), Table T6; population data extrapolated from the April 1987 census, *Ministère du Plan/Bureau central de recensement* (1987).

Within the Northeast, the government was forced to limit eligibility to buy from OPAM to consumer cooperatives in the cities and federations of rural cooperatives in the countryside and to employees of "public services agencies" (the military and police, hospitals, school canteens and prisons), often on credit due to late salaries.[9] Other sales were rationed through ration cards (*bons d'achat*) issued by the local administrator or commander.

The result was segmented markets due to differential access.[10] Those with access to ration cards were able to buy at subsidized official prices. Limited access to subsidized cereals led to diversions, corruption and rent-seeking behavior, and profiteering by resale on parallel markets (Humphreys). To confound matters further, poor financial management of some consumer cooperatives in the cities forced OPAM to curtail deliveries of cereals (CRED, 1977). The cereals demand of those ineligible to buy from OPAM had to be met on the higher-priced parallel markets.

Lack of reliable data precludes statistical testing, but it is very probable that consumers in the Northeast were no more protected from cereals price fluctuations, despite the government's avowed equity objectives in marketing and pricing, than consumers elsewhere in Mali. It is even likely that consumers in the Northeast were more inured to price fluctuations, reflecting supply variability due to perennial production deficits and occasional ruptures in the long supply line from the south.

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[9]As of the mid-1970s, urban and rural cooperative members were rationed to 10 kg of sorghum and 7 kg of rice per adult and 5 kg of sorghum and 5 kg of rice per child (Richard and van den Berg).

[10]A market is segmented as a result of differing price elasticities of demand between fixed-price cereals and flexible (market) price cereals. With segmented markets, any shock to the fixed price market, such as a sudden supply shortfall, is automatically transferred to the "residual" parallel market where prices fluctuate disproportionately due to unexpected higher demand. Observations of this parallel market "anarchy" simply fueled the arguments of those seeking more public control. The paradox is that a good part of parallel market fluctuations was caused by official market actions.

A2.2. The Market Liberalization Period: PRMC I (1981-87)

By the end of the 1970s, the official marketing system was near financial collapse. OPAM suffered frequent and heavy financial losses, partly due to internal operating deficiencies, but primarily as a result of the restrictive pricing policy imposed on OPAM which forced it to subsidize consumer prices through accumulated operating deficits. Rising interest payments on bank debt and unrecovered sales on credit to public agencies simply exacerbated the problem.[11] Perhaps worse, the system of state controls on cereals marketing was not only ineffective, but alienating farmers, traders and most consumers.

A2.2.1. Objectives of PRMC I

Internal and external pressures mounted for cereals pricing and marketing policy reforms. To stem OPAM's unsustainable financial losses,[12] donor countries proposed a multi-year commitment of food aid and use of the sales revenues to underwrite specific marketing policy reforms. Agreement was reached between the government and donors in March 1981 on the Reorganization of the Cereals Market Program (commonly known by its French accronym, the PRMC).

The three objectives of the PRMC aimed at 1) rapid increases in producer prices; 2) liberalizing the cereals market by legalizing the participation of cereals traders; and 3) reducing costly subsidies to the official cereals marketing system by gradually raising

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[11]OPAM's cumulative budget deficit reached MF 39 billion by 1976/77, equivalent to three times its annual grain sales (E. Berg, 1979; Humphreys).

[12]New monetary and budgetary restrictions imposed by agreements with France and the IMF no longer allowed the government to cover OPAM losses from transfers frrom the OSRP (price stabilization and cross-subsidy fund), domestic borrowing through credit expansion by the central bank, reliance on foreign aid or accumulation of arrears.

consumer prices to cover OPAM's actual costs (PRMC, 1980). The assumptions underlying these objectives were thought to be self-evident.[13] First, producer price parity with neighboring countries would stem the flow of illegal exports and encourage greater production through a supply response, both reducing the cereals deficit. Second, allowing the private sector to compete openly and legally, in recognition of its de facto existence, reflected growing acceptance of the role of market forces and limits of government intervention. It would also improve efficiency by removing the element of risk from trader marketing margins. Third, higher consumer prices would reduce the drain on the budget for operating subsidies.

By the end of the PRMC, official consumer prices would be aligned with market prices, eliminating the dual market structure. In the meantime, OPAM's unit operating costs were to be cut as quickly as possible through tighter management, stricter controls over stocks and reductions in staff. The need for OPAM as the central grain-handling authority was never in question. Indeed, OPAM was the centerpiece of the PRMC and would become the chief recipient of its funds.

OPAM's statute was revised in early 1982 to order to conform with the PRMC initiative. OPAM was charged with a) carrying out general cereals marketing; b) supplying cereals to the public service agencies; c) supplying cereals to the deficit production zones (based on annual assessments of need); d) constituting and managing the National Security Stock; e) supporting official producer and consumer prices through market stabilization

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[13]For a critique of the assumptions of the first PRMC and general overview of cereals market liberalization in Mali, see Humphreys; Dioné and Staatz (1987); Simmons; and Staatz, Dioné and Dembélé (1988). For a review of cereals market liberalization centered on OPAM, see Steffen (1994).

operations; and f) managing and distributing food aid according to the agreements between the government and donors.

In parallel action, the government partially abolished OPAM's monopoly in late 1981, allowing registered traders to market domestic millet, sorghum and maize as well as import all cereals, including rice. OPAM retained its monopoly on cereals exports. The domestic paddy market would not be fully liberalized until 1986.

A2.2.2. Improved Market Performance: Mixed Achievements

Some of the rigidities characterizing the earlier monopoly period eased a bit during the market liberalization period, thanks to the PRMC. A price band concept was adopted for coarse grains in 1981/82, but dropped several years later.[14]

Without the latitude to adjust its prices as a function of market conditions and its own stock levels, OPAM remained the buyer of last resort for farmers (because its prices were typically lower than market prices) and seller of first resort for its preferred customers (also because its prices were typically lower). The resulting squeeze on OPAM volumes was eased only by the availability of donor cereals food aid. This contradictory environment, in which OPAM was charged with ensuring competition and regulating a liberalized market at fixed producer and consumer prices, continued to confound progress.

In 1985/86, OPAM unexpectedly became the buyer of first resort when an unexpectedly large harvest and late deliveries of food aid depressed market prices below

[14]Starting with the 1981/82 marketing campaign, the "official" producer purchase price was changed to "minimum" producer price, a price that OPAM would guarantee and that traders were expected to respect. On the consumer side, the government decreed a modified price band for coarse grains, based on an official consumer price for OPAM sales but allowing a higher ceiling price for private retailers. Whenever market prices exceeded the ceiling price, OPAM was to intervene by selling off supplies in order to bring market prices back down to within the price band. Similar intervention prices for rice were not established.

official prices. Unusually well financed, OPAM bought cereals from all sellers until its funds were exhausted. When OPAM withdrew abruptly from the market in March 1986, free-market prices plummeted. The destabilizing effects of this buying campaign rippled through the cereals market for the next 18 months as OPAM was unable to sell its stocks at high fixed prices. The coincidence of a second good crop in 1986/87 simply added to the glut of cereals on the market. Almost overnight, OPAM's principal concern was transformed from deficit rationing to surplus management.

Some performance indicators for the official marketing system improved, especially during the early years of the market liberalization period. OPAM's operational efficiency was improved by cutting fixed overhead costs (such as deep cuts in permanent staff) or transforming them into variable costs. Technical assistance to OPAM also resulted in better management of variable costs. Distribution costs were reduced by systemmatic planning of least-cost cereals transfers within country to minimize interregional transport. Some of OPAM's improved performance was misleading as the government shifted the incidence of OPAM's financial losses to the ODRs, allowing the government to meet another IMF target of reducing public transfers to OPAM without raising consumer prices (Humphreys).

PRMC cereals pricing targets were only erratically implemented as the government linked official consumer prices with wage and spending constraints. After two years of consumer price increases, prices stood still for three years, allowing the government to freeze wages until 1985, in compliance with IMF stand-by targets relating to spending and inflation, and meet its real wages objectives. Moreover, pricing changes were essentially flat in real terms (except for producer paddy prices); farmer prices for coarse grains and consumer prices for rice actually declined in real terms during PRMC I (Humphreys; Dioné and Staatz, 1987).

But despite measures to improve overall productivity and widen the spread between purchase and sales prices, OPAM continued to lose money on every transaction (even after PRMC subsidies) because internal costs continued to widely exceed allowable gross margins. The massive buying in 1985/86, which left large carry-over stocks unsold, reversed some cost-savings trends as OPAM's operating deficit more than doubled in 1986/87 over 1985/86 (Steffen, 1994). It also reversed earlier progress in reducing OPAM's financial deficit and reliance on budget subsidies and bank credits.

Lastly, it is doubtful whether OPAM succeeded in stabilizing farmer and consumer prices.[15] At best, OPAM's efforts would have only a temporary and local impact. Even the well-financed 1985/86 marketing campaign exposed the limitations of OPAM's intervention to stabilize prices.[16] OPAM could not control the market but nonetheless displayed great facility for disrupting it.[17]

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[15]To be effective, a price-based buffer stock strategy in a highly unstable production environment, such as Mali's, would have required OPAM to have enormous budgetary resources and storage capacity to a) buy all the grain offered at the producer price, and b) hold that grain off the market for long periods until demand drove producer prices above the support level. A consumer price support strategy works in the opposite direction, requiring release of sufficient stocks to augment supplies and drive prices down to ceiling prices.

[16]Results showing that consumer prices in Bamako were more stable during the period 1982-87 (when OPAM was supposed to stabilize the market) than during earlier periods are far from conclusive, however, and it would be erroneous to attribute signs of greater price stability to OPAM alone (Steffen, 1994). The period 1982-87 also coincided with the legalization of the private grain trade, a liberalized cereals import policy and large scale food aid imports, all of which helped to smooth out fluctuations in production. More likely, all of these changes in the grain market contributed to market price stability.

[17]At the producer level, the large-scale purchases by OPAM in 1985/86 succeeded briefly in supporting rural market prices near the official level of 55 FCFA/kg. These prices plunged as soon as OPAM withdrew. Maize prices in southeastern Mali which stood at 51 FCFA/kg in January 1986, for example, dropped to 28 FCFA/kg in June when prices normally rise sharply with the approach of the "hungry season." In fact, coarse grain prices continued to decline through the post-harvest period, effectively *inverting* the seasonal price cycle until nearly one year later (Staatz, Dioné and Dembélé, 1988).

A2.3. PRMC II (1987-1990)

The destabilizing effects of the 1985/86 buying campaign finally prompted a hard look at the costs of the government's fixed price policies, continued market segmentation and the consequences for OPAM.[18] The donors presented a proposal to the government in June 1987 to extend the PRMC for three more years. Agreement was reached in March 1988.

A2.3.1. Objectives of PRMC II

The objectives of PRMC II aimed at: a) a better balance between public- and private-sector roles at all levels of the cereals market; b) flexible cereals marketing policies compatible with government resources; and c) reform of public cereals marketing agencies such as OPAM and the ODRs (PRMC, 1987).

The government ordered OPAM to come up with an internal reorganization plan based on drastic reductions in personnel, new operating procedures and repayment of long-standing debts as a prelude to negotiations of an "interim" contract-plan specifying the reciprocal obligations of the government and OPAM, running from 1988/89 through 1989/90.

According to the preamble, the government and OPAM entered into the contract plan in order to "limit" OPAM's activities while making it more efficient. OPAM's "three principal missions" turned on safe-guarding minimum food security levels in hard-to-reach, high risk zones of the country, principally the Northeast. These missions were: a) constituting and managing the strategic grain reserve (SNS); b) assuring that the deficit zones

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[18]The first results of empirical research and analysis of the cereals market helped to guide this rethinking.

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are supplied with cereals, based on the annual marketing action plan; and c) managing and distributing food aid according to agreement with donors. OPAM was also charged with six "secondary missions." The contract-plan warns OPAM repeatedly against taking precipitous actions which unnecessarily disrupt or destabilize normal market functions.

For its part, the government pledged not to jeopardize the contract-plan by assigning OPAM additional functions. Government obligations chiefly focused on helping to clean up OPAM's cluttered finances.

Within tightly defined standard operating procedures and performance targets, on balance, the contract-plan strengthened OPAM's autonomy in two key areas of interest to the Northeast, management of the strategic grain reserve (SNS) and use of food aid. The contract-plan called for the closer integration of the SNS within the overall OPAM management structure. It reaffirmed strict adherence to the SNS management code by which the SNS would be drawn down only in the event of well documented emergencies or within the context of normal out-rotations of old stock.

The contract-plan also insulated OPAM from costly and occasionnally unnecessary requests for distribution of free food aid by limiting food aid requests to "an absolute minimum" after consideration of food need evaluations from the early warning system (SAP), price trends from the market information system (SIM), annual agricultural production estimates (DNA and DNSI) and available SNS inventories. For its part, OPAM agreed to issue an annual national cereals marketing action plan in December of each year, to be updated periodically, to coordinate the interdependent management of the SNS and food aid.

A2.3.2. New Developments for the Cereals Market

PRMC II coincided with three significant changes in the cereals market in the areas of pricing, trade policy and the new market information system. PRMC II also channelled more funds to the private cereals sector.

A2.3.2.1. Pricing

In pricing, all remaining fixed prices and margins for cereals were eliminated in favor of market-determined prices.[19] OPAM agreed to abandon fixed-price sales to individuals with ration cards. Additionally, OPAM retained the right to deduct internal handling costs from the sale of food aid and obtained the right for reimbursement from CNAUR for distribution costs of free food aid, thereby making all food aid operations cost-neutral, in principle.

The other pricing change with the greatest impact on OPAM concerns the SNS. OPAM agreed to buy coarse grains for the sole purpose of bringing the SNS up to its authorized ceiling of 58,500 tons. All purchases will be carried out by competitive tender in the surplus-producing regions where market prices are usually lower.[20] At least sixty percent of all sales by volume, limited to out-rotations from the SNS or food aid, must be

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[19]The single exception was a floor price (*prix minimum garanti*) for paddy farmers in the irrigated rice production ODRs to stay in effect until 1990. Also refer to the following paragraph.

[20]Recognizing that the successful switchover to OPAM's new policy of buying and selling by auction depended crucially on expanding market competition to protect it from possible trader collusion or other abuses, the government pledged to a) organize farmer groups as a means to strengthen their bargaining power; and b) expand seasonal credit programs, particularly in outlying regions, to facilitate the emergence of small trader associations and wholesalers.

made by competitive bids in the deficit zones, also at prevailing prices.[21] For the first time in OPAM's history, the Director-General is delegated the authority to set the sales price on the remaining 40 percent of SNS or food aid sales in the deficit zones. These OPAM prices have generally reflected market retail prices reported by the SIM (see below).[22]

A2.3.3.2. Market Information System

The Market Information System (SIM) only got off ground in mid-1988, but farmers, traders and consumers increasingly depend on SIM bulletins and radio broadcasts for better-informed marketing decisions (Steffen, 1990a). The SIM has already proved its value to policy makers in several instances (Dembélé and Staatz, 1989). Although the SIM is only a "secondary" objective of OPAM, in practice it may turn out to be one of the most important functions of OPAM in explaining how markets work under uncertainty. Access to accurate, up-to-date information is a necessary component of an efficient marketing system. By improving market transparency through the dissemination of a wide range of information, information facilitates competition (Sall, 1989).

A2.3.3.3. Trade Policy

The long-standing state monopoly of cereals imports and exports started easing in 1982 when it became possible for private traders, in addition to OPAM, to engage in grain

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[21] The government also agreed to intervene on OPAM's behalf with the donors to: a) obtain replacement food aid for the SNS and financing to cover SNS management costs; b) seek financing to reimburse OPAM for handling costs of distributing free cereals aid on behalf of CNAUR; c) seek financing for annual audits of OPAM's books; d) obtain training for OPAM personnel as needed; and e) obtain technical assistance for studies and long-range planning in areas having to do with OPAM's objectives or internal management.

[22]Realignment of prices and margins alone have not resulted in OPAM breaking even. A mid-term evaluation of the contract plan insisted that making a dent in OPAM's operating deficits would require more vigorous improvements in three key areas: auction procedures, internal financial controls, and physical stock management controls (Thènevin and Waddell).

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imports and exports under license.[23] This licensing system was discontinued in mid-1989 in favor of a simplified system under which the importer (exporter) registered his "Intent to Import (Export)" with the Economic Affairs Agency. Restrictions are no longer placed on the quantity for import (export) nor on the status of the importer (exporter) as a private individual or legal corporation. It is expected that this new measure will reduce the time formerly needed to acquire an import (export) license. It is also likely that this liberalized import-export policy will improve market stability through diversification of suppliers and clientele (Steffen and Dembélé, 1990).

A2.3.3.4. Funds for the Private Sector

Lastly, PRMC II accelerated the policy started belatedly during PRMC I of channeling PRMC counterpart funds (food aid sales revenues) to the private sector to improve its capacity to market cereals efficiently.[24] Two loan guarantee programs, one for farmer-level Village Associations and the other for cereals wholesalers, were financed by the PRMC in 1986/87 as the first direct financing for the private sector. These credit programs were expanded in subsequent years both in scope and level of financing. Other programs followed, such as the SIM. Over the course of PRMC II, some 4.254 billion CFAF, or 39.5 percent of all funding, was targeted for the direct benefit of farmers and traders (Charles May, personal communication).

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[23]The government reserved the right to temporarily suspend export licensing in order to avoid a rupture in domestic supplies.

[24]With over 95 percent of PRMC I funding going to the official marketing sector, of which two-thirds went to OPAM, the irony did not escape notice that "the PRMC, with a major focus on increasing private sector participation in a freer cereals trade, has spent most of its expatriate staff time and financial resources attempting to keep the state trade agency afloat" (Wilcock *et al.*).

Given the public sector's record of ineffective intervention in the cereals market, letting go of OPAM's commanding role did not provoke market instability or disclocation as some had feared. Thanks to an active trader class, most grain markets are highly competitive. Despite oligopolistic concentration in some wholesale markets (especially for rice), these markets are contestable in that relative grain price increases will attract new entrants fairly quickly.[25] It is clear that even the formal devolution of day-to-day responsibility for the critical functions of grain market spatial and temporal arbitrage from OPAM to the private sector could not have occured in the absence of a dynamic trader network.

A2.4. PRMC III (1990-93)

The PRMC was extended for a third phase in late 1990 to cover the three- year period through October 1993. The overarching objective of PRMC III is to "assure food security through regular cereals supplies facilitated by a restructured cereals market making maximum recourse to domestic resources." The objectives of PRMC II remain valid and funds will be programmed to consolidate progress achieved (PRMC, 1990). PRMC III is beyond the scope of this dissertation and, with rare exceptions, will not be considered.

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[25]See Chapter 8. The newly liberalized cereals import regime (section A2.3.2.3. above) is likely to reduce concentration among rice importers.

A2.5. A Summary Assessment of Cereals Market Liberalization

A2.5.1. Critical Factors Driving Market Liberalization

Several converging factors have contributed to this remarkable change in the regulatory framework of the cereals market and OPAM's structural transformation from adversary to ally of the private cereals sector.

Progress was facilitated by moderation and flexibility at the outset; donors and Malians wisely avoided taking rigid, dogmatic positions. By paying attention to domestic political and social concerns, liberalizing the market has been perceived as a collaborative undertaking, bolstered by an expanding pro-reform constituency on the Malian side.

Policy relevant research and empirical analysis of alternative marketing policies has become an indispensable and valued input into the reform debate by supplying information to test the assumptions underlying PRMC objectives (Weber, *et al.*).

Transforming OPAM, rather than building a new agency from the ground up, has been more palatable politically to Malian reformers, a point accepted by the donors, while avoiding the disruptive effects of institutional instability which has plagued other marketing agencies in Africa (Lele and Christiansen). Reforms have been facilitated by a responsive and dynamic network of experienced traders to take over OPAM's commercial operations. The success of the Market Information System (SIM) has given renewed visibility to the OPAM reforms.

The large infusion of donor funds to underwrite the costs of market liberalization, roughly equivalent to 5-6 percent of government tax receipts and nearly one-fifth of extra-budgetary income during the first six years of the PRMC (1981/82-1986/87), convinced the Malians of the depth of donor commitment to see the reform effort through.

Skillful sequencing of pressure and incentives by the World Bank and the IMF, although not direct participants in the PRMC, proved crucial in consolidating agreed-upon reforms and in removing most lingering resistance to market liberalization and the reorganization of OPAM.

Lastly, and perhaps most important, growing confidence by the government has permitted more recent reform agreements to set increasingly specific objectives and accelerated timetables for achieving them.

A2.5.2. Winners and Losers in OPAM's Structural Transformation

Cereals market liberalization has noticeably shifted the incidence of the government's policies among three broad population classes and several government institutions.

A2.5.2.1. Grain Farmers

Market liberalization has had a differential impact on Malian grain farmers depending on their status as surplus (net-selling) or deficit (net-buying) farmers. In the early days, the questionable accuracy of grain production estimates used to introduce a random element into the setting of local quotas. Mandatory requisition of grain by OPAM at below-market prices caused hardships on farm households having to buy for their own consumption later in the year. This inequitable feature eased after sales quotas were dropped. Whether a farmer sold to OPAM depended largely on personal circumstances and relative opportunity costs.

Both procurement systems, with or without quotas, nevertheless represented an implicit tax on net-selling farmers equivalent to the difference between the market price and the lower official producer price.[26] Net-selling farmers emerge winners from the

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[26]The incidence of this tax fell more heavily on rice farmers due to the relatively higher market share of paddy captured by the public marketing sector. The producer tax declined from an estimated 8.9 billion CFAF in 1976/77-1979/80 to 5.1 billion CFAF in 1981/82-

liberalization of the market since farmer taxation no longer exists.[27] Coarse grain producers have not faced price discrimination from OPAM since a unified market was achieved in 1987/88 when official producer prices were eliminated. The case of rice farmers is less categorical. Although paddy marketing was not immediately liberalized (footnote 19), OPAM no longer buys paddy or domestic rice.

For farming households who sold nothing to OPAM (and/or net-buying households), there was no implicit taxation. However, few net-buying households had access to OPAM's subsidized consumer prices. Net buyers, therefore, did not necessarily benefit from the former procurement system either.

A2.5.2.2. Grain Traders

Grain traders have also benefitted from the liberalization of the cereals market. Once outlawed and harassed by the public sector in effort to protect OPAM's market, traders have been progressively enabled to trade openly and deliver grain to OPAM under contract.

Today, a business-like relationship is cautiously evolving between grain traders and OPAM as old attitudes soften and suspicions about the other's motives are allayed. OPAM increasingly relies on grain traders for carrying out its objectives. Traders fill all of OPAM's buying orders through competitive bids. OPAM sells food aid cereals or old SNS stocks to traders in auction. Traders even stand to pick up some of OPAM's former institutional clients if they are willing to sell on credit, terms proscribed for OPAM by the contract plan.

1984/85, but only as a result of lower government purchases during the second period, not a decrease in unit tax (Humphreys, p. 28). This net transfer from the countryside reversed directions briefly in 1985/86 for those producers who reaped one-shot windfall gains by selling directly to OPAM at official prices that were higher than market prices.

[27]The sole exception would be maize farmers in the CMDT zone who, at least for a time, had a guaranteed market at above-market prices under the former system.

A2.5.2.3. Grain Consumers

Consumers fall into two distinct categories: those who used to have access to OPAM's subsidized cereals and the larger group of those who did not. Within the first group, the loss by the public service agencies and consumer cooperatives of the privilege to buy subsidized cereals from OPAM, a long standing property right, translates into a drop in real incomes. Overall, the impact of OPAM's transformation may be felt most by Bamako consumers who used to receive a disproportionate share of OPAM's subsidized sales (Humphreys, Tables 14 and 19; Table A.2.1.).

The second group, cereals consumers outside of Bamako who paid market prices all along, have benefitted to the extent that market liberalization facilitates the performance of private traders. Any localized increase in prices (due to increased market demand from displaced OPAM consumers) is probably offset by the drop in consumer prices (due to reduced trader transaction costs and margins, and the influx of PRMC food aid for sale), although this is an empirical question. Consumers and deficit households report that the availability of cereals all year round without long waits in line is one of the primary benefits of the OPAM reforms (D'Agostino). For nearly all consumers, markets have become more reliable as a stable supply source.

Annex 3.1. Rainfall and Agricultural Production in the Rural Household Survey Villages

Rainfall for the district seats in the Gao Region zones shows a pattern of variability similar to that of regional capitals in the deficit zones (Table 2.1 in Chapter 2). Results of the rural household surveys are better understood in the context of the 1987, 1988 and 1989 rainy seasons (corresponding to the 1987/88, 1988/89 and 1989/90 crop years) marking the parameters of the survey year, 1988/89.[1] This background is equally pertinent to the analysis of rural market performance in Chapter 7.

A3.1.1. The 1987 Rainy Season

Although Table A3.1.1 does not show rainfall data for the rural survey sites for all years, annual rainfall data and long term averages (1956-85) for the respective District seats offer a medium-term perspective. As shown in the bottom half of the table, rainfall in 1987 for the (future) rural survey sites fell considerably below the nearby long term average. Consequences of this low rainfall continued to be felt during 1987/88, the crop year before the rural surveys began.[2]

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[1]This brief account highlights only events occurring at Project survey sites (including the rural market sites of Ansongo and Bourem to be added in Chapter 7), although similar conditions prevailed throughout the Northeast.

[2]The following events have been compiled from various issues of the Regional Early Warning System *Reports* (*Rapports* du S.A.P. régional) and national Early Warning System Bulletins (*Bulletins* S.A.P.) during 1988.

Table A3.1.1. Recent Rainfall Data for the Gao Region: Cumulative Rainfall, May through October

(Millimeters)

District Seat	**Latitude**	**1985**	**1986**	**1987**	**1988**	**1989**	**Average Rainfall, 1956-85**
Kidal	18° 30' N	99	72	31	127	64	136
Bourem	16° 57' N	98	112	163	92	59	115
Gao-Central	16° 16' N	204	138	52	149	148	207
Ansongo	15° 40' N	.	110	89	316	190	241
Ménaka	15° 50' N	201	198	181	248	156	286

Rural Survey Sites	**Latitude**	**1985**	**1986**	**1987**	**1988**	**1989**	**Average Rainfall, 1956-85**
Bourem							*115*
Almoustarat	17° 25' N	.	.	61	105	.	.
Temera	17° 0' N	.	.	73	150	.	.
Gao-Central							*207*
Djebok	16° 20' N	.	.	98	160	.	.
Ansongo							*241*
Bara	15° 48' N	.	.	70	219	218	.
Tessit	15° 10' N	.	92	127	223	.	.

Sources: *Comité National d'Actions d'Urgence et de Réhabilitation/Projet Système d'Alerte Précoce*. Bulletin S.A.P., Number 5 (October 1986), Number 17 (October 1987), Number 29 (October 1988) and Number 41 (October 1989) and *Région de Gao, CNAUR/DNSI/Projet Système d'Alerte Précoce*. Bulletin Régional S.A.P., (October 1988).
Note: Rainfall for Bara was measured at Haoussa Foulane (latitude 15° 58' N), 20 kilometers northwest of Bara in the Gao-Central District.

"Very poor" pasture and watering for herds and low cereals supplies during 1987 prompted unusually large numbers of households throughout the Gao Region to migrate in search of better conditions, typically to the Mopti Region or coastal West African countries. Temporary migrant camps sprung up in various locations, exacerbating local shortages.

Some 461 of 1,171 nomadic households camped near Tessit to the south left in March 1988 for opportunities elsewhere. Twenty tons of free maize food aid were distributed following month for those remaining. To the north, pond recession sorghum failed in Bourem District and the area planted to river recession sorghum dropped by half due to poor flooding conditions during April and May.[3] The Saudi Red Crescent Society released 120 tons of food aid for distribution in the Bourem District in March. Two medical-nutritional surveys conducted in Bourem-Central and Almoustarat subdistricts in May found stable levels of child malnutrition, but a "worsening" food situation, especially at Almoustarat.

Maize food aid was distributed in May 1988 in the subdistricts of Almoustarat (707 tons) and Temera (411 tons) to cover the period April through September. Even so, it appears that food aid provided only temporary relief as cereals became "hard to find" and "non-existent on the market" in Almoustarat and Temera by July.

A3.1.2. The 1988 Rainy Season

For many rural households, these scarcities were eased only with the arrival of good rains and abundant wild cereals during August and September. It is very likely that a broad number of households in the sample were still recovering from drought and migration-induced stress on the eve of the survey period beginning in November. The 1988 rainy season thus set the tone for household welfare at the outset of the Project surveys by influencing the initial

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[3]As reported by SAP. The apparent contradiction between above average rainfall and poor flooding conditions may represent either poor distribution of rainfall within the year (causing low flooding in April and May) or prevailing conditions in other river sites within Bourem District away from Bourem town, or both.

endowments of sample households and their expenditure patterns and cereals consumption during the course of the survey year.

Table A3.1.1. shows that local rainfall in 1988 registered large percentage increases over the previous year, although the long term average was not reached (except at Ansongo, where flash flooding destroyed part of the off-season rice crop).

Chapter 2 details the record cereals harvest during 1988/89 at the national level. It appears from Table A3.1.2 that the districts in the Gao Region in which the Project rural survey sites are located contributed to this increase in gross production in aggregate terms.[4]

Table A3.1.2. indicates that the production increase was attributable to traditional rice cultivation.[5] Thus, the incidence of the 1988/89 regional harvest favored rice farmers to the detriment of producers of other crops.[6]

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[4]An expected infestation of 17-year locusts was limited to the extreme northern parts of the Gao Region where little damage could be done to crops.

[5]The Niger River crested at higher levels (3.5 to 4 meters) during December 1988 than those of the two previous years.

[6]The apparent sharp drop in millet-sorghum production in 1988/89 is difficult to interpret. Some millet-sorghum production appears to go unreported (note the divergence between Early Warning System accounts of local harvests and the "missing data" reported by the annual Agricultural Survey, *Enquête agricole*). More importantly, the unusually high millet-sorghum production in 1987/88 appears to be an anomaly, although regression analysis of production trends is inconclusive due to limited (and missing) observations following the division of the former Gao Region into the Tombouctou and Gao Regions in 1977.

Table A3.1.2. Gross Cereals Production in Gao Region, By District (Metric Tons)

	Millet-Sorghum	Traditional Sector Paddy	Modern Sector Paddy
Bourem District			
1987/88	236	3313	..
1988/89	..	12846	..
1989/90	..	9718	..
Gao-Central District			
1987/88	13094	5881	..
1988/89	1539	5530	..
1989/90	779	14629	..
Ansongo District			
1987/88	1506	6732	..
1988/89	73	6898	..
1989/90	..	7825	..
Total Gao Region			
1987/88	14836	15927	833
1988/89	1612	25273	337
1989/90	779	32172	NA

Sources: Ministère du Plan/DNSI/PADEM, *Enquête Agricole de Conjoncture* (1987/88, 1988/89 and 1989/90); OSCE (1989). Note: Millet-sorghum production for Bourem and Ansongo for 1988/89 and 1989/90 appears to be underreported (or not reported) compared to the number of hectares cultivated as reported in the *Enquête*. Data for 1989/90 do not disaggregate traditional sector and modern sector paddy production; figures reported are presumed to be traditional sector paddy production.

Indeed, a review of the Early Warning System *Bulletins* confirms that rural households in Gao Region shared unevenly in the crop increases of 1988/89.[7] In the northern Bourem District, submerged and irrigated rice production decreased due to flooding

[7]The following events have been compiled from various issues of the Regional Early Warning System *Reports* (*Rapports* du S.A.P. régional) and national Early Warning System Bulletins (*Bulletins* S.A.P.) during 1989.

and rupture of dikes. Recession sorghum was off by more than half. The subdistricts of Almoustarat and Temera were categorized "at nutritional risk" starting in December 1988, the second month of Project surveys. By January and February 1989, the food situation was "deteriorating perceptibly". An investigation into the medical-nutritional status of villages in the Temera subdistrict in January found that due to the third successive crop failure, consumption of wild cereals was statistically significantly higher than that recorded one year before, while consumption of coarse grains was significantly lower. Nonetheless, the prevalence of child malnutrition was considered with the "acceptable range". Nearly one-quarter of 210 households surveyed declared having no means of subsistence during the immediate coming months.

In view of "the precariousness of the food situation," the Early Warning System recommended that nine subdistricts in the Gao Region, including the subdistricts of Almoustarat and Temera, receive distributions of food aid on the basis of 7 kg of cereals per capita per month, or half of the government's cereals consumption norm. Thus, Almoustarat was scheduled to receive 318 tons per month from March through August 1989, while Temera was to receive 196 tons per month over the same period. In March, these distribution schedules were revised downward to 106 tons per month for Almoustarat from May through August and 62.5 tons per month for Temera. Due to numerous delays and confusion within government and donor circles, however (refer to Chapter 7), food aid was not distributed until December 1989 in Almoustarat, *after* the termination of the Food Security Project surveys and after the "at risk" designation for Almoustarat had been removed. It does not appear that food aid was distributed at Temera.

The other three subdistricts in which rural household surveys were underway, Djebok, Ansongo-Central (Bara), and Tessit, were placed "under surveillance" for most of 1989.

A3.1.3. The 1989 Rainy Season

Initial uncertainties about the outcome of the 1989 rainy season influenced rural household welfare and economic decisions during the latter part of the survey period. Once again, northern survey sites appeared worse off. The Early Warning System noted the departure of large numbers of families as a signal of impending distress. Even "whole villages were abandoned" in the Temera subdistrict in July due to lack of food, seeds and money. Household purchasing power was "low" in Almoustarat and Temera during September. By October, two months before the distribution of food aid, the crop report in Almoustarat was labelled "poor".

As a region, Gao received less rainfall during 1989 (Table A3.1.1), resulting in lower cresting of the River. While initial rainfall was judged "sufficient" for agriculture, pasturage and watering points for animals in August, the "average to good" crop season was endangered by an early end to the rains in September, poor flooding and an infestation of grasshoppers. As of October, the availability of wild cereals was rated "average". However, the outlook for the rice harvest was "better" than that the year before (Table A3.2), leaving the Gao Region harvest for 1989/90 "satisfactory overall" except in the Ansongo District, where significant damage to crops was caused by grasshoppers in December 1989.[8]

For Mali, the 1989/90 harvest was the second best on record, second only to the previous harvest (DNSI in *l'Essor*, FEWS).

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[8]As of October, the National Crop Protection Service estimated that 40-50 percent of the millet and sorghum crops in the Ansongo and Ménaka Districts were lost to grasshopper damage (as reported by the USAID/Bamako food security operations cable for October 1989).

Annex 4.1. Comparison of Household Income and Expenditures

Comparison of household income and expenditures is more than a test of how well they tally. It is also a check on the validity of the measurement of these two critical variables of household economic behavior.

As measured in this study, seasonal household expenditures usually exceed seasonal household incomes for some villages and strata. This raises the question of systematic downward bias in the measurement of income.

By design, the household income questionnaire only recorded cash income. However, given the focus on cereals as the variable of interest, the imputed value of home consumption of own-produced (own-gathered) cereals was later added to measurements of household income (section 4.2.1). This imputation was *not* expected to introduce systematic bias into income calculations, given favorable rainfall in 1988/89 (Annex 3.1), as farming households had the opportunity to produce cereals and ex-pastoralist families had the opportunity to gather cereals, or do both. In any case, the additional value of home consumption of cereals would be imputed for all households in all strata. Nonetheless, it is possible that this imputation introduces bias by not considering household consumption of non-cereal products.

The purpose of Annex 4.1 is three-fold. First, it examines the relation between household income and expenditure patterns. Second, Annex 4.1 discusses possible explanations for bias in the measurement of income. Third, Annex 4.1 proposes how to proceed with analysis of household cereals consumption in Chapter 5.

The intention is to see how individual households fared. Analysis therefore focuses on *household* measures of income minus expenditure per adult-equivalent (AE), rather than the aggregate sum of income and expenditures by all households.

All tables in Annex 4.1 are based on strictly paired observations of income and expenditures per AE, household by household, for the relevant period. For comparison with average *monthly* income, average *weekly* expenditures have been expanded to a monthly basis by multiplying by 4.345. Where households are ranked by tercile, household expenditures correspond to the respective household income tercile. To reduce the possibility of measurement error, all households whose income *and/or* expenditure figures are statistical outliers (± three standard deviations from the mean) have been dropped, based on Chebyshev's rule (discussed in section 4.2.3.), with minimal loss of observations.[1]

A4.1.1. Relation between Household Income and Expenditures

The effect of imputing the value of home consumption of own-grown (own-gathered) cereals and adding this value to income is expected to appear in survey villages where farming dominates as a source of household income because of more favorable rainfall and/or proximity to the Niger River — principally, Temera and Bara. Conversely, households with poorer opportunities for farming (or gathering wild cereals) — those in Almoustarat, Djebok and (to a lesser extent) Tessit — are expected to be at a disadvantage.

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[1]At least two observations were required for a household to be included in each seasonal average. At least three observations were required for a household to be included in each annual average. Note that a seasonal outlier household, whose observation was removed for a seasonal average, might not have been an outlier for the annual average, for which its observation was included. Thus, the number of households in the annual average may slightly exceed the number in any given seasonal average. For this reason, the annual average exceeds the range of the seasonal averages in a few instances.

Table A4.1.1. Comparison of Average Monthly Household Income per Adult-Equivalent with Average Monthly Expenditures, by Income Terciles

(CFA Francs, rounded)

	Annual Average			Harvest/Post-Harvest			Hot Dry Season			Rainy Season		
	Income	Expend	Net	Income	Expend	Net	Income	Expend	Net	Income	Expend	Net
Almoustarat	2593	3819	*-1226*	2846	3974	*-1129*	2851	4906	*-2055*	2039	2395	*-356*
Temera	1535	1236	*299*	2377	1599	*778*	1250	1057	*193*	991	1061	*-71*
Djebok	1519	2056	*-537*	1995	2473	*-478*	1375	2392	*-1017*	1187	1302	*-115*
Bara	4767	4122	*645*	7051	3321	*3730*	3361	4443	*-1082*	3976	4592	*-618*
Tessit	1853	3025	*-1172*	1745	2924	*-1179*	1774	3761	*-1987*	2020	2437	*-416*

Outlier households removed.
CESA-MSU Food Security Project Surveys, 1988/89

Table A4.1.1 seems to bear this out. Based on the annual average of all household-seasons, households in Temera and Bara earned more than they spent, leaving a positive balance, whereas households in Almoustarat, Djebok and Tessit spent more than they earned, resulting in a negative balance.

Looking at the survey year by season, average expenditures per AE exceeded average incomes per AE in each of the three seasons for households in Almoustarat, Djebok and Tessit. As expected, incomes exceeded expenditures, on average, in Temera and Bara during the harvest/post-harvest period. Thereafter, households spent more than they took in in one of the remaining seasons (Temera) or both (Bara). While Table A4.1.1 shows that this overspending could have been financed from previous period savings, drawdown of savings (decapitalization) was to have been reported as current income, and thus incorporated into the figure appearing in the income column. According to this same reporting rule, the possibility that households in Almoustarat, Djebok and Tessit financed their consistent overspending from savings can also be discounted. Lastly, expenditures on credit could cause expenditures to exceed income in the short run (Table A4.1.5.), but such credit would have to be repaid in the long run. On average, households in each of the five villages spent more than they took in during the rainy season.

Next, Table A4.1.2 examines income and expenditure per AE by season and strata according to income tercile. The results reflect the composition of each stratum by the villages whose household income-expenditure patterns were just seen. This time, any bias toward households with better farming (gathering) opportunities should appear in the South and On-River strata. Indeed, annual average incomes exceeded annual average expenditures for one tercile in the South stratum and for two terciles in the On-River stratum. In contrast,

Table A4.1.2. Comparison of Average Monthly Household Income per Adult-Equivalent with Average Monthly Expenditures, by Income Terciles (CFA Francs, rounded)

	Annual Average			Harvest/Post-Harvest			Hot Dry Season			Rainy Season		
	Income	Expend	Net	Income	Expend	Net	Income	Expend	Net	Income	Expend	Net
North												
Upper Income	3546	3668	*-121*	4461	4662	*-201*	3652	4386	*-735*	2452	1825	*627*
Middle Income	1437	1454	*-17*	2146	1315	*831*	1197	1576	*-378*	985	1464	*-479*
Lower Income	728	1192	*-464*	1030	1895	*-865*	627	1017	*-391*	536	678	*-142*
South												
Upper Income	5765	4586	*1179*	8414	3570	*4844*	4406	6065	*-1659*	4565	4026	*539*
Middle Income	2696	3271	*-574*	3682	3074	*608*	1981	3718	*-1737*	2488	3007	*-519*
Lower Income	1186	2464	*-1278*	1275	2736	*-1461*	931	2483	*-1551*	1351	2174	*-822*
Off-River												
Upper Income	3320	4141	*-821*	3593	4304	*-711*	3486	5346	*-1859*	2881	2774	*107*
Middle Income	1479	2612	*-1133*	1614	3112	*-1498*	1314	2642	*-1328*	1522	2128	*-606*
Lower Income	721	1654	*-932*	776	1561	*-786*	724	2415	*-1691*	668	980	*-312*
On-River												
Upper Income	5644	3829	*1815*	8414	3570	*4844*	3990	4002	*-12*	4528	3916	*612*
Middle Income	2565	2627	*-62*	4207	2825	*1381*	1662	2707	*-1045*	1837	2325	*-499*
Lower Income	974	813	*161*	1554	959	*595*	720	681	*38*	646	798	*-151*

Outlier households removed.
CESA-MSU Food Security Project Surveys, 1988/89

annual average incomes fell below annual average expenditures in each tercile in the North and Off-River strata.

If present, income measurement bias should be most pronounced by contrasting primarily farming On-River households with primarily non-farming Off-River households. The breakdown by seasons shows that households in five (and nearly six) of nine On-River income terciles reported income greater than expenditures whereas only one of nine Off-River income terciles reported income greater than expenditures.

All upper income terciles recorded positive income less expenditure balances in the rainy season, owing to the clustering of farming households in each stratum in the higher income terciles. Table A4.1.2 unexpectedly shows one "expenditure reversal" where the lower income tercile spent sizably more than the respective middle income tercile (North, harvest/post-harvest season).

This annex next makes a sensitivity analysis with two adjustments to the previous measures — in order to compare *cash* incomes with *cash* expenditures. The first adjustment is to remove the imputed value of home consumption of own-grown (own-gathered) cereals from the measure of income.[2] The second adjustment removes purchases on credit from the measure of household expenditures on grounds that credit represents income, already recorded

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[2]A related test was to check how sensitive the measure of household income is to the inclusion of home consumption of cereals — specifically, whether valuation of consumption of own-produced (own-gathered) cereals boosted some households into higher income brackets than they would otherwise have reached as a result of high levels of home consumption, particularly in the harvest/post-harvest period. In this sensitivity test, the value of home consumption is subtracted from other income to check for "income reversals," whether average income levels by tercile reverse ranks.

Results (not shown) indicate that removing the average value of home consumption by tercile does *not* alter the ranking of income terciles. This signifies that, on average, the value of home consumption of own-produced and own-gathered cereals is not the chief influence on the distribution of households into income terciles. Removing the average value of home consumption lowers the absolute value of income tercile by tercile, affecting farming (gathering) households rather than non-farming (non-gathering) households.

on the income side of the ledger, and that repayment of credit is appropriately recorded as an expenditure.[3]

Table A4.1.3. shows new net income less expenditure figures based on income without home consumption and expenditures without credit purchases. Two results are clear. First, since the average value of home consumption usually dominates the average value of credit purchases, removing home consumption and credit purchases simply adds five more strata-terciles to the large number of negative income less expenditure balances. Unlike Table A4.1.2., where all upper-income terciles showed positive balances in the rainy season, no household terciles show positive rainy season balances in Table A4.1.3. Second, the aggregate difference between income and expenditure — "overspending" — increases by more than 40 percent.

The aggregate difference between average adult-equivalent household income less expenditure, with and without the value of home consumption and with and without credit purchases, is also summarized in Table A4.1.4 for the Off-River and On-River strata by household-seasons, containing all survey households.[4]

[3]Note that purchases on credit are not removed from the tables in Chapter 4, Annex 4.3 or expenditure elasticity calculations in Chapter 5 on the rationale that the full range of expenditures, including those on credit, will better indicate how households managed their resources and made budget allocation decisions than if credit purchases were removed.

[4]Recall that households in Djebok are not included in the North/South stratification.

Table A4.1.3. Comparison of Average Monthly Household Cash Income per AE with Average Monthly Household Cash Expenditures by Income Terciles, (CFA Francs, rounded)

	Annual Average			Harvest/Post-Harvest			Hot Dry Season			Rainy Season		
	Income	Expend	Net	Income	Expend	Net	Income	Expend	Net	Income	Expend	Net
North												
Upper Income	3438	4385	*-946*	4001	4187	*-186*	3607	4959	*-1352*	2435	1378	*1057*
Middle Income	1100	1662	*-562*	1278	1550	*-273*	1172	1896	*-704*	933	1133	*-200*
Lower Income	502	467	*35*	458	473	*-15*	491	537	*-46*	449	522	*-73*
South												
Upper Income	3829	4050	*-221*	6069	3122	*2948*	3550	5933	*-2383*	3577	4377	*-800*
Middle Income	1862	3168	*-1306*	2601	2197	*404*	1608	3630	*-2023*	1788	2590	*-801*
Lower Income	860	1701	*-841*	908	1234	*-326*	824	2490	*-1666*	814	1909	*-1094*
Off-River												
Upper Income	3080	4353	*-1273*	3484	3607	*-124*	3396	5418	*-2022*	2545	2592	*-47*
Middle Income	1176	2007	*-831*	1368	2633	*-1265*	1230	2667	*-1437*	1189	1802	*-613*
Lower Income	583	1198	*-615*	502	692	*-190*	612	1967	*-1354*	529	994	*-465*
On-River												
Upper Income	3999	3728	*271*	5811	2671	*3140*	3093	3953	*-860*	3507	3860	*-353*
Middle Income	1827	2650	*-823*	2402	2125	*276*	1405	2351	*-947*	1619	1782	*-163*
Lower Income	651	608	*43*	660	620	*40*	600	690	*-90*	538	681	*-144*

Imputed value of home consumption of cereals removed from income. Purchases on credit removed from expenditures. Outlier households removed.
CESA-MSU Food Security Project Surveys, 1988/89

According to the top half of Table A4.1.4 where home consumption of cereals is counted as income and expenditures on credit are included, average income per adult-equivalent exceeded average adjusted expenditure per AE in a little less than half of the household-seasons (146, or 45.5 percent). Few household-seasons in the Off-River strata showed a positive balance (65, or 35.5 percent) while the majority of household-seasons in the On-River strata showed a positive balance (81, or 58.7 percent). This average adult-equivalent monthly over-spending totalled 90,889 CFAF during the survey year, or an average of 283 CFAF per AE per month in a given season — about 65 CFAF per AE per week.

Once the value of home consumption of cereals is subtracted from income and credit purchases from expenditures, the bottom half of Table A4.1.4 shows that average AE monthly over-spending increased to 130,925 CFAF during the survey year, or an average of 409 CFAF per AE per month in a given season — about 94 CFAF per AE per week. Despite these adjustments in the computation of income and expenditure, the number of household-seasons where average income per AE exceeded average expenditure per AE does *not* shift much in percentage terms. The number of household-seasons with positive balances slips slightly from 146 to 138 (or from 45.5 percent to 43.1 percent). Most of this shift occurs in the On-River stratum where an additional 7 household-seasons had negative balances (5.1 percent of the total), compared to the Off-River stratum which picked up only one more negative household-season (0.5 percent of the total).

As in the top part of Table A4.1.4., just over one-third of Off-River household-seasons and just over one-half of On-River household-seasons showed positive income minus expenditure balances. Somewhat perplexing, however, is that Off-River households still "overspend" their income by about 50 percent, while the rate of "underspending" by On-River

Table A4.1.4. Aggregate Seasonal Average Monthly Income, Expenditure and Income less Expenditure per AE: With and Without the Value of Home Consumption of Cereals and Expenditures on Credit

With Home Consumption of Cereals and Expenditures on Credit			Seasonal Average Monthly Income less Expenditure		Household-Seasons with Positive Income less Expenditure	
	Income (CFAF)	Expenditure (CFAF)	Aggregate (CFAF)	Per AE (CFAF)	N	Percent
Off-River (N = 183)	336,434	513,220	-176,450	-964	65	*35.5*
On-River (N = 138)	420,896	334,999	85,897	622	81	*58.7*
Total (N = 321)	757,330	848,219	-90,889	-283	146	*45.5*

Cash Income and Cash Expenditures Only			Seasonal Average Monthly Income less Expenditure		Household-Seasons with Positive Income less Expenditure	
	Income (CFAF)	Expenditure (CFAF)	Aggregate (CFAF)	Per AE (CFAF)	N	Percent
Off-River (N = 183)	298,517	447,684	-149,167	-815	64	*35.0*
On-River (N = 137)	297,595	279,353	18,242	133	74	*54.0*
Total (N = 320)	596,112	727,037	-130,925	-409	138	*43.1*

N refers to the number of household-seasons. Outlier households removed. Outlier households vary slightly between sensitivity analyses.
CESA-MSU Food Security Project Surveys, 1988/89.

households decreases in the expected direction from about 20 percent (top part of the table) to about 6 percent (bottom part). The issue of possible systematic bias in the measurement of income — or expenditures — remains.

A4.1.2. Possible Explanations for the Divergence between Incomes and Expenditures

While expenditures normally reflect income, expenditures can exceed income in any given period, thanks to dissaving or borrowing (although interpretations differ by theory, Chapter 3). Thus, of less concern is the number of households whose average seasonal income per AE falls less than average seasonal expenditures per AE — more than half, but fairly close to half. Of greater concern is the relative importance of average over-spending as a percentage of average income. Table A4.1.4 shows that over-spending was equivalent to 12.0 percent of income for the combined strata when the value of home consumption of cereals is counted as income and credit purchases included. This over-spending climbs to 22.0 percent when home consumption is excluded from income and credit purchases excluded from expenditures. Further, these average over-spending figures are consistently higher for the Off-River stratum, as previously pointed out.

These results might be acceptable, if it is assumed that households were going into short-term debt by borrowing against expected higher long-term income based on the recovery of rainfall and/or repaying old debts. The former assumption might explain the widespread occurrence of over-spending in Almoustarat and Djebok. The last column of Table A4.1.5. shows that households in Almoustarat and Djebok were strong net borrowers on average, the impact of which can be seen in the North and Off-River strata. The latter assumption appears to be more plausible for the South and On-River strata, both containing relatively prosperous farming households from Bara. Table A4.1.5. confirms that average South and On-River households made net negative credit purchases: The value of debts reimbursed (expenditures) was greater than the value of purchases on credit (also expenditures). As for the North stratum, the net negative credit purchases (reimbursements) in Temera (-3.9 percent) is offset by the stronger net credit purchases in Almoustarat (5.7 percent).

A second explanation might be that some households underreported credit income as a function of the period under observation. Smaller *weekly* purchases on credit may have been easily overlooked or assumed less consequential when reporting *monthly* income, for which lumpy credits would be less forgettable. Indeed, Table A4.1.5. also shows that tabulated purchases on credit, as a percentage of total purchases, often exceeded reported credit income (Annex 4.2) by several percentage points — by as much as 13 percent and 9 percent, in Almoustarat and Djebok, respectively, and by as much as about 5 percent by strata. Reported credit income was greater than tabulated credit purchases by a comfortable margin only in Temera.

A third explanation could be that households *made* disproportionately large expenditures during the monthly survey week. As a result, "expanding" weekly expenditures to monthly expenditures (by multiplying by 4.345 weeks per month) overstates actual monthly expenditures, causing "monthly" expenditures to exceed monthly income.

Fourth, households might have *reported* disproportionately large expenditures during the survey week. This is a source of bias known as the "end period effect," where respondents overestimate expenditures during short reference periods, especially for durables or less frequently purchased consumables (King and Byerlee, pp. 8-9). Once again, expanding weekly expenditures to a monthly basis may involve multiple counting of certain expenditures such that "monthly" expenditures inaccurately exceed monthly income.

Table A4.1.5. Comparison of Reported Credit Income, Tabulated Credit Purchases and Tabulated Net Credit Purchases, by Strata

(Percent)

	Reported Credit Income	Tabulated Credit Purchases	Tabulated Net Credit: Credit Purchases less Reimbursements
Villages			
Almoustarat	3.1	13.5	5.7
Temera	6.7	3.9	-3.9
Djebok	0.1	9.0	8.0
Bara	0.5	3.8	-3.3
Tessit	2.8	2.9	1.0
Strata			
North	6.2	9.3	3.0
South	1.0	3.6	-1.7
Off-River	2.1	7.0	4.1
On-River	3.0	4.3	-4.2

Income includes the implicit value of home consumption of own-grown (own-gathered) cereals.
CESA-MSU Food Security Project Surveys, 1988/89

Measurement error, a fifth possibility, should not be discounted, especially for household consumption of own cereals whose imputed value was incorporated into household income. As demonstrated in section A4.1.1., however, correcting for this type of measurement error by dropping consumption of own cereals from household income widens the divergence between income and expenditures (more than excluding credit purchases narrows it). Another possible source of measurement error could be respondent reticence to fully declare income in general — or expenditures, causing income (or expenditures) to be systematically undercounted. This may be a cultural factor affecting non-Songhaï households.

A related concern with the contribution of home consumption to household income is that only cereals are counted. In view of the traditional importance of animal products in the diet of rural pastoralist populations, particularly milk (Chapter 5), another source of bias may have been introduced into the calculation of household income by excluding the value of consumption of other (non-cereal) own-produced goods.[5]

Separate analysis, summarized but not shown here, checked the importance of animal ownership across income terciles and strata to test the hypothesis of systematic bias in estimates of household income per adult-equivalent due to the exclusion of the value of home milk consumption.

According to the results of the 1988/89 nationwide household budget-consumption study in Mali, the rural population in the Gao Region consumed a total of 26.61 kg of milk and milk products per person per year (*Ministère du Plan/DNSI/PADEM*, 1991b, no table number, no page number). Conservatively assuming that all of this milk was home consumed, the value of seasonal average monthly income from the home consumption of milk was imputed at about 190 CFAF per AE. If this entire amount were concentrated in one season (logically, the rainy season), the imputed value would be three times as great, or 570 CFAF per month per AE. Thus, home consumption of milk would raise household incomes in all terciles. Again, if this additional income were concentrated in the rainy season alone, it would represent a non-negligible increase for the lower income terciles, especially in the North where monthly income would more than double.

The next step was to look at the distribution of livestock ownership to determine which terciles might be most effected by the exclusion of milk products. If livestock

[5]The following discussion is appropriate to Tables A4.1.1. and A4.1.2., as well as analysis in Chapter 4, rather then the discussion of the divergence between cash income and cash expenditures.

ownership were concentrated among lower income tercile households, these households would have substantially greater income than otherwise measured.

Yet, analysis found no statistically significant correlation in any strata between household income levels and the value of owned milk-producing livestock, cattle and camels.[6] Nor was there found a concentration of cattle and camel ownership among the low-income terciles, as hypothesized. Except for the South stratum, where the most households owning animals were found in the upper-income tercile, more middle-income households owned animals than in other terciles. Unsurprisingly, the *lowest* number of households owning animals was found in the Off-River stratum, comprised mainly of ex-pastoral families, sedentarized by drought-induced loss of animals. Lastly, in no strata did the low income tercile own the highest value of animals.

This cumulated evidence led to rejection of the hypothesis of systematic downward bias in the incomes of low-income tercile households whose home consumption of milk and milk products was not counted. Low income tercile households have low income, by definition, *and* they own fewer milk-producing animals by value.

This section has attempted to explain the frequent discrepancy between paired measures of household income and expenditures. No single explanation is conclusive. In all likelihood, as many questions can be raised about the accuracy of expenditure data (and the procedure used to adjust weekly expenditure figures to monthly ones) as about the comprehensiveness of the measurement of household income. At this stage, the best recourse is to note the possible sources of bias and describe their probable impact on results.

[6]Data are unavailable on goat ownership by survey households.

A4.1.3. Implications for Analysis of Household Cereals Consumption

The possibility of income measurement bias, while neither intended nor expected, cannot be ignored. This calls for several alternatives in the econometric modelling of household cereals consumption in Chapter 5. Three alternative measures of income will be considered: 1) household income, as originally measured and discussed in Chapter 4; 2) a combination of household expenditures and the imputed value of home consumption of own-produced (own-gathered) cereals; or 3) use of cash income and cash expenditures only.

Annex 4.2. Household Income

The following annex presents summaries of household income by strata and season in support of Section 4.2 of Chapter 4. These income data are not disaggregated by income terciles. The first table in each set per stratum displays average household monthly income by season. The second table puts the same information in percentage terms.

Tables in Annex 4.2 correspond directly with Tables 4.5, 4.6, 4.10 and 4.11 (average monthly household income by tercile), for the respective stratum, in terms of annual and seasonal averages and participating households. Statistical outliers (households whose income per AE was greater than $\pm$ 3 standard deviations from the seasonal or annual mean consumption) have been removed. Note that to facilitate the comparison between household income and household expenditures (Annex 4.1), a household whose observation was an outlier for either household income or household expenditures has been removed from both sets of tables, resulting in slightly more outliers per annual or seasonal average than the calorie consumption tables (Annex 5.2). In no case do these outliers represent more than 6 percent of all household observations; outliers represent about 4 percent, or less, of all observations in more than half of the averages. Thus, the annual and seasonal average income tables by strata (Annex 4.2) and annual and seasonal average expenditure tables by strata (Annex 4.3) are based on the exact same grouping of households.

The full set of observations are available for most households (although income data of households were not recorded for the first month in Almoustarat). While a large majority of households participated throughout the year-long survey, a few households dropped out.

These were replaced by randomly selected substitute households. Removal of outlier households and replacement of drop-out households with substitute households result in a slight variation in participating households and their number per season.

A summary of available observations per household is shown below for the annual average, where *n* refers to the maximum number of monthly observations, 12.

	All Observations (*n*) or (*n*-1) Observations		All Observations (*n*), (*n*-1) Observations or (*n*-2) Observations		Number of Minimum Observations (3)	
North (N=44)	38	86.4%	40	90.9%	0	0%
South (N=51)	39	76.5%	42	82.4%	3	5.9%
Off-River (N=67)	53	79.1%	56	83.6%	3	4.5%
On-River (N=49)	43	79.6%	45	91.8%	0	0%

The first column of each annex table represents an annual average of monthly household observations, not an average of the seasonal averages in the following columns. At least two observations were required for a household to be included in each seasonal average. At least three observations were required for a household to be included in each annual average. Note that a seasonal outlier household, whose observation was removed for a seasonal average, may not be an outlier for the annual average, for which its observation is included. Thus, the number of households in the annual average may slightly exceed the number in any given seasonal average. For this reason, the annual average exceeds the range of the seasonal averages in a few instances.

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Table A4.2.1.
Average Monthly Household Income per Adult-Equivalent by Source and Season: North Villages (Almoustarat and Temera; Gao Region, Mali)

CFA Francs

	Annual Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Agricultural Production and Sales	53	137	28	1
2. Livestock Production and Sales	133	207	127	90
3. Gathering/Sale of Natural Products	17	41	15	2
4. General Commerce	321	304	331	43
5. Agricultural Trade	47	39	54	20
6. Livestock Trade	.	.	.	.
7. Trade of Artisanal Products	5	7	8	.
8. Vending of Prepared Foods	7	16	.	5
9. Rental Income	6	9	4	8
10. Wage Income	300	307	270	202
11. Salary Income	278	326	280	126
12. Sale of Household Durables	24	36	23	18
13. Drawdown of Savings	29	5	33	51
14. Charity Aid	381	411	304	384
15. Household Member Remittances	63	7	135	54
16. Reimbursements Received	57	8	40	112
17. Credit Received	134	17	56	176
18. Consumption of Cultivated Cereals	213	530	68	22
19. Consumption of Gathered Cereals	68	175	15	39
20. Other Income	21	1	19	11
Average Monthly Income	2159	2583	1811	1363
Coefficient of Variation	0.81	0.65	0.92	0.71
Gini Coefficient of Equality	0.39	0.40	0.46	0.41
Number of Households	44	41	43	40
(Outlier Households removed)	(1)	(2)	(2)	(2)

CESA-MSU Food Security Project Surveys, 1988/89

Table A4.2.2.

Average Monthly Sources of Household Income per Adult-Equivalent, by Season: North Villages (Almoustarat and Temera; Gao Region, Mali)

Percent

	Annual Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Agricultural Production and Sales	2.4	5.3	1.5	0.0
2. Livestock Production and Sales	624	8.0	7.0	6.3
3. Gathering/Sale of Natural Products	0.8	1.6	0.8	0.1
4. General Commerce	14.9	11.8	18.3	3.2
5. Agricultural Trade	2.2	1.5	3.0	1.5
6. Livestock Trade	.	.	.	.
7. Trade of Artisanal Products	0.2	0.3	0.4	.
8. Vending of Prepared Foods	0.3	0.6	.	0.4
9. Rental Income	0.3	0.3	0.2	0.6
10. Wage Income	13.9	11.9	14.9	14.8
11. Salary Income	12.9	12.6	15.5	9.3
12. Sale of Household Durables	1.1	1.4	1.3	1.3
13. Drawdown of Savings	1.3	0.2	1.8	3.7
14. Charity Aid	17.6	15.9	16.8	28.2
15. Household Member Remittances	2.9	0.3	7.5	4.0
16. Reimbursements Received	2.6	0.3	2.2	8.2
17. Credit Received	6.2	0.7	3.1	12.9
18. Consumption of Cultivated Cereals	9.9	20.5	3.8	1.6
19. Consumption of Gathered Cereals	3.1	6.8	0.8	2.9
20. Other Income	1.0	0.0	1.1	0.8
Total (Rounded)	100.0	100.0	100.0	100.0
Number of Households	44	41	43	40

CESA-MSU Food Security Project Surveys, 1988/89

Table A4.2.3.
Average Monthly Household Income per Adult-Equivalent by Source and Season: South Villages (Bara and Tessit; Gao Region, Mali)

CFA Francs

	Annual Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Agricultural Production and Sales	691	2062	227	276
2. Livestock Production and Sales	331	180	340	450
3. Gathering/Sale of Natural Products	7	15	.	7
4. General Commerce	57	123	43	49
5. Agricultural Trade	19	48	11	5
6. Livestock Trade	.	.	.	.
7. Trade of Artisanal Products	8	21	.	6
8. Vending of Prepared Foods	23	30	28	12
9. Rental Income	7	3	6	14
10. Wage Income	263	168	332	295
11. Salary Income	250	142	132	143
12. Sale of Household Durables	23	.	42	20
13. Drawdown of Savings	57	33	44	5
14. Charity Aid	186	130	185	137
15. Household Member Remittances	434	179	504	544
16. Reimbursements Received	40	33	41	42
17. Credit Received	32	11	61	31
18. Consumption of Cultivated Cereals	633	1232	467	410
19. Consumption of Gathered Cereals	127	46	6	221
20. Other Income	.	.	.	.
Average Monthly Income	3190	4457	2471	2666
Coefficient of Variation	0.65	0.76	0.67	0.60
Gini Coefficient of Equality	0.34	0.42	0.37	0.35
Number of Households	51	45	47	48
(Outlier Households removed)	(3)	(1)	(2)	(1)

CESA-MSU Food Security Project Surveys, 1988/89

Table A4.2.4.

Average Monthly Sources of Household Income per Adult-Equivalent by Season: South Villages (Bara and Tessit; Gao Region, Mali)

Percent

	Annual Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Agricultural Production and Sales	21.7	46.3	9.2	10.3
2. Livestock Production and Sales	10.4	4.0	13.8	16.9
3. Gathering/Sale of Natural Products	0.2	0.3	.	0.3
4. General Commerce	1.8	2.8	1.7	1.8
5. Agricultural Trade	0.6	1.1	0.5	0.2
6. Livestock Trade	.	.	.	.
7. Trade of Artisanal Products	0.3	0.5	.	0.2
8. Vending of Prepared Foods	0.7	0.7	1.1	0.5
9. Rental Income	0.2	0.1	0.2	0.5
10. Wage Income	8.2	3.8	13.4	11.1
11. Salary Income	7.8	3.2	5.4	5.4
12. Sale of Household Durables	0.7	.	1.7	0.7
13. Drawdown of Savings	1.8	0.7	1.8	0.2
14. Charity Aid	5.8	2.9	7.5	5.1
15. Household Member Remittances	13.6	4.0	20.4	20.4
16. Reimbursements Received	1.3	0.7	1.7	1.6
17. Credit Received	1.0	0.3	2.5	1.2
18. Consumption of Cultivated Cereals	19.9	27.7	18.9	15.4
19. Consumption of Gathered Cereals	4.0	1.0	0.3	8.3
20. Other Income	.	.	.	.
Total (Rounded)	100.0	100.0	100.0	100.0
Number of Households	51	45	47	48

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Table A4.2.5.
Average Monthly Household Income per Adult-Equivalent by Source and Season: Off-River Villages (Almoustarat, Djebok and Tessit; Gao Region, Mali)

CFA Francs

	Annual Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Agricultural Production and Sales	32	77	17	9
2. Livestock Production and Sales	231	253	233	239
3. Gathering/Sale of Natural Products	10	27	0	5
4. General Commerce	223	254	138	103
5. Agricultural Trade	14	14	15	9
6. Livestock Trade	4	.	11	3
7. Trade of Artisanal Products	3	7	4	.
8. Vending of Prepared Foods	.	.	.	.
9. Rental Income	4	2	4	7
10. Wage Income	244	225	232	230
11. Salary Income	484	438	510	348
12. Sale of Household Durables	9	.	.	18
13. Drawdown of Savings	20	.	52	7
14. Charity Aid	283	367	284	262
15. Household Member Remittances	87	57	106	73
16. Reimbursements Received	29	26	35	22
17. Credit Received	40	8	39	77
18. Consumption of Cultivated Cereals	93	156	92	49
19. Consumption of Gathered Cereals	120	103	17	175
20. Other Income	15	.	36	7
Average Monthly Income	1946	2015	1824	1642
Coefficient of Variation	0.72	0.72	0.78	0.57
Gini Coefficient of Equality	0.36	0.42	0.42	0.36
Number of Households	67	59	62	62
(Outlier Households removed)	(2)	(3)	(2)	(2)

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Table A4.2.6.

Average Monthly Sources of Household Income per Adult-Equivalent by Season: Off-River Villages (Almoustarat, Djebok and Tessit; Gao Region, Mali)

Percent

	Annual Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Agricultural Production and Sales	1.6	3.8	0.9	0.6
2. Livestock Production and Sales	11.9	12.5	12.8	14.6
3. Gathering/Sale of Natural Products	0.5	1.4	0.0	0.3
4. General Commerce	11.5	12.6	7.6	6.2
5. Agricultural Trade	0.7	0.7	0.8	0.6
6. Livestock Trade	0.2	.	0.6	0.2
7. Trade of Artisanal Products	0.2	0.3	0.2	.
8. Vending of Prepared Foods	.	.	.	.
9. Rental Income	0.2	0.1	0.2	0.4
10. Wage Income	12.5	11.2	12.7	14.0
11. Salary Income	24.9	21.7	28.0	21.2
12. Sale of Household Durables	0.5	.	.	1.1
13. Drawdown of Savings	1.0	.	2.9	0.4
14. Charity Aid	14.6	18.2	15.6	15.9
15. Household Member Remittances	4.4	2.8	5.8	4.4
16. Reimbursements Received	1.5	1.3	1.9	1.3
17. Credit Received	2.1	0.4	2.1	4.7
18. Consumption of Cultivated Cereals	4.8	7.7	5.0	3.0
19. Consumption of Gathered Cereals	6.1	5.1	0.9	10.6
20. Other Income	0.7	.	2.0	0.4
Total (Rounded)	100.0	100.0	100.0	100.0
Number of Households	67	59	62	62

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Table A4.2.7.
Average Monthly Household Income per Adult-Equivalent by Source and Season: On-River Villages (Temera and Bara; Gao Region, Mali)

CFA Francs

	Annual Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Agricultural Production and Sales	745	2098	236	270
2. Livestock Production and Sales	280	195	264	364
3. Gathering/Sale of Natural Products	13	27	13	1
4. General Commerce	47	71	20	45
5. Agricultural Trade	49	68	45	21
6. Livestock Trade	.	.	.	.
7. Trade of Artisanal Products	13	27	7	6
8. Vending of Prepared Foods	30	44	28	17
9. Rental Income	7	8	3	11
10. Wage Income	236	173	289	214
11. Salary Income	180	76	29	62
12. Sale of Household Durables	34	32	63	11
13. Drawdown of Savings	72	37	44	39
14. Charity Aid	195	83	173	169
15. Household Member Remittances	395	109	408	522
16. Reimbursements Received	55	7	36	109
17. Credit Received	99	15	63	81
18. Consumption of Cultivated Cereals	748	1541	380	373
19. Consumption of Gathered Cereals	43	103	2	31
20. Other Income	0	1	.	.
Average Monthly Income	3239	4714	2104	2347
Coefficient of Variation	0.70	0.68	0.75	0.79
Gini Coefficient of Equality	0.37	0.38	0.42	0.45
Number of Households	49	46	47	47
(Outlier Households removed)	(3)	(1)	(2)	(2)

CESA-MSU Food Security Project Surveys, 1988/89

Table A4.2.8.

Average Monthly Sources of Household Income per Adult-Equivalent by Season: On-River Villages (Temera and Bara; Gao Region, Mali)

Percent

	Annual Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Agricultural Production and Sales	23.0	44.5	11.2	11.5
2. Livestock Production and Sales	8.6	4.1	12.6	15.5
3. Gathering/Sale of Natural Products	0.4	0.6	0.6	0.1
4. General Commerce	1.4	1.5	0.9	1.9
5. Agricultural Trade	1.5	1.4	2.1	0.9
6. Livestock Trade	.	.	.	.
7. Trade of Artisanal Products	0.4	0.6	0.3	0.3
8. Vending of Prepared Foods	0.9	0.9	1.3	0.7
9. Rental Income	0.2	0.2	0.2	0.5
10. Wage Income	7.3	3.7	13.7	9.1
11. Salary Income	5.6	1.6	1.4	2.6
12. Sale of Household Durables	1.0	0.7	3.0	0.5
13. Drawdown of Savings	2.2	0.8	2.1	1.7
14. Charity Aid	6.0	1.8	8.2	7.2
15. Household Member Remittances	12.2	2.3	19.4	22.2
16. Reimbursements Received	1.7	0.2	1.7	4.6
17. Credit Received	3.0	0.3	3.0	3.4
18. Consumption of Cultivated Cereals	23.1	32.7	18.0	15.9
19. Consumption of Gathered Cereals	1.3	2.2	0.1	1.3
20. Other Income	0.0	0.0	.	.
Total (Rounded)	100.0	100.0	100.0	100.0
Number of Households	49	46	47	47

CESA-MSU Food Security Project Surveys, 1988/89

Annex 4.3. Weekly Household Expenditures

A4.3.1. Weekly Household Total Expenditures

The following annex first presents summaries of weekly household total expenditures by strata and season in support of Section 4.3 of Chapter 4. These total expenditure data are not disaggregated by income terciles. The first table in each set per stratum displays average weekly total expenditures by season. The second table puts the same information in percentage terms.

Tables in Annex 4.3 correspond directly with Tables 4.13 through 4.16 (average weekly household expenditures and budget shares by tercile), for the respective stratum, in terms of annual and seasonal averages and participating households. Statistical outliers (households whose income per AE was greater than $\pm$ 3 standard deviations from the seasonal or annual mean expenditure) have been removed. Note that to facilitate the comparison between household income and household expenditures (Annex 4.1), a household whose observation was an outlier for either household income or household expenditures has been removed from *both* sets of tables, resulting in slightly more outliers per annual or seasonal average than the calorie consumption tables (Annex 5.2). In no case do these outliers represent more than 6 percent of all household observations; outliers represent about 4 percent, or less, of all observations in more than half of the averages. Thus, these annual and seasonal average expenditure tables by strata (Annex 4.3) and seasonal average income tables by strata (Annex 4.2) are based on the exact same grouping of households.

The full set of observations are available for most households (although weekly expenditures observations during July 1989 have been dropped from the analysis due to the uneven influence of spending for Tabaski across survey villages). While a large majority of households participated throughout the year-long survey, a few households dropped out. These were replaced by randomly selected substitute households. Removal of outlier households and replacement of drop-out households with substitute households result in a slight variation in participating households and their number per season.

The first column of each annex table represents an annual average of monthly household observations, not an average of the seasonal observations. At least two observations were required for a household to be included in each seasonal average. At least three observations were required for a household to be included in each annual average. Note that a seasonal outlier household, whose observation was removed for a seasonal average, may not be an outlier for the annual average, for which its observation is included. Thus, the number of households in the annual average may slightly exceed the number in any given seasonal average. For this reason, the annual average exceeds the range of the seasonal averages in a few instances.

Gini coefficients have not been calculated due to the discontinuous nature of once-a-month weekly observations.

Table A4.3.1.

Average Weekly Household Total Expenditures per Adult-Equivalent by Season, 1988/89
North Villages (Almoustarat and Temera; Gao Region, Mali)

CFA Francs

	Seasonal Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Cereals	227	262	256	160
2. Legumes and Tubers	0	1	0	.
3. Meat, Poultry and Fish	36	45	52	10
4. Vegetables	9	12	9	5
5. Fruit	0	1	0	.
6. Condiments and Spices	68	87	75	40
7. Processed Foods	40	57	39	23
8. Housewares	23	30	23	14
9. Clothing and Accessories	37	72	32	5
10. Live Animals	6	.	11	6
11. Miscellaneous	29	40	35	11
Average Weekly Expenditures	473	608	531	273
Coefficient of Variation	1.19	1.12	1.12	0.97
(Number of Household-Seasons)	(124)	(41)	(43)	(40)

Weekly observations for July 1989 have been excluded.
CESA-MSU Food Security Project Surveys, 1988/89

Table A4.3.2.

Average Weekly Household Total Expenditures per Adult-Equivalent by Season, 1988/89
North Villages (Almoustarat and Temera; Gao Region, Mali)

Percent

	Seasonal Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Cereals	47.9	43.2	48.1	58.6
2. Legumes and Tubers	0.1	0.2	0.0	.
3. Meat, Poultry and Fish	7.6	7.3	9.7	3.5
4. Vegetables	1.8	2.0	1.6	1.9
5. Fruit	0.1	0.1	0.0	.
6. Condiments and Spices	14.3	14.3	14.2	14.5
7. Processed Foods	8.4	9.3	7.3	8.4
8. Housewares	4.8	5.0	4.3	5.1
9. Clothing and Accessories	7.8	11.9	6.0	2.0
10. Live Animals	1.2	.	2.0	2.1
11. Miscellaneous	6.1	6.6	6.6	4.0
Total	100.0	100.0	100.0	100.0
(Number of Household-Seasons)	(124)	(41)	(43)	(40)

Weekly observations for July 1989 have been excluded.
CESA-MSU Food Security Project Surveys, 1988/89

Table A4.3.3.

Average Weekly Household Total Expenditures per Adult-Equivalent by Season, 1988/89
South Villages (Bara and Tessit; Gao Region, Mali)

CFA Francs

	Seasonal Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Cereals	265	133	320	334
2. Legumes and Tubers	12	11	16	8
3. Meat, Poultry and Fish	127	140	151	90
4. Vegetables	23	27	23	19
5. Fruit	2	1	2	4
6. Condiments and Spices	120	124	121	113
7. Processed Foods	60	65	62	55
8. Housewares	56	56	68	45
9. Clothing and Accessories	63	76	90	25
10. Live Animals	20	17	31	11
11. Miscellaneous	53	71	63	28
Average Weekly Expenditures	801	720	949	733
Coefficient of Variation	0.75	0.72	0.74	0.74
(Number of Household-Seasons)	(140)	(45)	(47)	(48)

Weekly observations for July 1989 have been excluded.
CESA-MSU Food Security Project Surveys, 1988/89

Table A4.3.4.

Average Weekly Household Total Expenditures per Adult-Equivalent by Season, 1988/89 South Villages (Bara and Tessit; Gao Region, Mali)

Percent

	Seasonal Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Cereals	33.0	18.4	33.8	45.5
2. Legumes and Tubers	1.5	1.5	1.7	1.1
3. Meat, Poultry and Fish	15.8	19.5	14.8	12.2
4. Vegetables	2.9	3.7	2.4	2.6
5. Fruit	0.3	0.1	0.2	0.5
6. Condiments and Spices	14.9	17.3	12.8	15.5
7. Processed Foods	7.5	9.0	6.5	7.5
8. Housewares	7.0	7.8	7.2	6.2
9. Clothing and Accessories	7.9	10.5	9.5	3.5
10. Live Animals	2.5	2.3	3.3	1.5
11. Miscellaneous	6.6	9.8	6.6	3.8
Total	100.0	100.0	100.0	100.0
(Number of Household-Seasons)	(140)	(45)	(47)	(48)

Weekly observations for July 1989 have been excluded.
CESA-MSU Food Security Project Surveys, 1988/89

Table A4.3.5.

Average Weekly Household Total Expenditures per Adult-Equivalent by Season, 1988/89 Off-River Villages (Almoustarat, Djebok and Tessit; Gao Region, Mali)

CFA Francs

	Seasonal Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Cereals	265	267	304	224
2. Legumes and Tubers	3	3	6	.
3. Meat, Poultry and Fish	60	72	80	29
4. Vegetables	10	13	14	5
5. Fruit	2	1	3	3
6. Condiments and Spices	96	101	105	81
7. Processed Foods	55	64	61	40
8. Housewares	29	29	37	20
9. Clothing and Accessories	60	74	97	10
10. Live Animals	17	26	9	17
11. Miscellaneous	48	45	76	22
Average Weekly Expenditures	645	694	792	452
Coefficient of Variation	0.96	1.00	0.86	0.86
(Number of Household-Seasons)	(183)	(59)	(62)	(62)

Weekly observations for July 1989 have been excluded.
CESA-MSU Food Security Project Surveys, 1988/89

Table A4.3.6.

Average Weekly Household Total Expenditures per Adult-Equivalent by Season, 1988/89 Off-River Villages (Almoustarat, Djebok and Tessit; Gao Region, Mali)

Percent

	Seasonal Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Cereals	41.0	38.4	38.4	49.4
2. Legumes and Tubers	0.5	0.4	0.7	.
3. Meat, Poultry and Fish	9.3	10.3	10.1	6.4
4. Vegetables	1.6	1.8	1.7	1.1
5. Fruit	0.4	0.2	0.3	0.7
6. Condiments and Spices	14.9	14.6	13.3	18.0
7. Processed Foods	8.5	9.2	7.7	8.8
8. Housewares	4.4	4.1	4.7	4.5
9. Clothing and Accessories	9.4	10.7	12.3	2.3
10. Live Animals	2.6	3.7	1.1	3.8
11. Miscellaneous	7.4	6.5	9.6	5.0
Total	100.0	100.0	100.0	100.0
(Number of Household-Seasons)	(183)	(59)	(62)	(62)

Weekly observations for July 1989 have been excluded.
CESA-MSU Food Security Project Surveys, 1988/89

Table A4.3.7.

Average Weekly Household Total Expenditures per Adult-Equivalent by Season, 1988/89
On-River Villages (Temera and Bara; Gao Region, Mali)

CFA Francs

	Seasonal Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Cereals	194	108	201	273
2. Legumes and Tubers	8	8	8	9
3. Meat, Poultry and Fish	86	101	85	73
4. Vegetables	20	25	15	20
5. Fruit	0	1	0	1
6. Condiments and Spices	75	93	69	64
7. Processed Foods	40	47	37	37
8. Housewares	39	47	38	33
9. Clothing and Accessories	43	61	50	17
10. Live Animals	17	13	29	8
11. Miscellaneous	37	63	36	13
Average Weekly Expenditures	561	566	569	547
Coefficient of Variation	0.89	0.73	0.89	1.05
(Number of Household-Seasons)	(140)	(46)	(47)	(47)

Weekly observations for July 1989 have been excluded.
CESA-MSU Food Security Project Surveys, 1988/89

Table A4.3.8.

Average Weekly Household Total Expenditures per Adult-Equivalent by Season, 1988/89 On-River Villages (Temera and Bara; Gao Region, Mali)

Percent

	Seasonal Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Cereals	34.7	19.1	35.3	49.9
2. Legumes and Tubers	1.4	1.4	1.4	1.6
3. Meat, Poultry and Fish	15.3	17.8	15.0	13.3
4. Vegetables	3.6	4.3	2.7	3.6
5. Fruit	0.1	0.1	0.0	0.1
6. Condiments and Spices	13.4	16.5	12.1	11.7
7. Processed Foods	7.2	8.3	6.5	6.8
8. Housewares	7.0	8.2	6.6	6.0
9. Clothing and Accessories	7.6	10.8	8.9	3.1
10. Live Animals	3.0	2.3	5.2	1.5
11. Miscellaneous	6.6	11.1	6.4	2.4
Total	100.0	100.0	100.0	100.0
(Number of Household-Seasons)	(140)	(46)	(47)	(47)

Weekly observations for July 1989 have been excluded.
CESA-MSU Food Security Project Surveys, 1988/89

A4.3.2. Weekly Household Cereal Expenditures

The annex next presents summaries of weekly household expenditures on cereals by strata and season based on the previous set of total expenditure tables. These household cereals expenditure tables are not disaggregated by income terciles. The first table in each set per stratum displays average weekly cereals expenditures by season while the second table puts the same information in percentage terms.

These tables correspond directly with Tables 4.18 through 4.21 (average weekly household cereals expenditures and budget shares by tercile), for the respective stratum, in terms of annual and seasonal averages and participating households. Statistical outliers (households whose income per AE was greater than ± 3 standard deviations from the seasonal or annual mean expenditure) have been removed.

The full set of observations are available for most households (although weekly expenditures observations during July 1989 have been dropped from the analysis due to the uneven influence of spending for Tabaski across survey villages). While a large majority of households participated throughout the year-long survey, a few households dropped out. These were replaced by randomly selected substitute households. Removal of outlier households and replacement of drop-out households with substitute households result in a slight variation in participating households and their number per season.

The first column of each annex table represents an annual average of monthly household observations, not an average of the seasonal averages in the following columns. At least three observations were required for a household to be included in each annual average. Thus, the number of households in the annual average may slightly exceed the number in any given seasonal average. Note also that a seasonal outlier household, whose observation was removed for a seasonal average, may not be an outlier for the annual average, for which its observation is included. For this reason, the annual average exceeds the range of the seasonal averages in a few rare instances.

At least two observations were required for a household to be included in each seasonal average.

Gini coefficients have not been calculated due to the discontinuous nature of once-a-month weekly observations.

Table A4.3.9.

Average Weekly Household Expenditures on Cereals per AE by Season, 1988/89
North Villages (Almoustarat and Temera; Gao Region, Mali)

CFA Francs

	Seasonal Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Millet	153	132	156	133
2. Sorghum	0	.	.	0
3. Maize	6	3	8	3
4. Maizemeal	8	3	15	4
5. Paddy	33	41	41	9
6. Local Rice	16	12	14	4
7. Other Rice	23	38	14	.
8. Wheat	0	1	.	.
9. Wild Fonio	7	14	1	7
10. Cram-cram	7	19	5	.
Average Weekly Expenditures	256	262	256	160
Coefficient of Variation	0.93	1.05	0.92	0.89
Number of Households	44	41	43	40
(Outlier Households removed)	(1)	(2)	(2)	(2)

Weekly observations for July 1989 have been excluded.
CESA-MSU Food Security Project Surveys, 1988/89

Table A4.3.10.

Average Weekly Household Expenditures on Cereals per AE by Season, 1988/89
North Villages (Almoustarat and Temera; Gao Region, Mali)

Percent

	Seasonal Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Millet	59.2	50.5	61.2	83.2
2. Sorghum	0.0	.	.	0.2
3. Maize	2.3	1.1	3.2	1.8
4. Maizemeal	3.1	1.3	5.9	2.8
5. Paddy	12.7	15.6	16.1	5.6
6. Local Rice	6.2	4.4	5.6	2.7
7. Other Rice	8.9	14.6	5.6	.
8. Wheat	0.1	0.2	.	.
9. Wild Fonio	2.6	5.2	0.5	4.1
10. Cram-cram	2.8	7.1	1.9	.
Total	100.0	100.0	100.0	100.0
Number of Households	44	41	43	40

Weekly observations for July 1989 have been excluded.
CESA-MSU Food Security Project Surveys, 1988/89

Table A4.3.11.

Average Weekly Household Expenditures on Cereals per AE by Season, 1988/89
South Villages (Bara and Tessit; Gao Region, Mali)

CFA Francs

	Seasonal Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Millet	80	29	108	112
2. Sorghum	59	13	102	109
3. Maize	0	1	1	.
4. Maizemeal	.	.	.	.
5. Paddy	31	17	35	21
6. Local Rice	71	55	60	61
7. Other Rice	.	.	.	.
8. Wheat	.	.	.	.
9. Wild Fonio	19	18	14	31
10. Cram-cram	0	.	1	.
Average Weekly Expenditures	261	133	320	334
Coefficient of Variation	0.95	1.48	1.20	1.09
Number of Households	51	45	47	48
(Outlier Households removed)	(3)	(1)	(2)	(2)

Weekly observations for July 1989 have been excluded.
CESA-MSU Food Security Project Surveys, 1988/89

Table A4.3.12.

**Average Weekly Household Expenditures on Cereals per AE by Season, 1988/89
South Villages (Bara and Tessit; Gao Region, Mali)**

Percent

	Seasonal Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Millet	30.8	21.7	33.7	33.5
2. Sorghum	22.7	9.9	31.9	32.7
3. Maize	0.2	0.6	0.2	.
4. Maizemeal	.	.	.	.
5. Paddy	12.0	12.5	10.9	6.3
6. Local Rice	27.0	41.8	18.8	18.2
7. Other Rice	.	.	.	.
8. Wheat	.	.	.	.
9. Wild Fonio	7.2	13.6	4.3	9.2
10. Cram-cram	0.1	.	0.2	.
Total	100.0	100.0	100.0	100.0
Number of Households	51	45	47	48

Weekly observations for July 1989 have been excluded.
CESA-MSU Food Security Project Surveys, 1988/89

Table A4.3.13.

**Average Weekly Household Expenditures on Cereals per AE by Season, 1988/89
Off-River Villages (Almoustarat, Djebok and Tessit; Gao Region, Mali)**

CFA Francs

	Seasonal Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Millet	144	121	181	126
2. Sorghum	26	19	35	30
3. Maize	2	4	2	.
4. Maizemeal	.	.	.	.
5. Paddy	7	3	.	5
6. Local Rice	59	62	62	50
7. Other Rice	15	27	13	.
8. Wheat	.	.	.	.
9. Wild Fonio	15	26	11	11
10. Cram-cram	1	5	0	.
Average Weekly Expenditures	269	267	304	224
Coefficient of Variation	0.93	1.08	0.90	1.13
Number of Households	67	59	62	62
(Outlier Households removed)	(2)	(3)	(2)	(2)

Weekly observations for July 1989 have been excluded.
CESA-MSU Food Security Project Surveys, 1988/89

Table A4.3.14.

Average Weekly Household Expenditures on Cereals per AE by Season, 1988/89
Off-River Villages (Almoustarat, Djebok and Tessit; Gao Region, Mali)

Percent

	Seasonal Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Millet	53.6	45.4	59.6	56.5
2. Sorghum	9.8	7.1	11.5	13.5
3. Maize	0.7	1.4	0.8	.
4. Maizemeal	.	.	.	.
5. Paddy	2.7	1.2	.	2.4
6. Local Rice	21.8	23.3	20.3	22.6
7. Other Rice	5.5	10.0	4.2	.
8. Wheat	.	.	.	.
9. Wild Fonio	5.5	9.9	3.6	5.0
10. Cram-cram	0.5	1.7	0.0	.
Total	100.0	100.0	100.0	100.0
Number of Households	67	59	62	62

Weekly observations for July 1989 have been excluded.
CESA-MSU Food Security Project Surveys, 1988/89

Table A4.3.15.

Average Weekly Household Expenditures on Cereals per AE by Season, 1988/89
On-River Villages (Temera and Bara; Gao Region, Mali)

CFA Francs

	Seasonal Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Millet	58	14	67	88
2. Sorghum	45	4	36	93
3. Maize	4	3	5	2
4. Maizemeal	7	3	14	3
5. Paddy	52	49	55	29
6. Local Rice	38	22	16	34
7. Other Rice	.	.	.	.
8. Wheat	0	1	.	.
9. Wild Fonio	8	2	2	22
10. Cram-cram	5	11	5	.
Average Weekly Expenditures	222	108	201	273
Coefficient of Variation	0.96	1.25	0.86	1.26
Number of Households	49	46	47	47
(Outlier Households removed)	(3)	(1)	(2)	(2)

Weekly observations for July 1989 have been excluded.
CESA-MSU Food Security Project Surveys, 1988/89

Table A4.3.16.

Average Weekly Household Expenditures on Cereals per AE by Season, 1988/89
On-River Villages (Temera and Bara; Gao Region, Mali)

Percent

	Seasonal Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Millet	26.1	13.2	33.4	32.4
2. Sorghum	20.3	3.4	18.1	34.2
3. Maize	2.0	3.1	2.5	0.9
4. Maizemeal	3.2	2.7	6.9	1.2
5. Paddy	23.4	44.9	27.4	10.7
6. Local Rice	17.1	20.5	8.0	12.5
7. Other Rice	.	.	.	.
8. Wheat	0.1	0.0	.	.
9. Wild Fonio	3.5	1.7	1.2	8.1
10. Cram-cram	2.3	10.0	2.6	.
Total	100.0	100.0	100.0	100.0
Number of Households	49	46	47	47

Weekly observations for July 1989 have been excluded.
CESA-MSU Food Security Project Surveys, 1988/89

Annex 5.1. Determining a Threshold of Household Food Security

Annex 5.1 describes the procedure used to obtain a measure of nutritionally adequate consumption in terms of adult-equivalents for the rural households surveyed in the Gao Region of Mali.

The first question is where to take the measurement. Ultimately, food security must be measured according to the nutritional status of the individual. Pinstrup-Andersen diagrammatically shows the diverse influences on the nutritional status of an individual within the household, not the least important of which is the health of the individual at the moment food is ingested (Pinstrup-Andersen, 1989, Table 1). The synergism between health and nutritional status is well known: illness decreases or inhibits the absorption of nutrients in the diet while poor nutritional status weakens the body's resistance to infectious or parasitic diseases and slows the recovery process (Sundberg, 1988).

This dissertation stops short of assessing the health status of household members or measuring actual food intake. As noted in Chapter 3, measurement of household cereals consumption is based on an accounting approach in which cereals disappearance, or apparent consumption, equals initial cereal stocks plus additions to stocks minus drawdowns of stocks plus ending stocks. This residual volume can be divided among household members on either a per capita or per adult-equivalent basis. Annex 5.1 uses the adult-equivalent approach which more closely approximates caloric needs of each member. The nutritional adequacy of this consumption bundle of cereals can be evaluated according to Malian and international standards as an indication for food security of household members in adult equivalent terms.

A5.1.1. Estimating Nutritional Requirements per Adult-Equivalent

Two approaches will be used to fix a standard for an adequate nutritional intake. Both approaches will use calories as the unit of measure based on the values in Table A5.1.1. below (the same coefficients used in Chapter 5). The first approach works down from an international standard of total caloric requirements to determine the share of calories represented by cereals. Calories derived from cereals within total calories consumed will be alternatively weighted as 70 percent, 80 percent and 90 percent, corresponding to the range of historical survey data (FAO, 1989, p. 5). The inverse approach builds up from a given cereals consumption objective specific to Mali, converted into calories, to determine total caloric needs where the contribution of cereals will again be weighted as 70 percent, 80 percent and 90 percent. Results from the two approaches and the different weights assigned to cereals will be compared, from which one standard will be determined.

A5.1.1.1. International Energy Requirements Approach

The first approach is based on international nutrition standards for daily average energy requirements, expressed as calories. These standards were most recently set by the Joint FAO/WHO/UNU Expert Consultation on Energy and Protein Requirements, held in 1981, whose recommendations were published in 1985 (WHO).

For a healthy person, energy needs are largely determined by energy expenditure. The energy costs of various occupational and discretionary activities were calculated as a multiple of the basal metabolic rate (BMR), defined as the obligatory rate of energy loss for an individual in the "postabsorptive state and at complete rest" (WHO). These energy costs were weighted by the time (hours and minutes) allocated to each activity during the course of a 24-hour period and then summed as the total daily average energy requirement. The BMR varies according to body weight, age, gender, level of physical activity, health and, in the

Table A5.1.1. Calorie Conversion Table for Cereals
(Kcal per 1000 grams edible portion)

	Kcal		kcal
Millet, grain	3400	Wheat, grain	3320
Millet, flour	3350	Wheat, flour	3400
		Wheat pasta, dry	3690
Sorghum, grain	3420	Fonio, hulled	3490
Sorghum, flour	3350	Fonio, paddy	3320
Maize, grain, dried	3640	Cram-cram, paddy	3600
Maize, meal	3680	Cram-cram, cleaned	3700
Rice, hulled	3620		
Rice, paddy	3350		

Source: Sundberg and Adams, based on HEW/FAO, Food Composition Table for Use in Africa, 1968; West *et al.*, "The Composition of Foods Commonly Eaten in East Africa," 1988. Caloric value of uncleaned cram-cram estimated by the author.

case of women of child-bearing ages, pregnancy and lactation. Energy costs for a given activity likewise vary across categories.

Based on FAO/WHO/UNU recommendations, Tables A5.1.2 and A5.1.3 calculate a weighted average daily energy requirement for four age classes for which recent demographic data are available (less than one year old, 1 through 12 years, 13 through 59 years, and over 60 years of age) which also correspond to household composition data (0 through 12 years and 13 and over).[1] Figures for adults in Table A5.1.4 assume first, that men attain a weight

[1]Demographic data come from the administrative and tax census of 1986 (*Ministère de l'Administration territoriale,* 1987). For children, census data are based on the age brackets, less than 1 year old and 1 through 13 years, while CESA/MSU survey data for children are based are based on one bracket, 0 through 12 years. To make these brackets correspond, census data for year 13-14 were transferred by simple extrapolation to the adult age bracket

Table A5.1.2.
Calculation of Average Daily Energy Requirements (Kcal) for Children by Age (0-13), Gender, Median Weight and Moderate Level of Activity

A. Calculation of Daily Energy Requirement (Kcal), Ages 0-1 Year Old

Month	Boys	Girls	Sum	Months	Average
0-1	470	445	915	0-3	520
1-2	550	505	1055	4-6	700
2-3	610	545	1155	7-9	810
				10-12	950
Total			3125	Total	2980
Average			520.8	Average	745
Rounded			520		

B. Calculation of Daily Energy Requirement (Kcal), Ages 1-13 Years Old

Year	Boys	Year	Girls
1-2	1150	1-2	1150
2-3	1350	2-3	1350
3-4	1550	3-4	1550
4-5	1550	4-5	1550
5-6	1850	5-6	1750
6-7	1850	6-7	1750
7-8	2100	7-8	1800
8-9	2100	8-9	1800
9-10	2100	9-10	1800
10-11	2200	10-11	1950
11-12	2200	11-12	1950
12-13	2400	12-13	2100
Sum	22400	Sum	20500
Average	1866.7	Average	1708.3
Rounded	1867	Rounded	1708

Source: WHO, Tables 21, 48 and 49.

14-59 years. The resulting census data for less than 1 year old and 1 through 12 years and census data for 13 through 59 years and 60 years and above were aggregated into one bracket each, 0 through 12 years and 13 years and over, respectively.

Table A5.1.3. Calculation of Average Daily Energy Requirements (Kcal) for Men and Women by Age (13-60+), Median Weight and Moderate Level of Activity

Year	Men (Kcal)	Year	Women (Kcal)
13-14	2400	13-14	2100
14-16	2 x 2650	14-18	4 x 2150
16-18	2 x 2850	18-32	14 x 2707
18-30	12 x 3000	32-60	28 x 2350
30-60	30 x 2950		
Sum	137900	Sum	114398
Average	2934.0	Average	2434
Rounded	2934	Rounded	2434

Year	Men (Kcal)	Year	Women (Kcal)
60+	2450	60+	2100

Assumptions: Men reaching 65 kg at age 18; women reaching 55 kg at age 18; moderate level of activity (1.8 BMR).

Women: Calculation of Additional Energy Requirements (kcal) during Pregnancy and Lactation

1. Assume 7.0 births per woman of child-bearing age (15-49) in Mali (1988); Source: World Bank World Development Report, 1990, Table 27: Demography and Fertility.
2. Assume one birth per two-year cycle, from age 18-19 through age 31-32.
3. Assume full activity during pregnancy: 285 kcal per day over 9 months.
4. Assume lactation requirement: 500 kcal per day for one year.

Year		**(kcal)**
1	base requirement:	2350.00
	pregnancy (285 kcal x 0.75 yr):	213.75
2	base requirement:	2350.00
	lactation (500 kcal x 1 yr):	500.00
	Sum	5413.75
	Annual Average	2706.88
	Rounded	2707

Source: WHO, Tables 42-50.

of 65 kg by age 18 and maintain it; second, that women attain a weight of 55 kg by 18; and third, that both men and women participate in a "moderate level of activity," equivalent to an energy expenditure of 1.8 BMR.[2]

Table A5.1.4 calculates an age-weighted average daily calorie requirement for children, aged 0-13 years, based on demographic data for the Gao Region. This average requirement is rounded to 1610 calories per day.

Next, the table calculates a composite, age-weighted average daily calorie requirement for adults, based on international standards applied to demographic data from the Gao region and on the stated assumptions concerning the body weights of adult men and women, their level of physical activity, and the extra energy requirements of pregnant and lactating women. Table A5.1.4 shows that average daily energy requirement for adults is approximately 2,650 kcal.

Lastly, the table expresses the average daily calorie requirement for children as a percent of average daily calorie requirements for adults in order to establish an adult-equivalent (AE) weight for children. According to Table A5.1.4, the age-weighted child

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[2]It may be questioned whether the recommended energy requirements for a "moderate physical activity" is sufficient for rural farming households whose activities are often seasonally labor intensive. Mondot-Bernard estimates that mean daily requirements are 2700 calories for adult men farmers and 2600 calories for adult women farmers, compared to her national per capita requirement of 2400 calories, representing 110 percent of needs (Mondot-Bernard and Labonne, pp. 52-53). Similarly, Dos Santos and Damon believe that adult men farmers require an additional 500-1000 calories per day to their base requirement of 2350 calories and that adult women easily require 3000 calories (Dos Santos and Damon, p. 24).

Nonetheless, a moderate level of physical activity will be retained for two reasons. First is the apparently low percentage of sedentary farmers in the Gao region, roughly 40 percent in 1970 (Piché and Gregory, p. 174), but probably somewhat higher now. Of the two (of five) predominantly agricultural survey sites, Temera and Bara, intensive double-cropped irrigated rice production is found only at Bara. Secondly, a non-sedentary pastoral lifestyle seems to require fewer daily calories than a farming lifestyle (Mondot-Bernard and Labonne, pp. 200-201), tending to lower the overall average.

Table A5.1.4.
Calculation of Average Daily Caloric Requirements for Children in terms of Adult Equivalency: Gao Region

Children: Ages	Children: Number	Daily Calories	Total Daily Calories
Boys 0-1	10143	745	7556535
Boys 1-13	45108	1867	84216636
Girls 0-1	8593	745	6401785
Girls 1-13	46210	1708	78926680
Total	110054		177101636
Weighted Average Daily Calories for Children			**1609.2**
Rounded			**1610**

Adults: Ages	Adults: Number	Daily Calories	Total Daily Calories
Men 13-60	123532	2934	362442888
Men 60+	14063	2450	34454350
Women 13-60	111513	2434	271422642
Women 60+	13569	2100	28494900
Total	262677		696814780
Weighted Average Daily Calories for Adults			**2652.7**
Rounded			**2650**

Children as Adult-Equivalents (1610 kcal / 2650 kcal)	**0.6075**

Sources: *Ministère de l'Administration Territoriale*, 1987; WHO, 1985.

represents 0.6075 AE in terms of calorie requirements. Further, the ratio of total population to its adult-equivalent population is 1.13 (372,731/329,436).[3]

A5.1.1.2. Malian Cereals Requirements Approach

The second approach is based on cereals requirements for Mali. Table A5.1.5 compares various estimates of annual per capita cereals requirements and their corresponding daily per capita total caloric requirements, where available. The study by Mondot-Bernard and the Mali Food Strategy were the first to assign explicit weights to cereals within total caloric requirements, 71 percent and 70 percent, respectively (Mondot-Bernard and Labonne, 1982, p. 63; *Ministère de l'Agriculture*, 1982, p. 20).

More recently, the year-long 1988/89 budget-expenditure survey of 3,400 households throughout Mali established a weighted average consumption figure of 212.4 kg of cereals per capita per year (*Ministère du Plan/DNSI/PADEM*, 1990).[4] This average consumption figure does not represent a nutritional norm (based on the nutrients in such a quantity of cereals). However, this figure has become an implicit consumption benchmark among certain government and donor circles,[5] for which a caloric value can be derived. These consumption data are also reported in Table A5.1.5.

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[3]For Mali as a whole, one child is equivalent to 0.6318 adults and the ratio of total population to AE population is 1.15.

[4]As shown in Table 5.1 in Chapter 5, the national consumption average (212.4 kg) and the average for the Gao Region (212.9 kg) are unexpectedly similar to each other (although composition by cereal differs). This small variation in quantity accounts for a marginal difference of 10 calories, effectively making the national cereals consumption average interchangeable with average cereals consumption in the Gao Region.

[5]Personal communication from Yves Gueymard, representative of France (*Fonds d'aide et de coopération*) to the PRMC, December 1990.

Table A5.1.5. Annual Per Capita Cereals Consumption Requirements/Average and Daily Per Capita Caloric Requirements/Average

A. Per Capita Cereals Consumption Requirements/Average in Kilograms per Year

				Northeast, 1982			
	1961-63	1972-74	1974-78	farmers	herders	1982	Average, 1988-89
Total	..	..	206.3	170.0	170.0	168.3	212.4
Millet	..	..	..	166.6	146.9	..	120.2
Maize	..	..	..	..	..	..	35.4
Rice	..	..	27.5	3.4	7.9	35.0	50.1
Wheat	..	..	..	..	7.9	..	2.4
Other	..	..	..	..	..	..	4.4
Coarse Grains	..	..	178.8	..	..	133.3	..

B. Per Capita Consumption Requirements/Average in Calories per Day

				Northeast, 1982			
	1961-63	1972-74	1974-78	farmers	herders	1982	Average, 1988-89
Total	2350	2350	..	2400	2200	2450	..
(Cereals)	..	..	1943	1757	1625	1715	2035
(Millet)	..	..	..	1723	1462	..	605
(Maize)	..	..	..	..	..	..	519
(Rice)	..	..	273	34	76	350	496
(Wheat)	..	..	..	..	88	..	354
(Other)	..	..	..	..		..	21
							40
(Coarse Grains)	..	..	1670	..		1360	..

Note: Millet includes sorghum; coarse grains are comprised of millet, sorghum and maize. Data shown for 1988/89 are derived from national average per capita consumption and do not represent (part of) a nutritional requirement. Sources: FAO, 1977 (Appendix C.), for 1961-63 and 1972-74; *Direction Générale du Plan*, 1974, p. 40, for 1974-78 (figures raised by 25 percent to correspond to requirements, implicit caloric requirements based on requirements in kilograms); Mondot-Bernard and Labonne, pp. 62, 200-201, for the Northeast, 1982 (projected requirements for 1990, figures in grain equivalent, rounded); *Ministère de l'Agriculture*, 1982, p. 50, for 1982; and *Ministère du Plan/DNSI/PADEM*, 1990, for 1988/89 (for which caloric values are derived, figures rounded).

Note that these per capita cereals requirements and their equivalent values in calories can be expressed in terms of adult-equivalents by multiplying 1.13, the factor used in the previous section to convert total population to adult-equivalent population for the Gao region. Thus, the total daily energy requirement of 2400 kcals per capita for farmers in the Northeast becomes 2715 kcal per AE; that for herders becomes 2489 kcals per AE; and the national requirement of 2450 kcal becomes 2772 kcal per AE. By the same token, the most recent average consumption figure of 212.4 kg per capita or 2035 kcal per day per capita can be expressed as 240.3 kg per AE or 2300 kcal per AE, respectively.

A5.1.2. Selection of a Nutrition Standard and a Cut-off Level of Food Security

Table A5.1.6 summarizes two nutrition standards per adult-equivalent based on the FAO/WHO/UNU adult energy requirements and the new average per capita cereals consumption figure for Mali, established by the Ministère du Plan, converted to calories on an adult-equivalent basis. The table shows that both estimates are very sensitive to assumptions about the percent contribution of cereals calories to total calories. For example, going from 70 percent contribution of calories from cereals to 80 percent (lefthand column) represents an incremental cereals consumption of 27.6 kg per AE (based on 1 kg cereals equals 3500 kcal). Likewise, going from 70 percent contribution of calories from cereals to 80 percent (righthand column) represents a decrease in cereals consumption of 42.8 kg per AE.

Note that these two standards are equivalent when cereals contribute 86.8 percent of total calories. This percent contribution, although falling safely within the range of survey data, appears somewhat higher than commonly thought. As shown in Table A5.1.7, FAO data for Mali over the past 30 years indicate that the average contribution of cereals typically lies within the range of 75-80 percent. The most recent estimates show cereals contributing

Table A5.1.6.
Equivalency between Total Average Daily Energy Requirements and Average Daily Energy Requirements derived from Cereals, per Adult-Equivalent

1. FAO/WHO/UNU, 1985			2. Ministère du Plan, 1990		
Average daily *energy* requirements for adults (rounded)	2650	kcal	Average daily *cereals* consumption for adults (rounded)	2300	kcal
Calories derived from cereals, assuming contribution of cereals is:			Total calories, assuming contribution of cereals is:		
70 percent	1855	kcal	70 percent	3285	kcal
80 percent	2120	kcal	80 percent	2875	kcal
90 percent	2385	kcal	90 percent	2555	kcal
86.8 percent	2300	kcal	86.8 percent	2650	kcal

79 percent of all calories in 1985 (FAO, 1989, p.4) and 79 percent of all *purchased* calories in Gao-City during 1985/86 (Rogers and Lowdermilk, 1988b, p. 10). However, the apparent overvaluation of 8-10 percent when the two nutrition standards in Table A5.1.6 are equivalent may simply reflect the record harvest and per capita availability during 1988/89 (see Table 2.4 in Chapter 2), the same year in which the rural households in Gao were surveyed.

Taking all these considerations into account, this dissertation will establish a threshold of food security based on a contribution of cereals to total calories of 85 percent, a round number close to the equilibrium contribution of 86.8 percent. Thus, 85 percent of the international requirement of 2650 kcal per adult is 2252.5 kcal, rounded to 2250 kcal. This caloric contribution from cereals is about 50 kcal (or 2 percent) less than the Ministry of Planning's derived caloric contribution of cereals of 2300 kcal per adult.

Table A5.1.7.
The Per Capita Contribution of Cereals to Total Energy and Total Protein Intake in Mali

	Total Energy (kcal)	Energy from Cereals (kcal)	Percent Energy from Cereals	Total Protein (g)	Protein from Cereals (g)	Percent Protein from Cereals
1961-65	2016	1532	76.0	55.8	35.3	63.0
1967	2040	1546	75.8	56.4	34.7	61.2
1968	2116	1606	75.9	57.8	36.0	62.0
1969	2107	1601	76.0	57.9	35.8	61.5
1970	2124	1604	75.5	57.6	35.7	61.8
1971	1980	1480	74.7	54.4	33.2	60.8
1972	1800	1381	76.7	48.2	30.8	63.6
1973	1799	1397	77.7	47.1	31.7	67.0
1974	1956	1524	77.9	51.5	34.9	67.5
1975	2065	1591	77.0	54.7	36.1	65.6
1976	2131	1639	76.9	56.0	36.6	65.0
1977	2101	1594	75.9	55.4	35.7	64.1
1979-81	1883	1391	73.9	..	..	..
1981-83	1808	1339	74.0	50.3	29.7	59.0
1985	2032	1605	79.0	54.6	35.7	65.4

Note: Total calories and protein exclude alcohol. Sources: FAO, 1977a, for 1961-65 through 1977; FAO, 1985b, for 1979-81; FAO, 1989, for 1981-83 and 1985.

Reardon, Matlon and Delgado, in their study of household food security in the drought affected areas of neighboring Burkina Faso, established an average daily caloric intake for a moderately active adult at 2850 kcals (Reardon, *et al.*, p. 1066). This figure, also based on FAO/WHO/UNU recommendations, differs from that calculated for Gao (2650 kcal) due to the different demographic profile in Burkina Faso and a higher cutoff used for children (age 15, rather than 13), having the effect of skewing average caloric requirements for adults upwards.[6] Reardon, Matlon and Delgado use 80 percent of average caloric requirements as the level above which adult-equivalent household members are considered "consumption secure" if this level is met during at least three-fourths of the survey period (Reardon, *et al.*).

The choice for this dissertation of 85 percent of total required calories as the cutoff level per adult-equivalent within the household nonetheless corresponds closely to the ***absolute*** cutoff level used by Reardon et al. (2650 kcal x 0.85 = 2250 kcal compared with 2850 kcal x 0.8 = 2280 kcal, a slight difference of 1.3 percent). This dissertation will also consider that a household is consumption secure if the average adult-equivalent within a household consumes the caloric equivalent from cereals which is at least equal to 85 percent of 2650 kcal per day — or 2250 kcal per day — during at least two of the three four-month seasons surveyed.

A5.1.3. In Defense of Calories as a Proxy for Sufficient Nutritional Intake

The composition of food may be broken into three broad categories: calories (for body energy), proteins (for body maintenance and growth) and vitamins and minerals (for body protection against illness). Given the requirement for all three categories of nutrients, the question arises whether defining household food security on the basis of calorie consumption alone represents a valid approach. The answer, in brief, is that calorie intake remains a more universal measure of nutritional status and hence a very useful proxy indicator.

Part of the confusion about the supposed inadequacy of calories stems from the notion of protein-calorie malnutrition (PEM). While a specific form of severe malnutrition caused

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[6] Thomas Reardon, personal communication, November 1990.

by a diet high in carbohydrates and low in proteins is known as kwashiorkor, affecting infants and children, the term PEM came to describe the total spectrum of severe malnutrition, including both kwashiorkor and marasmus, the wasting of body tissue due to deficiencies in all nutrients (CDC, in Sheets and Morris, pp. 132-133). Nevertheless, the term protein-energy malnutrition is misleading because in most instances, malnutrition is the result of insufficient energy intake (Sukhatme, in Strauss and Thomas; Rivers, p. 63) and protein deficiency as such almost never occurs (McLaren, in Rivers).

Use of calories as an indicator of food security and nutritional balance is defended on the grounds that a portion of total calories is supplied as protein and that calories from cereals are a significant source of protein (Dos Santos and Damon; Watier), as shown by the percent contribution of cereals in Table A5.1.7. For example, millet, sorghum and maize represent important sources of protein supplements with protein-energy ratios of about 10 percent (the percent of calories coming from protein as measured in grams). The protein-energy ratio of the wild cereal, cram-cram, is even higher at 18 percent (HEW/FAO). Generally, in a diet where the protein-energy ratio is at least 10 percent, meeting caloric requirements will also meet protein requirements (Sundberg, 1988).[7]

Even diets high in cereals provide sufficient protein (Dos Santos and Damon; Rivers; Sundberg, 1988) and are likely to satisfy the nutritional needs of even infants and children, provided that sufficient foods are available to cover caloric needs; otherwise, a part of

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[7]According to Rivers, "an adult maintaining weight requires about 8 percent of...energy as mixed proteins and a fast growing child about 10 percent. If the protein is very good quality these figures would be reduced to 4 percent and 6 percent. Most diets in the world provide 10-15 percent of the energy as protein, cereals alone provide 8-11 percent" (Rivers, footnote, p. 85).

Diets where this ratio is difficult to achieve are those where the staple is a starch, such as yams or cassava (Sundberg, personal communication, 1991). Starchy staples are virtually unknown in Northeastern Mali.

proteins will be metabolized as energy (Watier). The problem is that calorie consumption is often seasonally less than calorie needs.

The overwhelming nutrition problem then seems to be simply getting enough calories (Falcon). For starving people, energy deficiency, not protein deficiency, is critical. This energy deficiency can be corrected by supplying more of ordinary and available foods, including cereals (Rivers). When energy intake rises, so does protein intake as well as many of the nutrients associated with proteins in food (WHO). Even the extreme case of total deprivation is a race between energy deficiency and various mineral and vitamin deficiencies, rather than protein deficiencies (Rivers).

Clearly, no single food, or class of foods such as cereals, can hope to provide all nutrients. Cereals do not provide all essential minerals, such as calcium, or vitamins, such as Vitamins A and C (Sundberg, 1988; Watier). A diversity of food sources in the diet, therefore, is required to ensure a desirable nutritional balance. While diversity may be difficult to achieve in the Northeast as supplies vary seasonally, a "balanced diet" remains the objective of the Food Strategy of Mali (*Ministère de l'Agriculture*, 1982).

Nonetheless, calories (like prices) embody a great deal of information about the adequacy of nutritional intake. Knowing that these calories are derived from cereals makes this information more specific. All things considered, calories will be retained as a robust measure for the food security status of rural household members.

Annex 5.2. Average Daily Calories from Cereals by Season: Summary Tables

Seasonal summaries of household cereals consumption by strata are presented in support of Chapter 5. These tables are aggregated by season and strata, but not disaggregated by consumption terciles. The first table in each set per stratum displays average seasonal calorie consumption by cereal and by source of procurement. The second table puts the same information in percentage terms.

Tables in Annex 5.2 correspond directly with Tables 5.4 - 5.7 (calorie consumption by cereal) and Tables 5.8 - 5.11 (calorie consumption by source), for the respective stratum, in terms of annual and seasonal averages and participating households. Statistical outliers (households whose cereals consumption per AE was greater than $\pm$ 3 standard deviations from the seasonal or annual mean consumption) have been removed.

The full set of observations are available for most households (although cereals consumption of households was not recorded for the first month in Almoustarat and Djebok). While a large majority of households participated throughout the year-long survey, a few households dropped out. These were replaced by randomly selected substitute households. Removal of outlier households and replacement of drop-out households with substitute households result in a slight variation in participating households and their number per season.

A summary of available observations per household is shown below for the annual average, where *n* refers to the maximum number of monthly observations, 12.

	All Observations (n) or (n-1) Observations		All Observations (n), (n-1) Observations or (n-2) Observations		Number of Minimum Observations (3)	
North (N=45)	39	86.7%	41	91.1%	0	0%
South (N=53)	41	77.4%	43	81.1%	3	5.7%
Off-River (N=69)	55	79.7%	57	82.6%	4	5.8%
On-River (N=51)	45	88.2%	47	92.2%	0	0%

The first column of each annex table represents an annual average of monthly household observations, not an average of the seasonal observations. At least two observations were required for a household to be included in each seasonal average. At least three observations were required for a household to be included in each annual average. Note that a seasonal outlier household, whose observation was removed for a seasonal average, may not be an outlier for the annual average, for which its observation is included. Thus, the number of households in the annual average may slightly exceed the number in any given seasonal average. For this reason, the annual average exceeds the range of the seasonal averages in a few instances.

Table A5.2.1.

Average Monthly Household Consumption of Cereals per Adult-Equivalent, 1988/89
North Villages (Almoustarat and Temera, Gao Region, Mali)

Kilocalories

By Cereal	Annual Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Millet	823	601	896	853
2. Sorghum	12	24	9	5
3. Maize	139	103	210	118
4. Paddy	433	1074	204	85
5. Local Rice	43	34	34	29
6. Other Rice	56	97	49	4
7. Wild Fonio	162	359	40	134
8. Cram-cram	68	161	63	6
By Source				
1. Home Production	288	842	75	.
2. Gathering	125	318	28	91
3. Market Purchases	1174	1177	1240	980
4. Non-Market Barters	1	4	1	.
5. Aid and Transfers	140	112	162	143
6. Seed Reserves	7	.	.	21
Average Daily Calories	1736	2453	1505	1235
Coefficient of Variation	0.38	0.43	0.46	0.43
Gini Coefficient of Equality	0.21	0.24	0.25	0.23
Number of Households	45	45	45	41
(Outlier Households removed)	(0)	(0)	(0)	(1)

CESA-MSU Food Security Project Surveys, 1988/89

Table A5.2.2.

Average Monthly Household Consumption of Cereals, 1988/89
North Villages (Almoustarat and Temera, Gao Region, Mali)

Percent

By Cereal	Annual Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Millet	47.4	24.5	59.5	69.0
2. Sorghum	0.7	1.0	0.6	0.4
3. Maize	8.0	4.2	14.0	9.6
4. Paddy	25.0	43.8	13.6	6.9
5. Local Rice	2.5	1.4	2.2	2.4
6. Other Rice	3.2	4.0	3.2	0.3
7. Wild Fonio	9.4	14.7	2.7	10.9
8. Cram-cram	3.9	6.6	4.2	0.5
Total	100.0	100.0	100.0	100.0
By Source				
1. Home Production	16.6	34.3	5.0	.
2. Gathering	7.2	13.0	1.8	7.4
3. Market Purchases	67.6	48.0	82.4	79.3
4. Non-Market Barters	0.1	0.2	0.0	.
5. Aid and Transfers	8.1	4.6	10.7	11.6
6. Seed Reserves	0.4	.	.	1.7
Total	100.0	100.0	100.0	100.0
Number of Households	45	45	45	41

CESA-MSU Food Security Project Surveys, 1988/89

Table A5.2.3.

Average Monthly Household Consumption of Cereals per Adult-Equivalent, 1988/89
South Villages (Bara and Tessit, Gao Region, Mali)

Kilocalories

By Cereal	Annual Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Millet	619	442	851	523
2. Sorghum	222	129	279	296
3. Maize	3	.	9	1
4. Paddy	975	1655	739	711
5. Local Rice	156	204	152	85
6. Other Rice	1	0	3	.
7. Wild Fonio	394	311	107	593
8. Cram-cram	.	.	.	.
By Source				
1. Home Production	1005	1827	724	646
2. Gathering	290	189	.	489
3. Market Purchases	862	548	1117	883
4. Non-Market Barters	39	32	3	74
5. Aid and Transfers	168	145	285	107
6. Seed Reserves	7	.	9	11
Average Daily Calories	2371	2741	2139	2211
Coefficient of Variation	0.34	0.46	0.50	0.40
Gini Coefficient of Equality	0.19	0.26	0.26	0.22
Number of Households	53	49	49	49
(Outlier Households removed)	(2)	(0)	(0)	(1)

CESA-MSU Food Security Project Surveys, 1988/89

Table A5.2.4.

Average Monthly Household Consumption of Cereals, 1988/89
South Villages (Bara and Tessit, Gao Region, Mali)

Percent

By Cereal	Annual Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Millet	26.1	16.1	39.8	23.6
2. Sorghum	9.4	4.7	13.0	13.4
3. Maize	0.1	.	0.4	0.1
4. Paddy	41.1	60.4	34.5	32.1
5. Local Rice	6.6	7.4	7.1	3.8
6. Other Rice	0.0	0.0	0.1	.
7. Wild Fonio	16.6	11.4	5.0	26.8
8. Cram-cram	.	.	.	.
Total	100.0	100.0	100.0	100.0
By Source				
1. Home Production	42.4	66.7	33.9	29.2
2. Gathering	12.2	6.9	.	22.1
3. Market Purchases	36.4	20.0	52.2	39.9
4. Non-Market Barters	1.6	1.1	0.2	3.3
5. Aid and Transfers	7.1	5.3	13.3	4.9
6. Seed Reserves	0.3	.	0.4	0.5
Total	100.0	100.0	100.0	100.0
Number of Households	53	49	49	49

CESA-MSU Food Security Project Surveys, 1988/89

Table A5.2.5.

Average Monthly Household Consumption of Cereals per Adult-Equivalent, 1988/89
Off-River Villages (Almoustarat, Djebok and Tessit, Gao Region, Mali)

Kilocalories

By Cereal	Annual Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Millet	953	759	1115	931
2. Sorghum	352	317	429	352
3. Maize	27	66	18	8
4. Paddy	17	17	23	12
5. Local Rice	118	156	121	66
6. Other Rice	93	133	96	56
7. Wild Fonio	376	470	103	468
8. Cram-cram	0	.	0	.
By Source				
1. Home Production	201	351	157	99
2. Gathering	270	276	24	392
3. Market Purchases	1238	1055	1411	1212
4. Non-Market Barters	23	7	.	57
5. Aid and Transfers	204	229	293	132
6. Seed Reserves	.	.	.	.
Average Daily Calories	1936	1918	1885	1893
Coefficient of Variation	0.41	0.43	0.44	0.46
Gini Coefficient of Equality	0.23	0.24	0.24	0.25
Number of Households	69	65	64	63
(Outlier Households removed)	(1)	(0)	(1)	(1)

CESA-MSU Food Security Project Surveys, 1988/89

Table A5.2.6.

Average Monthly Household Consumption of Cereals, 1988/89
Off-River Villages (Almoustarat, Djebok and Tessit, Gao Region, Mali)

Percent

By Cereal	Annual Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Millet	49.2	39.6	59.2	49.2
2. Sorghum	18.2	16.5	22.8	18.6
3. Maize	1.4	3.5	1.0	0.4
4. Paddy	0.9	0.9	1.2	0.6
5. Local Rice	6.1	8.1	5.4	3.5
6. Other Rice	4.8	6.9	5.1	3.0
7. Wild Fonio	19.4	24.5	5.4	24.7
8. Cram-cram	0.0	.	0.0	.
Total	100.0	100.0	100.0	100.0
By Source				
1. Home Production	10.4	18.3	8.3	5.2
2. Gathering	13.9	14.3	1.3	20.7
3. Market Purchases	64.0	55.0	74.8	64.0
4. Non-Market Barters	1.2	0.4	.	3.0
5. Aid and Transfers	10.5	11.9	15.5	7.0
6. Seed Reserves	.	.	.	.
Total	100.0	100.0	100.0	100.0
Number of Households	69	65	64	63

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Table A5.2.7.

Average Monthly Household Consumption of Cereals per Adult-Equivalent, 1988/89 On-River Villages (Bara and Temera, Gao Region, Mali)

Kilocalories

By Cereal	Annual Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Millet	261	106	347	323
2. Sorghum	138	52	117	198
3. Maize	112	54	196	100
4. Paddy	1372	2567	794	767
5. Local Rice	68	90	50	31
6. Other Rice	1	.	.	3
7. Wild Fonio	83	133	19	112
8. Cram-cram	60	145	59	5
By Source				
1. Home Production	1079	2242	515	519
2. Gathering	75	191	5	69
3. Market Purchases	824	609	939	824
4. Non-Market Barters	10	28	4	.
5. Aid and Transfers	94	77	110	100
6. Seed Reserves	13	.	9	29
Average Daily Calories	2096	3148	1582	1540
Coefficient of Variation	0.38	0.38	0.45	0.51
Gini Coefficient of Equality	0.21	0.21	0.25	0.28
Number of Households	51	50	48	49
(Outlier Households removed)	(1)	(0)	(2)	(0)

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Table A5.2.8.

Average Monthly Household Consumption of Cereals, 1988/89
On-River Villages (Bara and Temera, Gao Region, Mali)

Percent

By Cereal	Annual Average	Harvest/ Post-Harvest	Hot, Dry Season	Rainy Season
1. Millet	12.5	3.4	21.9	21.0
2. Sorghum	6.6	1.7	7.4	12.9
3. Maize	5.3	1.7	12.4	6.5
4. Paddy	65.5	81.6	50.2	49.8
5. Local Rice	3.4	2.9	3.1	2.0
6. Other Rice	0.1	.	.	0.2
7. Wild Fonio	4.0	4.2	1.2	7.2
8. Cram-cram	2.9	4.6	3.7	0.3
Total	100.0	100.0	100.0	100.0
By Source				
1. Home Production	51.5	71.2	32.5	33.7
2. Gathering	3.6	6.1	0.3	4.5
3. Market Purchases	39.3	19.3	59.3	53.5
4. Non-Market Barters	0.5	0.9	0.2	.
5. Aid and Transfers	4.5	2.5	7.0	6.5
6. Seed Reserves	0.6	.	0.6	1.9
Total	100.0	100.0	100.0	100.0
(Number of Households)	51	50	48	49

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Annex 8.1. Urban Wholesale Prices in Mali, 1988/89

A8.1. Methodology

The Food Security Project distributed a form to all participating traders for the purpose of recording monthly purchase and sales transactions, as well as gifts in kind. These forms were for the traders to keep as part of their own records. It was hoped that these "self-questionnaires" would encourage basic book-keeping on the part of those traders not keeping accounts. Once a month, Project enumerators copied these monthly transactions data onto the same form as the Project's copy, at which time transactions were verified. From time to time, enumerators filled out the forms directly by helping traders unable to read or write to reconstruct their daily transactions.

In order to make purchase prices from multiple sources comparable with each other, purchase price was defined as the *delivered price* to the trader's warehouse in the respective city — either the actual delivered price (purchase price at place of purchase plus all transfer costs on a per kilogram basis) or purchase price plus estimated transfer costs. Sales prices were defined as the *exit price* from the trader's warehouse.

Average monthly prices are weighted by quantity. Transactions by wholesalers (*grossistes*) and semi-wholesalers (*demi-grossistes*) have been combined for this price series. The larger volumes handled by wholesalers, however, weight these prices in favor of wholesalers.

See Chapter 8 for an analysis of marketing margins between wholesalers and semi-wholesalers. See Annex 8.2 for an enumeration of the numbers of traders in each urban sample.

A8.2. Adjustments to the Price Series

Generally, no adjustments have been made to the price series. A few transactions were excluded from analysis where it was clear that both purchase and sale of the same lot took place outside the trader's home market. Prices are expressed in nominal terms. Mean prices, on which the coefficients of variation are based, are simple averages of the weighted monthly prices. Coefficients of variation are given for markets with at least 10 monthly price observations.

A8.3. Definition of Local Rice

Local rice refers to locally grown and milled rice (hand pounded or mechanically milled). Local rice is distinct from rice grown in the large irrigated perimeters, such as *Office du Niger* or *Opération Riz Ségou*. This latter rice is milled industrially and separated into standard grades on the basis of the maximum percent of broken grains.

It is believed that little, if any, local rice from one region is traded within another region.[1]

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[1]Questionnaire data show only two purchases of local rice from outside the region, both by Tombouctou traders (40 tons from Mopti and 40 tons from Ségou). Data on location of purchase are unavailable for traders from Koutiala, Sikasso and Ségou.

Table A8.1.1.

Wholesale Millet Prices in Mali, 1988/89
(CFA Francs per Kilogram)

1. Millet Purchase Price

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	73.2	.	.	40.8	62.4	65.5	58.5
December	64.7	58.6	43.6	40.0	41.0	48.9	51.8
January 1989	60.3	62.4	46.1	39.8	40.9	51.7	52.1
February	67.1	60.8	43.3	39.8	44.5	57.8	55.2
March	62.7	59.0	43.2	45.8	47.3	59.5	56.3
April	61.0	59.7	44.8	42.4	41.3	55.1	49.3
May	61.2	54.9	43.4	42.0	38.6	52.1	53.4
June	60.1	53.2	41.1	34.1	41.1	52.1	49.5
July	.	53.4	42.0	32.2	39.5	52.2	52.3
August	55.4	54.7	39.3	32.8	33.1	51.6	53.6
September	44.4	51.8	38.4	30.1	34.4	47.4	48.5
October	44.3	58.1	44.3	31.3	39.1	48.7	46.7
Mean	59.5	56.9	42.7	37.6	41.9	53.6	52.3
CV	0.147	0.062	0.054	0.138	0.179	0.097	0.066

2. Millet Sales Price

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	84.9	.	.	60.3	75.4	74.2	65.3
December	79.5	72.1	47.6	45.7	48.0	61.5	63.9
January 1989	68.7	68.9	50.2	43.7	48.5	63.9	58.0
February	67.0	69.4	47.6	45.2	50.0	68.9	72.0
March	70.0	65.9	47.0	51.4	53.5	69.6	62.0
April	68.3	65.7	49.0	46.6	49.4	68.6	57.6
May	70.3	63.4	47.1	46.5	47.3	67.1	58.9
June	67.0	56.2	45.1	40.5	46.5	66.7	60.9
July	70.0	60.2	40.2	40.4	49.3	64.0	61.6
August	70.0	58.5	44.0	47.7	44.8	62.8	59.8
September	58.6	53.5	44.6	36.1	42.8	59.5	65.7
October	62.4	65.6	49.7	39.5	46.6	57.9	50.1
Mean	69.7	63.6	46.6	45.3	50.2	65.4	61.3
CV	0.099	0.092	0.063	0.133	0.167	0.071	0.087

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Table A8.1.2.

Wholesale Sorghum Prices in Mali, 1988/89
(CFA Francs per Kilogram)

1. Sorghum Purchase Price

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	73.7	.	.	38.3	43.4	44.4	53.7
December	60.3	63.2	46.2	39.8	40.8	46.0	44.9
January 1989	56.2	65.0	47.4	42.4	40.6	49.7	51.4
February	64.4	61.4	49.7	43.5	42.3	50.4	50.9
March	61.5	63.4	49.9	45.9	46.8	54.4	54.6
April	57.5	65.0	50.9	42.8	40.0	50.8	48.0
May	37.6	60.8	45.2	41.6	39.0	44.3	53.9
June	55.6	61.4	46.1	35.9	41.3	49.5	50.1
July	.	62.4	50.7	38.7	40.4	50.6	59.1
August	55.0	59.3	47.1	39.4	34.1	52.2	55.9
September	35.0	50.0	44.4	37.3	34.8	46.5	53.6
October	35.0	59.5	50.0	38.0	34.6	36.0	43.1
Mean	53.8	61.0	48.0	40.3	39.8	47.9	51.6
CV	0.235	0.068	0.049	0.073	0.095	0.102	0.088

2. Sorghum Sales Price

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	80.2	.	.	51.4	58.3	54.9	60.0
December	73.4	78.2	50.5	48.5	48.7	57.6	62.2
January 1989	60.1	74.1	51.6	48.7	48.4	59.5	58.1
February	63.5	74.8	53.6	48.9	48.6	60.1	72.0
March	70.0	74.6	59.6	51.8	52.0	61.1	59.5
April	65.0	74.0	56.8	47.5	48.2	61.2	55.2
May	55.8	69.8	46.1	45.4	47.2	54.4	60.0
June	59.3	68.1	51.8	45.5	47.8	62.1	59.9
July	60.0	66.5	55.7	49.9	50.5	59.8	64.2
August	60.0	70.0	54.6	51.8	44.8	60.7	60.9
September	50.0	62.9	49.8	43.6	42.3	58.7	65.6
October	.	65.5	54.6	49.1	44.5	49.2	51.8
Mean	63.4	70.8	53.2	48.5	48.4	58.3	60.8
CV	0.134	0.070	0.070	0.054	0.084	0.064	0.084

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Table A8.1.3.

Wholesale Maize Prices in Mali, 1988/89
(CFA Francs per Kilogram)

1. Maize Purchase Price

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	56.9	.	.	.	32.1	42.9	44.9
December	41.9	58.5	46.9	37.4	32.4	41.9	38.2
January 1989	30.1	42.5	25.0	35.0	37.0	41.2	52.2
February	31.0	.	35.0	.	39.5	50.3	50.5
March	33.4	.	.	45.0	40.7	53.9	50.4
April	35.9	.	.	.	39.6	48.0	43.1
May	31.9	.	35.0	.	40.0	44.5	55.3
June	30.0	.	.	.	40.0	45.1	38.0
July	.	.	.	.	39.6	49.0	60.0
August	.	40.0	.	.	34.5	49.9	.
September	30.0	.	.	40.0	33.4	44.4	50.2
October	25.0	.	35.0	30.0	25.0	34.9	40.0
Mean	34.6	47.0	35.4	37.5	36.2	45.5	47.5
CV	0.259	.	.	.	0.133	0.112	0.152

2. Maize Sale Price

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	54.5	.	.	.	43.7	53.7	51.4
December	57.3	70.0	49.4	41.1	39.3	51.5	47.1
January 1989	40.0	.	30.0	42.5	44.9	53.4	57.8
February	40.0	70.0	.	.	48.9	57.3	55.0
March	.	.	.	50.0	48.2	59.8	55.0
April	46.6	.	.	.	48.9	56.4	51.7
May	34.5	.	.	.	50.7	54.9	59.1
June	40.0	.	.	.	45.9	58.2	60.2
July	.	.	.	.	46.5	60.0	65.0
August	40.0	.	.	.	42.2	59.5	.
September	.	.	.	45.0	40.0	55.2	56.5
October	35.0	.	.	40.0	35.5	48.0	46.2
Mean	43.1	70.0	39.7	43.7	44.6	55.7	55.0
CV	0.091	.	.	.	0.103	0.066	0.103

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Table A8.1.4.

Wholesale Rice Paddy Prices in Mali, 1988/89
(CFA Francs per Kilogram)

1. Rice Paddy Purchase Price

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	99.4	.	.	.	.	.	.
December	98.3	.	.	.	.	.	.
January 1989	91.2	.	.	.	.	.	.
February	64.9	.	.	.	.	.	.
March	98.4	.	.	.	.	.	.
April	94.1	.	.	.	.	.	.
May	79.5	.	.	.	.	.	.
June	.	.	.	.	.	.	.
July	100.0	.	.	.	.	.	.
August	90.0	.	.	.	.	.	.
September	90.0	.	.	.	.	.	.
October	90.0	.	.	.	.	.	.
Mean	90.4	.	.	.	.	.	.
CV	0.114	.	.	.	.	.	.

2. Rice Paddy Sales Price

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	115.8	.	.	.	.	.	.
December	110.7	.	.	.	.	.	.
January 1989	115.7	.	.	.	.	.	.
February	81.5	.	.	.	.	.	.
March	111.8	.	.	.	.	.	.
April	101.7	.	.	.	.	.	.
May	96.6	.	.	.	.	.	.
June	100.0	.	.	.	.	.	.
July	100.0	.	.	.	.	.	.
August	100.0	.	.	.	.	.	.
September	100.0	.	.	.	.	.	.
October	105.0	.	.	.	.	.	.
Mean	103.2	.	.	.	.	.	.
CV	0.092	.	.	.	.	.	.

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Table A8.1.5.

Wholesale Local Rice Prices in Mali, 1988/89
(CFA Francs per Kilogram)

1. Local Rice Purchase Price

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	.	.	.	.	.	.	.
December	.	185.0	108.1	143.5	.	137.4	159.6
January 1989	160.0	200.0	101.0	138.3	.	146.0	172.7
February	166.5	.	85.4	137.5	.	160.7	160.0
March	165.0	.	90.7	161.4	.	160.9	.
April	.	.	89.9	146.2	.	152.9	155.3
May	.	.	99.7	145.0	.	171.3	147.6
June	135.0	.	94.4	150.0	.	170.7	153.7
July	.	120.0	97.3	156.4	.	166.0	149.1
August	.	130.0	100.4	159.0	.	167.5	166.0
September	.	121.4	90.9	155.9	.	168.9	165.4
October	.	.	99.7	.	.	160.9	.
Mean	156.6	151.3	96.1	149.3	.	160.3	158.8
CV	.	.	0.068	0.057	.	0.068	

2. Local Rice Sales Price

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	.	.	.	.	.	.	.
December	.	.	114.5	165.3	.	168.3	170.9
January 1989	190.0	.	109.8	153.2	.	175.0	183.6
February	160.0	.	100.0	150.0	.	172.4	167.9
March	.	.	90.0	175.0	.	174.4	.
April	.	.	97.0	164.3	.	190.0	169.2
May	.	.	108.3	162.5	.	190.0	162.9
June	145.0	190.0	98.9	170.0	.	190.0	167.7
July	.	125.0	102.6	171.4	.	180.0	168.3
August	.	.	108.0	170.0	.	180.0	177.5
September	.	127.9	104.2	170.0	.	180.0	175.6
October	.	123.6	107.0	.	.	182.7	170.0
Mean	165.0	141.6	103.6	165.2	.	180.2	171.0
CV	.	.	0.066	0.049	.	0.042	0.031

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Table A8.1.6.

Wholesale 80 Percent Brokens Rice (*Riz BB*) Prices in Mali, 1988/89 (CFA Francs per Kilogram)

1. 80 Percent Brokens Rice Purchase Price

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	186.4	.	.	.	.	.	152.0
December	166.0	.	.	.	.	.	152.5
January 1989	182.5	.	.	.	.	.	156.3
February	.	.	.	.	.	.	162.1
March	162.5	.	.	.	.	.	147.6
April	.	.	.	.	.	.	152.0
May	.	.	.	.	.	.	150.4
June	.	.	.	.	.	.	156.0
July	.	.	.	.	.	.	156.3
August	.	.	.	.	.	.	157.9
September	.	.	.	.	.	.	157.7
October	.	.	.	.	.	.	154.1
Mean	174.3	.	.	.	.	.	154.6
CV	.	.	.	.	.	.	0.025

2. 80 Percent Brokens Rice Sales Price

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	202.2	.	.	.	.	.	160.7
December	207.0	.	.	.	.	.	167.1
January 1989	195.0	.	.	.	.	.	156.9
February	.	.	.	.	.	.	164.8
March	170.0	.	.	.	.	.	158.8
April	.	.	.	.	.	.	161.9
May	.	.	.	.	.	.	163.4
June	.	.	.	.	.	.	166.6
July	.	.	.	.	.	.	163.7
August	.	.	.	.	.	.	160.8
September	.	.	.	.	.	.	164.8
October	.	.	.	.	.	.	160.3
Mean	193.6	.	.	.	.	.	162.5
CV	.	.	.	.	.	.	0.019

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Table A8.1.7.

Wholesale 40 Percent Brokens Rice (*Riz RM40*) Prices in Mali, 1988/89 (CFA Francs per Kilogram)

1. 40 Percent Brokens Rice Purchase Price

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	198.2	.	.	.	.	.	171.8
December	196.1	200.8	.	.	.	185.00	170.3
January 1989	179.7	.	.	160.0	.	.	189.2
February	174.8	173.7	.	160.0	.	.	173.7
March	175.6	169.0	.	175.8	.	.	173.7
April	141.6	183.3	.	.	.	176.6	167.2
May	151.0	142.7	.	.	.	178.8	162.7
June	182.2	177.0	.	.	.	178.8	166.0
July	.	165.0	.	.	.	185.0	150.9
August	150.0	180.0	.	.	.	185.0	160.2
September	155.0	149.8	.	.	.	175.7	166.9
October	.	.	.	165.0	.	175.0	166.5
Mean	170.4	171.3	.	165.2	.	180.0	168.2
CV	0.117	.	.	.	.	.	0.055

2. 40 Percent Brokens Rice Sales Price

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	208.7	.	.	.	.	.	186.2
December	204.3	195.5	.	.	.	200.0	180.1
January 1989	196.9	187.4	.	185.0	.	.	182.0
February	171.9	190.0	.	180.0	.	.	182.4
March	185.0	190.6	.	190.8	.	.	184.6
April	183.0	194.8	.	.	.	196.3	179.5
May	190.0	169.0	.	.	.	200.0	179.9
June	190.0	170.3	.	.	.	200.0	179.8
July	.	171.4	.	.	.	200.0	170.8
August	160.0	200.0	.	.	.	200.0	173.5
September	160.0	175.0	.	.	.	195.5	173.5
October	.	175.0	.	180.0	.	190.0	169.4
Mean	185.0	183.6	.	184.0	.	197.7	178.5
CV	0.091	0.063	.	.	.	.	0.030

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Table A8.1.8.

Wholesale 25 Percent Brokens Rice (*Riz RM25*) Prices in Mali, 1988/89
(CFA Francs per Kilogram)

1. 25 Percent Brokens Rice Purchase Price

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	200.0	.	.	168.5	.	188.5	.
December	.	180.0	.	180.0	.	.	160.1
January 1989	.	175.0	.	150.0	.	180.0	180.0
February	.	169.4	.	150.0	.	.	185.0
March	.	165.0	.	.	.	185.0	.
April	.	180.0	.	.	.	.	.
May	.	180.0	.	.	.	.	.
June	.	170.0	.	.	.	.	.
July	.	170.0	.	.	.	.	148.3
August	.	175.0	.	.	.	.	.
September	.	170.0	150.0	.	.	180.0	186.7
October	.	175.0	.	.	.	180.0	.
Mean	200.0	173.6	150.0	162.1	.	182.7	172.0
CV	.	0.029	.	.	.	.	0.099

2. 25 Percent Brokens Rice Sales Price

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	.	.	.	182.6	.	200.0	.
December	.	190.0	.	190.0	.	.	180.1
January 1989	.	190.0	.	170.0	.	180.0	195.0
February	.	190.0	.	170.0	.	.	180.3
March	.	190.0	.	.	.	200.0	.
April	.	190.0	.	.	.	.	.
May	.	190.0	.	.	.	.	.
June	.	180.0	.	.	.	.	.
July	.	180.0	.	.	.	.	155.0
August	.	180.0	.	.	.	.	.
September	.	180.0	155.0	.	.	197.2	184.4
October	.	185.0	.	.	.	200.0	.
Mean	.	185.9	155.0	178.2	.	195.4	179.0
CV	.	0.026	.	.	.	.	.

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Annex 8.2. Urban Wholesale Cereals Volumes Transacted in Mali, 1988/89

A8.2.1. Methodology

Data on cereal volumes transacted were collected at the same time as price data. The Food Security Project distributed a form to all participating traders for the purpose of recording monthly purchase and sales transactions, as well as gifts in kind. These forms were for the traders to keep as part of their own records. It was hoped that these "self-questionnaires" would encourage basic book-keeping on the part of those traders not keeping accounts. Once a month, Project enumerators copied these monthly transactions data onto the same form as the Project's copy, at which time transactions could be verified. From time to time, enumerators filled out the forms directly by helping illiterate traders reconstruct their daily transactions.

A8.2.2. Adjustments to the Volumes Series

No adjustments have been made to the volumes transacted. Monthly volumes are unweighted by the total number of wholesalers in each market. The total number of traders is not known with certainty because there is not a central registry of traders by market, the number of active traders varies in any month, and entry and exit is fluid.

The proportion of traders in the CESA-MSU Food Security Project sample in terms of *known* traders (on the basis of questionnaire data, section 8.2.5.) is given in the following table. This proportion may be slightly overstated in any given market. No distinction has been made between wholesalers (*grossistes*) and semi-wholesalers (*demi-grossistes*) whose transactions have been aggregated. Volumes transacted by traders in Ansongo and Bourem are not shown in this Annex.

Wholesale Market	**Number of Traders in Sample**	**Proportion of Known Traders**	**Weight for Total Volumes Transacted**
Tombouctou	11	0.65	1.55
Gao[1]	13	0.65	1.54
Mopti	16	0.73	1.37
Ségou	14	0.74	1.36
Koutiala	9	0.56	1.78
Sikasso	8	0.67	1.50
Bamako	32	0.65	1.53

The weight for total monthly volumes transacted is the inverse of the estimated portion of known traders. Monthly volumes may be multiplied by the appropriate weight to get an estimate of total volumes transacted for that wholesale market.

Volumes may be compared directly *across cities* for the same month or across cereals for the same city and the same month. To make monthly volumes comparable *within the same city*, it is necessary to divide by the appropriate number of days in the month and then multiply by 30.4167, the average number of days in each month.

The mean volume is the unweighted average of listed monthly volumes. Coefficients of variation are given for markets with at least 10 monthly volume observations.

A8.2.3. Definition of Local Rice

Local rice is defined in Annex 8.1.

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[1]This figure was valid through June 1989, after which one trader dropped out.

Table A8.2.1.

Wholesale Millet Transactions in Mali, 1988/89
(Metric Tons)

1. Millet Purchases

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	209	.	.	261	165	48	662
December	169	176	459	316	241	44	289
January 1989	239	360	634	621	161	29	626
February	147	298	595	625	148	28	3185
March	68	337	707	294	129	19	833
April	57	306	690	1145	194	40	694
May	88	260	743	1212	232	19	319
June	99	440	705	468	225	43	768
July	.	134	630	540	167	41	477
August	35	180	442	358	155	29	224
September	130	303	332	135	149	33	300
October	35	170	504	201	49	10	181
Mean	106.25	269.66	585.59	514.63	167.90	31.76	713.09
CV	0.695	0.353	0.227	0.676	0.312	0.365	1.223

2. Millet Sales

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	174	.	.	261	180	48	187
December	110	166	366	316	201	44	166
January 1989	94	229	614	621	161	29	440
February	100	120	517	625	148	28	3073
March	31	242	656	294	129	18	769
April	50	196	685	1145	194	40	381
May	58	112	743	1212	232	19	343
June	79	257	705	468	225	43	891
July	5	190	582	540	199	41	348
August	14	224	400	358	155	29	209
September	9	241	330	135	149	33	269
October	30	96	458	201	49	10	267
Mean	62.68	188.55	555.47	514.61	168.48	31.66	611.83
CV	0.801	0.304	0.261	0.676	0.295	0.370	1.319

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Table A8.2.2.

Wholesale Sorghum Transactions in Mali, 1988/89
(Metric Tons)

1. Sorghum Purchases

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	49	.	.	113	246	50	809
December	71	28	98	178	268	48	806
January 1989	120	21	112	343	121	32	804
February	135	46	201	263	169	25	4083
March	50	142	56	116	133	20	813
April	10	115	50	162	200	26	299
May	54	34	102	117	143	19	297
June	54	28	43	179	134	27	762
July	.	15	66	143	145	42	649
August	22	45	67	55	135	31	486
September	10	13	18	58	124	32	593
October	20	119	53	67	146	28	232
Mean	49.58	54.99	78.77	149.42	163.67	31.51	886.02
CV	0.860	0.852	0.623	0.569	0.298	0.320	1.163

2. Sorghum Sales

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	50	.	.	113	261	50	265
December	64	41	93	178	268	48	342
January 1989	56	32	112	343	121	32	476
February	85	31	176	263	169	25	3962
March	27	75	37	116	133	20	713
April	15	83	43	162	200	26	267
May	31	47	102	117	143	18	282
June	37	34	21	179	133	29	577
July	3	7	69	143	145	42	743
August	3	22	47	55	135	31	751
September	4	31	18	59	124	32	495
October	.	50	51	67	146	28	435
Mean	31.15	41.08	69.81	149.42	164.88	31.68	775.64
CV	0.898	0.543	0.677	0.569	0.311	0.317	1.314

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Table A8.2.3.

Wholesale Maize Transactions in Mali, 1988/89 (Metric Tons)

1. Maize Purchases

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	23	.	.	.	105	39	1038
December	47	26	3	3.800	46	28	50
January 1989	115	0	39	5.000	16	25	7
February	30	.	1	.	10	15	29
March	17	.	.	0.800	36	12	62
April	53	.	.	.	38	14	21
May	34	.	0	.	34	9	17
June	5	.	.	.	13	11	4
July	.	.	.	.	29	15	40
August	.	12	.	.	26	22	.
September	3	.	.	20.000	21	20	17
October	10	.	2	25.000	81	16	22
Mean	28.04	3.48	4.13	4.964	37.84	18.65	108.76
CV	1.169	.	.	.	0.742	0.461	2.696

2. Maize Sales

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	21	.	.	.	109	39	44
December	13	1	3	4	46	28	36
January 1989	68	.	39	5	16	25	5
February	20	0	.	.	10	15	17
March	.	.	.	1	36	12	42
April	11	.	.	.	38	14	21
May	10	.	.	.	34	9	11
June	3	.	.	.	13	11	23
July	.	.	.	.	29	15	19
August	1	12	.	.	26	22	.
September	.	.	.	20	21	20	14
October	3	.	.	25	81	16	26
Mean	12.49	1.15	3.80	4.96	38.26	18.65	21.37
CV	.	.	.	.	0.762	0.461	0.645

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Table A8.2.4.

Wholesale Rice Paddy Transactions in Mali, 1988/89
(Metric Tons)

1. Rice Paddy Purchases

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	31	.	.	.	.	.	.
December	47	.	.	.	.	.	.
January 1989	108	.	.	.	.	.	.
February	68	.	.	.	.	.	.
March	227	.	.	.	.	.	.
April	40	.	.	.	.	.	.
May	71	.	.	.	.	.	.
June	.	.	.	.	.	.	.
July	35	.	.	.	.	.	.
August	38	.	.	.	.	.	.
September	63	.	.	.	.	.	.
October	17	.	.	.	.	.	.
Mean	62.00	.	.	.	.	.	.
CV	0.952	.	.	.	.	.	.

2. Rice Paddy Sales

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	31	.	.	.	.	.	.
December	34	.	.	.	.	.	.
January 1989	38	.	.	.	.	.	.
February	55	.	.	.	.	.	.
March	19	.	.	.	.	.	.
April	58	.	.	.	.	.	.
May	66	.	.	.	.	.	.
June	36	.	.	.	.	.	.
July	19	.	.	.	.	.	.
August	31	.	.	.	.	.	.
September	42	.	.	.	.	.	.
October	15	.	.	.	.	.	.
Mean	37.00	.	.	.	.	.	.
CV	0.435	.	.	.	.	.	.

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Table A8.2.5.

Wholesale Local Rice Transactions in Mali, 1988/89 (Metric Tons)

1. Local Rice Purchases

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	.	.	.	.	.	.	.
December	.	4	22	10	.	10	454
January 1989	40	18	10	22	.	3	18
February	40	.	21	10	.	12	23
March	10	.	0	7	.	11	.
April	.	.	59	9	.	23	494
May	.	.	14	3	.	15	125
June	20	.	14	3	.	14	135
July	.	16	34	7	.	8	27
August	.	10	34	25	.	2	30
September	.	40	15	23	.	9	26
October	.	.	6	.	.	3	.
Mean	9.17	8.06	21.80	9.88	.	8.98	111.02
CV	.	.	0.750	0.893	.	0.722	.

2. Local Rice Sales

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	.	.	.	.	.	.	.
December	.	.	16	10	.	10	49
January 1989	30	.	7	22	.	3	313
February	30	.	1	10	.	10	19
March	.	.	0	7	.	9	.
April	.	3	29	9	.	22	241
May	.	.	13	3	.	15	123
June	20	1	9	3	.	14	118
July	.	2	31	7	.	8	58
August	.	.	25	25	.	2	26
September	.	14	15	23	.	9	25
October	.	11	4	.	.	3	3
Mean	6.66	2.79	13.67	10.77	.	9.44	81.20
CV	.	.	0.807	0.804	.	0.664	.

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Table A8.2.6.

Wholesale 80 Percent Brokens Rice (*Riz BB*) Transactions in Mali, 1988/89 (Metric Tons)

1. 80 Percent Brokens Rice Purchases

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	**Bamako**
November 1988	144	.	.	.	.	.	6261
December	8	.	.	.	.	.	2936
January 1989	80	.	.	.	.	.	2717
February	.	.	.	.	.	.	526
March	50	.	.	.	.	.	6084
April	.	.	.	.	.	.	1777
May	.	.	.	.	.	.	610
June	.	.	.	.	.	.	2535
July	.	.	.	.	.	.	1546
August	.	.	.	.	.	.	1562
September	.	.	.	.	.	.	855
October	.	.	.	.	.	.	320
Mean	23.50	.	.	.	.	.	2310.62
CV	.	.	.	.	.	.	0.866

2. 80 Percent Brokens Rice Sales

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	**Bamako**
November 1988	139	.	.	.	.	.	5632
December	8	.	.	.	.	.	1512
January 1989	40	.	.	.	.	.	2971
February	20	.	.	.	.	.	1286
March	.	.	.	.	.	.	6237
April	.	.	.	.	.	.	1309
May	.	.	.	.	.	.	505
June	.	.	.	.	.	.	2306
July	.	.	.	.	.	.	1314
August	.	.	.	.	.	.	1674
September	.	.	.	.	.	.	978
October	.	.	.	.	.	.	775
Mean	17.25	.	.	.	.	.	2208.08
CV	.	.	.	.	.	.	0.844

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Table A8.2.7.

Wholesale 40 Percent Brokens Rice (*Riz RM40*) Transactions in Mali, 1988/89 (Metric Tons)

1. 40 Percent Brokens Rice Purchases

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	219	.	.	.	.	.	648
December	161	9	.	.	.	2	1216
January 1989	249	.	.	3	.	.	60
February	120	8	.	4	.	.	303
March	40	47	.	6	.	.	1603
April	40	33	.	.	.	8	1673
May	37	215	.	.	.	4	774
June	27	32	.	.	.	6	953
July	.	5	.	.	.	10	1514
August	25	1	.	.	.	6	2907
September	13	351	.	.	.	11	678
October	.	.	.	7	.	6	390
Mean	77.57	63.65	.	1.67	.	4.43	1059.85
CV	1.129	.	.	.	.	.	0.739

2. 40 Percent Brokens Rice Sales

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	209	.	.	.	.	.	532
December	93	35	.	.	.	5	803
January 1989	112	10	.	3	.	.	397
February	154	6	.	4	.	.	378
March	27	13	.	6	.	.	1358
April	33	13	.	.	.	8	1035
May	2	49	.	.	.	4	800
June	19	29	.	.	.	6	1258
July	.	50	.	.	.	10	1330
August	6	0	.	.	.	6	2859
September	2	3	.	.	.	11	785
October	.	29	.	7	.	6	821
Mean	54.74	21.46	.	1.82	.	5.11	1029.63
CV	1.288	0.828	.	.	.	.	0.647

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Table A8.2.8.

Wholesale 25 Percent Brokens Rice (*Riz RM25*) Transactions in Mali, 1988/89 (Metric Tons)

1. 25 Percent Brokens Rice Purchases

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	10	.	.	54	.	17	.
December	.	4	.	1	.	.	503
January 1989	.	9	.	2	.	2	5
February	.	8	.	4	.	.	8
March	.	8	.	.	.	2	.
April	.	14	.	.	.	.	.
May	.	8	.	.	.	.	.
June	.	14	.	.	.	.	.
July	.	14	.	.	.	.	9
August	.	37	.	.	.	.	.
September	.	24	0	.	.	9	30
October	.	13	.	.	.	12	.
Mean	0.83	13.92	0.02	5.08	.	3.38	46.21
CV	.	0.674	.	.	.	.	.

2. 25 Percent Brokens Rice Sales

	Tomb'tou	Gao	Mopti	Ségou	Koutiala	Sikasso	Bamako
November 1988	.	.	.	54	.	17	.
December	.	5	.	1	.	.	613
January 1989	.	11	.	2	.	2	4
February	.	10	.	4	.	.	413
March	.	14	.	.	.	2	.
April	.	13	.	.	.	.	.
May	.	8	.	.	.	.	.
June	.	11	.	.	.	.	.
July	.	12	.	.	.	.	9
August	.	34	.	.	.	.	.
September	.	27	0	.	.	9	127
October	.	13	.	.	.	12	.
Mean	.	14.30	0.02	5.08	.	3.38	97.19
CV	.	0.593	.	.	.	.	2.079

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