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SHORT RUN NET IMPORT ELASTICITY ESTIMATES
FOR WHEAT AND COARSE GRAINS, 1960-1981

By

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ABSTRACT

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This research focusses on characteristics of net import demand for grain. Using prevailing economic theory as a guide, the study attempts to isolate economic forces as they interact within an environment where policy decisions can affect the outcome. A major hypothesis is that policy decisions taken at the national level change the character of net import demand contrary to standard trade theory expectations.

The main objective of this research is to estimate the responsiveness of net import demand of wheat and coarse grains to economic variables without relying on a priori assumptions about domestic demand and supply elasticities. A further goal is to interpret results in terms of selected national agricultural policies.

Individual country import demand is estimated over the period 1960 to 1981. Besides the traditional net import demand variables of price, income and supply, exchange rates and foreign exchange reserves are tested for their influence on quantities imported. Resulting

price elasticity estimates are low and/or insignificant for both wheat and coarse grain import demand. Income and production elasticity estimates are more in line with standard trade theory expectations. The impacts of the exchange rate and of foreign exchange reserves are not subject to generalization.

With respect to United States policies, attempts to shield domestic grain producers from market forces have increased the dependency of these producers on export markets. Other U.S. actions such as the blended credit program are explicitly designed to take advantage of the international market environment. This may be effective in meeting certain policy goals at least in the short run. However, the economic position of other exporters will be affected and may elicit unanticipated policy responses on their part. Policy impacts on trade and, in turn, of trade on policy decisions cannot be ignored.

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CHAPTER ONE

INTRODUCTION

Food is a fundamental concern and increasingly one not confined to national borders. Agricultural trade now plays a key role in the well-being of both exporters and importers. It also provides links between countries, links which are important to understand if both domestic and international relations are to be ameliorated. However the issues are complex. As trade grows, it both shapes and is shaped by the broader political-economic environment.

The volume of trade in grains has grown by more than two and one-half times over the last two decades. Chapter Two documents this and other changes in the trade environment since 1960. This massive increase in the volume of trade has imposed greater economic interdependence between importer and exporter, and between individual consumers and producers. There has been little change in the concentration of traditional exporters, who still supply most of grain traded, while the number and variety of importers have increased over time. Old alliances in agricultural trade have faded and new ones have developed.

These changes evidence opportunities perceived by nations involved in trade. However, increased global interdependence through trade opens new avenues of conflict as well as opportunity. Rapid change can bring uncertainty. With limited information about economic characteristics of the international market, each individual participant responds to his perception of reality but at the same time has greater occasion to affect others. Countries worldwide are engaged in attempts to isolate their own economies from the vagaries of world trade. A review of studies documenting protectionist policies is given in Chapter Three of this study. Such protection originates from importer and exporter policies alike.

An examination of phenomena in the trade arena is needed to examine both the internal environment of individual countries and the external environment they face. It is at the intersection of these two realms that trade decisions are made. Direct estimation of a key feature of this changing environment, net import demand, is aimed at better understanding how countries interrelate through trade.

1.1 RESEARCH OBJECTIVES

This research focusses on the demand for grains as this demand is met through international markets. It's broad objective is to identify characteristics of the

international market by studying the import behaviour of individual countries over time, and to examine these characteristics in the light of existing domestic agricultural policies in foreign importing countries and in the United States. The net import demand of both industrial and less developed countries is examined, with more emphasis given to the latter group. The study covers a period from 1960 to 1981.

Three sub-objectives can be delineated which represent steps towards understanding the process by which countries undertake trade.

1. To identify a theoretical framework within which net import demand may be examined in the context of today's trade environment. While based on the market mechanism, this framework incorporates influences on trade arising from government policy intervention and international financial interdependence.
2. To test hypotheses concerning the determinants of net import demand.
3. To examine the implications of empirical results vis a vis domestic policies found in importing countries and in the U.S.

1.2 PROCEDURES

Economic theory provides basic guidelines for this research. In a fundamental way, trading patterns respond to economic variables. However traditional economic

variables used in trade analyses, as suggested by neoclassical economic theory, tend to focus on the criterion of economic efficiency and on the benefits of free trade. An argument will be advanced that this focus is not broad enough to political/economic interactions occurring in today's complex trade environment. An attempt is made here to incorporate at least part of this trade environment, while at the same time it is recognized that this is merely one step toward such an end.

The theoretical model fits into a partial equilibrium framework. Net import demand for each country and each commodity is examined separately, without taking into consideration any joint interaction. However, by including domestic policy in the framework of analysis, allowance is made for possible friction stemming from political-economic behaviour of trade participants. Variables such as price, income and domestic supply--which are traditionally included in trade analyses--form the basis of import demand estimation here. Beyond this, exchange rates and foreign exchange availability are included as possible determining variables. Exchange rates are used for two distinct purposes: first, as they affect the import price of the good in question relative to the world price; and second, as they affect relative prices within an importing country. Foreign exchange availability is considered as a possible constraint on income used for net

import purposes.

1.3 OUTLINE OF THE STUDY

There are five parts to this research beyond the introduction. Chapter Two provides a description of international trade in wheat and coarse grains over the study period 1960-81. Trade patterns between major exporters and importers are discussed, along with changes in domestic production and consumption of grains in selected countries and regions throughout the world. Variability in import markets is considered an important aspect of the trade environment. Variability in prices and quantities can add to instability felt by both importers and exporters. A final section in this chapter examines some of the factors contributing to change in the trade environment over time. Specific indicators of change as well as changes in the broader political-economic landscape are described.

Literature which contributes to the development of a research approach is outlined in Chapter Three. This chapter establishes the basis for the method subsequently used to analyse the characteristics of net import demand. The literature is divided into three main sections, each of which deals with a specific aspect of our knowledge about agricultural markets. These sections are organized with a view to tracing the advancement of ideas about major determinants of net imports and the structure of the

market.

The first section reviews literature concerned with the interface of agriculture and the macroeconomy. The role of the exchange rate in agricultural trade has been a key issue here, although there has been some discussion of balance of payments effects. With respect to the exchange rate, studies have been both theoretical and empirical. They typically address specific aspects of the topic such as the price transmission mechanism, cross-price effects or links with other monetary variables. A difference of opinion is evident between those who assume the total exchange rate effect is seen in price (and sometimes income) and those who argue for the presence of a separate exchange rate effect.

A second set of studies deals with the issue of imperfect agricultural markets. Two different approaches to market imperfections are evident. One treats trade restrictions as deviations from some norm (such as perfect competition), the elimination of which would reduce costs of trade. The second approach sees trade restrictions in the light of conflicting national goals. This approach provides room for broader analyses of constraints on trade, recognizing the (sometimes political) costs of removing trade barriers.

Third, the question of elasticities in international agricultural trade is taken up. Studies have followed either one of two approaches. Under the assumption that

trade price elasticities are the sum of domestic demand and supply elasticities, studies have estimated domestic supply and demand responses and/or calculated trade elasticities from prior estimates. Other studies concerned with the magnitude of trade elasticities have argued that the presence of domestic policies prevents the use of domestic demand and supply responses as adequate indicators of the trade response. Such studies pose direct trade estimation as a more appropriate means of obtaining information about trade elasticities.

Chapter Four provides the theoretical foundation for estimating net import demand directly. A 'market-plus' framework is proposed which implicitly incorporates domestic policies into the market mechanism and allows for testing of hypotheses concerning the role of debt and exchange rates on trade. Structural relations for price, demand and supply (including stockholding behaviour) are discussed with reference to how these relate to net import demand.

Empirical estimation of the net import demand of wheat and coarse grains is carried out in Chapter Five. A range of individual countries is examined, including both industrial countries and less developed countries. Emphasis is given to how net imports respond to changes in structural variables. Elasticity estimates of net import demand with respect to price, income and domestic

production as well as other exogeneous variables are calculated and then compared with estimates from previous studies.

The results obtained from empirical study lend themselves to an examination of how specific domestic and international agricultural policies interact. This is the focus of the final chapter. Elasticity estimates resulting from the empirical part of this study indicate ways in which importer country policies relating to price, production, stocks, credit and exchange rates have an impact on net import demand. In turn there are implications of the results for current United States agricultural policy. Pressures, both political and economic, for a change in the current environment are indicative of the effects of past policy choices. Several of the policies discussed demonstrate the need for future research on the structure of international markets.

CHAPTER TWO

AN OVERVIEW OF THE TRADE ENVIRONMENT 1960-1981

The structure of international agricultural markets has changed substantially and fundamentally during the decades of the 1960s and 1970s. This study focusses on wheat and coarse grains trade. Grains have always played a key role in the economic well-being of people worldwide. Not only are they the staple food in most diets, but also grains are a principal source of income for many producers. Since 1960, agricultural trade has become a significant factor in maintaining and improving the well-being of both producer/exporter and consumer/importer nations. In the process, trade has become a prime focus of today's political economy.

This chapter describes the trade environment for grains from two perspectives: the structure of markets and the causes of change. First, overall trade patterns are discussed with respect to the growth of trade and its variability. Attention is given to how different regions of the world have responded to their economic environment as producers, consumers, and traders of wheat and coarse grains. Second, determinants of change are examined. Changes in specific economic variables often indicate

shifts in trade patterns. Such factors are discussed independently and then the overall climate of trade is described within which these factors act and react. A summary is provided at the end of the chapter.

2.1 THE STRUCTURE OF INTERNATIONAL GRAINS MARKETS

2.1.1 SHIFTS IN TRADE PATTERNS, 1960-1981

World trade in cereals has increased substantially since 1960. According to United States Department of Agriculture (USDA) Foreign Agriculture Service (FAS) data, world wheat and coarse grains trade averaged 184.4 million metric tonnes (MMT) annually over the three year period, 1978/9-1980/1. This represents an increase of 154 percent since the early 1960s, or 7.3 percent per year. Although more recently total trade in grains has dropped slightly, the overall increase is impressive.

The structure of international grain markets has undergone dramatic changes during this period of trade growth. According to Hathaway (1979), developed market economies dominated trade in grains immediately following the Second World War. North America and Australia were the major exporters while Japan and Western Europe were the major importers. Today, traditional exporters still dominate the supply side but significant change has taken place on the demand side. Less developed countries (LDCs) and centrally planned economies (CPEs) have grown in

importance as importers relative to developed regions. This change has also been documented in a recent report by CIMMYT (1982) with respect to trade in wheat.

Changes over time in the pattern of trade between regions can be seen from Table 2.1. The importance of North America as an exporter of grains has increased between 1961 and 1981. Other areas of the world, notably the less developed countries in Asia and Africa, have become major importers. The role of Western Europe is also of interest in that the countries comprising this region, and in particular the European Community (EC-9), have become more or less self-sufficient in grain over the 20-year period.

Table 2.1

NET TRADE IN CEREALS--1961,¹ 1971, 1981²

<u>Region</u>	<u>1961</u> - - million	<u>1971</u> metric tonnes	<u>1981</u> - -
North America	-43.5 ³	-53.6	-134.6
South America	- 2.0	- 6.4	- 7.0
Oceania	- 7.1	-11.5	- 12.9
Western Europe	28.3	25.7	3.9
Eastern Europe and the USSR	- 2.2	2.1	52.6
Asia	13.6	34.8	65.1
Africa	2.7	5.5	19.7

- 1) Cereals include wheat, maize, barley, rye, oats, and mixed grains for the crop year 1961/2.
- 2) Cereals include wheat, rice, maize, barley, rye, oats, and mixed grains. Data for 1971 and 1981 refer to calendar years.
- 3) A negative sign indicates net exports.

Source: Food and Agricultural Organization of the United Nations Trade Yearbook, various issues.

Wheat trade still represents the largest portion of total cereal imports. Again using USDA FAS data, approximately 44.3 MMT of wheat were exported annually in the early 1960s, comprising 56 percent of all grains traded. By the latter part of the period, this volume had risen to 84.0 MMT--or 45.6 percent of wheat and coarse grains trade. These figures represent an annual trade growth rate for wheat of 4.3 percent over the period.

Imports of coarse grains have been growing even faster. Coarse grain imports averaged 28.3 MMT annually in the early 1960s, according to USDA data. This represented 38.9 percent of the trade in wheat and coarse grains. After experiencing an annual trade growth rate of 5.6 percent, world trade in coarse grains averaged 100.3 MMT per year over the 1978/9-1980/1 period, or 54.4 percent of total trade in wheat and coarse grains.

North America's position as major world supplier of grain has continued to be strong. A study by Perraut and Sorenson (1983) has measured changes in net imports as a percent of total net exports of major world exporters.¹ Using these data, exports from North America made up 60 percent of world coarse grain exports in 1960. By 1980, this share had risen to 70 percent. For wheat, North America's share of major exports fell over the period, from 77 percent in 1960 to 67 percent in 1980.

Meanwhile, participants in the import market for

these grains have changed dramatically over the period. Again using data from Perraut and Sorenson, importer participation in the wheat market is measured in terms of the proportion of net imports to exports from major world exporters. For wheat, the proportion of net imports by Japan dropped slightly from 8 percent to 6 percent and the position of LDCs as a whole changed only slightly.² Over the same period, net imports by Western Europe fell significantly. This area imported 31 percent of major wheat exports in 1960 and exported 13 percent by 1980. Centrally Planned Economies (CPEs) have shown large increases in wheat net imports over the two decades. The USSR moved from a net export position (12 percent of major wheat exports) to a net import position (19 percent) over the period. Net imports by Soviet Bloc as a whole rose from a negligible amount in 1960 to 23 percent by 1980. In China this ratio rose from 5 percent to 16 percent.

The distribution of coarse grain imports has changed more than that for wheat. In Western Europe, net imports of coarse grains declined from 73 percent of major exports in 1960 to a scant 14 percent by 1980. Japan's imports of coarse grains rose from 11 percent to 18 percent of major world exports over the same period. For LDCs and CPEs this ratio has also been increasing. Among LDCs, net imports of coarse grains as a percent of major world exports has grown particularly in Central and South America and in

oil-exporting regions. The USSR and the Soviet Bloc as a whole moved from a net export position in 1960 to a net import position of 9 percent and 17 percent, respectively, of major world exports by 1980.

Projections of wheat and coarse grain trade up to 1990 provided by Mitchell and Ross (1981) show the growing role of less developed countries in world markets. Currently, developing countries already import the majority of wheat and are projected to soon be the world's major feed grain market. The flip side of this coin is that these regions are increasingly dependent on imports for their well being.

2.1.2 DIFFERENTIAL RATES OF GROWTH

2.1.2.1 Consumption

Consumption levels have increased worldwide but faster in CPEs and LDCs than in developed market economies. Grain production and consumption levels for selected countries and regions at the beginning and end of the study period are shown in Table 2.2. Total cereal consumption increased approximately 30 percent in the United States and the European Community (EC-9) between 1960 and 1981, and 68.6 percent in Japan. Consumption growth in LDCs was 72.2 percent and in centrally planned economies 90.8 percent over the same period.

In terms of specific commodities, wheat consumption increased relatively more than coarse grain consumption

in most countries, the EC-9 and Japan being significant exceptions. Consumption of wheat in the United States increased 38 percent between 1960/1 and 1980/1 and that of

Table 2.2

PRODUCTION AND CONSUMPTION OF GRAIN BY REGION,
1960/1-1962/3 AND 1978/9-1980/1

<u>Region</u> ¹	<u>1960/1-1962/3</u>			<u>1978/9-1980/1</u>		
	<u>Prod.</u> mmt	<u>Cons.</u> mmt	<u>Prod/</u> <u>Cons.</u> %	<u>Prod.</u> mmt	<u>Cons.</u> mmt	<u>Prod/</u> <u>Cons.</u> %
CEREALS ²						
Exporters	202.9	159.3	1.27	338.7	208.3	1.63
U.S.	168.3	139.8	1.20	276.7	177.9	1.56
EC-9	71.5	92.0	.78	116.9	119.5	.98
Japan	15.6	21.0	.74	11.3	35.4	.32
CPEs	292.3	295.7	.96	514.4	564.2	.91
LDCs	244.1	255.6	.96	387.9	440.2	.88
WHEAT						
Exporters	53.5	22.7	2.36	91.5	31.3	2.92
U.S.	33.4	16.3	2.05	57.2	22.5	2.54
EC-9	29.8	36.0	.83	48.5	41.7	1.16
Japan	1.6	4.2	.38	1.5	6.1	.25
CPEs	103.1	107.7	.96	189.6	213.0	.89
LDCs	43.1	57.9	.74	90.0	127.7	.70
COARSE GRAINS						
Exporters	147.3	135.6	1.09	242.1	175.2	1.38
U.S.	133.0	122.5	1.09	215.1	153.6	1.40
EC-9	41.1	55.2	.74	67.8	76.9	.88
Japan	2.3	4.8	.48	1.2	19.0	.06
CPEs	137.1	136.2	1.01	229.0	256.2	.89
LDCs	102.3	98.9	1.03	152.3	165.2	.92

1) Exporters include the United States, Canada and Australia; CPEs include Eastern Europe, the USSR and the People's Republic of China; LDCs include countries in Middle and South America, North Africa/Middle East, Central and East Africa, South Asia, Southeast Asia, and East Asia. See reference 3 at the end of this chapter for the individual country list.

2) Includes wheat and coarse grains (corn, barley, oats, rye and mixed grains).

Source: USDA, World Agriculture Situation, #19 (July 1979) pp.40-43, and #24 (Dec. 1980) pp.41-43.

coarse grains 25 percent. Centrally planned countries increased consumption of wheat by 98 percent and of coarse grains by 88 percent over the same period. Comparable figures for LDCs are 121 percent for wheat and 67 percent for coarse grains. In contrast, consumption of wheat in the EC-9 increased only 15.8 percent while their consumption of coarse grains increased almost 40 percent. In Japan, wheat consumption increased 45.2 percent and coarse grains by an impressive 300 percent.

2.1.2.2 Production

Total world production of cereals has increased 66 percent over the last two decades. Wheat production has increased 80 percent and that of coarse grains by 62 percent. Among importing regions, LDCs have increased production of wheat by 109 percent, CPEs by 84 percent and the EC-9 by 63 percent. For coarse grains, CPEs and the EC-9 increased production by 67 percent and 65 percent respectively. LDCs trail in the growth of the production of coarse grains at 49 percent. Japan has experienced a net decline in production of both wheat and coarse grains, particularly the latter, over the study period.

A comparison of how domestic production has changed relative to consumption demonstrates the dependence of different regions on trade. For all cereals, the ratio of production to consumption given in Table 2.2 has increased

for major exporters and also for the EC-9, while declining for other importers, especially Japan. For major exporting countries, the production/consumption ratio for cereals as a whole increased from 1.27 in the early 1960s to 1.63 by 1981. In the EC-9 this ratio increased from .78 to .98 as this area moved toward self-sufficiency. On the other hand, greater import dependence has developed in other major importing regions. The production/consumption ratio for cereals as a whole has declined from .74 to .32 in Japan, from .99 to .91 in centrally planned economies and from .96 to .88 in LDCs. This pattern is similar for both wheat and coarse grains.

2.1.2.3 Net Trade

As a corollary to consumption and production patterns, trade now makes up a larger share of grain consumed worldwide than was the case in the early 1960s. Using trade data published by the USDA in World Agricultural Situation, world cereal trade as a proportion of total cereal consumption has grown from an average of 9.5 percent in the 1960-63 period to 15.3 percent in the 1979-81 period. This growth in trade relative to consumption has been larger for coarse grains than for wheat. The trade/consumption ratio for wheat has increased slightly--from 18.5 percent in the early 1960s to 20.2

percent in 1981. For coarse grains this ratio has more than doubled, from 6.2 percent to 13.6 percent over the same period.

2.1.3 VARIABILITY OF IMPORT MARKETS

A significant characteristic of international agricultural markets is the degree to which key economic variables fluctuate. Typically, the degree of variability does not remain constant over time. For example, international agricultural markets in the 1970s were perceived as being relatively more unstable when compared with earlier periods. This perception is evidenced by D. Gale Johnson (1973), G.E. Schuh (1974), M.D. Bale and E. Lutz (1979), the OECD (1980), L. Tweeten (1983), and D. Blandford (1983), among others. However, Miller et al. (1983) show that variations experienced in the 1970s appear to represent the exception rather than the rule when viewed in a longer term context.

The concept of variability can be defined in terms of a number of economic indicators. It can indicate variation in agricultural prices, volume produced, or volume traded relative to some longer term trend. Some price and quantity indicators of variability are described below. Ultimately variability is important in the way that price and quantity changes affect the stability of incomes and thus the economic opportunities of producers and consumers. These concerns of policy makers are

addressed in the final chapter of this study.

Instability in agricultural markets today stems from causes which are different from those in the past. Some variability in agricultural markets is inherent. The dependence of agricultural output on unpredictable and uncontrollable weather conditions is one source of variability. To this can be added the typically larger price changes relative to changes in food demand and/or supply. Technology has mitigated at least some of the susceptibility of agricultural production to weather and has increased opportunities of storing agricultural products. However, as trade has grown, variable yields in any one country are more easily and quickly transmitted to other countries. Further, opportunity for friction between countries arising from conflicting national goals is increased as trade becomes more widespread. Instability resulting from such friction can be heightened as countries recognize that influences traditionally considered outside the purview of, or at best peripheral to, the agricultural trade arena have grown in importance. Such influences include the role of agricultural trade in balance of payments positions and the related exchange rate effect. As the perception of instability in international agricultural markets increases, so does the politicization of trade opportunities which then affect the future trade environment.

Several measures can be used to describe variability in an economic indicator. The standard error represents an estimate of the deviation of the probability distribution of actual net trade with respect to, say, a time trend. The standard error is positively associated with the range of the confidence interval around the estimate--that is, the higher the standard error, the larger the confidence interval. Since this measure is expressed in the same units as the indicator under consideration, difficulty of interpretation may exist where there has been rapid growth in the variable. The coefficient of variation, defined as the standard error divided by the mean of the variable, is scale-free. Thus, it can be used to compare variation across indicators with different mean levels. These and other measures of variability are discussed at length in Newbery and Stiglitz (1981).

Here, attention has been given to the coefficient of variation because of the increase in mean net import levels between the periods 1960-70 and 1971-80 and the difference in quantities imported by various countries and regions.

2.1.3.1 Quantity Variability

2.1.3.1.1 Variability in Quantities Imported

Given the increase in volume of trade, it is perhaps not surprising that the standard errors about trend for both wheat and coarse grains have increased in most

regions between the decades of the 1960s and the 1970s. However, as can be seen from Table 2.3, the coefficient of variation generally falls between the two periods. Exceptions tend to occur where changes in the volume of trade have not been great. Variation in wheat imports tends to be smaller than that for coarse grains except for the Soviet Union and the People's Republic of China. A partial explanation can be suggested for the difference between wheat and coarse grains. In the typical case, the uses to which these grains are put are different--wheat is largely demanded as a food grain whereas coarse grain demand is derived from that for livestock production. The population growth component of food grain demand can be expected to differ from the cyclical nature of livestock herd numbers.

2.1.3.1.2 Variability in Quantities Produced

Quantities of wheat and coarse grains produced typically have exhibited less variability than net imports (see Table 2.4). Variation in output among major producers tends to be less than that of more marginal producers.⁵ With some exceptions, not much difference in variability is observed between the two time periods. Notable examples where variability in wheat production declined include Canada and South Asia. It increased only in countries and regions with relatively small production levels. For coarse grain production, variability increased in Argentina and the USSR, while it fell in

Eastern Europe and Mexico.

Table 2.3

COEFFICIENT OF VARIATION IN NET IMPORTS AND EXPORTS
FOR WHEAT AND COARSE GRAINS IN SELECTED REGIONS,
(Averages for Periods 1960-70 and 1971-80)

<u>Region</u> ¹	<u>Wheat</u>		<u>Coarse Grains</u>	
	<u>1960-70</u>	<u>1971-80</u>	<u>1960-70</u>	<u>1971-80</u>
EXPORTER				
U.S.	14.4	15.5	19.3	8.5
Canada	25.9	13.7	127.4	34.6
Australia	18.8	15.7	66.1	30.4
Argentina	64.1	40.9	20.7	32.8
IMPORTER				
Western Europe	43.0	-114.2	15.0	23.8
Japan	8.4	4.1	6.5	5.0
USSR	-217.4	100.4	-35.8	48.5
Eastern Europe	36.5	24.8	65.4	19.0
PRC	26.4	38.4	121.3	115.0
Mid-East Oil exporters	47.3	19.1	1304.6	45.6
East Asia	24.1	11.0	54.4	17.4
South Asia	27.5	34.0	129.4	45.7
Africa	19.1	5.2	215.0	33.3
Mexico	-136.0	63.0	184.7	49.6
South America	12.9	9.3	145.0	73.3

1) For regional breakdown by country, see reference 4
at the end of this chapter.

Source: E. Perraut and V. Sorenson, Trends in World
Grain Trade, Consumption and Production, 1960-1980,
Ag Econ Staff Paper #83-51 (30 August 1983).

As reported in a study by Blandford (1983), domestic
production variability in many countries has been found to
contribute significantly to variability in world trade. In
particular, as much as 33 percent of production
variability in the Soviet Union appears to be transmitted

onto the world market for wheat, and 24 percent for coarse grains. Other countries examined in this study transmitted considerably less of their production variability. Blandford argues that this is largely because their actual output levels are much smaller.

Table 2.4

COEFFICIENT OF VARIATION IN PRODUCTION
FOR WHEAT AND COARSE GRAINS IN SELECTED REGIONS,
(Averages for Periods 1960-70 and 1971-80)

<u>Region</u> ¹	<u>Wheat</u>		<u>Coarse Grains</u>	
	<u>1960-70</u>	<u>1971-80</u>	<u>1960-70</u>	<u>1971-80</u>
EXPORTER				
U.S.	8.7	8.9	7.1	9.9
Canada	28.4	15.3	12.8	9.6
Australia	26.1	24.2	26.1	8.8
Argentina	31.9	21.4	14.0	23.0
IMPORTER				
Western Europe	8.0	8.1	4.1	6.3
Japan	22.3	38.4	20.2	*
USSR	21.6	16.0	9.6	19.2
Eastern Europe	8.0	9.1	5.7	2.2
PRC	9.1	10.0	7.3	4.1
Mid-East oil exporters	11.8	12.8	8.3	9.1
East Asia	8.4	32.7	12.5	19.5
South Asia	17.2	7.3	6.4	6.9
Africa	14.3	10.3	2.9	4.3
Mexico	10.6	18.8	19.3	8.8
South America	15.2	18.2	4.4	10.0

1) Region definitions are the same as Table 2.3.

* Too small to measure.

Source: same as Table 2.3.

2.1.3.2 Price Variability

International prices for agricultural products have varied considerably over time. Here, U.S. prices are used to demonstrate variation in grain prices over an extended

time period. As indicated by Table 2.5, average prices for both wheat and corn have increased throughout the 20th century. Standard deviations also show an upward trend but coefficients of variation are highest in the period encompassing the two world wars.

Table 2.5

INSTABILITY OF WHEAT AND CORN PRICES, 1900-1982

<u>Period</u>	<u>WHEAT</u>			<u>COARSE GRAINS</u>		
	<u>Avr.</u> <u>Price</u> <u>U.S.\$</u>	<u>Stand.</u> <u>Dev.</u>	<u>Coeff.</u> <u>of</u> <u>Var.</u>	<u>Avr.</u> <u>Price</u> <u>U.S.\$</u>	<u>Stand.</u> <u>Dev.</u>	<u>Coeff.</u> <u>of</u> <u>Var.</u>
1900-15	.83	.14	17	.54	.24	23
1915-38	1.12	.49	44	.80	.34	42
1938-50	1.41	.58	41	1.12	.47	42
1950-71	1.73	.31	18	1.23	.19	15
1971-82	3.13	.91	29	2.30	.56	25

Source: T.A. Miller, et al., World Food Study: Implications of Increasing World Market Instability on U.S. Agriculture, ERS, USDA mimeo (16 September 1983) p.9.

2.2 FORCES AND FACTORS CREATING CHANGE

In economics, it is often difficult to trace the relationship between cause and effect. Rather, any given economic situation is subject to a host of influences which act both separately and in unison to create change. This is, of course, an ongoing process. To identify causes of change at any given time, one must be selective, somewhat arbitrary and willing to categorize.

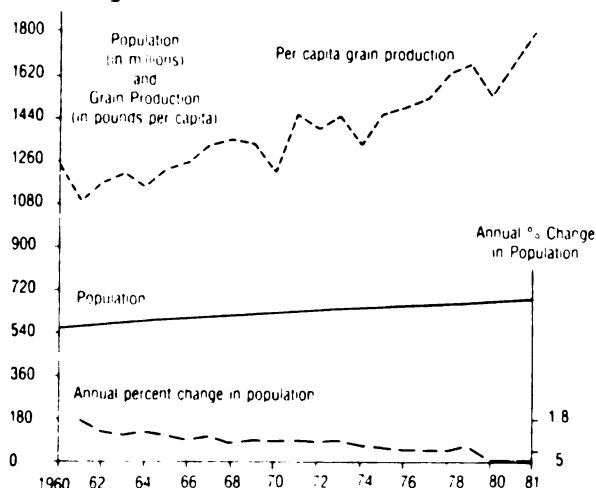
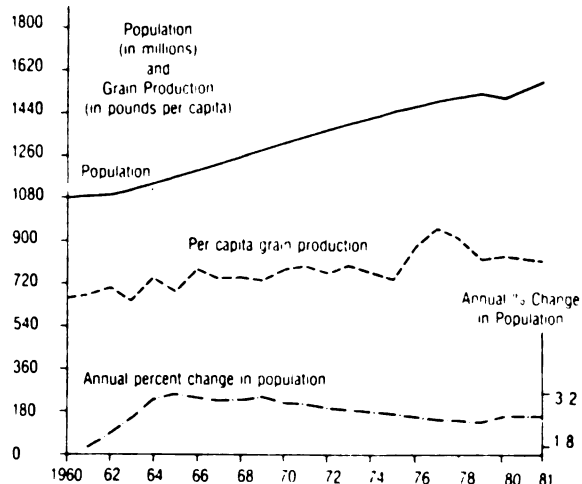
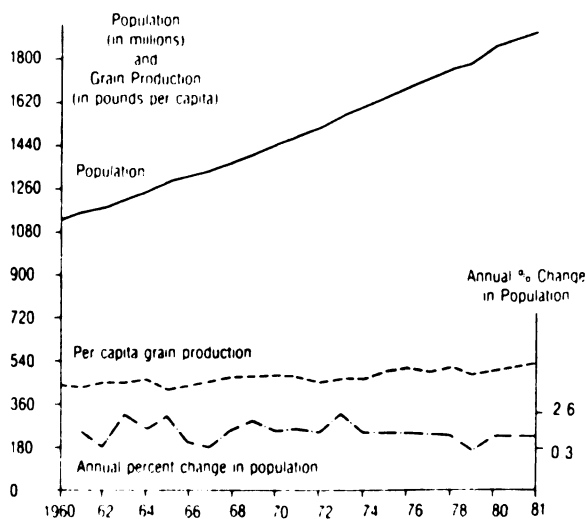
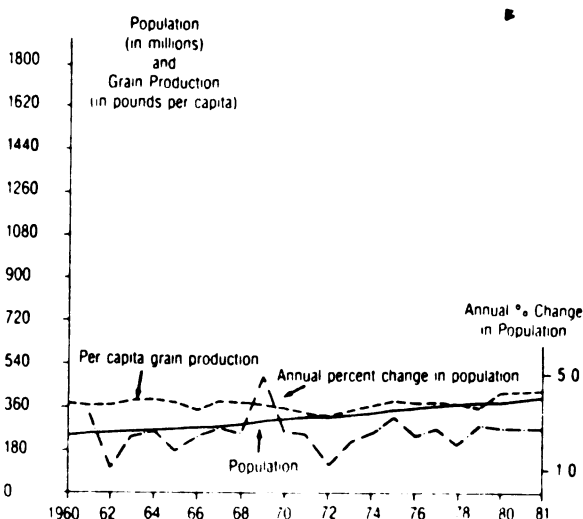
Causes of change are often grouped in terms of traditional economic indicators, and some of these will be

discussed below. Another way of viewing the dynamics of the trade environment is in terms of the overall climate within which these variables interact. Some characteristics of the changing climate of trade will be discussed.

2.2.1 TRADITIONAL ECONOMIC INDICATORS OF CHANGE

Economic indicators such as population, income and yields are subject to change over time. They are thus instrumental in changing agricultural demand and supply relationships and, through these, price. Production of wheat and coarse grains has increased in all countries (except Japan) over the period 1960-81. However, domestic production growth rates when coupled with different rates of population growth have resulted in production per capita increasing much faster in developed market economies and centrally planned economies than in LDCs. Indeed, according to a U.S. Department of Agriculture report (USDA 1981), production per capita has actually declined recently in Africa.

Trends in population, population growth rates and per capita grain production for four regional/economic subclasses between 1960 and 1981 are illustrated in Figure 2.1. Higher production levels coupled with slower population growth rates in developed market economies demonstrate more rapid growth in per capita production of grains in these areas in contrast to less developed areas.

Developed Market Economies**Centrally Planned Economies****Rapidly and Moderately Developing Nations****Other Developing Nations****Figure 2.1**

**TRENDS IN POPULATION, POPULATION GROWTH RATES AND
PER CAPITA GRAIN PRODUCTION BY ECONOMIC GROUPING
OF NATIONS, 1960-1981**

Source: R.N. Wisner and Craig A. Chase, World Food Trade and U.S. Agriculture, 1960-81, The World Food Institute, Iowa State University, Ames Iowa (8/81) p.57, 3rd edition.

The pattern of income growth helps to explain changes that have taken place in consumption and imports. There is a progression from root crop consumption upward through cereals to livestock consumption as incomes increase. These movements have been documented by Rojko et al. (1971). Consumption of root crops such as potatoes or casava declines through all income levels. Initial displacement is through increased consumption of cereals. Cereal consumption peaks at some point in the mid-income range and declines thereafter. The rate of livestock product consumption grows throughout all income ranges, slowly at low income levels, more rapidly in the mid-income range and gradually tapering off at the high end of the income scale. This relationship is evident in the slower growth of wheat consumption relative to feedgrain consumption in industrial countries or conversely, the relatively stronger demand for wheat in less developed countries.

Demand-side factors point to a continuation of LDC dependence on imported grain. The growing use of wheat in LDCs for increased daily calorie supply per capita relative to total calorie supply has been documented in a CIMMYT study (1982). Developing countries are shown to have increased per capita calorie intake through wheat consumption by 93 calories per day, compared with a decrease in developed regions of 69 calories per day

between the periods 1961-65 and 1975-77.

Supply-side factors also play a role in deciding trading patterns. Weather typically causes yields to be either lower or higher than expected levels, contributing to short run instability in domestic production levels. Over time, yields also are a function of technology. In general, industrial countries experience higher yields due in part to their ability to adopt new production techniques.

Other economic indicators used to explain changes in trade point to the difficulty of separating cause and effect. As early as 1945, T.W. Schultz (1945) drew attention to macroeconomic policy as a cause of instability in international agricultural markets. A more recent reminder of the place of the agriculture sector within a wider economic framework has been given by D. Gale Johnson (1973). More recently, attention has been given to the impact of specific financial variables on trading patterns. For example, exchange rate changes have been suggested by Schuh (1974) and others as having a separate effect on trade by introducing disequilibrium to which domestic markets must adjust. From the perspective of LDCs, debt and debt servicing have been singled out as potentially limiting some countries' ability to import. Concern in this regard has been expressed, for example, by the USDA (1984). These factors will be considered in more detail in the following chapter.

2.2.2 THE CLIMATE OF TRADE

The climate of trade has been both cause and effect of changing trade patterns. T.K. Warley (1976) has drawn attention to five characteristics of the international grains market which are indicative of the current environment within which specific factors interrelate. Rather than trying to specifically measure change, these characteristics are indicative of the complex economic, political and social interactions which surround international trade decisions. They are used here to describe ways in which changes in the global landscape can have an impact on trading relationships.

Warley's first point is related to changes in the goal-orientation of policy. Economic policies have taken precedence in foreign policy relations between countries in recent years. This is a change from the formerly more dominant concerns about military and ideological power. National economic policies are no longer considered in isolation from each other. They are now recognized as being mutually interdependent. This change in orientation is potentially critical for domestic agricultural policies.

The second point concerns the increase in the number and variety of relationships between countries. International relations are now more pluralistic than ever before. Many different avenues of communication must be

maintained. New relationships must be devised as agricultural trade no longer primarily involves industrial countries alone but centrally planned and less developed countries as well.

A third, related characteristic focusses on changes in national dominance of economic activity. Over time the power of the United States on the world stage has diminished. Economic power is now more diffused--shared by a greater number of countries, each with its own goals and priorities. Even as a major supplier of grains, United States' interests and wishes do not necessarily take precedence in economic decisions. This point has recently been reiterated by Alex McCalla (1984).

Fourth, problems of individual countries now spill more readily to areas outside their borders. It is not enough, for instance, to assume that problems with development have no meaningful economic consequences for industrial countries when LDCs make up a significant share of the market for industrial country products, including grains.

A final characteristic of international relations discussed by Warley is concerned with the need for all concerned to recognize that economic interdependence has costs as well as benefits. Countries have different needs, aspirations and opportunities which interact in the international arena. Decisions taken to improve a

domestic situation can impose costs on other countries. As a report by B.F. Jones and R.L. Thompson (1978) expresses this concern with respect to agriculture: "domestic agricultural policies that support farm prices above world price levels necessitate restrictions on imports and export subsidies" which are bound to affect the well being of their trading partners.

2.3 SUMMARY

The structure of international trade has changed substantially over the last two decades. Industrialized countries, particularly those in North America, have increased net exports of wheat and coarse grains, while less developed countries and centrally planned economies have become major importers. The European Community, meanwhile, has become at least self-sufficient in grains as it has made a concerted effort to increase domestic production, and has become a significant exporter of some agricultural products.

At the same time, the trade environment within which these changes have taken place has been evolving. Interdependence among countries has grown not only through growth in physical trade but also through financial and political links.

The following chapters trace analyses of these developments and provide a framework from which to examine characteristics of net import demand.

2.4 REFERENCES FOR CHAPTER TWO

1. Major wheat exporters include the United States, Canada, Australia, France, Argentina, Turkey, South Africa. Major coarse grain exporters include the above minus Turkey and plus Thailand.

2. Less-developed-country regions which have increased wheat imports include Africa, the oil-exporters, Central America and South America; whereas Southeast Asia decreased such imports.

3. The country list per LDC region includes: Middle America: Mexico, Honduras, British Honduras, Guatemala, El Salvador, Nicaragua, Costa Rica, Panama, Dominican Republic, Haiti, Jamaica, Trinidad and Tobago, Caribbean Islands, Bahamas, Bermuda; South America: Venezuela, Brazil, Argentina, Bolivia, Chile, Columbia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Uruguay; North Africa/Middle East: Algeria, Bahrain, Cyprus, Iran, Iraq, Israel, Kuwait, Libya, Oman, Qatar, Saudi Arabia, United Arab Emirates; Central and East Africa: Angola, Burundi, Cameroon, Central Africal Republic, Chad, Congo, Dahomey, Equatorial Guinea, Ethiopia, French Terr. of Afars and Issas, Gabon, Gambia, Guinea, Ivory Coast, Liberia, Malagasy, Mali, Mauritania, Mauritius, Niger, Nigeria, Portugal Guinea, Reunion, Rwanda, Senegal, Sierra Leone, Somalia, Spanish Sahara, Togo, Upper Volta, Zaire, Kenya, Malawi, Mozambique, Uganda, Tanzania, Zambia, Zimbabwe; South Asia: Afganistan, Bangladesh, Bhutan, India, Nepal, Pakistan, Sri Lanka; Southeast Asia: Burma, Klmer, Laos, South Vietnam, Thailand; East Asia: Indonesia, Hong Kong, Singapore, South Korea, Taiwan, Brunei, Malaysia, Philippines.

4. Table 2.3 regions comprise Western Europe: the EC-9, Austria, Finland, Greece, Iceland, Malta, Norway, Portugal, Spain, Sweden, Switzerland; Eastern Europe: Poland, Yugoslavia; Mid-East Oil Exporters: Iran, Iraq, Saudi Arabia; East Asia: Korea, Taiwan, Singapore; South Asia: Bangladesh, Pakistan, Philippines, Malaysia, Sri Lanka, India, Indonesia, and for wheat only Thailand; Africa: Algeria, Lybia, Nigeria, Angola, Egypt, Morocco, Mozambique, Tunesia, Zaire, Zambia, Botswana, Burundi, Cameroon, Chad, Dahomey, Ethiopia, Ghana, Guinea, Ivory Coast, Kenya, Lesotho, Mali, Malagasy Rep., Malawi, Niger, Rwanda, Senegal, Sierra Leone, Somali Rep., Sudan, Tanzania, Togo, Uganda, Upper Volta, Zimbabwe; South America: Bolivia, Brazil, Chile, Columbia, Ecuador,

Guyana, Paraguay, Peru, Surinam, Uruguay, Venezuela.

5. Major producers of wheat include the United States, Canada, Western Europe, the USSR and Eastern Europe, the PRC, and South Asia; to which is added for coarse grains Africa and South America.

6. M. Blaug, Economic Theory in Retrospect, Richard D. Irwin Inc., Illinois (1962) pp.114-115.

7. See Joan Robinson, Economic Philosophy, Anchor Books, Edition (1964) p.64.

8. Refer to the discussion in B. Gardner "On the Power of Macroeconomic Linkages to Explain Events in U.S. Agriculture", AJAE 63:5 (Dec. 1981) pp.871-878.

CHAPTER THREE

LITERATURE REVIEW

It is not the purpose here to review all available literature pertaining to international trade in grains. This would be a monumental task indeed. Rather it is to select several strands of trade literature and use these to focus on the task at hand. Much of this literature has concentrated on the position and problems of the U.S. in trading arrangements and that orientation is reflected in this review. However, within a trade environment, such studies often consider the relative position of other countries, either explicitly or implicitly.

Three strands of argument stand out as contributing to a study devoted to estimating net import demand. The first concerns those studies that concentrate on the macro environment within which the agriculture sector exists. Much recent literature in this area has focussed on the relationship between agriculture and the exchange rate but other connections exist. The role of agriculture in the balance of payments and the level of indebtedness particularly in some LDCs have also been considered. Second, there has been and continues to be considerable attention given to the way in which international markets

are imperfect. Typically studies focus either on direct government involvement in markets through state trading institutions or on government management of markets via regulation. A third group of studies has been concerned with income and/or price elasticity estimates in international trade. There is some disagreement about what range should be considered appropriate, in particular for trade price elasticities. As might be expected, these three strands of trade literature are not mutually exclusive. However, their discussion as a continuum provides a background to the model used in this research.

3.1 MACROECONOMIC LINKAGES WITH AGRICULTURAL TRADE

3.1.1 THE EXCHANGE RATE

In a seminal article, G.E. Schuh (1974) initiated a debate about the role of exchange rates in agricultural trade which is still current a decade later. He contends that in analyses on why the United States is not fully competitive in world markets, "a very important variable has been left out in the conception of the problem ... the exchange rate" [p.1]. Previous to Schuh's attestation, the problem had been interpreted as hinging on domestic pricing policies, to which was added the impacts of barriers to trade, viz. for example, T.W. Schultz' analysis (1945) and D. Gale Johnson's (1973).

Schuh's ex post analysis of post-World War II

developments in agricultural trade identifies the value of the U.S. Dollar as having a key role. The study covers a period of relatively fixed exchange rates and focuses not as much on the problem of instability in agriculture as on the longer run problem of structural disequilibrium. The over-valuation of the Dollar, which Schuh identifies as occurring around the time of the Korean War, stimulated a policy response in the U.S. which led to stock accumulation. Following policy adjustments which took place over the next two decades, agriculture in the United States "was about as close to being in adjustment at prevailing domestic price ratios as it had been for twenty years" [p.10, emphasis in the original].

Schuh wants to provide not only an historical analysis of structural change but also a perspective from which to view the future. He cautions that his argument does not exclude previously-identified forces on agricultural trade, such as how the development process affects the sectoral position of agriculture or the existence of barriers to trade. However, he points out that the exchange rate had thus far been a neglected variable in agricultural economic literature.

Analysis of the role of exchange rates in agricultural trade has continued throughout the last decade. The tenor of treatment, however, has shifted from the structural impact of the exchange rate on agriculture to its relevance in explaining the variability of trade.

This shift in orientation no doubt reflects in part the changed climate of international agricultural trade over the 1970s, in particular the move to flexible exchange rates between 1971 and 1973. Arguments have tended to focus on the relationship between the exchange rate and elasticities of demand and supply. Moreover, most the the studies following Schuh emphasize the undervaluation of U.S. currency rather than its overvaluation.

A pair of studies done in 1976--one theoretical, the other empirical--examine the impact of an exchange rate change on prices and quantities traded within a free trade environment. In his theoretical analysis, Wm. E. Kost (1976) contends that a change in an exporter's exchange rate alters the perceived supply and demand functions in the importing country, thus shifting import demand in the trade sector. Similarly, a change in an importer's exchange rate alters the excess supply function of the exporter. In this analysis, the impact of changes in the exchange rate depends solely on the magnitude of the exchange rate change and the elasticities of excess demand and supply. Assuming that these functions, derived from inelastic domestic functions, are themselves inelastic, Kost concludes that the impact of exchange rate changes on trade is small and "what effect there is will be primarily on price rather than quantity." [p.104]

Amalia Vellianites-Fidas (1976) tests Kost's

theoretical implications using both cross-section and time-series regression analyses. The cross-sectional study examined changes in U.S. trade in wheat, corn and soybeans during the two devaluation periods in 1971 and 1973. These exchange rate changes did not appear statistically significant in explaining either price or quantity changes for any of the commodities examined. The time-series study spanned trade among 20 countries over the 1960s, with similar results. Explanation for this insignificant relationship rests on the inelastic nature of excess supply and demand, although in the cross-sectional study, the price-insulating policies of the European Community are noted also.

M.E. Bredahl and P. Gallagher (1977) challenge Kost's assumption about the inelastic nature of excess supply and demand. Even if domestic relationships are inelastic, they argue, theory shows that the elasticity of excess relationships is the sum of domestic supply and demand elasticities and therefore may be greater than one. This study concludes that, although the size of the price effect may be confined to that of the exchange rate change, the quantity effect may be more if either of the excess relationships is elastic.

Subsequent studies on the impact of exchange rates on agriculture typically recognize that a perfectly competitive market does not obtain. This observation changed the focus of argument from the elasticity

relationship between domestic and excess functions to how and by how much exchange rate changes are transmitted. To analyse these questions, some level of demand and supply elasticities are typically assumed.

P.R. Johnson, T. Grennes and M. Thursby (1979) employ a differentiated goods model to examine U.S. wheat trade during the 1972-74 period, incorporating policy changes in major exporting countries. They note that devaluation by the United States was not the only economic variable whose fluctuation influenced trade during the period reviewed. Also during this period, the European Community and Japan lowered their tariff levels, Canada and Australia restricted exports by selling wheat domestically at lower-than-world prices, and costs of shipping U.S. wheat increased. Johnson, Grennes and Thursby develop a model which incorporates these policy changes and allows for goods to be differentiated with respect to place of origin. In their model, which is short run in nature, supply is exogeneous. Their results show that dollar devaluation did contribute to an increase in wheat prices in 1972 and 1974 but they caution that while "the monetary effect should not be ignored ... neither should it be exaggerated" [p.624].

This study also attempts to measure distributional effects on factor prices, an hypothesis of Schuh. Empirical estimates do not bear out Schuh's forecast.

However, it is pointed out that price changes in 1973-74 could have been perceived as transitory rather than permanent, thus not warranting capitalization into land.

M.E. Bredahl, Wm. Meyers and K. Collins (1979) hold that domestic agricultural policies which insulate domestic prices from world price changes lower the price transmission elasticity (the response of one country's price to a change in another's price). Measures of this effect on export demand elasticities are provided. Bredahl, Meyers and Collins note that the price transmission elasticity will normally be between zero and one--equal to one with free trade conditions prevailing and zero with complete isolation. Three estimates of exchange rate effects are calculated: a minimum under restricted trade where the price transmission elasticity for all countries equals zero (a lower bound); a maximum under restricted trade where it may equal one for some countries and zero for others; and a free trade case (an upper bound).

In a later article, Collins, Meyers and Bredahl (1980) include the differential impacts of inflation in an analysis of exchange rate effects under both fixed and flexible exchange rate assumptions. They conclude that "as the pervasiveness of nominal-price insulation policies increases, the impact of exchange rate changes on U.S. export demand and real commodity prices increases significantly" [p.664].

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R.G. Chambers and R.E. Just (1979) break from tradition in their treatment of the role of exchange rates in the agricultural sector. Their concern revolves around a perception that "the most common specification [of the exchange rate] in empirical work is overly restrictive" [p.255] in that it forces all adjustments to exchange rate changes onto the price variable. Thus the price response is typically assumed to lie between zero and one. Chambers and Just say that this imposes an implicitly false assumption that cross-price elasticities are equal to zero. They contend that an exchange rate change can cause changes in all other prices and suggest the inclusion of the exchange rate in agricultural trade models to account to this effect.

Given non-zero cross-price elasticities, a change in the exchange rate can shift both demand and supply of a commodity, and these shifts can result in price or quantity changes which are larger than the original exchange rate fluctuation. This contrasts with Collins, Meyers and Bredahl's conclusion that exchange rates equilibrate changes in relative inflation rates. Under flexible exchange rates, Collins, et al. say inflation will change nominal commodity prices, leaving demand and supply unchanged; while under fixed exchange rates, inflation will change supply and demand but not nominal prices. Chambers and Just conclude that trade elasticity

estimates which limit exchange rate impacts on prices to the zero-one range may be biased downward.

Using what is essentially a macroeconomic model, Chambers and Just (1981) measure the impacts of exchange rate changes on both domestic and foreign sectors of U.S. agriculture. Both the short and long runs are examined for wheat, corn and soybeans. Results show that domestic disappearance and inventories decline with a devaluation while exports and prices increase. Short-run elasticities with respect to exchange rate changes are found to be higher than long run elasticities. Soybeans are more price responsive, while wheat and corn are more quantity responsive.

Michael R. Reed (1980) comments that the solution offered by Chambers and Just of employing the exchange rate as a separate variable to capture cross-price effects is theoretically inappropriate. Since "the exchange rate, in and of itself, is only relevant to excess demand functions as a domestic deflator" [p.253], Reed suggests that actual prices of relevant substitutes and complements be used. However, this begs the question of whether such prices are available for incorporation into trade analyses.

Bruce Gardner (1981) points to an inconsistent use of theory in incorporating the exchange rate in agricultural trade models. When looked at in the Marshallian sense, exchange rate influences enter via the standard exogeneous

determinants of demand and supply. Essentially this is Reed's view. However, when using Keynesian analysis, nonstandard variables such as the exchange rate and recessions/inflation can be included separately.

In Gardner's own econometric analysis, dependent variables such as farm prices received, real net farm income and real farm land prices are regressed on macro variables which include recession, inflation, productivity, nonfarm wages, and the exchange rate. Where exchange rate is included, it typically is the most significant explanatory variable for the data period 1956-78. Gardner suggests that before this period, recessions had a major influence on the agricultural economy.

Alex F. McCalla (1982) examines linkages between instability and international monetary variables. Macro variables have a variety of effects: the exchange rate affects price; interest rates affect supply; recession affects demand through income; and there is also a portfolio effect. McCalla finds that "demand impacts [from inflation and recession] through income may be as large or larger than price impacts that come about through exchange rate changes." [p.866]

Dennis R. Starleaf (1982) tests the hypothesis that exchange rate changes affect farm prices. Farm product prices are regressed on changes in the exchange rate (as measured by a trade-weighted market basket of foreign

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currencies) and changes in domestic farm and nonfarm output. As expected, results show a significant negative relationship between exchange rate changes and farm product prices.

A study by Jim Longmire and Art Morey (1982) addresses dollar appreciation rather than depreciation, since the dollar had in fact appreciated by the early 1980s. A succinct summary of the still-open questions about the exchange rate effect on trade is provided [p.3-4]: (1) whether the impact of exchange rate changes on price should be confined to the range 0-1; (2) whether and by how much the price transmission elasticity is less than one; and (3) what impact cross-price effects have.

Adopting domestic price elasticity estimates from previous studies, Longmire and Morey use the inflation-adjusted exchange rate as the key variable. In this they follow the procedure used by Collins, Meyers and Bredahl (1980). This procedure accepts that inflation is dependent on factors other than the exchange rate, factors such as real shifts in supply and demand, unanticipated policy shifts and short term capital movements, and rigidities in labour and goods markets. The approach used by Longmire and Morey makes explicit assumptions with respect to inflation but modify these to allow for cross-price effects between commodities, alternative assumptions with respect to expectations, and also different stockholding behaviour.

Estimates of the exchange rate effect are calculated under assumptions of both perfect nominal price transmission and less-than-perfect transmission, though Longmire and Morey agree with previous authors that the latter is more realistic given the degree of domestic protection. They find that both price-insulating domestic policies and stockholding programs reduce the impact of exchange rate changes on U.S. agriculture. However, they concur with Chambers and Just that the direction and magnitude of change in exports and prices resulting from an exchange rate shift cannot be predicted a priori.

Several general equilibrium models have been proposed to examine various aspects of the macroeconomic environment, in particular the exchange rate. Shun-Yi Shei (1978) found that in a general equilibrium framework, the estimated impact of exchange rate changes are somewhat less than that found in partial approaches [pp. 110-111]. David Orden (1983) presents a general equilibrium model which he expects will show a modification of exchange rate impacts [p.4] but does not test it empirically. Finally, R.G. Chambers (1984) develops a theoretical model which "provides rigorous justification for Schuh's assertion" [p.18] that exchange rate changes cause disequilibrium in agriculture.

Thus the arguments surrounding the role of exchange rates in agriculture have come full circle to focus again,

through the use of general equilibrium models, on structural impacts. One outcome of this review is clear: there is still no agreement on what impact exchange rate changes have on agriculture. Another outcome is that exchange rate effects are hard to measure. Results depend critically on underlying assumptions. In particular, one assumption that appears critical to measurement of the exchange rate effect is the degree of reliance on domestic demand and supply elasticities determine trade elasticities. The validity of this assumption will be examined in a later section of this chapter.

3.1.2 BALANCE OF PAYMENTS ISSUES

With the shocks imposed on the international financial system by the Organization of Petroleum Exporting Countries and associated recessions in both the industrialized and the developing world, the role of debt in trade has received some attention. Focus has been given to how debt positions of LDCs has affected or will affect their ability to import. The relationship between agricultural trade and balance of payments also has received some attention.

With respect to the balance of payments issue, C. Fred Bergsten (1980) found that the sharp growth in oil imports in the mid-1970s, coupled with world recession, contributed to the deterioration of the U.S. trade balance as well as that of many other industrialized countries.

According to the World Food Institute (1983), at least part of this effect was mitigated by a positive balance of agricultural trade. Such a positive contribution to the U.S. trade balance has not always been the case. In the early 1960s, for example, the net contribution of agriculture to the U.S. balance of payments was negative, as reported by R.C. Christensen and O.H. Goolsby (1973).

With respect to some LDCs, debt problems have caused serious concern. In a study covering trends in the external debt of developing countries from the mid-1950s to mid 1970s, Gordon Smith (1979) documents the increases in debt and associated debt servicing requirements of non-oil LDCs. From 1960 to 1973, total LDC debt increased 5.4 times to almost 120 billion dollars. It is noted that subsequent events "have brought dramatic changes, probably for the worse" [p.291]. Smith expresses "tentative optimism" [p.321] in that inflation and traditional rescheduling have provided some relief. However, he suggests that employment of other mechanisms may be necessary to ward off serious contingencies [p.316].

B. Huddleston (1984) also seems to share some optimism about the ability of LDCs to pay for agricultural imports. She compares the total cost of cereal imports to export earnings between the periods 1961-3 and 1976-8. It appears that this ratio has declined in most LDCs [p.36]. Exceptions to this decline can be found in countries in Latin America and North Africa/Middle East. When food aid

is taken into consideration, the value of total cereal imports to export earnings increased only in Latin America over the time period studied.

A USDA study (1984) links the current weakening of the U.S. position in trade first to "the incapacity of major LDC importers to buy" [p.14]. Other factors contributing to a weakened U.S. trade position include the appreciation of the dollar and U.S. farm programs. This study discusses both financial system linkages between countries and also how these relate to current and future U.S. policy. It is remarked that "In today's environment, the majority of LDCs are facing a large debt overhang, a significant reduction in new credit availability, and stringent economic austerity." [p.5]. Part of the response to this situation, being encouraged if not imposed by the International Monetary Fund, is a reduction of imports by these countries while exports are fostered.

This brief review of balance of payments concerns brings into focus the changing role of debt in international trade. Putting a date on when debt becomes a serious problem seems to be a matter of opinion, as evidenced by the discussion of the topic in Cline (1979). However, it does appear evident that debt will loom larger in future trade considerations.

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3.2 IMPERFECT MARKETS

Literature on imperfect markets in agricultural trade is almost as ubiquitous as that on exchange rate effects and often such topics overlap. As noted above, T.W. Schultz (1945) points out that a deterrent to U.S. trade post World War II was the essentially protective domestic pricing policies in effect at that time. This section of the review of literature provides a representative selection of recent studies, each of which attempts to measure the effects of indirect government involvement in agricultural trade. This literature is typified in two ways: (1) from the point of view of deviations from a desired norm of 'perfect' markets and (2) from the point of view of different national goals and constraints.

No consideration is given here to the effects of various international commodity agreements, nor to literature describing direct government control of markets. A comprehensive review of state trading organizations can be found in M.M. Kostecki (1982). The effects of a grain export cartel are discussed in A. Schmitz et al (1981). Other studies focussing on market structure include A.F. McCalla (1966) and C.M. Alaouze, A.S. Watson and N.H. Sturgess (1978).

3.2.1 IMPERFECTIONS AS DEVIATION FROM A DESIRED NORM

Shel and Thompson (1977) examine the effect of trade restrictions on world wheat price stability over the 1972-

3 period. They begin with the premise that "theoretical arguments concerning the global gains from free trade due to more efficient resource use are well known. Less well recognized are the price-stabilizing effects of free agricultural trade." [p.628] Their goal is to draw attention to the latter. Presumably their analysis has a nation-neutral application; however their initial assumptions involve price restrictions in all importing countries and in the European Community, while prices in other exporting countries are assumed responsive to changes in demand and supply.

Rather than directly estimating excess demand, a , quadratric programming model is used to examine trade flows and prices. Price elasticities are generated by combining a given domestic elasticity with the ratio of total quantities demanded to quantities imported. Data are applied to three scenarios, each with a different level of trade restrictions. Their results demonstrate greater world price variability as domestic price restrictions apply. It is noted, however, that the magnitude of shock effect is very sensitive to price elasticity assumptions.

A study by Firch (1977) examines the sources of U.S. farm market receipts over the period 1920-75. With respect to U.S. domestic price policies, it is concluded that these "effectively buffered the variance of market

receipts from the instability of foreign demand and largely explain the relatively low variance of market receipts in these periods [1946-55 and 1966-75]." [p.166] This contrasts with the Shei-Thompson results. However, the two sets of results apply to different time periods, and also the Shei-Thompson study focusses on world price rather than domestic income.

In Firch's study, the business cycle appears to be most highly associated with the variability of market receipts over most of the period, with exchange rate changes being highly associated with market receipt variability in the period 1966-75. Looking at receipts for specific commodities (cotton, wheat, corn and soybeans), Firch finds that "inventory changes buffered variance that would otherwise have arisen from changes in production" [p.167] since 1945. However, he is not arguing for a government stock program, stating that "any commodity reserve program that is intended to stabilize farm income will likely neutralize a substantial amount of free-market stabilizing capacity before it achieves any net stabilization of income." [p.168].

M.D. Bale and E. Lutz offer further argument against the presence of trade restrictions. In a theoretical study (1979) they examine how different types of government market intervention generate different levels of instability as compared with the free trade case. For example, quotas are more destabilizing to world price than

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In a subsequent paper, Bale and Lutz (1980) measure welfare effects of market intervention in nine countries (including both industrialized and developing) for several agricultural commodities in 1976. A partial equilibrium comparative statics model is used, and assumptions are made with respect to direct price elasticities. Cross-price elasticities are assumed to be zero. In their results, producers in developed countries are shown to benefit from government price intervention while those in developing countries are taxed. The impact on consumers in these two areas is the reverse. Governments in all but one country (France) gain revenue. These results are apparently "stable with respect to elasticity assumptions" [p.19].

3.2.2 CONFLICTING NATIONAL PRIORITIES

T. Josling (1980) provides a study of the effects of domestic policies on world wheat trade. Consumer and producer subsidies/taxes are measured for five developed countries plus the European Community, and their impact on developing countries is discussed. A major conclusion of this study is that price and stock policies in developed countries often work together to increase supply variability on international markets. Although this outcome is not likely the intention of such policies, it exacerbates grain availability problems experienced in

developing countries.

In two papers, P.C. Abbott (1979a, 1979b) presents a model which makes the government decision-making process either explicitly or implicitly endogenous. Whether, which and to what extent trade policies are adopted are matters of choice. Abbott states that "the assumption that free market behavior is sufficient to find the response of a country's net import demand to changes in international prices may no longer be valid." [1979a, p.23] In these studies, Abbott shifts attention from domestic demand and supply to net import demand.

Abbott's model incorporates three policy instruments: the producer price, the consumer price and the release of stocks. Using data which cover the period 1951 to 1973, his econometric results indicate that "domestic prices and net imports are unrelated to border prices in many countries" [1979a, p.29]. Moreover, exporters appear to adjust stocks in response to market conditions. Domestic price policies make the net import demand function less elastic; whereas stock adjustment policies make the net export supply function more elastic.

In a study appearing about the same time, A.C. Zwart and K.D. Meilke (1979) model government price policy and buffer stock policy as instruments affecting price stability. They simulate market outcomes over the period 1976/7 to 1990/1 for major wheat exporters and importers.

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Their findings indicate that domestic price policies blunt the relationship between domestic prices and world price, increasing world price instability. Stock policies typically add stability, though at some holding cost in absorbing market fluctuations. The stability generated through stockholding is subject to correct specification of the storage rule.

A study by P.L. Paarlberg and R.L. Thompson (1980) points to the partial equilibrium nature of previous national policy research as such policies affect trade. They show that unless cross effects between commodities are taken into account, estimated effects of policies may be biased. Empirical application of their theory reveals how critical are assumptions with respect to own- and cross-price elasticities. Analysis of an initial situation where cross-price elasticities are assumed to be low relative to own-price elasticity shows little difference from a single-commodity approach. However, where the assumed relative size of these elasticities is switched, the price response to policies is much more significant.

Nancy E. Schwartz and David Blandford (1981) place less emphasis on the destabilizing effect of domestic policies, particularly those of developed countries, on trade than on production variability. They note that increased trade with developing and centrally planned countries has altered market structure. Regions with

higher production variability have entered international markets and regions with more stable output have left. For example, consumption of wheat in developed countries relative to LDCs and CPEs has been falling steadily over time. Their reminder that physical variables are important is well taken. However, these relatively new entrants in international markets also bring with them their own political constraints.

3.3 ELASTICITY ESTIMATES

The concept of elasticity is fundamental to much economic analysis. Early international trade studies, examining price and income responses focus mainly on trade in non-agricultural sectors of the economy. Such reviews include, for example, H.S. Cheng (1959-60), S.J. Prais (1962) and R.M. Stern, J. Francis and B. Schumacher (1976). Those elasticity estimates which have been provided for traded agricultural commodities typically are tied to neoclassical trade theory. Following this theoretical approach, empirical estimates of domestic demand and supply elasticities are used to generate estimates of the responsiveness of excess relationships. More recently, other factors such as the exchange rate and domestic protection policies have been cited as affecting trade elasticities. The outcome has been a reinterpretation of the relationship between trade and its

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determinants, with more focus now given to direct estimation of demand.

3.3.1 EARLY ELASTICITY ESTIMATES IN INTERNATIONAL TRADE

L.G. Tweeten (1967) provides some of the earliest estimates of trade elasticities in agriculture, along with elasticity estimates for domestic U.S. demand. To calculate U.S. export demand elasticities for food and feed exports, individual country import demand elasticities for U.S. grain exports are calculated for countries and regions encompassing much of the world. These are then summed to obtain a total price elasticity of demand for U.S. grain exports. The equation used for this calculation involves domestic demand and supply elasticity estimates for each country or region, which are weighted by the ratio of relevant quantities of individual countries' demand and supply to total U.S. exports and also by the elasticity of domestic prices with respect to the U.S. price (here and elsewhere called the price transmission mechanism). The price transmission mechanism is assumed by Tweeten to equal one in the long run.

The various import demand elasticities are formed by subtracting the weighted domestic supply elasticity from the weighted domestic demand elasticity. These are then summed over countries and regions to get the total elasticity for U.S. exports. The calculation yields an estimated excess demand elasticity of -15.85. Tweeten then

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scales this initial estimate down by considering factors such as foreign supply elasticity, aid and tariff barriers and arrives at a U.S. export demand elasticity of -6.42.

Tweeten points out that his elasticity estimate pertains to U.S. exports alone. World demand elasticity for grains would be smaller by the proportion of U.S. exports to world production [p.365].

H.S. Houthakker and S.P. Magee (1969) estimate elasticities of U.S. exports by commodity class. They use a double logarithmic equation to regress agricultural and nonagricultural exports on first differences of income and price. World income elasticity for total agricultural exports is estimated at 1.02 and price at -.96. When agriculture sector data are broken into commodity classes, the income elasticity for crude foods is .97; no price elasticity is given for this commodity class. In all cases, the significance of income is greater than that of price in determining U.S. exports.

Paul R. Johnson (1977) takes issue with Tweeten's procedure for arriving at import demand elasticities for U.S. products, though not with the estimate itself. He interprets Tweeten as not taking into account the share of U.S. exports in total exports. Johnson suggests that rather than looking for an aggregate elasticity over commodities within each country and then summing, as he says Tweeten does, it is preferable to estimate elasticities for individual commodities and then weight

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these by level of market participation to arrive at an aggregate demand elasticity. In a reply to Johnson's critique, Tweeten (1977) correctly points out that his procedure also uses weights, though at an earlier stage, thus obviating Johnson's criticism.

In an informative study by H. Coffin (1970), net import demand for wheat is estimated directly for the period 1959-66. Both industrial and less developed countries are examined. The method to obtain price and income elasticity estimates involves, first, estimating a model in which all parameters of the exogeneous variables are assumed to be constant. Then the model is reestimated, employing different combinations of dummy variables to account for variation between countries (measured by changes in the intercept term and in the slopes of price and income parameters). Overall results place the price elasticity for wheat import demand between -0.21 and -0.87 [p.89]. Net import demand elasticity estimates obtained by Coffin for individual countries are discussed further at the end of Chapter Five.

Results of a study by A.S. Rojko, F.S. Urban and J.J. Naive (1971) have often formed the basis of import elasticities estimates employed in subsequent research. For example, Shei and Thompson (1977) and also Bale and Lutz (1981) use these results to examine the effects of trade restrictions. Domestic demand and supply

elasticities for wheat, coarse grains and rice are estimated by Rojko et al. for selected countries using multiple regression techniques. Along with elasticity estimates, this study demonstrates how preferences change for different grains throughout the development process [pp.28-9]. Although their focus is on domestic elasticities, a world elasticity of demand is inferred from the price flexibility of major grain exporters of close to unity for wheat and somewhat higher for coarse grains [pp.39-40].

3.3.2 RECENT IMPORT DEMAND ELASTICITY ESTIMATES

Abbott's argument (1979a) rests on there being forces in the international market apart from domestic market conditions that affect the response of import demand to changes in world price. He begins his analysis with the premise that "the assumption that free market behaviour is sufficient to find the response of a country's net import demand to changes in international prices may no longer be valid." [p.23] Abbott estimates consumption elasticities (the change in trade given a change in import price, calculated at a mean consumption level) which for developing countries are typically lower than the domestic demand price elasticities for both wheat and feed grains. For exporters, his calculated elasticities are typically higher than those which are suggested by looking only at domestic supply and demand responses.

A.C. Zwart and K.D. Meilke (1979) use assumptions similar to those of Abbott but rather than staying with the net import demand function, they simulate derived domestic demand elasticities. Their estimates of derived demand price elasticities are significantly lower than those reached by Rojko et al. [p.439].

M.E. Bredahl, Wm. H. Meyers and K.J. Collins (1979) accept Tweeten's method for estimating excess demand elasticity (that is that excess demand and supply elasticities are derived from summing domestic demand and supply elasticities). However, Bredahl, Meyers and Collins do not assume unity for price transmission. Using given domestic elasticity estimates and implied values for the price transmission elasticity (where zero represents complete price insulation and one represents free trade), they modify Tweeten's excess demand elasticity estimates. Estimates of export demand elasticities for U.S. grain are provided for major regions of the world [p.62]. Their estimates are typically greater than one for both wheat and corn. Elasticities for wheat demand range between -.4 (Japan) to -6.78 (USSR) and those for corn between -.39 (Japan) and -9.02 (Eastern Europe).

C.L. Jabara (1982) uses Abbott's procedure for estimating a reduced form net import demand equation for wheat. Pooled time-series and cross-sectional data for a group of LDCs over the period 1976-79 are used. Two subgroups are compared: those producing wheat and those

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not. Her import demand elasticity estimates are lower than those of Bredahl, Meyers and Collins. Price elasticity is higher and more significant in nonwheat producing countries ($-.18$) than in those producing their own wheat (-0.07).

3.4 SUMMARY

In all these studies, the importance of elasticities in international trade is recognized. Yet major methodological and empirical differences exist.

J. David Richardson (1976) has pointed to two different views of the international trade environment. One takes what he calls a "monetarist" approach, which carries with it the assumption that a domestic good is a perfect substitute for a foreign good. Another fundamentally different approach assumes "imperfect substitutability between foreign and domestic commodities" [p.183]. The first implies that foreign and domestic prices must equate, at least in the long run; the second implies that real factors may exist which prevent these prices from equating. Such factors affect not only assumptions with respect to the price transmission elasticity, but also expectations about demand and supply elasticities. The two approaches can lead to different questions about relationships in international trade and to different ways of modelling these relations. Different

ways of treating the exchange rate or elasticities issues in international trade seem to reflect one or the other of these approaches. No conclusive test has been provided to choose between them.

Throughout this study it is considered that real forces may exist which keep domestic and foreign goods from being perfect substitutes. These forces include different roles for the agricultural sector in different countries, and different goals nations have for the growth and development of their economies. These are implicit in the model described in the next chapter.

CHAPTER FOUR

A STRUCTURAL MODEL FOR INTERNATIONAL TRADE

4.1 A CONCEPTUAL FRAMEWORK

A 'market-plus' framework is used to consider characteristics of agricultural trade. Neoclassical trade theory tells us something about the international environment of grain markets. It describes behavioural relationships between individuals as they act independently in a market environment. This theory typically leaves government out of the picture, except perhaps by treating government decisions as market interference. It also leads to attention being given to traditional economic variables to the exclusion of some of the influences on demand which more recently have gained importance. In this chapter, direct estimation of net import demand is suggested as a way to incorporate implicitly into a market framework some of the influences brought about by government interaction and the macroeconomic environment.

4.1.1 THEORY OF COMPARATIVE ADVANTAGE

The main arguments for trade lie in the theory of comparative advantage. Under the theoretical assumptions of perfect competition, flexible prices and full

employment, trade enables efficient use of each country's resources and maximizes each country's preference structure.

Comparative advantage can be defined in general terms as the relative ranking of products or resources between countries. A problem which has been encountered in applying the theory is how or what to measure for ranking purposes. This is more than just a technical question of measurement; it involves differences of opinion with respect to how comparative advantage theory is best formulated.

In Ricardo's original formulation of comparative advantage, gains from trade arose because relative costs of production for different products differed between two countries.¹ It was assumed that goods were produced at constant costs within countries but that costs could differ between countries. A theoretical implication of this formulation is that under either a decreasing or a constant cost structure, perfect specialization would occur. This realization led to an investigation of the determinants of cost.

The Heckscher-Ohlin formulation of the theory of comparative advantage explained cost differentials on the basis of different factor proportions, or natural endowments, between countries. As trade occurs, the cost structures in the trading countries tend toward equality.

When used in conjunction with the law of diminishing returns, an equilibrium can be reached with incomplete specialization.

Subsequently, many product and market characteristics have been put forward to explain observed trading patterns in terms of comparative advantage theory. For example, as discussed in Kreinin (1979) different levels of technology between countries, differences in labour skills embodied in products and differences in demand preferences have been used to defend the existence of mutual gains from trade.

Under assumptions pertaining to perfect competition, domestic demand and supply functions give rise to excess demand and supply functions found at the international trade level. Domestic prices in countries trading with each other tend toward equalization through trade. Equilibrium occurs through the interaction of individual countries' excess supply and demand functions, at which point related exports, imports and prices in each country are determined. Figure 4.1, adapted from Kost (1967), depicts this interaction.

In reality this does not occur. Prices in different countries are observed to diverge from those anticipated by the theory. This observation has led to use of either an imperfect-substitutes model or an imperfect markets model in trade analyses. In the former, as Richardson (1976) points out, the domestic good and the foreign good

are treated as separate entities. This allows for differentiated prices in each market. Analogously, using the imperfect markets framework, imperfections such as tariffs, quotas and other forms of protection, explain the persistence of price differences. Such models are reviewed in Chapter Three, section two. In such models, the relevant price to substitute for the domestic price of the commodity under consideration typically becomes the foreign price of the good, under the implicit assumption that all other relative price relationships remain constant.

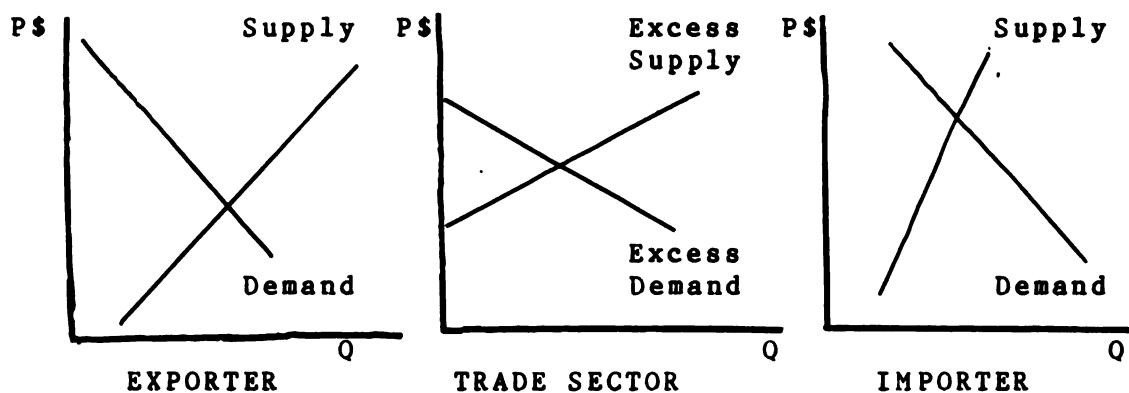


Figure 4.1

TRADE UNDER PERFECT COMPETITION

A problem in applying the theory of comparative advantage to real world situations is related to the unattainable nature of its assumptions. The theory rests on there being a static set of known resources which

operate in perfectly competitive markets at full employment.² In such a world, the question is one of efficiency--how to minimize resource use while maximizing consumer preferences. Comparative advantage thus becomes a technical issue. This approach omits from analysis conflicts with respect to preferences and other values, not to mention the dynamics of value formation.

Here it is hoped to get around some of the difficulties in applying the concept of comparative advantage. To achieve this, attention is given to how trading countries actually respond to their economic environment rather than on how they would respond given assumptions with respect to domestic demand and supply relationships. In terms of Figure 4.1, the subject of investigation is the net import demand function (excess demand) in the trade sector.

4.1.2 DIRECT IMPORT DEMAND ESTIMATION

To examine structural characteristics of trading patterns, the net import demand relation is estimated directly, as opposed to estimating trade relationships from domestic demand and supply functions. Public intervention by governments acting on behalf of domestic special interest groups often means that the effect of world prices and production on trade is less than that suggested by domestic demand and supply relations. Thus, it is assumed that government policy can alter trade

patterns by influencing parameters of domestic demand and supply. Further, what is traded may be strongly influenced by changes in the monetary environment in which trade takes place. For instance, factors such as exchange rates and debt relationships are usually not specified in the standard demand/supply model.

Economic interdependence has increased between countries which are geographically and politically independent. Aspects of growing interdependence are witnessed, for example, by increased volumes of trade internationally, which transmit weather-induced supply uncertainty further afield. There are also closer monetary connections between countries, adding a dimension to the need for coordinated efforts.

Along with increased interdependence has come a growing awareness within individual countries of the impact of trade-induced instability on the well-being of their own domestic economies. Growth of economic interdependence erodes de facto political sovereignty. Domestic public choice decisions, intended to minimize the negative effects of such instability domestically, can magnify instability for others and eventually lead to a further round of policy responses affecting their own instability, albeit in different ways. Types of choices having such an effect not only include the setting of goals with respect to a desired level of protection and degree of self-sufficiency, but also include the degree of

regulation of domestic prices and/or stocks. Seen in this light, actions taken within a domestic-country often will clash at the international level, leading to unexpected results.

4.2 THE PROPOSED THEORETICAL MODEL

The theoretical model is intended to highlight the importance of the changing environment of international grain trade. The proposed behavioural relationships seek to reflect this focus.

There are aspects of grain trade that will be ignored for reasons of simplicity, even though there is evidence that they matter for some types of analysis. Such aspects include the sourcing of grain (for example, the question of whether purchases are made out of habit which overrides other considerations), and the difference between qualities of grain. Other studies, such as Johnson, Grennes and Thursby (1979), have focussed on these issues. For purposes at hand, wheat and coarse grains are each viewed as homogeneous products. Also, transportation costs are not explicitly considered in this analysis.

The model is intended to provide clues as to what characteristics of net import demand may be important within various economic, political and societal environments. It builds on the neoclassical supply/demand equilibrium model and, following a model developed by

Abbott (1976), an explicit price relationship between the world price and domestic prices is incorporated which allows for adjustments in policy.

Drawing from previous theoretical studies, in particular that of Chambers and Just (1979), other variables are added to consumption and production relationships to take into account the growing interdependence among trading nations. Variables warranting attention here relate to the monetary aspects of trade. They include effects of exchange rates and rates of inflation, aid, and the level of foreign exchange reserves. These are all affected to some extent by public choice decisions, either at the domestic policy level, at the foreign policy level, or both. In addition, a domestic stockholding relationship is specified which takes into account both individual and government participation.

4.2.1 PRICE RELATIONSHIPS

Following a theoretical model developed by Abbott, domestic prices for traded goods may bear resemblance to international prices to a greater or lesser degree, or they may be independent of world prices. The relationship of domestic prices and world prices is assumed to depend on price connectors such as the exchange rate and/or relative inflation rates, but also on the degree of government-induced intervention in the domestic economy.

As will be seen below, the role of government policy is crucial to theoretical expectations with respect to price elasticities of net import demand.

Under autarky, domestic market price in competitive theory equilibrates domestic demand and supply. Within this theoretical framework, prices (of both inputs and products) are assumed to be perfectly flexible. For a traded good, traditional trade theory typically (for the small-country case) assumes that world price determines domestic prices; that is, price is an exogenous variable except for the major trading countries. However, it seems reasonable to assume that government decisions can and may affect the relationship between the world price and domestic prices, particularly in the short run.

Starting with the neoclassical market model and assuming both perfect competition and zero transportation costs, domestic price (PD) would be expected to equal world price (PW), ignoring for the moment the exchange rate. Allowing for the imposition of a fixed tariff and/or nonzero transportation costs, domestic price would be expected to be some constant proportion to world price:

$$PD_{x1t} = PW_{xt}(1+Z) \quad [4.1]$$

where Z represents either the tariff or transportation costs or both, x represents the specific commodity, i the specific country in question, and t the time period. Without considering the presence of domestic price-insulating policies, changes in domestic prices would be

expected to reflect changes in the world price, at least in some constant proportion.

Contrary to the above expectation about domestic prices for traded goods, the hypothesis here is that domestic pricing policies may intervene in the relationship between domestic and world prices. It may even be that domestic prices are completely isolated from world prices. However, it is considered unlikely that complete isolation between domestic prices and the world price could continue in the long run. A more plausible hypothesis is that there may be partial adjustment of domestic prices to changes in the world price in the short run to accommodate domestic pricing policies. Given that such an adjustment takes place due to policies which at least in part insulate domestic prices from changes in the world price, an initial price relationship might be:

$$PD_{xit} = a_0 PD_{xi(t-1)} + mPW_{xt} \quad [4.2]$$

where:

PD_{xit} = domestic price, current time period

$PD_{xi(t-1)}$ = domestic price, previous time period

PW_{xt} = world price

This relationship expresses domestic prices as a function of both the domestic economic environment (allowing for the response of current domestic prices to previous domestic prices) and the world environment (allowing for the response of current domestic prices to

world price changes).

Summing over j time periods, domestic price response to world price can be expressed as a function of changes which took place in an earlier period and the current response:

$$PD_{xit} = m a^j PW_{(t-j)} \quad [4.3]$$

where m shows the immediate adjustment of domestic prices to world price changes and a shows the importance of previous period's world price on current domestic prices. If $j=0$, the lagged response becomes a constant and all that is reflected is the immediate price adjustment of domestic price to changes in world price. The coefficient m , then, is the short run response of domestic prices to changes in world price. Where domestic pricing policies do not exist and where domestic prices vary proportionally to the world price, $m=1$. Where domestic policies completely dominate, $m=0$. So far, the price specification is as formulated by Abbott.

There are other factors, either external or internal to an economy, which can affect the relationship between domestic and world prices. Foreign exchange availability, foreign aid and stocks are considered in this context.

Where foreign exchange availability is limited, governments may be unwilling or unable to maintain domestic prices below the world price. Spending of foreign exchange will depend not only on income earned through export receipts, representing repayment capacity,

but also on the existing level of debt in the country under consideration. Further, foreign aid may affect the price -relationship by supporting or thwarting the intent of domestic pricing policies, making the latter easier or more difficult to maintain. The role of foreign aid in trade analysis is discussed at the end of this chapter. Such factors as aid and foreign exchange availability are likely to have a greater effect in developing economies than in more industrialized countries. These factors may change from year to year or may represent a relatively permanent situation, depending on the country.

Internal country stockholding behaviour may also have an effect on the relationship between domestic and world prices. The extent to which a country holds stocks (at the moment ignoring any difference in behaviour stemming from private versus public holding of stocks), will be affected by the level of domestic production and also the availability of storage capacity. Thus, stockholding behaviour is likely to be more significant for major producers and exporters of grain.

Taking the above factors into consideration, the price relationship suggested here for a given commodity is:

$$PD_{xit} = f(PW_{xt}) + g(FX_{it}, ST_{xit}, AID_{it}) \quad [4.4]$$

where:

PD_{xit} and PW_{xt} are as described above

FX_{it} = a measure of foreign exchange availability

ST_{xit} = beginning stocks

AID_{it} = foreign aid

Similar arguments can be made to derive separate relationships for consumer prices and producer prices vis a vis the world price. For purposes here it is assumed that domestic producer and consumer prices respond similarly with respect to changes in the world price as well as in other variables. This treatment differs from that of Abbott, who specified an enclave production sector where domestic production goes directly into on-farm domestic consumption without first moving through the market. Thus Abbott separated domestic production price from domestic consumption price. Such enclaves exist in all countries, including major exporters. It is felt here, however, that the inadequacies in information relating to enclave production in many countries, coupled with the value of using the same specification for all countries, justifies the use of a single country price.

4.2.2 CONSUMPTION

In demand theory, individual consumers are assumed to maximize their preferences for a set of commodities, given their income and a set of market prices. Assuming conditions hold which allow maximization of preferences, individual demand for a commodity can be expressed as:

$$d_{xit} = c(i_{it}, PD_{xit}, Py_{it}) \quad [4.5]$$

where:

d_{xit} = domestic demand of individual consumers

i_{it} = individual income

PD_{xit} = consumer price of a given commodity

Py_{it} = price of other commodities relevant to consumers

To put individual demand and supply functions into national aggregates, Marshallian neoclassical theory is often used.³ This results in a partial equilibrium model where demand and supply relationships are summed across individuals, typically considering economic relationships for only one commodity or group of commodities at a time.

Using this partial equilibrium model, determinants of the aggregate domestic demand function are similar to those for an individual. Ignoring for the moment variables specific to feedgrain demand, aggregate demand is specified as a function of national income, population, the (endogenous) domestic price, and the aggregate price level of all other goods.

$$D_{xit} = d(I_{it}, POP_{it}, PD_{xit}, Py_{it}) \quad [4.6]$$

where:

D_{xit} = aggregate domestic consumption

I_{it} = gross domestic product, or equivalent

POP_{it} = population

and PD_{xit} and Py_{it} are defined as above.

As shown by Leamer and Stern (1970), if no money illusion is assumed, the above demand function can be

represented by dividing all prices and income through by the general price level. Aggregate demand is assumed thereby to respond to real prices and income so that a doubling of prices and of income will not affect quantity demanded. Population, too, can be incorporated into other variables by estimating per capita demand as a function of per capita income.

As will be seen in Chapter Five, price and income variables are specified as real (deflated) values and income is on a per capita basis. Leamer and Stern note that the assumption of no money illusion may be too strong to impose globally on the data a priori [their footnote 3, Chapter 5]. However, in a multi-country analysis such as the present one, the variation in inflation rates between countries is considered too important to ignore. A per capita specification of income (and other exogenous variables) is used, in part, because of the strong possibility of population being collinear with other exogenous variables.

Other factors may also be considered as determinates of aggregate demand for imported grain. Food aid is included in Abbott's study (1976), and the importance of the exchange rate is proposed by Chambers and Just (1979). To the extent that these change effective demand, they should enter as separate variables in the domestic consumption function. These variables are discussed separately at the end of this chapter.

Demand for coarse grains follows a pattern similar to that for food grains in terms of basic determinants. A major difference between the two is that the demand for coarse grains is in many instances derived from the demand for meat products. Therefore, the amount of coarse grain demanded is related to the number of animals fed in a region. This relationship would be tempered by the methods used in animal production in each individual country. For example, more purchased feed would typically be associated with a more industrialized feed sector. Feedgrain demand would also be affected by the particular mix of animal types fed in specific countries. For instance, the ratio of feed to meat in poultry production is higher than that for beef.

Despite these considerations, no livestock variable has been included to account for the derived demand component of feedgrain demand. Reasons for this are associated with weaknesses in available data and also potential econometric problems. The accuracy of data available on livestock numbers is questionable for many LDCs. Further, inclusion of a livestock component may introduce multicollinearity with other theoretically-based variables such as income (Royko et al 1971) and also domestic production of feed (FAO 1963).

4.2.3 SUPPLY

Total aggregate supply of the commodity in question, without trade, is the sum of production and stocks.

$$S_{xit} = PRO_{xit} + ST_{xit} \quad [4.7]$$

Specifically, stock levels at the beginning of every time period (one year) plus production during that year make up domestic aggregate supply.

4.2.3.1. Production

A standard neoclassical production relationship at the firm level is derived from the producer's goal of profit maximization subject to input costs, the technical relationships between inputs and output portrayed by a production function and exogeneous events such as weather.

Planned grain production, then, is a function of expected price of the commodity under consideration, prices of inputs, acreage and other fixed inputs devoted to grain production, and the level of technology. Actual production is the result of these factors, plus exogenous conditions such as weather which affect yields.

The Nerlovian adaptive expectations specification of profit maximization assumes that production responds to lagged rather than current or projected future prices, and that only partial adjustment takes place between planned production and expected prices. This naive formulation of producer expectations implies that last year's price is a reasonable proxy for the expected price operative when

planting decisions are made.

As another extreme, the rational expectations assumption in which all available information is incorporated into production decisions may be appropriate for some, but not likely all farmers. When dealing with multi-country situations, an assumption that all producers utilize all available information in production decisions is difficult to make. Further, where different attitudes toward risk are taken into account, the choice between rational and adaptive expectations becomes unclear (Newbery and Stiglitz, p.142). Here, the simplistic adaptive expectations formulation of producer expectations is applied to all countries and all producers.

Fertilizer availability and use may be cited as an example of an input to production which is a function both of technology and of government policy. Even in industrial countries, fertilizer use can be subject to regulation. In many developing countries, fertilizer procurement and distribution is a matter of direct government involvement in markets. This may also be the case for other inputs. The World Bank (1981) notes this role of government policy in inputs available for production.

A specification of a national aggregate production function for a specific commodity parallels the individual production relationship, where exogeneous variables relate

to the national economy.

$$PRO_{xit} = g(Pd_{xit}, Pn_{it}, ACR_{xit}, T_{it}, W_{it}) \quad [4.8]$$

where:

PRO_{xit} = planned quantity produced

Pd_{xit} = domestic price

Pn_{it} = domestic price of inputs

ACR_{it} = acres planted

T_{it} = time trend/technology

W_{it} = weather

4.2.3.2. Stocks

Grains are produced seasonally but consumed throughout the year. It is necessary, therefore, for some grain stocks to be held, whether by producers, consumers, private interests, or government.

Several motives for holding stocks can be delineated and are discussed briefly here. For a more detailed discussion of stockholding motives, refer to David J. Eaton (1980). A portion of individual or national stocks must be held in preparation for imminent use. Such stocks can be thought of working or pipeline stocks. Some national stocks may also be held to ward off potential dangers arising due to an uncertain future. Grains are to a degree storeable but their seasonal production is susceptible to factors beyond the control of even the best planning. Buffer stocks may be held to satisfy a demand for food security, as well as for speculative purposes. Pipeline stocks (or those needed for day-to-day activities

throughout the year) provide intra-year stabilization, while buffer stocks (those stocks held as carryover between years) provide inter-year stabilization. To these two domestic demands for stocks can be added food aid reserves and emergency reserves.

Stocks are held at a cost to the stockholder. The most direct opportunity cost of withholding grain from the market is the price at which output may be sold.

$$ST_{xit} = h(PD_{xit}) \quad [4.9]$$

PD_{xit} represents the private opportunity cost of holding stocks. Voluntary private stockholding (by producers, consumers or business) will depend on the expected price of grain, as well as on the current level of stocks relative to working-stocks (pipeline) demand.

Government stockholding behaviour is also expected to be sensitive to price not only with respect to the opportunity cost of reserving grain but also with respect to the motive of influencing producer and/or consumer prices. It is also possible that governments may enter directly into stockholding activities, for example for food security reasons, and indirectly through manipulation of consumer and/or producer prices. Although the relationship between price and government-held stocks is expected to have a negative relationship, the levels of desired price maintenance may involve lags in this response. This is especially so when price is increasing

and is coupled with producer-price policy, or when price is falling and is coupled with a consumer-price-maintenance policy. A more immediate response between price changes and government stocks can be expected where the aim of policy is to maintain producer (consumer) price as market price declines (rises).

4.2.4 NET IMPORT DEMAND

The basic economic relationship to be modelled in this study is derived from the identity that domestic consumption (C) plus exports (X) (or total domestic demand) is equal to domestic production and stocks (S) plus imports (M) (or total domestic supply).

$$C+X = S+M \quad [4.10]$$

From this identity the international component of domestic demand is obtained for any given time period. Net imports (NM = imports net of exports) are defined as:

$$NM = M-X = C-S \quad [4.11]$$

Ex post, net imports represent the difference between domestic consumption and domestic production (including beginning stocks).

4.2.5 OTHER FACTORS IN NET IMPORT DEMAND

4.2.5.1 Food Aid

In some studies, food aid has been taken into account as a separate variable in trade analyses. For example, Abbott (1976, 1979a) includes food aid in his net import

equation. Abbott notes, however, that aid should not be treated simply as an addition to imports since some aid may substitute for commercial imports. Grisby (1983), in a study of food aid on the Columbian economy concluded that aid affects domestic price more than being a net addition to domestic consumption. A recent study by Barbara Huddleston (1984) points out that growth in cereal imports among less developed countries has increased fastest in those countries where the importance of food aid has fallen. Such evidence indicates that the demand creation component of aid may be small, at least for some countries where imports are increasing significantly.

4.2.5.2 The Exchange Rate

The questions of whether, how, and/or by how much exchange rates have a separate impact on current net imports has yet to be resolved. This was evidenced in the section on exchange rates in Chapter Three. Two exchange rate effects are commonly identified: the short-run relative-price effect between countries and the long-run income effect within a country. The former adjusts the world price to a domestic economy; the latter operates through changes in imports and exports (expenditures and revenues) which arise from changes in the exchange rate. For example, a deterioration of a country's exchange rate can have the effect of reducing imports, encouraging domestic production and in the long run increasing

domestic income.

A third argument for a short-run exchange rate effect on domestic consumption and production--as distinct from the price effect--has been suggested by Chambers and Just (1979). The exchange rate is postulated to be a proxy for a price index for all other traded goods. In this argument, the relative price effect refers not to prices between countries for the same good but prices within a country between tradable and nontradable goods. When a change in the exchange rate makes imports more expensive for a country, there may be goods within the country which can substitute for the now more expensive traded good. Similarly, an exchange rate variable is suggested to capture choices of producers between substitute crops. Changes in the exchange rate are thus used to capture cross-price effects.

Differences of opinion over the exchange rate specification appear to arise out of differences in accepted theory. Where the *ceteris paribus* assumption is maintained that, given a price change of one good, all other relative prices are held constant, the only short-run effect of a change in exchange rates is on the price of the particular commodity. A further result of this assumption is that the size of the effect of the exchange rate change on price must be between zero and one. Such an assumption may be too restrictive to maintain, even in partial equilibrium analyses. Exchange rate changes do

change all relative prices and, importantly, thus change the relative ranking of products under comparative advantage theory. Somehow these changes must be taken into account in determining the impact of exchange rate changes on the demand for a commodity.

The position taken in this study is that it is worthwhile to test the *ceteris paribus* assumption implicit in trade demand theory that relative prices do not change. A means of doing this is to include the exchange rate as a separate variable in the net import demand function. It can be expected that where relative ranking has indeed changed as a result of exchange rate changes, there will be a noticeable effect on net imports.

4.2.5.3 Foreign Exchange Availability

Foreign exchange availability has been treated by Abbott as having an impact on price, consumption and production. It also has been suggested by Leamer and Stern (1970) to take the place of income in representing the level of economic activity in LDCs and this suggestion was applied by Jabara (1982) in empirical estimation of net import demand. As noted in Chapter Three the growing foreign debt of many LDCs has been related to their ability to import or to continue to import at historical levels. In this study, the level of foreign exchange reserves is suggested as having a potential independent impact on net imports.

4.3 SUMMARY

Chapter Four has provided a theoretical basis for direct estimation of net import demand. Structural relationships are identified for domestic price, consumption and supply (production and stocks). Exchange rates and foreign exchange variables form part of the demand relationships. The price equation is crucial in that it specifies the link through which domestic policies may intervene in net imports. A net import demand equation is specified as the difference between domestic consumption and production (plus stocks).

4.4 REFERENCES TO CHAPTER FOUR

1. M. Blaug, Economic Theory in Retrospect, Richard D. Irwin Inc., Illinois (1962), pp.114-115.
2. See Joan Robinson, Economic Philosophy, Anchor Books Edition (1964), p.64.
3. Refer to the discussion in Bruce Gardner, "On the Power of Macroeconomic Linkages to Explain Events in U.S. Agriculture", AJAE 63:5 (Dec. 1981), pp.871-878.

CHAPTER FIVE

EMPIRICAL ESTIMATION OF NET IMPORT DEMAND

The purpose of estimating a net import demand equation is to examine how its determinants behave under various economic and policy conditions. Also of interest is whether inclusion of international financial variables such as the exchange rate and foreign exchange availability add significantly to analyses of the trade environment. The structural equations in Chapter Four suggest variables for inclusion in a single net import demand equation. Construction of a reduced form net import demand equation follows theoretical considerations discussed by Leamer and Stern and also by J. David Richardson. The resulting reduced form equation forms the basis for estimating net import demand.

This chapter provides empirical estimates of net import demand for a set of countries representing wheat and coarse grain importers, excluding centrally planned economies (CPEs). Although CPEs are significant importers, data critical for demand estimation, such as for the income variable and also for cross price effects are not available or are considered too unreliable to use. For demand estimation, wheat and coarse grains are treated

as individual commodities.

5.1 THE ESTIMATING EQUATION

5.1.1 A REDUCED FORM EQUATION

A generalized reduced form net import demand equation expresses net imports as a function of independent variables relating to the structural framework as described in Chapter Four. The reduced form equation in this study is specified as follows, all variables being expressed in the current time period.

$$NI_{xit} = a_0 + a_1P_{xit} + a_2I_{it} + a_3PRO_{xit} + a_4ST_{xit} \\ + a_5FX_{it} + a_6XR_{it} + u_{it} \quad [5.1]$$

where:

NI = net imports (imports less exports)
P = a border price estimate of world price
I = gross domestic product
PRO = annual level of production
ST = annual beginning stocks
FX = foreign exchange availability
XR = domestic exchange rate relative to the U.S. dollar
u = the error term
x refers to an individual commodity group
i refers to an individual country
t refers to the current time period

To determine the additional influence of financial variables, two equations per country are estimated. One includes all variables in equation 5.1 and the other is similar but omits foreign exchange availability and the exchange rate as independent variables.

A linear functional form is used, largely for pragmatic reasons. Concerns exist as to the accuracy of

the data. In particular, many estimates of income, inflation rates, and exchange rates are at best rough for many less developed countries. Therefore, the ordinary least squares method of estimation has been used. Further, although a nonlinear form may fit the net import relationship of some countries better than others, it is desirable that the functional form be consistent across countries studied.

The time period of the study is another consideration. Since an objective of this study is to understand structural relationships of import demand for grains, there is an underlying assumption that these relationships have not changed fundamentally throughout the period chosen. A 22-year period from 1960-81 is used in estimation of net import demand. Variables are measured on an annual basis, since the commodities in question--wheat and feedgrains--typically have an annual production pattern.

A distinction can be made between the long run and the short run. In the short run, it is assumed that habits in consumption and standard production practices do not change. Therefore, short run elasticities are expected to be smaller than those for the longer run. Here, only short run influences on net import demand are estimated.

5.1.2 VARIABLE SPECIFICATON

All physical variables are expressed in metric quantities while financial variables are either in domestic currency of the country (price and income) or in United States currency (foreign exchange reserves). The exchange rate is a ratio of domestic currency per unit of United States currency.

5.1.2.1 Net Imports

The quantity of imports rather than value of imports is preferable on theoretical grounds since using quantities directly avoids variation introduced through prices. This point is made in Leamer and Stern [p.8]. Quantity data are readily obtained for agricultural commodities. It is assumed here that wheat and coarse grains each form a homogenous product. Thus the distinctions in quality of grains as well as individual components of coarse grains are ignored. As with all physical variables, net imports are expressed on a per capita basis. Specifically,

$$NI_{xit} = (M_{xit} - X_{xit})/POP_{it} \quad [5.2]$$

where:

- NI_{xit} = physical net imports, in kilos per capita
- M_{xit} = quantities of imports, in thousand metric tonnes
- X_{xit} = quantities of exports, in thousand metric tonnes
- POP_{it} = annual population, in millions

5.1.2.2 Traditional Independent Variables

The basic explanatory variables are suggested by neoclassical economic theory. Income, the price of the product in question, production, and stocks enter as separate variables in the net import demand function.

All monetary variables are measured in real (deflated) terms. This is a simplification to the model which Leamer and Stern note may be too strong to impose a priori [p.47]. However, given that this study involves net import demand estimation for many different countries, there is an overall advantage to using real estimates of monetary variables rather than nominal figures. A choice must be made as to what price deflator to use in transforming nominal values into real values. Here, a consumer price index estimate for each country has been used as a proxy for for national price changes. As well as being a traditionally acceptable general price deflator, it is the only price index available for many countries under consideration here. It is considered the most consistent estimate available for domestic inflation rates since the same source (the International Monetary Fund) can be used for all countries.

5.1.2.2.1 Price

The price variable represents a border-price-equivalent of the world price (PW) in real domestic currency. The base price used for all countries is a

United States export price for wheat and coarse grains. This price is expressed in domestic currency using the official exchange rate and deflated by the domestic consumer price index.

$$P_{xit} = (PW_{xt} * XR_{it})/CPI_{it} \quad [5.3]$$

where:

P_{xit} = price, expressed in real domestic currency

PW_{xt} = world price, in U.S. dollars per metric tonne

CPI_{it} = consumer price index

5.1.2.2.2 Income

Gross domestic product measures the degree of capacity utilization, or economic activity, for each country. This variable is expressed in real values on a per capita basis.

$$I_{it} = (GDP_{it}/POP_{it})/CPI_{it} \quad [5.4]$$

where:

I_{it} = income per capita in units of real domestic currency

GDP_{it} = gross domestic product in millions of domestic currency

5.1.2.2.3 Production

Annual physical supply variables are expressed in per capita terms (as are net imports and income). The production variable represents domestic output of the specific commodity group under consideration.

$$PRO_{xit} = Q_{xit}/POP_{it} \quad [5.5]$$

where:

PRO_{xit} = domestic production, in kilos per capita

Q_{xit} = domestic production, in thousand metric tonnes

5.1.2.2.4 Stocks

A separate stocks variable is used to capture stockholding behavior independent of production considerations. A priori, it is reasonable to expect that stockholding policy has a unique influence on imports. Here, per capita beginning stock levels are included as a separate variable.

$$ST_{xit} = STT_{xit}/POP_{it} \quad [5.6]$$

where:

ST_{xit} = beginning stocks, in kilos per capita

STT_{xit} = beginning stocks, in thousand metric tonnes

5.1.2.3 Financial Variables

5.1.2.3.1 Foreign Exchange Availability

Access to foreign currency may be a constraint on the ability of a country to import. Foreign exchange reserves are used to represent foreign currency available for international transactions. Given that most international grain transactions are carried out in United States dollars, reserves are expressed in United States dollars, on a per capita basis. The U.S. consumer price index is used as a deflator.

$$FX_{it} = (FEX_{it}/POP_{it})/CPI_{ust} \quad [5.7]$$

where:

FX_{it} = foreign exchange reserves, in real U.S. dollars
per capita

FEX_{it} = foreign exchange reserves, in nominal U.S.
dollars

CPI_{ust} = consumer price index for the United States

5.1.2.3.2 Exchange Rate

The exchange rate plays two roles in this study. First is its traditional influence on the own-price variable. As such, the exchange rate is used to translate world prices into boarder price equivalents as specified in equation 5.3. In the long run exchange rates may have an effect on income via changing the trade balance of a country. As a separate independent variable, its second role comes into play. The exchange rate has been included separately here as a proxy for cross price effects. It is hypothesized that changes in the exchange rate can change relative prices between exportables and importables. That is, exchange rate changes can alter the price relationship between the commodity being imported and domestic prices of alternative goods and services in consumption and/or alternative products in national output. The response of net imports to changes in relative domestic prices is interpreted as a cross-price effect. As an independent

variable, exchange rates are expressed as the value of a domestic currency in terms of a unit of United States currency.

$$XR_{it} = \frac{\text{domestic currency value per U.S.}}{\text{dollar value}} \quad [5.8]$$

5.1.3 DATA SOURCES

Estimates for physical variables are found in various issues of USDA Foreign Agriculture Service Foreign Agriculture Circular: Grains. Data include estimates for physical imports, exports, production and stocks, all expressed in thousands of metric tonnes. Periods of collection for physical variables differ among different countries. Physical data on grains are reported on a crop-year basis, from 1 July of the indicated production year. Early harvests of grain in the Northern Hemisphere are included in the July accounting period.

Not all data used in this study have equal credibility. L.A. Paulino and S.S. Tseng (IFPRI, 1980) observe that, for developed countries, estimates of physical variables from different sources (for example, the Food and Agriculture Organization, United States Department of Agriculture) are in close agreement. However, data for developing countries are less in agreement and for centrally planned economies they diverge the most. The USDA estimates used here are typically lower than FAO estimates.

The International Monetary Fund publication, International Trade Statistics (various issues) provides data for components of financial variables such as gross domestic product, population, foreign exchange availability, exchange rates, and domestic consumer price indices.

The consumer price index (CPI) has been used to measure changes in the level of domestic prices (inflation). CPI estimates are annual averages of domestic price changes over the year, with a base year of 1981 for all countries. The CPI price deflator captures changes in a composite set of prices faced by consumers and producers. It is not concerned with a specific commodity or use group. The general nature of the CPI is considered desirable, yet it would have been preferable to exclude changes in domestic grain prices from the measure. The choice of the CPI also reflects the practical consideration that it is the most frequent and consistent index used to report changes in national price levels for countries covered in this study. It is recognized that national differences are likely to exist in the market basket which forms national CPIs and, further, that no one series for a single country is likely to contain the same basket of goods throughout the full 22-year period studied.

Estimates of gross domestic product for each country are reported by the IMF in either millions or billions of

domestic currency. Here, all GDP estimates are expressed in millions of domestic currency units prior to equation estimation. IMF estimates of GDP represent transactions which take place over a one-year period. GDP data are put on a per capita basis using population data which are based on mid-year estimates.

The foreign exchange availability variable is represented by IMF annual stock estimates of foreign reserves, measured at 31 December of each year. It includes changes in the value of a country's exports and imports of goods and services, inflows of foreign capital and its access to credit, all denominated in U.S. dollars. Such reserves reflect a country's purchasing power for imports over the year.

IMF exchange rate estimates reflect annual average exchange rates expressed in national currency per unit of U.S. currency. The estimates provide conversion factors that report rates in reference to "par" rates (official or central rates) and take into account changes in exchange rate regimes, such as between periods of fixed and floating exchange rates. Although official exchange rates do not entirely reflect specific grain price differentials between countries and do not take into consideration rationing of foreign currency, they are considered adequate to capture at least general tendencies in grain trading situations.

Given the predominant role of the United States in world grain trade, the U.S. grain price is used as a proxy for world price. Corn prices are used to represent coarse grain prices since the majority of coarse grain trade is in corn and, given close substitutability in use, coarse grain prices tend to move together. U.S. wheat price estimates (f.o.b. Chicago) are obtained from the USDA Wheat Situation publication. Corn price estimates (f.o.b. U.S. Gulf) are found in USDA World Agriculture Situation WAS-20.

5.1.4 EXPECTED RESULTS

5.1.4.1 Traditional Variables

The coefficient on price measures the response of an individual country's net imports with respect to a change in the world price, expressed in real domestic currency. Since transportation costs have not been included, this 'border' price estimate is lower than that actually faced by an individual country, assuming the importer pays to move the product.

It is hypothesized that many countries attempt to isolate their internal prices from changes in the world price, at least in the short run. However, net imports of different countries may respond to a greater or lesser extent to world price changes. For example, for countries in the European Community, it is expected that the import response to border price changes will be small relative to

that of more open trading regions. This is expected for both wheat and coarse grains. Indeed, under the European Community's variable levy system, net import demand can be expected to be nearly perfectly inelastic over a range of prices. Price elasticities for LDCs in general are expected to be small due to the presence of domestic price policies. Typically such policies keep domestic consumer prices low for political or other reasons. However, they may also include producer price policies used as incentives for increasing domestic production. Price insulation may be difficult for some low-income countries to maintain because of budget constraints, even in the short-run. This constraint is likely to be felt more for wheat price policies than for those for coarse grains, since wheat import quantities are higher than those for coarse grains in many of these countries and domestic consumption, too, is typically higher. Price elasticities for coarse grains are expected in general to be higher than those for wheat, given the relatively high price elasticity of meat from which the demand for coarse grain is derived.

To summarize, three hypotheses have been made with respect to price. First, it is expected that the price coefficient for most countries will be relatively small, depending on the level of domestic protection. Second, the significance of price as a variable in explaining net

imports will depend in part on the degree to which imports make up total domestic consumption. Where domestic supply is large relative to consumption, it is expected that price will be less significant in explaining changes in net import demand than where the opposite is true. Third, economic theory predicts a negative relationship between price and quantity demanded and such an outcome is expected here in general. However, a positive price coefficient cannot be ruled out in some situations, especially where significance levels are very low.

The sign on gross domestic product is expected to be positive in accordance with neoclassical demand theory. However, as with the sign on the price variable, the opposite result cannot be ruled out a priori. A negative income coefficient is possible in the sense that, in the process of economic development and income growth of countries where production self-sufficiency is a feasible national goal, higher incomes permit more investment in domestic agricultural production. The dynamics of this situation are discussed by Stephen Magee (1975, p.190). Self-sufficiency goals are more likely to exist for wheat than for coarse grains, given the growing importance of wheat in diets in many LDCs. Moreover, in some industrialized countries, wheat consumption may actually be declining over time as incomes rise, indicative of wheat being an inferior good for many industrial country consumers.

Domestic production elasticities are expected to be negative in the sense that imports provide a substitute for domestic output. The size and significance of the elasticity estimate is anticipated to relate to a combination of factors. Perhaps the most dominant criterion is the degree to which domestic production satisfies domestic demand requirements. Where a large part of domestic demand is filled by imports, the percentage change in imports given a change in domestic supply is expected to be small. In this situation, net imports are inelastic with respect to domestic supply. Where net imports fill only a small gap between domestic production and domestic consumption, the size of the production elasticity is expected to be larger. These considerations are expected to hold for both wheat and coarse grains.

A further consideration supporting the above argument is that countries with larger indigenous production bases are likely also to be countries where consumer habits in using the grain are well established. In such countries, a smaller, more significant domestic production elasticity can be expected as compared with countries with only nascent production and consumption patterns. For coarse grains, a strong desire to maintain or increase livestock herds is also expected to increase need to import when domestic production declines, within of course income

constraints. This desire suggests a relatively inelastic import response with respect to price changes.

A related point is the degree to which a country can achieve self-sufficiency goals. Domestic production is likely to be more variable in countries where it has not been a traditional output but where a concerted effort to funnel resources into import-substitution production is being made. Reasons for this include the likely use of more marginal land in domestic production and also the lack of experience with the crop on the part of farm managers. When a self-sufficiency policy is coupled with a desire to maintain or increase domestic demand, import responsiveness is expected to remain high, especially if the domestic production base is still very small. However, a larger production elasticity can be expected if maintenance of current levels of domestic demand is of less concern.

Estimates of stockholding elasticities are also expected to be country-specific, dependent in part on the level of world supplies and the role stocks play in each country. When world supplies are low, more stocks may be held for security reasons in countries which feel particularly vulnerable to changes in supply. In this case, net imports and stocks are expected to have a positive relationship, at least until reserves have been built up. However, in a surplus supply situation, stocks are expected to show a negative relationship with net

imports in performing their role as buffer for short term market variations. Thus, when beginning stocks are low, imports are used to rebuild them; when they are high, imports can be reduced.

5.1.4.2 Financial Variables

The sign associated with the elasticity estimate for foreign exchange availability is expected to be positive, in the sense that greater foreign exchange availability reduces a constraint on a country's imports. It is likely that for smaller countries which have a low ratio of export earnings to foreign interest payments, foreign exchange availability will have more significance than it would for more industrial countries.

As mentioned earlier in this chapter, exchange rates are used in net import demand estimation in two ways. First, exchange rates are used along with inflation rates to translate world prices into border price equivalents. Second, exchange rates represent an estimate of all cross prices affecting the demand for imported grains. That is, as the value of a domestic currency increases relative to the United States dollar, internal opportunities stemming from a change in relative domestic prices (tradeables versus nontradeables) may dictate a change in production or consumption patterns which either discourage a particular class of imports or induce them.

As a proxy for cross-prices, expectations with

respect to sign of the exchange rate coefficient depend on whether imported grain and domestic goods and services are complements or substitutes. Normally a negative cross-price elasticity indicates that two goods are complements, and a positive sign indicates substitutes. However, here these signs are reversed because of the way the exchange rate is defined.

Exchange rates are defined as domestic currency units in terms of the U.S. dollar. This ratio falls when domestic currency appreciates relative to the U.S. dollar, implying imports are relatively cheaper and domestic goods relatively more expensive than before. Thus, a drop in the exchange rate implies an increase in domestic prices relative to import prices; and an increase in the exchange rate implies a fall in relative domestic prices. As domestic prices increase (domestic currency strengthens), the quantity of grain imported will increase if a predominantly substitute relationship exists--i.e. the sign of the exchange rate variable here will be negative. On the other hand, if domestic goods are basically complements to imported grain, the sign will be positive.

5.1.5 SCOPE OF THE STUDY

Countries chosen for empirical estimation represent a cross-section of grain importers (excluding centrally planned economies), with emphasis given to less developed countries. Some importing countries are excluded at the

outset on structural grounds. For example, the separation of Bangladesh from Pakistan and the entry of the United Kingdom into the European Economic Community were events which occurred within the time period covered in the study.

Some countries initially selected for examination are excluded because of large gaps in available data. For example, consumer price index estimates are not available for Algeria, a relatively major importer of wheat, for nine of the 22 years. Other countries in this category include Indonesia, Iran, Iraq, Zaire, Zambia, and Kuwait.

Mexico and India have been both a net importer and a net exporter of wheat and coarse grains for different years during the study period. They are excluded because of their role as exporter. Germany also has been a net exporter of wheat for several years over this period. However, Germany is included in the wheat sample, however, to improve the European Community representation. For coarse grains, Germany has consistently been a net importer between 1960 and 1981.

Initially, it was planned to group countries on the basis of income levels and geographical location. However, the sample proved too small to group effectively.

Countries included in the study were net importers of both wheat and coarse grains over the period (with the exception of Germany for wheat). However, the sample is

not exactly the same for both commodities. Specifically, net import demand equations were estimated for 24 wheat importing countries and 18 coarse grain importing countries. A complete list of countries covered in this study is given in Appendix A.

5.2 STATISTICAL RESULTS

5.2.1 OVERALL MODEL PERFORMANCE

All equations estimated are provided in Appendix B. Among the six variables included in this study, coefficients for income and production variables are typically largest and most significant. The response of net imports to changes in the border price varies among countries and commodities. Typically it is lower for wheat than coarse grains, and lower for European Community countries than low income countries. The signs associated with independent variables generally meet expectations: income is most often positive, production negative, stocks and price more mixed.

Financial variables are less easily characterized. Neither foreign exchange availability nor exchange rate variables appear highly significant in explaining net imports compared with, say, income or production. The sign associated with foreign exchange reserves is occasionally negative in both wheat and coarse grain equations, where a positive sign was expected throughout.

Other factors may have to be taken into account when assessing this variable; these are discussed below. In its role as a proxy price for substitutes and complements, the sign associated with exchange rates could theoretically be positive or negative. Estimation of net imports resulted more often in a negative exchange rate elasticity, indicating more countries have substituted use of domestic resources for imports as relative domestic prices are altered through exchange rate changes.

The statistical properties of the equations are generally acceptable. Judging from the corrected R^2 and t statistics, wheat equations appear weakest for countries in South East Asia (Malaysia, the Philippines and Sri Lanka) and some countries in South America (Chile, Paraguay and Venezuela). For Asian countries, this is understandable given the importance of rice in diets in these areas. Except for Chile, the equations which are weak in explanatory power in South America are for countries with high corn consumption levels relative to wheat.

Among the coarse grain equations, the corrected R^2 statistics are particularly low for Germany, Chile and Libya. These countries have somewhat different characteristics, although they are all countries where domestic production is high relative to consumption. Libyan production and net imports are highly variable and inversely related. On average, Libyan coarse grain

production is more than 50 percent of total consumption, though less in the 1970s than in the 1960s. Germany and Chile each typically produce over 60 percent of coarse grain consumed. Each exports a small amount of domestic production and imports a substantially larger amount.

Autocorrelated disturbances may be a problem in net import demand estimation over time. It is possible that shocks affecting domestic production and/or consumption have effects which persist longer than one time period. Such impacts might arise, for example, from severe weather conditions or from domestic policies. Further, data represent national aggregate estimates which may involve a degree of interpolation or smoothing. As stated by Kennedy (1980), such data manipulation tends to average true disturbances over successive time periods.

The Durbin-Watson statistic is one test for the presence of first order autocorrelation. In estimated equations, this measure generally falls within the upper and lower bounds of statistical acceptability at the five percent level. If it is outside these bounds, it is usually on the high side by no more than two percentage points. A Durbin-Watson statistic exceeding this range is found in four wheat equations (Bolivia, Israel, Libya, and Columbia) and in three coarse grain equations (Columbia, Ecuador and Nigeria). In these countries, the presence of positive autocorrelation may cause standard errors to

appear lower than is actually the case, and thus significance levels of coefficients to be higher. No correction has been made for these effects.

Another consideration in multiple regression analysis is the degree to which independent variables are linearly related. Where variables are collinear, it is difficult to determine their separate effects on the dependent variable. Insignificant coefficients, as found especially for financial variables, are an indication that there may be problems due to multicollinearity, making interpretation of coefficients difficult.

The admittedly cursory check on the presence of multicollinearity--that of simple correlation between independent variables--is used here to better understand the extent of the problem. The variables with highest correlation are the financial variables, the exchange rate and foreign exchange reserves, most commonly with income. In 17 of the 24 wheat equations and 12 of the 18 coarse grain equations, either exchange rate or foreign exchange reserves have a simple correlation ratio with income of greater than the corrected R^2 of the equation. For wheat equations, exceptions are Ecuador, Egypt, Italy, Japan, Libya, Thailand, and Tunisia. For coarse grain equations, exceptions are Israel, Italy, Japan, Korea, Nigeria, and Saudi Arabia.

To a lesser extent, domestic supply variables (production and/or stocks) are linearly correlated with

gross domestic product. One-third of both wheat and coarse grain equations show a larger correlation between domestic supply and gross domestic product than the corrected R^2 . For wheat equations, such countries include Brazil, Germany, Israel, Korea, Malaysia, Paraguay, Peru, Saudi Arabia, and Sri Lanka. For coarse grain importers, they are Egypt, Germany, Italy, Libya, the Phillipines, and Switzerland.

The price variable shows less linear relationship with other independent variables. For wheat equations, five countries (Malaysia, Nigeria, Paraguay, Portugal, and Sri Lanka) show high correlations between price and other independent variables. For coarse grain equations, the price variable of Germany and Switzerland has a strong linear relationship with other independent variables.

In summary, the presence of multicollinearity in approximately two-thirds of the equations when financial variables are included, and in approximately one-third of equations when financial variables are excluded, makes it difficult to interpret related regression coefficients. One option to get around this difficulty would be to drop the income variable from net import demand equations. However, this variable is considered a fundamental determinant of net import demand for both wheat and coarse grains and therefore it has remained in the model. Nowhere are independent variables perfectly correlated,

though as discussed in Leamer (1983), the presence of some collinearity implies the empirical outcomes are weaker.

For large trading countries, there is the possibility of simultaneous bias, where price cannot be considered independent of net imports. Most countries covered here do not fall into this category. Although it is possible that the European Community as a whole could have such an influence, it is not considered likely for individual country imports. Where simultaneous bias is more likely is in the coarse grain equations for Japan. Japan has been a significant importer in this market, currently importing approximately 20 percent of world coarse grain exports.

5.2.2 ELASTICITY ESTIMATES FOR WHEAT

Elasticity estimates obtained from wheat net import equations are presented in Tables 5.1 to 5.3. Table 5.1 covers those for low-income developing countries, Table 5.2 for middle-income developing countries, and Table 5.3 for industrial countries. Results from both specifications (with and without financial variables) are provided.

The response of net imports to a change in price is generally negative but small and significance levels are low. For most countries, price elasticity is in the range of -0.1 to -0.3 and in four cases it is less than -0.1. Looking at price elasticity estimates between income groups, a negative relationship occurs consistently within

Table 5-1

WHEAT ELASTICITY ESTIMATES, LOW-INCOME COUNTRIES

<u>Country</u>	<u>Price</u>	<u>Income</u>	<u>Pro- duction</u>	<u>Stocks</u>	<u>Foreign Exchange Availab.</u>	<u>Exchange Rate</u>
Philippines	- .101 - .271**	.927** .367**	(a)	- .079*** - .064	-1.440***	- .031
Sri Lanka	- .102 - .257	1.242*** .414	(a)	.049 .072	- .225***	- .481
Thailand	- .391** - .380***	2.156* 1.861*	(a)	- .203* - .114***	- .414**	1.056
Egypt	.011 - .046	.915* .671*	- .429 - .349	.044*** .062*	- .034	- .232
Morocco	- .032 - .231	2.111* 2.123*	- .959* -1.075*#	- .137	- .276***	- .775
Nigeria	- .210 - .107	.599 .512**	.007 .011	.072* .064*	.008	.237
Tunisia	- .169 - .068	1.758* 1.904*	-1.731* -1.925*#	- .271***	.136	- .175
Peru	- .277* - .224*	.759*** .604*	.224 .138***#	.041	- .487	.344***
Columbia	- .252*** - .412*	1.222*** 2.204*	- .170*** - .074	- .284* - .242*	.118	.106
Ecuador	.025 - .008	.782** .937*	- .457* - .513*#	- .063	.042	- .033
Bolivia	- .103 - .166	.923*** .176	- .109 - .208#	- .013	.103	-1.040**
Paraguay	- .022 - .521***	-2.994* - .611**	- .038 - .189***	- .117*** - .197***	.477*	

* indicates significance level of at least 99%.

** indicates significance level of at least 95%.

*** indicates significance level of at least 80%.

(a) indicates variable equals zero from 1960-81.

production and stocks are combined.

Note:

1. All elasticity estimates are calculated at the mean of variables.

2. Statistical details are provided in Appendix B.

Table 5-2

WHEAT ELASTICITY ESTIMATES, MIDDLE-INCOME COUNTRIES

Country	Price	Income	Pro- duction	Stocks	Foreign Exchange Availab.	Exchange Rate
Saudi Arabia	-.993* -1.106*	.332 .287***	.223 .100	-.077*** -.049***	-.261***	-2.426***
Libya	-.068 .006	.535* .625*	-.127*** -.113***	-.032* -.040*	-.080***	-1.244***
Korea	-.060 .042	-.024 .072	-.233 -.226	.146** .165**	-.109	.297
Malaysia	.040 .023	.092 .082	(a)	-.009 -.020	.057	.222
Israel	.318* .201	.749* .327***	-.620* -.344*	-.326* -.148	.075	-.096*
Brazil	-.082 -.047	.730* .558*	-.317* -.313*	-.154** -.117**	-.060	-.025
Chile	.420** .280**	-.401 .644**	-.075 .265#	.042	.171	.104
Venezuela	-.159 -.180	-.303 .088	.072 .003#	-.030***	.075	1.505*

See Table 5-1 for notes.

Table 5-3

WHEAT ELASTICITY ESTIMATES, INDUSTRIAL COUNTRIES

Country	Price	Income	Pro- duction	Stocks	Foreign Exchange Availab.	Exchange Rate
Japan	<u>-.269***</u> - .273	<u>-.349</u> 1.408*	<u>-1.119*</u> - .765*#	<u>-.533</u>	<u>-.064</u>	<u>-.499</u>
Italy	.155 .188	1.162** .272	-5.442* -4.642*	- .802* - .648**	- .231	- .888***
Portugal	- .107 .015	.936*** .926***	- .968* -1.264*	- .265*** - .085	- .079	.378***
Germany	.859 .337	.998 -2.574***	-1.060 - .660	-2.227** -2.947*	1.198***	5.282***

See Table 5-1 for notes.

low-income developing countries but the sign is quite mixed for higher income countries. In only one equation among industrial countries is it significant. Low price elasticity estimates support the theory that domestic pricing policies which tend to insulate domestic markets from a change in the world price exist in most of the sample countries. For example, when border price falls, no more imports are allowed in order to protect domestic prices. Price elasticity estimates in the lowest income group are marginally higher than those for higher income groups, indicating greater sensitivity of imports to border price changes. This may be because the costs of domestic price-maintenance policies become prohibitive beyond a certain range of price fluctuations.

Countries in the European Community, Israel and Chile show significant, positive price elasticities, indicating the strength of domestic policies in isolating domestic markets from changes in the import price. Jabara (1981) and Josling and Pearson (1982) have noted that European Community pricing policies benefit producers. Israeli policies on the other hand, according to a USDA Economic Research Service publication (May 1983), largely benefit consumers. Both sets of policies appear to be completely effective in insulating domestic prices from changes in the world price over the short run. Chile also has had a policy of low producer prices which may have contributed to a separation of imports from import price changes over

the study period.

The largest wheat price elasticity, in the range of -1.0 for both specifications, was found in Saudi Arabia, a member of the Organization of Petroleum Exporting Countries (OPEC). This particular elasticity estimate is also highly significant. Although the Saudi Government has operated a food subsidy program (including wheat) since 1974, Royle (1983) has documented that actual imports are carried out by private traders, with Government involvement made subsequently. The relatively large negative price elasticity is indicative of private trader response to changes in the world price. Libya, by contrast, imports largely under long term contracts and therefore is less sensitive to short run changes in world prices.

Income elasticities are generally positive and somewhat higher than expected. The pattern of changing tastes and preferences for different grains associated with changing income levels emerges from empirical results. Wheat income elasticities for low-income countries are generally larger than in middle-income countries. In low-income LDCs, estimates are typically greater than 0.5 and in five of twelve countries are over 1.0. These compare with an average of less than 0.5 in middle-income LDCs. Income elasticities for industrial countries are unexpectedly high, often close to 1.0.

However, a negative income elasticity is found for Germany from the equation without financial variables. This result suggests that wheat is an inferior good to German consumers.

Another significantly negative income elasticity is found for Paraguay (-2.99). Here it is expected that import substitution policies rather than inferior qualities of wheat are the reason. Both domestic consumption and domestic production of wheat in Paraguay have grown over the study period. However, domestic production was 11 percent of total consumption in 1960 and 37.5 percent in 1981. The negative income elasticity shows the effects of import substitution.

The largest wheat income elasticities (close to 2.0) are found in the North African countries of Morocco and Tunisia, and surprisingly in Thailand. Wheat is a traditional staple in North Africa whereas consumption is very low in Thailand.

In general, the relationship between domestic production of wheat and net imports is negative, as expected. Where production elasticities are positive, they are statistically insignificant. Production elasticity estimates are somewhat larger (over -1.0) for higher income (industrial) countries compared with elasticities often less than -0.5 for lower income countries. In larger wheat-producing areas in the Middle East, domestic production elasticities are also relatively high (greater

than or equal to -1.0). The expectation that production elasticities are larger for countries having large production bases relative to consumption is borne out empirically. For example, production elasticities are larger in Tunisia and Morocco than in Libya, and those in Ecuador are high relative to Peru, Columbia and Bolivia.

In areas where the domestic production/consumption ratio is smaller, production elasticity is typically less than -0.5. Brazil, Egypt and Israel all have growing production bases but also are countries which have been concerned with maintaining or increasing consumption, keeping elasticities low. There was no production of wheat recorded for South East Asia over the study period.

Wheat net imports are typically inelastic with respect to beginning stocks, being in the range of -0.3 to -0.05 for most LDCs and slightly larger for industrial countries. Both positive and negative stock elasticities are observed, although as predicted, a negative relationship is found for most countries. A negative sign indicates that domestic stocks play at least some buffer role for net import requirements. Those countries with significantly positive stocks elasticities--Egypt, Nigeria and Korea--have a low domestic production/total consumption ratio and have begun holding stocks sometime after 1960. Egypt began stockholding wheat in 1974, Nigeria in 1966 and Korea in 1968. Positive stocks

elasticity estimates may reflect an increase in domestic milling capacity, as suggested by CIMMYT (1982), and/or a desire for food security in these countries, as suggested by Eaton (1980).

The foreign exchange availability variable has the expected positive sign in only 40 percent of sample countries. A positive sign on the foreign exchange coefficient indicates that when reserves increase (decrease) over the year, net imports rise (fall). Moreover, this variable has the least overall significance of the six independent variables tested. Except for Germany and the Philippines, the size of the foreign exchange elasticity estimates is less than 0.5, indicating a relatively small response of net imports to a change in foreign exchange reserves over the sample period.

In light of empirical results corresponding to the foreign exchange variable some explanations can be offered. First, as mentioned earlier, the often-close collinear relationship between foreign exchange and gross domestic product makes interpretation of coefficients and significance levels difficult. Second, debt may indeed not have been a crucial variable to net imports of grains during the study period. Associated with this aspect is that credit was available to most countries during the study period, which permitted countries to make import decisions independent of the current level of reserves. If this is the case, a shortage of credit can be expected

to be a more important constraint in the 1980s than in earlier periods for some countries. For example, the USDA Economic Research Service Supplement #5 describes the potential for this situation to develop in Latin America in coming years. Another possible reason for the weak link between foreign exchange reserves and wheat imports is the failure of this study to take into account the proportion of foreign exchange used for domestic economic, in particular industrial development.

The exchange rate has a negative relationship with net imports in 13 out of the 24 countries sampled. A negative relationship indicates countries which have to some extent substituted domestic food grains for imports as exchange rates increase (domestic currency depreciates), and have substituted imports for domestic grains as exchange rates decrease (domestic currency appreciates). Larger negative exchange rate elasticity estimates are found generally in major wheat-consuming areas, areas which also enjoy established production bases for wheat. The largest such effects are found in Saudi Arabia and Libya. Other countries with these characteristics include Morocco, Tunisia, Egypt and, to some extent, Israel. Both Bolivia and Ecuador, which also have negative exchange rate elasticities, produce greater quantities of corn than they do wheat. However, in proportion to domestic production, they consume more

wheat. Substitution for imports may also be made by other grains, such as rice in Southeast Asian countries or different types of coarse grains in countries such as Brazil.

Where changes in net imports of wheat are positively related to exchange rate changes, coarse grains tend to be the predominant domestic grain crops (excluding rice). Exceptions are found in Germany and Chile, both of which consume and produce more wheat than coarse grains. The largest positive exchange rate elasticities are found in Thailand and Venezuela, countries with virtually no domestic wheat production. Although data on internal use of resources have not been included in this study, a positive relationship between exchange rate changes and net imports would suggest that imported wheat, as a food grain, is a complement to use of other crops or other domestic resources.

5.2.3 ELASTICITY ESTIMATES FOR COARSE GRAINS

Coarse grains elasticity estimates are given in Tables 5.4 to 5.6. Table 5.4 covers estimates for low-income countries, Table 5.5 those for middle-income developing countries, and Table 5.6 for industrial countries. Again, both specifications (with and without financial variables) are reported. Elasticity results for coarse grains parallel those for wheat in many respects and therefore will be discussed more briefly.

Table 5-4

COARSE GRAINS ELASTICITY ESTIMATES, LOW-INCOME COUNTRIES

<u>Country</u>	<u>Price</u>	<u>Income</u>	<u>Pro- duction</u>	<u>Stocks</u>	<u>Foreign Exchange Availab.</u>	<u>Exchange Rate</u>
Egypt	.415 .135	2.661*** 1.685*	-2.170 .466*	- .034	- .046	-1.305
Nigeria	- .378 - .321	.033 - .719***	- .339 .321	.551* .459*	.146	8.070*
Tunesia	- .405 -1.572***	3.398* 2.451*	- .544 - .315#	- .055	- .947	-1.405
Philippines	-2.094** .288	- .810 7.423**	-5.967** -4.303***	.370 .122	1.509**	3.099***
Peru	.070 .528	3.123*** 4.556*	-3.287*** -3.178**#	.169	.037	- .053
Columbia	- .213 -1.017**	.204 4.090*	-2.348*** -1.545#	- .296	.527***	.617
Ecuador	-1.273* - .982**	-1.996*** 1.942*	-1.262*** -2.128***#	- .207	1.295*	1.415***

See Table 5-1 for notes.

Table 5-5

COARSE GRAINS ELASTICITY ESTIMATES, MIDDLE-INCOME COUNTRIES

Country	Price	Income	Pro- duction	Stocks	Foreign Exchange Availab.	Exchange Rate
Libya	-1.049*** - .917***	- .898 .140	- .410 -1.012**	(a)	1.037**	-.241
Saudi Arabia	-1.505** - .617	2.179** 1.242***	- .202 - .997	.127*** .266*	-2.206*	-1.768
Israel	.253*** .177	.623* .438***	- .078*** - .104**	.111 .064	- .203***	- .011
Korea	- .236 - .257	1.373** 1.560*	- .401 - .396***#	- .090	.081	.044
Malaysia	- .671*** - .207	.235 1.209***	.102 .294***#	.243	- .401	-3.503**
Chile	.033 - .174	1.115 .926***	.892*** 1.083***	- .198 - .103	.754*	- .565**
Venezuela	- .278 - .329	3.958* 2.980*	-1.338** -1.082**	.089 .116***	.299***	.042

See Table 5-1 for notes.

Table 5-6

COARSE GRAINS ELASTICITY ESTIMATES, INDUSTRIAL COUNTRIES

<u>Country</u>	<u>Price</u>	<u>Income</u>	<u>Pro- duction</u>	<u>Stocks</u>	<u>Foreign Exchange Availab.</u>	<u>Exchange Rate</u>
Japan	- .176** - .186**	.899* .859*	- .119** - .083***	- .070 .183*	- .140*	-1.023*
Germany	.120 .159	1.599** 1.551***	-1.658** -1.770**	- .745*** - .603***	.029	.974
Italy	- .284** - .154	1.632* 1.634*	-2.134* -2.561*	- .175*** - .146	- .103**	- .119
Switzerland	- .026 .056	1.816* 1.919*	- .382*** - .392***#	- .647**	- .162***	- .170

See Table 5-1 for notes.

In general, statistical properties are stronger for coarse grain equations than for wheat equations. Explanatory power is weakest in equations for Libya, Chile and Germany, where the corrected R^2 statistic is less than 0.5.

Price elasticity estimates for coarse grains are usually negative and, as with wheat estimates, significance levels continue to be low. This is to be expected where domestic policies are effective in insulating domestic prices from changes in the border price. However, coarse grain price elasticity estimates are in general a little larger than those for wheat. Even so, ten of the 18 countries examined had price elasticity estimates at or below -0.5 for at least one of the specifications.

Distinctions between income groups are not as clear for coarse grain price effects as they are for wheat. However, some of the lowest elasticity estimates are found in industrial countries, indicating more effective government pricing policies in these countries than exist in many LDCs.

High price elasticity estimates signify lack of effective domestic pricing policies which insulate a country from changes in the border price. Two of the four highest price elasticity estimates for coarse grain equations are found in the lowest income group (Philippines -2.1, and Ecuador -1.3). Both countries fill

less than 10 percent of their consumption needs with imports. The other two countries with price elasticity estimates at or greater than -1.0 are in the middle income group (Libya -1.0, and Saudi Arabia -1.5). These two countries are members of the OPEC and therefore may be in a position to have more price-elastic imports. Where positive price elasticities are found, they are small and insignificant.

Coarse grain equations appear more sensitive to the specification used than did those for wheat. In two cases (the Philippines and Chile) the sign changes on the price elasticity when financial variables are excluded, and in three cases (Columbia, Tunisia and Saudi Arabia) the estimated elasticity changes by more than 0.5.

In general income elasticity estimates for coarse grains are positive, as expected, and are more significant than those for other independent variables throughout the sample. Income elasticities are often larger than those for wheat, as expected given the pattern of grain use associated with income. The relatively large size of income elasticity estimates in low-income countries is surprising. However some lower income countries studied have increased consumption of coarse grains at a rate faster than their own production bases, with the result that changes in net imports of coarse grains have been closely aligned with changes in income.

Nigeria, Philippines and Ecuador show some tendency toward declining imports while income increases. Rather than considered a economically perverse outcome, these negative income elasticity estimates are more likely to reflect economic forces unique to specific country situations. In particular here, countries showing a negative income elasticity have enjoyed changes in domestic production paralleling changes in consumption, indicating that some effort is being made to increase self-sufficiency in coarse grains.

As in wheat equations, coarse grain production elasticity estimates are almost always significant and negative. In eight countries (Chile, Columbia, Ecuador, Italy, Germany, Peru, the Philippines, and Venezuela) production elasticities are greater than or close to -1.0 for both specifications. These countries have large domestic production bases for coarse grains relative to consumption levels, ranging from 62 percent in Peru to 93 percent in the Philippines. Libya and Egypt have high elasticities in one specification, with corresponding production-to-consumption ratios of 42 percent and 80 percent respectively. Where production elasticities are less than -1.0, the size of the domestic production base relative to consumption is typically small. Where the domestic production/consumption ratio is less than 25 percent (as in Saudi Arabia, Israel, Malaysia, and Japan), production elasticities are less the -0.2. Where this

ratio is larger (in the neighbourhood of one-quarter to one-half), as in Korea, Tunisia and Switzerland, production elasticity estimates are closer to -0.5. Venezuela and Nigeria are exceptions to this pattern.

The larger producers of coarse grains relative to consumption generally have the highest production elasticity estimates. The size of negative elasticity estimates for production indicates the degree countries use imports to offset variation in their own production through imports. This effect is strong in many LDCs and industrial countries alike and is similar to that found for wheat.

Stocks elasticity estimates are generally smaller in developing countries than in industrial countries (in the range of -0.5 to -0.1) and also are less significant. As for wheat equations, stocks elasticity estimates are negative for industrial countries. However, they are more often positive than found for wheat equations in LDCs.

A positive elasticity estimate indicates a country maintains at least some stocks for security purposes. Significant positive stocks elasticity estimates are typically found in countries with small stocks-to-consumption ratios (Nigeria, Philippines, Peru, Saudi Arabia, and Venezuela). Where coarse grain stocks elasticity estimates are positive but insignificant (Israel and Malaysia), stocks are larger than domestic

production bases and also are large relative to consumption levels. For these countries, it would appear that coarse grain stocks have played a less strategic role over the period studied.

Negative stocks elasticity estimates are found in six LDCs (Korea, Chile, Egypt, Tunisia, Columbia, and Ecuador) and also in industrial countries. The negative sign indicates the use of stocks as a buffer against short-run market variations. There are fewer LDCs holding coarse grain stocks for this use than for wheat. However, coarse grain stocks elasticity estimates are marginally larger than those for wheat.

Four countries (Saudi Arabia, Nigeria, Egypt, and Peru) have held coarse grain stocks for less than half the period. Libya did not hold stocks of coarse grains for any of the 22 years.

Foreign exchange availability elasticity estimates for coarse grains conform more closely to a priori expectations than for wheat. Here, ten out of 18 countries show a positive sign--indicating that as foreign reserves increase, so do imports. Five of the ten countries having a positive response of net imports to changes in foreign exchange availability are in the low income group, and four of seven in the middle income group. Moreover, elasticity estimates are larger for LDCs in general as compared with industrial countries. The sign and size of foreign exchange availability elasticity

estimates provide some basis for the hypothesis that imports of coarse grains by lower income countries are more constrained by this variable than are industrial countries.

There are still eight out of 18 countries (five out of 14 LDCs) for which a negative relationship is found between foreign exchange availability and net imports of coarse grains. The elasticity estimate for Saudi Arabia is the largest and most significant of these. This result is somewhat surprising in that this country (as compared with Libya for instance) consumes a larger quantity of coarse grains. However, the income elasticity is larger and more significant in Saudi Arabia than in Libya and the difference in the foreign exchange elasticity may reflect different priorities in the distribution of reserves between economic sectors.

Exchange rate elasticity estimates theoretically may have either a positive or a negative sign, depending on whether the predominant relationship between traded and nontraded goods is as complements or substitutes. In eleven out of 18 countries studied, the relationship between exchange rates and net imports is negative, indicating some substitution between domestic products and imports has occurred. The magnitude of the exchange rate elasticity estimates for coarse grains is generally larger than that for wheat.

The largest exchange rate elasticity estimates (greater than $|1.0|$) tend to be more significant than smaller elasticities, especially those that are large and positive (Nigeria, Philippines and Ecuador). These are countries whose coarse grain production-to-consumption ratios are large (greater than 90 percent). This result implies that coarse grain imports are a complement to domestic goods. As with wheat, Germany also has a positive (though insignificant) exchange rate elasticity, and a ratio of coarse grain production-to-consumption of 81 percent.

Where elasticity estimates are large and negative (Tunisia, Saudi Arabia, Malaysia, and Japan), domestic production bases tend to be smaller relative to consumption levels (highest is Tunisia with 37 percent). An exception to this pattern occurs with Egypt, where the estimate is large (and insignificant) and the domestic production/consumption ratio is also large (80 percent).

Exchange rate results for coarse grains can be compared with those for wheat. For net imports of both grains, a negative cross-price effect (indicating internal substitution) occurs most often when countries are major wheat producers and consumers. Partial explanations for this outcome can be suggested, although in-depth country studies are needed to confirm such suggestions. For example, wheat is likely to substitute for coarse grains in more situations than coarse grains do for wheat,

thereby providing wheat-producing countries with greater flexibility in substituting domestic crops for imports when their relative prices change. Further, wheat production practices may be more flexible than those for coarse grains in many countries (for example in equipment used or knowledge required in production), thus allowing a larger output effect in the short run when price incentives change.

5.3 COMPARISON OF PRICE ELASTICITY ESTIMATES

One way of evaluating results of this study is to compare estimates obtained here with those of other studies. Studies by Coffin (1970), Abbott (1976), and Jabara (1982) provide direct comparison with current results in the sense that they all employ some version of the direct net import demand estimation procedure rather than inferring trade elasticities from domestic demand and supply elasticities.

Estimates from the Coffin and Abbott studies are provided in Table 5.7. Abbott provides the only comparison for coarse grains. Jabara aggregated countries into two groups: those producing wheat and those not producing wheat. Her estimates for wheat price elasticities were -0.07 for wheat producing countries (Algeria, Brazil, Chile, Iraq, Mexico, Morocco, Peru, the Sudan, Tunisia, and Egypt) and -0.18 for non-producing

countries (Columbia, the Dominican Republic, Ecuador, El Salvador, Indonesia, the Philippines, Taiwan, Veneuela, and Republic of Korea).

Table 5.7

PRICE ELASTICITY ESTIMATES FROM OTHER STUDIES

Country	WHEAT		COARSE GRAINS
	<u>Coffin¹</u>	<u>Abbott²</u>	<u>Abbott²</u>
Japan	- .32	+ .069	(a)
West Germany	+ 3.91***	- .047	- .250
Italy	-11.75*	+ .024	+ .066
Portugal	- 3.74	- .063	+ .059
Switzerland	- .76	(b)	(b)
Israel	- .19	(b)	(b)
Egypt	(b)	+1.17**	+ .420
Bolivia	+ 1.44	(b)	(b)
Brazil	+ .20	-2.48	+ .250***
Chile	- 1.92	- .28	- .370
Columbia	- .02	- .52	+1.900***
Ecuador	- .73	(b)	(b)
Paraguay	+ .78	(b)	(b)
Peru	- .32	(b)	(b)
Venezuela	+ 3.07	(b)	(b)
Sri Lanka	- .41	(b)	(b)
Korea	- .08	(b)	(b)
Philippines	- .18	+ .15	- .033
Thailand	(b)	+1.60*	+ .760***

1. H.G. Coffin, "An Economic Analysis of Import Demand for Wheat and Flour in World Markets", the University of Connecticut, Ph.D. dissertation (1970) pp.61-63.

2. P.C. Abbott, "Developing Countries and International Grain Trade", Massachusetts Inst. of Technology, Ph.D. dissertation (1976) pp.176-179.

(a) reported as having an incorrect sign.

(b) not estimated

* significant at the 99% level; ** significant at the 95% level; *** significant at the 80% level.

These studies differ with respect to methods used in estimation, variable coverage and time period. Coffin combined all country data into one matrix and estimated

the effect of changing slopes and parameter levels through the use of dummy variables. Variables in his net import demand equation included substitute cereals and animal units as well as price, income and production. The estimation period was 1959-77. Abbott combined instrumental variables with the ordinary least squares regression technique for individual country equations, covering a period from 1951 to 1973. His specifications varied among countries but variables such as foreign exchange availability and aid could potentially be included. Jabara used a generalized least squares method on data pooled across countries for the period 1976-79. Foreign exchange availability was used in her study as a proxy for income, and aid was included as a separate variable. None of these studies treated the exchange rate independently.

As a general rule, individual country elasticity estimates from these studies are statistically insignificant and show a mixture of positive and negative signs. Elasticity estimates from the current research also demonstrate these characteristics, but are typically smaller than Coffin's estimates and more consistently negative than Abbott's.

Abbott's study is the closest approximation to this one in terms of methodology and estimation techniques. Differences exist with respect to variable selection and

specification, in particular his inclusion of aid (which has been omitted here for reasons cited earlier) and his candid omission of cross-price effects. Abbott's inclusion of aid may be a reason for differences with this study in wheat price elasticity estimates for some countries--notably Egypt and Brazil, where aid has been relatively large.

Except for one industrial country (Italy), none of the estimates obtained using a direct estimation approach are close to those of either Tweeten (1967) or Collins, Meyers and Bredahl (1980). These studies, it will be remembered, estimate trade elasticities indirectly from domestic elasticity estimates. It appears that direct estimation of net import demand yields lower estimates of trade price elasticity than would be expected from traditional trade theory analysis.

5.4 SUMMARY

Two specifications have been used to estimate net imports. One includes the standard variables of price, income, production and stocks. The second adds the exchange rate (as a proxy for cross-price effects) and also foreign exchange availability. These two specifications are used to estimate per capita net imports for 24 wheat importing countries and 18 coarse grain importing countries. The time period covered is 1960 to 1981.

Results from equations using standard variables only are fairly close to those expected from the theoretical model. Income and domestic production typically have higher statistical significance than other exogeneous variables. When financial variables are included equations perform less well. In particular the foreign exchange availability variable exhibits a high degree of multicollinearity with other included variables. Closer examination of the economic structure of individual countries would assist understanding the impact of exchange rates on net imports in its role as a proxy for cross prices.

Comparison of other price elasticity estimates shows that there is some agreement that a direct estimation approach yields relatively low estimates. This result contrasts with elasticity estimates obtained from the standard trade theory approach.

CHAPTER SIX

SUMMARY AND POLICY CONSIDERATIONS

Determinants of import demand are conditioned by the political-economic environment existing both inside and outside an importing country. To understand the structure of international agricultural markets, the interaction of political and economic constraints must be taken into account.

A framework has been suggested here to examine the structure of net import demand for grains. Empirical estimation of the resulting model has been carried out for selected industrial and less developed countries to investigate the responsiveness of imports to changes in the domestic and international environments. Demand for both wheat and coarse grains was examined.

Net import demand elasticities have been estimated to show the short run adjustment of imports to changes in price, income, production, stock, and financial variables. The theoretical specifications were based on a standard trade model that estimates net imports from domestic supply and demand functions. Specifications took into account the possibility that domestic policies in importing countries may intervene between domestic

economic relationships and actual net imports, under the assumption that domestic policies can cause net imports to be less responsive to changes in border prices than would be expected if only domestic demand and supply relations were considered. An attempt was made to measure the impacts on net grain imports of changes in relative prices and foreign exchange availability. A reduced form equation was constructed in order to estimate net import demand.

A brief review of research results is provided in the next section. Results are then used to indicate how domestic agricultural policies interact with the international environment. Importer-country policies and specific U.S. policies are discussed. A summary concludes the chapter.

6.1 REVIEW OF RESEARCH RESULTS

Basic structural characteristics of net import demand for wheat and coarse grains were derived from relationships between net import demand and price, income, domestic production and stocks. The price to which net imports would respond in the absence of domestic pricing policies is the world price expressed in deflated domestic country currency. The exchange rate and the level of foreign exchange availability were included as part of market structure.

A key focus of this research has been the expected low direct price elasticity estimates for net imports for

many grain consuming nations. This result was anticipated in that domestic policies were expected to weaken the price-net import relationship in the short run. As outlined in Chapter Three, price elasticity estimates obtained solely from domestic demand and supply relations are typically high relative to those anticipated from this study. Empirical results bore out a priori expectations. For wheat, short run price elasticity estimates were typically between -0.1 and -0.3. The highest significant estimate was found for Saudi Arabia (-0.99) and the lowest for Ecuador (-.003). Price elasticity estimates for coarse grains were, on average, a little higher than those for wheat, but were below -0.5 for the majority of countries studied. The price elasticity range for coarse grains was -2.1 (Philippines) and -0.03 (Switzerland). These results indicate that domestic policies are indeed often effective in isolating importing countries from changes in world prices, at least in the short run.

For most countries, income proved to be an important determinant in explaining changes in net imports. Estimates of income elasticities were generally positive and, along with production, income was one of the most statistically significant variables tested. Income elasticity estimates were higher for coarse grains than for wheat. Coarse grain income elasticities were generally over 1.0 and were greater than 2.0 in about half the countries sampled. For wheat, income elasticities

were typically closer to 1.0. Within each commodity group, the highest income elasticity estimates were found in low income countries, reflecting in part the relative importance of grain in diets at this stage of development.

As expected, the relationship between production and net imports was found to be negative for most countries examined. A negative relationship indicates that as domestic grain production fluctuates, imports are used to make up the difference, at least to some extent. In less developed countries, domestic production elasticity estimates for coarse grains were higher than those for wheat (often being greater than -1.0 while those for wheat were closer to -0.5). This result indicates the relative importance of stable wheat supplies for human consumption. Production elasticity estimates for industrial countries were close to -1.0 for both wheat and coarse grains.

Beginning stocks elasticity estimates were generally negative. However, especially among lower income countries, some positive estimates were found. A positive stocks elasticity indicates that security concerns are being reflected in demand, whereas a negative stocks elasticity indicates use of stocks as a buffer against short term market variations. The typical range for wheat stocks elasticities (-0.3 to -0.05) was lower than that for coarse grains (-0.5 to -0.1).

Inclusion of foreign exchange reserves as an

independent determinant of net imports in the short run was justified on grounds that the level of ownership of international currency could directly affect imports. A lack of such funds would constrain a country's ability to import in any given year. This expectation was not borne out in all countries studied. For about half the sample a negative relationship was found between net imports and foreign exchange reserves. Overall, foreign exchange availability elasticity estimates were small (often close to 0.2) and were less significant for wheat than for coarse grains. The role of debt in determining imports is considered in the next section.

Results suggest that further information is needed to clarify the role of exchange rates with respect to their effect on net imports. Conceptually, the exchange rate was included separately in net import demand equations to represent changes in relative domestic prices between traded goods and nontraded goods. That is, as the exchange rate changes, relative prices in a country cannot be assumed to remain constant. Characteristics unique to each country are expected to have a bearing on how changes in relative prices affect net imports of grains. Hypotheses can be developed to consider the nature of production and consumption opportunities in specific countries. Some of these are discussed in the following section.

6.2 DOMESTIC AGRICULTURAL POLICIES OF IMPORTERS

The results of this study relate most directly to policies of importing countries but have implications for major exporting countries. There are many different policy instruments and policy mixes which are used to achieve national objectives with respect to agriculture. Many of these are listed in Jabara (1982). The specific policies selected for discussion here have particular relevance to estimated trade elasticities. These include price and income policies, stock policies and financial policies.

6.2.1 PRICE AND INCOME POLICIES

Price and income policies are used for a variety of objectives: for example to improve welfare of producers or consumers, to raise government revenue, or to achieve long run development objectives. Most importing and exporting countries operate some kind of domestic agricultural price and/or income policy. Often price policies are a means of achieving income objectives for domestic consumers, domestic producers, or both and may also be used to enhance domestic government revenues.

6.2.1.1 The European Community

The Common Agricultural Policy (CAP) of the European Community is an example of a comprehensive policy which employs common border controls as a pivotal instrument to influence internal welfare. While initial objectives of

the CAP included consumer welfare along with that of producers, actual implementation of it favours the latter group. Josling (1980) has imputed subsidy equivalents of the CAP which are positive for domestic producers and negative for domestic consumers for most of the period 1968-76. During the period of high grain prices in the mid-1970s, policy-induced subsidies to producers were negative while those to consumers were positive. The impacts of the CAP illustrate a domestic price incentive structure which lacks orientation to changes in the world price.

The impact of CAP import levies is reflected in the low and insignificant price elasticities estimated for European Community countries. The response of these countries' grain imports to changes in the world price (expressed in real domestic country currency) appears very weak in the short run. Wheat price elasticity estimates for Italy and Germany were 0.19 and 0.34 respectively, using the four-variable specification. For coarse grains, price elasticity estimates were -0.15 and 0.16 respectively. These results imply that European demand responds weakly to border prices; the import levy 'cushion' between domestic prices and import prices is strong enough to offset any immediate import response to market conditions outside the European Community.

This outcome suggests that exporters can no longer

compete with European Community producers on the basis of price. Moreover, production incentives in the Community (and also the loan support price program in the United States to be discussed later) not only have encouraged a higher level of self-sufficiency in many agricultural commodities including grains over the last 20 years, but also have brought the European Community into export competition for some grains. This point is also made by Elleson (1983).

In spite the weak link between import prices and import demand in the European Community, the world market situation still has an impact on the Community as it affects the budget costs of the CAP. Josling and Pearson (1982) point to this potential longer run impact and find evidence of budgetary pressures. Such budget concerns may tend to increase import price elasticities over time. Gifford (1980) notes that it is the level of support above import prices rather than the specific instruments used that is of concern in this regard. As the exchange rate differential between the value of European currency and the U.S. dollar has widened recently these pressures have dissipated, at least for the time being.

The European Community response to budget pressures in the past has been to maintain the level of support to agriculture. What is important to other exporters, however, is the degree to which future pressure within the European Community to reduce farm support levels is

related to the difference between the world price and the internal support level. That pressure is likely to increase as the value of the U.S. dollar falls, or as the export price of U.S. commodities, or both. As discussed in Section 6.3 below, the potential for internal budgetary constraints to reduce Community price supports and/or export subsidies creates some incentive to major exporters to maintain a low world price.

6.2.1.2 Less Developed Countries

Included in the nomenclature of less developed countries is a heterogeneous group of nations, each with its own set of resources, goals and priorities. However, one relatively common thread among LDCs, cited in the USDA FAER Report 194 (1983), is government intervention in grain prices, particularly food grain (wheat and rice) prices. Low grain prices protect consumer interests often at the expense of producer interests. As has been suggested by Timmer (1981), political considerations provide one important reason for this strategy: "a government that cannot raise food prices because it will no longer be the government, will not raise food prices, no matter how critical that is to long-run efficiency." [p.122]

The effect of price policies in LDCs can be seen in low price elasticity estimates for net imports of grains, especially wheat. A CIMMYT study (1982) has documented

the existence of urban consumer-oriented policies in many LDCs--policies which set domestic prices at "reasonable" levels in light of political and economic concerns. Governments are often effective in insulating domestic wheat-product prices from changes in the world wheat price, and to some extent though less so for coarse grains. Low short run price elasticities can be expected where government policies are more effective than the external environment in influencing domestic demand and supply conditions and thus imports. LDC import price elasticities estimated for this study were lower for wheat than for coarse grains (typically between -0.3 to -0.05 as compared with -0.5 to -0.1). This result concurs with the CIMMYT finding that domestic wheat price policies are more complete than those for coarse grains in many LDCs.

Elasticity estimates of net imports with respect to domestic production of wheat are small when compared with those for coarse grains, and are smaller for many LDCs (less than -0.5 in 13 out of 16 countries) in comparison with those in developed countries. In some LDCs, the reason for low domestic production elasticities is likely to be the presence of domestic pricing policies as opposed to the existence of higher production levels relative to consumption. The distribution of benefits toward higher income, urban consumers at the expense of domestic producers has been noted, for example, by the USDA FAER

Report 194 and by Mellor (1978).

In the same vein, a scarcity of physical marketing channels through which to market domestic grain can effectively separate the domestic production/net import relationship. Abbott (1976), for instance, treats a part of the domestic production base as an enclave, isolated from the urban market.

One important implication of the apparent price-insulating effect of LDC policies is that international prices are a poor medium through which exporters can influence the level of net imports, at least in the short run. Given the positive, significant income elasticities for net imports of grains in many LDCs, a more appropriate means to achieve higher net imports may be by increasing ability to import in these areas. This might involve increasing income directly, for example by purchasing goods from LDCs, or the use of other options such as aid or concessional credit.

Related to income in LDCs is the issue of aid. Aid has not been an integral part of this study. However Grigsby (1983) has demonstrated that aid has both a direct consumption effect and an income-augmenting effect. Thus aid can affect trade volumes in two ways. First, aid may be tied to policies which increase consumption directly. Such policies might involve market promotion or the improvement of marketing infrastructure for wider dissemination of imports. Second, aid may induce income

growth. For example, aid can permit a country to save foreign exchange which can then be used for development purposes.

The impacts of aid on net imports may be felt both in the short run and in the longer run. In the short run, aid alters the domestic demand/supply balance. It increases supply and may increase demand if coupled with consumption-related policies such as market promotion. This effect would be captured in short run price or income elasticity estimates. However, changes in infrastructure due to aid, including its impact on overall economic growth and development, are likely to have longer run effects.

The existence of consumer-oriented price policies in many LDCs reflects an underlying tradeoff among multiple objectives, both government and social, and can lead to import dependency. In the short run, low consumer prices give more consumers greater exposure to imported grain. However through increased imports, income can be drained away from a country in the longer run. According to CIMMYT (1982), dependency on food imports can potentially strain domestic resources, especially where wheat is not a traditional staple (such as the tropical belt of the world) and/or where increased domestic production is difficult to sustain relative to consumption. This issue is one in which exporter and importer objectives appear to

coincide in the short run but in the long run may lead to deleterious effects for both. Where greater import dependence inhibits income growth in LDCs, more rather than less concessional trade may be required. It may be to the long run advantage of exporters to build up local markets for indigenous staples in order to maintain income growth and political stability, thus building up stronger markets for the future.

Returning to the issue of instability, studies such as Grennes, Johnson and Thursby (1978), Zwart and Meilke (1979), and White (1984) have pointed out that instability of world market prices is likely to increase in the presence of national price-insulating policies. This is , especially so if buffer stocks are absent. Blandford (1983) measured the extent to which short term variability in international grain prices is due to changes in domestic production in individual countries. He regressed the change in net imports of wheat and coarse grain against the change in domestic production and world prices. A non-zero negative production coefficient implied some transmission of domestic production instability to the world market. Among importers, Blandford found that most countries pass on at least some of their production variability to world markets. This result concurs with the current study where elasticity estimates for domestic production were typically small but negative.

In the Blandford study a zero price coefficient

implied complete insulation of domestic markets from international price changes, whereas a non-zero positive price coefficient implied the country contributes to world price instability through its trade practices. It was found that all countries except the U.S. were adding to international price instability. More negative price elasticities were estimated here than by Blandford, although such responses were often insignificant in both studies.

6.2.1.3 State Trading Organizations

State trading organizations (STOs) exist not only in centrally planned economies but also in some of the LDC , importers included in this study. Their impact on world market price stability is inconclusive. On one hand, STOs may be expected to decrease import demand elasticity. As noted by McCalla and Schmitz (1982), STOs are typically formed as an instrument of domestic policy rather than of foreign trade policy. Kostecki (1982) has remarked that where they concentrate on domestic stabilization goals, STOs are an effective instrument in separating domestic prices from world prices. As such, STOs cause import demand to be more price inelastic and thus contribute to world price instability. There is also opportunity for STOs to increase market instability if one side of the transaction is carried on by private traders. McCalla and Schmitz cite the Soviet Union as being in a position to

'manufacture' price instability intentionally to their own advantage.

On the other hand, as opposed to private traders who tend to maximize short run profits, state traders focus more on absolute price levels in achieving their objectives for domestic producers. In this sense, greater market stability may be introduced through state trading operations. Further, Kostecki remarks that the grain futures market, which provides a mechanism to shift risks arising from market volatility, may not function if all trade were on a government-to-government basis.

6.2.2 STOCKHOLDING POLICIES

Willingness to hold stocks relates to associated costs and benefits in each country. Costs of stockholding include physical and institutional characteristics of individual countries, and are related to technical knowledge about storage. According to a comprehensive report on wheat stockholding by Morrow (1980), the environment in exporting countries--including climate, pests, existing infrastructure, and technology--is more conducive to lower stockholding costs than in more tropical, less developed regions. Beyond necessary pipeline stocks, there are benefits of holding stocks to buffer short run market variation and to enhance food security.

Morrow discusses the impact of domestic stockholding

policies on stockholding behaviour, showing that policies cause differences between financially profitable (optimal) stocks and actual stocks. A benchmark for "optimal stocks" is provided by Gardner (1979). Morrow compares actual stockholding behaviour with Gardner's theoretical optimum and interprets the results in light of domestic agricultural policies. His findings show that the United States and other major grain exporters traditionally have held the majority of grain stocks, more as a corollary to domestic price and income policies than to concerted stockholding policies.

Differences between the two periods--1960/1-1970/1 and 1972/3-1978/9--are relevant to this policy analysis. Carryover stocks for four major exporters (the United States, Canada, Australia, and Argentina) as a percentage of world stocks declined from 83.8 percent to 52.9 percent between the two periods; stocks in the European Community rose from 7.3 percent to 9.5 percent; while stocks in the 'rest of the world' category rose from 4.7 percent to 24.7 percent. Another difference between the two periods is that in the earlier period, the majority of LDCs and all industrial countries used stocks largely as a buffer against short term market variations. In more recent years LDCs have increased their grain stocks for other purposes, particularly to meet food security concerns. It appears that when supplies are high, stocks fall below optimal

levels in the absence of exporter efforts to hold grain for the purpose of increasing price. This is because domestic market insulation policies (high producer prices) discourage private stockholding under such conditions. However, when supplies are short, food security concerns dominate and world stocks tend to exceed profitable levels.

The USDA FAER Report 194 (1983) agrees that "after the international grain price instability during 1973-75, many developing countries shifted the focus of their food policy objectives toward food self-sufficiency and domestic price stability." [p.3] It is somewhat ironic that the impetus for LDCs to incur costs of stockholding-- , that of grain price instability--is itself being exacerbated by LDC pricing policies. Further, a positive relationship between net imports and stocks found in this study for some LDCs can add pressure to world prices, especially when world supplies are tight.

The Morrow and USDA (1983) studies reveal that many developing countries absorb some cost of maintaining stocks within their technical and financial constraints, especially under tight market conditions. The relatively small short run stocks elasticities (generally less than 0.2) estimated in this study support this argument. The overall increase in world stockholding costs, because of higher carrying costs in many importing countries and the tendency to over-stock when world supplies are tight,

appears to be balanced by benefits felt by importers in having control over an adequate supply of grain.

In the longer run, maintenance of a stable supply by major producers can enhance export markets (by reducing the costs of LDCs in maintaining consumption levels) at the expense of domestic stock programs of exporters. As Kostecki has noted, STOs in importing and some exporting countries may play a role in reducing costs, either by passing on economies of scale in marketing or by subsidizing such market functions as storage, transportation or credit at levels unlikely by private traders.

6.2.3 FINANCIAL POLICIES

With respect to the level of foreign exchange reserves, the USDA Foreign Agricultural Service (1984) has cited external debt as being a direct cause of current lagging imports by many LDCs. Elasticities estimated here provide some evidence that import demand is constrained by foreign reserves more in low income countries than in higher ones. However, in general the response is small (less than 0.2) and of low significance.

To what extent has credit availability mitigated the expected positive relationship between the level of reserves and net imports? A USDA FAS report (1984) notes that an expansion of commercial lending to LDCs had a positive effect in bringing about economic recovery in

these countries after the first oil price shock in the early 1970s. However, the same recovery did not occur after the 1978 oil price shock and currently commercial banks have actually reduced their LDC lending below recent levels. Further, International Monetary Fund financing is increasingly associated with conditions aimed at increasing exports and reducing imports. In such an environment, credit policies of major exporters can be expected to have a significant impact on their level of exports to certain LDCs. Indeed, information on the competitive nature of such export promotion techniques would make an interesting study in itself.

Another question in this vein is: How recent and how widespread is the 'debt crisis'? The USDA FAS study (1984) cited above reports that growth of external debt in LDCs averaged 21 percent annually since the mid-1970s. Until 1981/2 exports from these countries "kept pace with the debt buildup" [pp.3-4], implying that the level of reserves had not been reduced to critical levels until at least after 1981. In future years there may be cause for concern among exporters and importers alike over the ability for some LDCs to pay for food imports. In-depth cross-sectional studies on ability to pay for imports could help in answering this question better than the time-series data used here. Consideration of this question could also include the credit aspects discussed

above.

Following the argument of Chambers and Just (1979), exchange rates have been included here as a separate variable in estimating net import demand. A negative relationship between net imports and exchange rates indicates that some substitution of domestic food grain supply for imports has taken place. For example, as foreign currency becomes stronger vis a vis the U.S. dollar (a fall in the exchange rate variable), prices of indigenous, nontraded foodstuffs rise relative to imported grains. A positive relationship indicates either the existence of country-specific characteristics which are not conducive to substitution or some complementarity, between domestic nontraded goods and grain imports.

Exchange rates also affect net import demand by directly altering the actual cost of imports through price. As seen in Chapter Three, some studies have hypothesized that recent appreciation (post 1981) of the U.S. dollar has hurt the competitive position of the United States as grain exporter. As far as LDCs are concerned, the USDA FAER Report 194 found that overvaluation of foreign currency was "symptomatic" of policies of developing countries. If this conclusion is accurate, exchange rate policies of LDCs have operated historically as a tax on exports and a subsidy on imports. More recently, financial pressures felt in many LDCs have led to devaluations of their currencies against

the U.S. dollar. This phenomenon has occurred throughout the world--in Latin America, the Middle East and North Africa, South Asia, and South East Asia--as evidenced in USDA World Agricultural Regional Supplements to WAS-31. A strong dollar will be an incentive to many LDCs to continue to reduce their reliance on imported food, particularly from the United States.

6.3 IMPLICATIONS FOR U.S. AGRICULTURAL AND TRADE POLICIES

As trade in grains has grown over the last two decades, so has the importance of the U.S. grown as a grain supplier to the rest of the world. Domestic agricultural and trade policies in the U.S. are increasingly interdependent with those of importing and other exporting countries. This final section uses elasticity estimates obtained from this study to examine how U.S. agricultural policies interact with the current trade environment. Three such policies are discussed: the loan rate, stocks policy, and export credit policies.

Two things should be borne in mind throughout this section. First, demand elasticity estimates obtained from this research relate to imports from all sources, only one of which may be the U.S. Since imports have not been differentiated as to source, the estimated elasticities reflect characteristics of the international market for grains, not solely characteristics of the foreign demand

for U.S. grains. Second, not all U.S. producers participate directly in all U.S. agricultural programs. Because of the voluntary nature of many agricultural support programs, it is perhaps technically inappropriate to generalize about how these programs tie in with elasticity results. Still, general participation does occur indirectly where policies affect "free" market conditions in which all producers deal. It is in this vein that the following comments are made.

6.3.1 THE LOAN RATE

U.S. farm price and income policy has been oriented historically toward domestic producers. It has been directed at alleviating problems inherent in the U.S. farm sector--essentially problems which stem from unstable farm prices and incomes, low farm prices and incomes relative to the non-farm sector, or both. As U.S. exports have grown, policy reactions to these domestic problems are increasingly linked to the international political-economic system. Berck and Schmitz (1984) and Duncan and Borowski (1984) provide recent examples of analyses which call for a change in agricultural policy orientation to take into account this changing environment.

U.S. loan rate policy dates back to the Agricultural Adjustment Act of 1933--the so-called 'New Deal' legislation. Essentially, loans have provided farmers with a guaranteed floor price for grain. If market prices

rise above the loan rate, producers can pay back the loan and retrieve ownership of their product; if the loan rate proves to be higher than the market price, farmers can retain the loan by forfeitting their grain. Subsequent legislation has maintained the basic provisions of this policy. However, as supply expanded in response to support levels, market price supports in the form of loan rates were separated from income supports in the form of target prices and deficiency payments. Deficiency payments, the size of which being determined by the difference between the (lower) loan rate and the (higher) target price, were made subject to acreage restrictions in an attempt to curb supply increases. This policy change, was coincident with an increase in the quantity of U.S. grain going to export markets.

Several consequences of U.S. price and income support policy have been significant from the standpoint of the international agricultural trade environment. For example, attempts such as acreage restrictions have had little effect in curbing increases in output. Burgeoning supplies from U.S. producers continue in response to expectations of higher and/or more stable returns. Much of this output finds its way to the international market. The relationship between growing U.S. supply and elasticity results will be discussed in more detail at the end of this section.

A perhaps more important consequence of U.S. policy

is that the loan rate has tended to be a dominant factor in influencing international grain price levels. This effect is due in part to the large quantities of U.S. product exported (especially since the early 1970s). In any case, the U.S. loan rate is an important planning tool both for domestic producers and for other grain trading countries.

This is not to say that countries are import-sensitive to changes in the U.S. loan rate when making short run trade decisions. In fact, as previously demonstrated, quite the opposite is occurring. Price elasticity estimates calculated in this study are almost invariably low for both wheat and coarse grains. By providing world grain prices with an effective floor (presumably higher than that which would prevail otherwise), the U.S. loan rate helps importers, as well as other exporters, predict costs and benefits of their own domestic pricing policies. As an extreme example, it may be economically rational for countries within the European Community to import more grain when the world price is going up (viz. their small, positive price elasticities), since revenues can increase through exports of different varieties of grain. However, even for LDCs with strong consumer price policies, prior knowledge of the U.S. loan rate can help them set a more politically acceptable domestic price range.

The range of income elasticities estimated in this research shows the sensitivity of various countries to the level of the U.S. loan rate. The difference between insulated importer prices and the world price is determined, to a greater or lesser extent, by the level of the U.S. loan rate. The costs of insulation, then, depend largely upon the level of domestic (importing country) support and the policy-determined level of U.S. loan rate. Different countries have different abilities to bear the costs of protectionist policies. The relatively high income elasticity estimates found for lower income countries reflect, in part, how difficult it is for some countries to maintain an isolated internal price structure.

Even for the European Community, the costs of the Common Agricultural Policy are not insignificant. The level of the world price as well as the level of internal prices affect the costs of EC import levies and export subsidies. Therefore, both external and internal forces potentially can influence the cost of EC interventionist policies and, perhaps, the continuation of such policies--at least at levels of the recent past. Although the time frame for empirical estimation in this study ended in 1981, it has been evident in more recent years that the rise in value of the U.S. dollar has helped Europe cut costs of its Common Agricultural Policy. A falling dollar would have the opposite effect, and would exacerbate the

negative impact on the Community of any drop in the loan rate.

One consequence of U.S. price and income policy yet to be discussed with respect to elasticity results is that mentioned earlier of increased U.S. grain supplies. The consequence of increased annual production demonstrates a rational producer response to domestic U.S. price and income policy. Internationally, however, as the U.S. exportable surplus has grown, the U.S. grains sector has become more dependent upon export markets at the same time as importers have become less sensitive to price signals. This low price response has been discussed earlier in this section. Essentially, predicted net import demand price elasticities are small due to domestic pricing policies in individual importing countries; empirical estimates support this argument.

Under freer trade conditions--where policies, programs and regulations play less of a role in day-to-day economic decisions--the U.S. could be expected to have a comparative advantage with many countries in producing, and exporting wheat and coarse grains. In contrast to such a trading environment, actual domestic commodity policies point to the existence of country-specific agricultural objectives (such as enhanced producer incomes, lower consumer food prices, or whatever). Both the literature reviewed for this research and empirical price elasticity

results evidence the existence of strong political-economic objectives with respect to domestic grains prices.

Despite strong internal pricing policies, strong domestic stocks policies are not evident from the results of this study. The stocks elasticity--or the short run import response to changes in domestic (importing country) stocks--provides an important indication of foreign behaviour in relation to increasing U.S. supplies. Very few countries studied demonstrated a willingness to hold stocks for security reasons, as would have been indicated by a positive stocks elasticity. Results indicate that few countries are concerned about the availability of grain in the short run.

In summary, inward-looking U.S. policies relating to the loan rate have encouraged competition from other exporters and have increased domestic production and supplies. Consequently, a buyers' market has emerged for international grain sales. U.S. price and income policy, then, has led to a market situation which is disadvantageous to the U.S. in terms of loss of bargaining power. Exporting competitors, in particular the European Community, have been able to use the loan rate to predict and/or to reduce costs of their own internal agricultural policies. Further, increased U.S. supplies are advantageous to importing countries. Not only are terms of trade easier to bargain for importers, but also the

costs of storage are borne, to an extent, by the U.S. This last point brings the discussion to the second U.S. policy under examination here--that of U.S. stocks policy.

6.3.2 STOCKS POLICY

U.S. policies affecting grain reserve levels are a corollary to domestic price and income policies. For the most part, U.S. stocks (particularly government-owned stocks) have been a direct outgrowth of price and income policy. The previous section sketched how the loan system in the U.S. works. Briefly, grain can be used by a producer as collateral security for a money loan from the U.S. government. Subsequently, the farmer has the option of repurchasing the grain or relinquishing it to the government. When the latter occurs, the institution supporting such non-recourse producer loans is the Commodity Credit Corporation (CCC).

Since 1933, grain surrendered to the government in payment for a loan has been acquired and stored by the CCC. Liquidation of these stocks is controlled through mechanisms stipulating the size of reserves, and domestic and international food aid programs. In 1983, CCC accumulations were offered to farmers in payment for reduction of planted acreage in certain grain crops. Government-supported farmer-owned reserves (FOR) have supplemented government-owned stocks since 1979.

Accumulation of U.S. grain reserves has occurred

essentially in isolation from international concerns. There are numerous ways to look at the internal policy implications of the domestic stocks policy of the U.S. One of these was discussed in the previous section with respect to the increase in U.S. supplies (production plus stocks). In particular, the foreign stocks elasticities estimated in this study reflect a lack of concern on the part of importing countries for domestic stocks held for security reasons.

In the sense that massive stocks have provided an incentive to U.S. international food aid programs, they have helped the U.S. derive some benefit from the relatively high income elasticities of grain import demand found in many importing countries (especially in LDCs). To the extent that aid has been used to overcome income and/or foreign exchange constraints, the presence of U.S. reserves has allowed this country to develop new markets. However, such flexibility comes at the cost of holding reserves.

Perhaps the most significant relationship between U.S. stocks policy and trade elasticities is in the area of instability (or market variability). A section on the international trade environment in Chapter Two of this study discussed this phenomenon. Instability in agriculture comes from a variety of sources and affects a variety of key economic variables, not the least of which

include production and price. Concern is not so much over unstable prices and quantities, though there may be reason to focus solely on one or the other variable from time to time. Rather, concern is with how income is affected and, along with income, the economic opportunities of individuals within a society.

Stocks elasticities found in this study were generally smaller than production elasticities. One possible explanation for this is that the presence of large U.S. stocks inadvertently, yet effectively, reduce the need of other countries to hold their own stocks. This would allow importing countries to be less sensitive to short run draw-downs in domestic reserves, while adjusting their imports relatively more to changes in domestic production. Viewed from a global framework, such behaviour implies that less domestic supply variability is being absorbed by these countries and more is being transmitted to the international grains markets.

To the extent that production variability in trading countries is synchronized (that is, production moves in the same direction at the same time), supplies and prices on international markets will fluctuate more widely. Current trading behaviour as indicated by elasticity results from this research may create greater stability within an importing country in the short run, but greater instability for producers and consumers abroad. In the longer run, a general 'instability inflation' may result

as market participants adjust and readjust to production and price fluctuations. There is some evidence of this outcome in current international grains markets, if only in the perception that these markets are more unstable than in the past.

U.S. stocks policy has essentially been inwardly oriented--aimed at strengthening market prices for grains by taking some supply off the market temporarily. Within an international framework, however, this policy has amplified a tendency for the U.S. to hold world stocks for food security purposes. Instability of international grains markets has also been affected by U.S. stocks policy. The reaction of importers to changes in domestic production and stocks indicated a willingness to transmit domestic production variability onto world markets. On a slightly more positive note, U.S. stocks policy has allowed the U.S. to take some advantage of the relative responsiveness of importing countries to income-related changes by encouraging the use of surpluses in the form of aid. This outcome is somewhat related to the impacts of U.S. export credit policies, the subject of the next section.

6.3.3 EXPORT CREDIT POLICIES

Countries exporting grain tend to finance at least part of their sales through export credits. The U.S. is no exception. Since the mid-1970s, the use of such

credits to capture export markets has grown to such an extent that it has been likened, by Harald Malmgren (1979) for one, to a war. Escalation of credit activities can be seen through changes in U.S. foreign marketing policies. These changes have been stimulated, at least in part, by financing arrangements offered by competitor countries and the weakness of international rules controlling their use.

Two U.S. decisions illustrate the competitive nature of export credits: the level of funds available to the U.S. Eximbank and, more directly in the case of grain sales, a program of blended credit aimed at enhancing the level and flexibility of credit available to potential buyers of U.S. agricultural products. Following a failure by the Organization for Economic Cooperation and Development to effectively curb international credit use, the U.S. in 1979 raised the level of Eximbank commitments from \$27 Billion to \$40 Billion over the subsequent five years. Albeit only a relatively small portion of these funds are used to finance agricultural exports, this action demonstrates awareness of the emerging credit "war" and a willingness on the part of the U.S. to defend her agricultural export markets.

The second action taken by the U.S. to heighten international export credit tensions came in October 1982. In the face of perceived erosion of U.S. agricultural export markets, the U.S. introduced a three-year, \$1.5

Billion blended credit program to provide purchasers of U.S. grain with a mix of commercial-rate and concessional (free) credit (in the ratio of 4:1). Within four months, an additional \$1.25 Billion was added (Perkins (1983); WAS-30 (1982); and WAS-32 (1983)).

The current research estimating elasticities relating to trade in wheat and coarse grains has shown that net import demand for grains is not as sensitive to price changes as it is to income changes. In fact, the estimated change in imports in response to a change in border prices was found to be close to zero for most countries studied. This relationship, discussed at greater length in earlier sections, was anticipated due to suspected frequent use of domestic pricing policies which serve to insulate a country from international price signals. Estimated income elasticities, on the other hand, were in the neighbourhood of unity for wheat imports and above that for coarse grain imports. Grain imports from lower income, less developed countries were the most sensitive to changes in income. Credit policies which succeed in tapping this income elasticity for grain imports are likely to make the U.S. more competitive in international markets, especially in low-income LDCs.

An important facet of the U.S. blended credit program is the ability to use credit strategically. Markets can be uniquely identified (based on commodity, country of destination, importing agent, timing, and so on), with

credit being offered as a unique package on each sale. Countries or groups eligible to receive credit can thus be targetted and marketing strategy enhanced.

Export credit is likely to be most effective when coupled with other policies which broaden the consumption base. This is true especially in LDCs. For example, agricultural credit can be supplemented by assistance to improve a country's marketing infrastructure and/or to provide greater access to imported grain through income distribution programs. There is likely to be positive effects of grain imports through direct income enhancement in such importing countries. Thus, use of credit might be combined, for example, with increased U.S. purchases of more foreign products from targetted potential markets. Of course, the benefits of such programs may not all accrue to the U.S. and, even if they do, there are likely to be tradeoffs between sectors of the U.S. economy.

To sum up this discussion on export credit, the relatively high income elasticity estimates in this study reveal that there are potential, positive benefits from current U.S. credit policies. Export credits enhance purchasing power of importing countries in the short run. Concessional credit for grain imports can help overcome income and/or foreign exchange constraints. Moreover, credit targetted strategically to specific markets will enhance the effectiveness of U.S. credit policies. Other

policies used to broaden demand in importing countries (such as infrastructure development or reciprocal trade) also may alleviate some of the income constraints experienced by grain-importing LDCs. However benefits from such policies as these are more difficult to capture by a single exporting country.

6.4. SUMMARY

Trade has a unique role in the international political-economy. While it helps shape the economy of a single country (either importer or exporter), trade also plays an important part in shaping the wider international environment in which individual countries exist. Problems associated with balancing the various internal and external impacts of trade have not always been well-understood, nor have their answers been readily available.

This study has focussed on short run import demand elasticities--a key economic variable which links importer and exporter and also contributes to the nature of the international market. The specific markets under study have been those for wheat and coarse grains in a variety of selected countries.

To measure demand elasticities in international grain trade, it is possible to assume that trade elasticities are dependent solely on standard domestic demand and supply characteristics. As seen in Chapter Three, this method of elasticity estimation historically has been the

norm. However, in view of the interdependent nature of national decision-making as discussed in Chapter Two, this approach was considered inadequate to describe trade behaviour in the current grain trade environment. A direct approach of estimating net import demand elasticities, described in the early part of Chapter Four, was used in this study.

Following this preliminary investigation, three basic steps have been taken to achieve the objectives of this research. First, a framework of analysis to examine import demand for grains was identified in Chapter Four and made operational in Chapter Five. Second, the short run trade elasticities estimated from the chosen trade model were reported in Chapter Five and compared with expected results. Third, Chapter Six discussed both domestic importer policies and selected agricultural and trade policies of the United States in the context of estimated elasticity results.

In establishing the framework of analysis for this research, economic variables significant to the structure of net import demand for wheat and coarse grains were identified. An econometric model was outlined through which net import demand can be estimated directly to take into account the effects of various domestic agricultural and trade policies on international markets. Thus, the partial equilibrium approach chosen for analysis

incorporated specification of potential importing-country policy influences on trade. As well, the estimated trade model recognized the potential effects stemming from trade-related financial variables. These variables were introduced in the review of literature as unresolved questions with respect to modelling international agriculture trade.

Estimation of short run demand elasticities was carried out using single equations, each representing net imports by a single country for both wheat or coarse grains, respectively. Two specifications were used for each country/commodity grouping: one with traditional trade variables such as price, income, domestic production, and stocks and a second which included two less-traditional variables along with these.

Elasticity estimates resulting from the first specification tended to bear out a priori expectations. In particular, it was found that direct estimation of short run price elasticities of net import grain demand yielded smaller import responses with respect to price than those estimated indirectly from domestic demand and supply functions. This had been a major focus of elasticity estimation. Further, resulting elasticities compared well with previous studies using a similar approach.

Net import demand elasticities were not as conclusive for the less traditional variables included in this study.

Two such variables were used: foreign exchange availability (to represent a possible constraint on imports) and the exchange rate (to capture cross-price effects between exportables and importables). The relatively low significance found for these variables was due in part to statistical problems encountered during estimation. Despite this empirical result, the changing nature of trade relationships appears to warrant further study into how such variables affect net imports. This is considered to be an important avenue for future research. Such relationships are complex and difficult to model. However, their potential influence is too important to ignore.

Analysis of elasticity results with respect to their policy implications showed that domestic price, production and stocks policies of importers typically have had a dampening effect on the response of net imports to a change in the world market situation. In particular, producer price policies in many higher-income countries and consumer price policies in many lower-income LDCs were found to isolate most domestic markets from changes in international prices in the short run. However, many of the countries studied showed a high, positive income elasticity for imports of both wheat and coarse grains. These outcomes imply that price manipulation on the part of exporting countries is a less effective means of

directly encouraging imports than are, say, policies which increase effective demand.

Elasticity results were also used to examine how selected policies of the United States interact with the international grain trade environment. Policies relating to domestic farm prices and incomes--such as the loan rate and stocks policies--essentially enhance the position of both export competitors and importers, to the detriment of U.S. producers. This is especially true in the longer run. Conversely, U.S. export credit policies tend to address the needs of importing countries, while at the same time weaken potential competitive strength of export competitors.

Ultimately, policies undertaken in a domestic environment are interdependent in an international setting. Policies of one country interact through international markets to affect opportunities and constraints felt by other countries. This impact of policies must be taken into account as part of the structure of international agricultural markets.

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APPENDICES

APPENDIX A
LIST OF COUNTRIES STUDIED

WHEAT

COARSE GRAINS

Less Developed Countries-Low Income¹

Philippines
Sri Lanka
Thailand
Egypt
Morocco
Nigeria
Tunisia
Peru
Columbia
Ecuador
Bolivia
Paraguay

Egypt
Nigeria
Tunisia
Philippines
Peru
Columbia
Ecuador

Less Developed Countries, Middle Income³

Korea
Malaysia
Israel
Brazil
Chile
Venezuela

Israel
Chile
Venezuela

Oil Exporters²

Saudi Arabia
Libya

Saudi Arabia
Libya

Industrial Countries

Japan
Germany
Italy
Portugal

Japan
Germany
Italy
Switzerland

-
1. Average per capita income \$400 - \$1630,
 2. Average per capita income \$8450 - \$24,660,
 3. Average per capita income \$1700 - \$5670,
according to the World Bank Annual Report.

APPENDIX B
ESTIMATED EQUATIONS

BOLIVIA

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
WHEAT									
50.91	- .567 (.582)*	.166 (1.849)	- .397 (.490)	- .785 (.228)	.181 (.960)	-2.642 (2.739)	2.987	2.595	.362
49.31	- .915 (.957)	.316 (1.036)	- .469# (1.215)				1.045	1.886	.641

BRAZIL

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
WHEAT									
25.74	- .149 (1.079)	.200 (4.832)	- .795 (5.464)	-1.302 (2.442)	- .446 (1.098)	- .557 (1.200)	10.135	1.724	.723
26.02	- .853 (.702)	.153 (7.189)	- .787 (6.331)	- .987 (2.572)			14.957	1.561	.727

CHILE

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
WHEAT									
42.77	.297 (2.543)	-.346 (.448)	-.403 (.143)	.103 (.197)	.146 (.907)	.643 (.558)	2.585	1.639	.312
-10.97	.198 (2.302)	.555 (2.144)	.117# (.719)				4.800	1.657	.352
COARSE GRAINS									
-15.67	.771 (.152)	.250 (1.167)	.257 (1.556)	-.394 (1.062)	.167 (3.295)	-.905 (2.378)	4.314	1.334	.486
-11.21	-.413 (.880)	.210 (1.988)	.312 (1.855)	-.205 (.440)			2.080	1.012	.171

COLUMBIA

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
WHEAT									
3.77	- .306 (1.977)	.311 (2.039)	- .602 (1.754)	-1.709 (6.585)	.350 (1.302)	.626 (.536)	20.496	2.055	.848
6.95	- .500	.561	- .262	-1.460			26.490	2.500	.829
	(4.480)	(6.147)	(.947)	(6.038)					
COARSE GRAINS									
12.48	- .116 (.314)	.178 (.065)	- .217 (1.634)	- .472 (.795)	.534 (1.559)	.126 (.496)	6.124	2.718	.594
- 2.60	- .553 (2.267)	.357 (5.726)	- .135# (1.176)				11.130	2.644	.591

ECUADOR

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
WHEAT									
14.53	.902 (.304)	.621 (2.739)	-1.077 (2.849)	-.499 (.993)	.177 (.555)	-.314 (.134)	82.911	1.922	.959
12.07	-.280 (.108)	.744 (4.023)	-.933# (3.107)				165.485	1.439	.959
COARSE GRAINS									
8.83	-.837 (3.648)	-.224 (2.006)	-.118 (1.544)	-.818 (.998)	.764 (4.631)	.191 (1.410)	21.680	2.651	.855
6.33	-.645 (2.201)	.218 (3.696)	-.161# (2.070)				16.946	1.818	.695

EGYPT

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
WHEAT									
64.08	.010 (.077)	.294 (3.348)	-.777 (1.223)	.555 (1.381)	-.322 (.499)	-45.370 (.892)	19.262	1.610	.839
58.06	-.043 (.383)	.215 (5.445)	-.631 (1.084)	.785 (2.853)			30.390	1.653	.848
COARSE GRAINS									
15.74	.603 (.703)	.103 (1.802)	-.235 (.864)	-.199 (.205)	-.525 (.137)	-30.698 (1.128)	4.492	1.365	.499
-13.67	.197 (.285)	.650 (3.083)	.426# (.577)				8.081	1.670	.503

GERMANY

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
WHEAT									
-53.76	.255 (1.184)	.696 (.324)	-.135 (.627)	-.678 (2.822)	.358 (1.609)	22.068 (1.830)	9.618	2.248	.711
90.87	.100 (.541)	-.179 (1.516)	-.844 (.384)	-.897 (4.167)			12.472	1.891	.686
COARSE GRAINS									
45.55	.244 (.39)	.564 (2.217)	-.530 (2.572)	-1.158 (1.969)	.443 (.104)	20.588 (1.132)	2.386	1.1	.284
166.61	.322 (.583)	.257 (1.551)	-.566 (2.802)	-.937 (1.667)			2.86	.738	.262

ISRAEL

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
WHEAT									
101.97	.182 (2.985)	.192 (4.041)	-1.299 (6.248)	-.616 (3.446)	.135 (.710)	-6.547 (4.793)	9.559	2.589	.710
109.68	.114 (1.297)	.838 (1.581)	-.720 (2.836)	-.280 (1.138)			3.728	1.933	.342
COARSE GRAINS									
77.45	.411 (1.651)	.349 (2.904)	-.906 (2.019)	.478 (.959)	-.795 (1.918)	-1.687 (.795)	16.366	2.218	.814
105.27	.287 (1.184)	.245 (2.030)	-1.079 (2.220)	.274 (.510)			19.138	1.811	.776

ITALY

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
WHEAT									
156.30	.163 (.50)	.516 (2.502)	-.721 (6.623)	-.906 (3.15)	-.370 (1.241)	-.278 (1.322)	11.647	1.732	.753
129.42	.197 (.592)	.121 (.711)	-.615 (5.235)	-.732 (2.284)			11.678	1.395	.670
COARSE GRAINS									
205.78	-.169 (2.168)	.309 (7.374)	-1.883 (5.035)	-1.431 (1.457)	-.703 (1.885)	-.163 (.519)	13.572	2.149	.782
210.21	-.920 (1.278)	.308 (7.214)	-2.260 (8.213)	-1.200 (1.164)			17.071	2.397	.754

JAPAN

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
WHEAT									
59.37	- .325 (1.381)	.168 (.632)	-1.176 (6.717)	- .384 (1.30)	- .349 (.499)	- .124 (.740)	79.546	2.284	.957
58.60	- .331 (1.249)	.688 (3.708)	- .804# (6.405)				120.721	1.369	.945
COARSE GRAINS									
159.94	- .365 (2.755)	.562 (6.304)	-1.269 (2.829)	- .626 (.955)	- .974 (3.737)	- .323 (4.172)	252.998	1.508	.986
22.18	- .389 (2.124)	.535 (4.646)	- .855 (1.406)	1.631 (3.010)			188.856	1.562	.973

KOREA

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
WHEAT									
38.71	- .164 (.357)	- .159 (.067)	-2.116 (1.165)	1.556 (2.124)	- .945 (.669)	.327 (1.015)	6.235	1.533	.599
37.23	.116 (.263)	.482 (.368)	-2.046 (1.096)	1.768 (2.620)			8.090	1.461	.575
COARSE GRAINS									
6.25	- .577 (.858)	.625 (2.755)	- .240 (1.089)	- .112 (.611)	.485 (.373)	.334 (.113)	36.072	1.963	.909
2.56	- .630 (1.209)	.710 (15.630)	- .160# (1.319)				84.772	1.859	.923

LIBYA

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
WHEAT									
257.05	- .155 (.931)	.405 (4.772)	- .451 (1.817)	-2.816 (2.871)	- .656 (1.327)	-478.357 (1.901)	40.625	2.390	.919
67.12	.143 (.088)	.474 (11.155)	- .403 (1.592)	-3.438 (3.364)			49.895	2.360	.903
COARSE GRAINS									
76.05	- .738 (1.581)	- .157 (1.223)	- .250 (.874)	(a)	.196 (2.768)	-21.702 (.059)	4.090	1.963	.469
82.82	- .645 (1.506)	.244 (.553)	- .617 (2.277)	(a)			4.242	1.437	.317

MOROCCO

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
WHEAT									
56.99	- .192 (.106)	.352 (3.389)	- .508 (4.148)	- .382 (.876)	- .599 (1.352)	-8.793 (.574)	7.719	1.306	.658
9.83	- .137 (.942)	.354 (5.716)	- .479# (4.143)				15.668	1.197	.677

MALAYSIA

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
WHEAT									
19.16	.315 (.276)	.116 (.305)	(a)	-.910 (.119)	.954 (.314)	2.585 (.320)	.198	2.185	-.236
29.32	.180 (.204)	.103 (.969)	(a)	-.199 (.296)			.316	2.193	-.108
COARSE GRAINS									
112.84	-.486 (1.849)	.208 (.246)	2.633 (.816)	2.059 (1.092)	-.472 (.943)	-28.762 (2.081)	24.229	1.559	.869
- 6.58	-.151 (.598)	.107 (2.024)	1.877# (1.455)				42.921	1.222	.857

NIGERIA

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
WHEAT									
-17.88	- .638 (.521)	.815 (1.067)	6.173 (.555)	10.270 (3.643)	.136 (.439)	24.366 (.883)	27.374	1.298	.883
- .80	- .325 (.354)	.696 (2.236)	9.665 (.971)	9.171 (4.163)			44.021	1.228	.891
COARSE GRAINS									
- 7.39	- .215 (1.278)	.642 (.044)	- .261 (.584)	1.384 (9.572)	.355 (.851)	2.547 (3.139)	39.390	2.906	.916
1.41	- .183 (.909)	- .138 (1.977)	.178 (.363)	1.154 (8.684)			38.549	2.131	.877

PARAGUAY

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
WHEAT									
124.15	- .233 (.108)	- .711 (5.296)	- .122 (.383)	- .811 (1.754)	.253 (4.520)	(a)	8.634	1.746	.645
84.69	- .518 (1.892)	- .145 (2.043)	- .615 (1.397)	-1.366 (2.095)			2.653	.835	.239

PERU

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
WHEAT									
12.27	- .145 (3.668)	.806 (1.814)	1.001 (1.294)	.747 (1.271)	- .518 (1.147)	.169 (1.400)	5.058	2.005	.537
22.00	- .117 (3.358)	.642 (3.869)	.496# (1.386)				9.467	1.914	.547
COARSE GRAINS									
9.78	.111 (.092)	.754 (1.327)	-.616 (1.898)	1.591 (.732)	.895 (.106)	-.588 (.326)	8.086	1.031	.669
- 9.40	.840 (.937)	.110 (4.166)	-.584# (2.628)				17.216	.928	.698

PHILIPPINES

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
WHEAT									
6.75	- .107 (.864)	.306 (2.105)	(a)	- .586 (1.422)	- .795 (1.833)	- .890 (.160)	2.767	2.141	.296
14.27	- .244 (2.427)	.121 (2.565)	(a)	- .476 (1.133)			3.241	1.878	.243
COARSE GRAINS									
9.27	- .347 (2.260)	- .323 (.211)	- .208 (2.087)	.109 (1.292)	.997 (2.508)	1.063 (2.011)	6.739	1.822	.621
- 4.79	.477 (.498)	.296 (2.616)	- .150 (1.368)	.361 (.442)			5.475	1.806	.460

PORTUGAL

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
WHEAT									
47.98	- .331 (.415)	.331 (1.772)	- .750 (5.760)	- .671 (1.613)	- .267 (.864)	.492 (1.524)	25.658	1.943	.867
61.15	.467 (.054)	.328 (1.663)	- .978 (9.423)	- .216 (.530)			28.967	2.028	.842

SAUDI ARABIA

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
WHEAT									
226.42	- .608 (3.730)	.101 (1.012)	.539 (.876)	-.872 (1.662)	-.896 (1.858)	-32.105 (1.618)	8.898	2.204	.693
95.16	-.677 (3.967)	.876 (1.881)	.243 (.379)	-.555 (1.459)			10.632	1.634	.647
COARSE GRAINS									
9.27	-.816 (2.777)	.451 (2.943)	-.316 (.325)	4.712 (1.496)	-.258 (4.833)	-15.892 (.614)	46.810	1.876	.929
- 4.79	-.336 (.810)	.257 (1.983)	-1.559 (1.106)	9.895 (2.984)			28.529	1.036	.840

SRI LANKA

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
WHEAT									
21.94	- .244 (.385)	.157 (1.713)	(a)	.991 (.957)	-.556 (2.048)	-2.452 (1.205)	2.717	2.287	.290
33.01	-.618 (.866)	.523 (1.023)	(a)	1.464 (1.295)			1.319	1.727	.044

SWITZERLAND

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
COARSE GRAINS									
24.58	-.912 (.147)	.950 (5.917)	-.877 (1.531)	-1.623 (2.126)	-.162 (1.759)	-6.326 (.697)	16.750	2.074	.818
-74.08	.196 (.379)	.100 (6.613)	-.469# (1.828)				28.999	1.621	.800

THAILAND

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
WHEAT									
- 2.75	- .205 (2.312)	.434 (8.271)	(a)	-1.024 (2.842)	-.174 (2.125)	.116 (.600)	28.167	1.090	.866
- .84	.199 (1.991)	.374 (7.057)	(a)	-.574 (1.622)			35.125	1.118	.830

TUNESIA

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R2
WHEAT									
93.91	- .146 (.776)	.312 (6.134)	-1.005 (6.796)	-1.106 (2.035)	.142 (.527)	-24.581 (.234)	24.912	2.011	.872
70.34	- .589 (.357)	.338 (12.148)	- .978# (9.085)				52.213	1.796	.880
COARSE GRAINS									
16.18	- .126 (.286)	.165 (3.639)	- .284 (1.096)	- .945 (.281)	- .261 (.969)	-54.142 (.496)	6.001	.703	.588
7.85	- .489 (1.695)	.119 (5.640)	- .132# (.602)				11.540	.758	.601

VENEZUELA

CONST.	PRICE	GDP	PROD.	STOCKS	FX	XR	F	DW	R ²
WHEAT									
- 9.59	- .114 (.799)	- .118 (1.120)	42.197 (.564)	- .875 (1.361)	.134 (.666)	21.748 (5.692)	6.415	2.331	.607
65.36	- .129 (1.125)	.343 (.519)	.720# (.081)				.488	.835	-.789
COARSE GRAINS									
-43.25	- .171 (.765)	.102 (5.092)	- .821 (2.608)	.532 (1.104)	.350 (1.484)	.405	18.743	2.154	.835
-27.14	- .201 (1.031)	.766 (7.076)	- .666 (2.319)	.697 (1.568)			27.187	2.164	.833

* T statistics are reported in parentheses.

(a) indicates series is zero from 1960-81.

indicates production and stocks are combined.