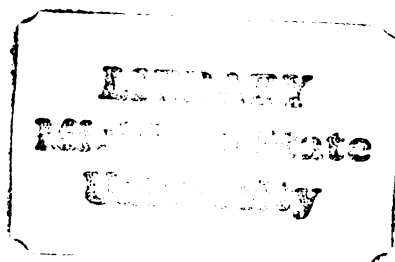This is to certify that the

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THE CASE OF RICE IN SENEGAL

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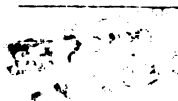has been accepted towards fulfillment
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GOVERNMENT FOOD IMPORT POLICY:
THE CASE OF RICE IN SENEGAL

By

Alassane Sow

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ABSTRACT

"Government food import policy: the case of rice in Senegal."

by

Alassane Sow - "Pap"

In this study, an attempt is made to shed light on the nature of the Senegalese rice import demand during the 1961-79 period. An econometric model is used to estimate the country's rice import demand which is defined as the gap between the domestic demand and supply of rice.

The results of the model showed that the high growth rate of the country's urban population is the most important determinant of the country's increasing need for rice imports. Rice consumption in Senegal is essentially an urban phenomenon. In addition, both price and income elasticities of rice demand are very small.

Suggested solutions to the rice import problem are twofold.

In the short and medium terms (two to ten years), priorities should be given to the promotion of local cereals - millet, sorghum and corn - as substitutes for rice. Such action would likely increase the price elasticity of demand for rice; hence, enabling more effective use of price policies in influencing rice consumption.

In the long run, increased productivity in the production of rice must be facilitated together with a committed effort to slow the high rate of urban migration.

ACKNOWLEDGMENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

In 1974, in reaction to the 2 percent decrease in world food output and the 4 percent decrease in world per capita food production, the World Food Conference in Rome centered its debates around the concept of food security. Agricultural prices had risen to very high levels, carry-over stocks of grains were low and most of the concern was focused on the undernourished millions in the Third World, suffering from food scarcity and high world prices. Fears developed that the world was moving toward chronic food shortages seriously menacing low income food deficit countries. These concerns were echoed in the Sahel with the creation of CILSS[1] in 1973 and the Club du Sahel in 1976. The former was formed with a view of Sahelian members to join forces for economic development. The establishment of the Club du Sahel provided a good basis for the international community and the CILSS members to coordinate their efforts in achieving the objectives of the Sahelian states.

At the present time, despite the significant increase in aid offered to the CILSS's member countries, restlessness about a successful implementation of the food self-sufficiency goals is not lacking. Such a disquiet is backed by the fact that without consistent development plans (both at the national and the regional levels), the program of

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[1]CILSS = Comité Inter Africain pour la Lutte contre la Secheresse dans le Sahel.

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action elaborated by the CILSS and the Club du Sahel to foster rural development in Sahel would likely be unsuccessful; rather, it could reinforce what Rene Dumont calls the "informal cycle of an increasing dependence."

Incidentally, the program of action developed by the CILSS and the Club du Sahel appears to be biased in favor of the supply of food goods. Possibly, that direction is stimulated by the drastic decrease in food production experienced by Sahelian countries during the drought period of 1969-73. Nevertheless, it is important that concerns be given to the demand side as well, particularly in cases where the divorce between locally produced cereals and imported food goods is important. A case in point is the Senegalese situation in which the demand for cereals in urban areas is essentially composed of rice, while the bulk of locally produced cereals are reduced to millet and sorghum.

Thus, it seems likely that a successful implementation of the goal of food security requires a good understanding of the behavior of both the demand and the supply of food goods in all Sahelian countries.

In Senegal, rice is by far the most important element in the country's food import bill. For this reason, this study is an attempt to shed light on the behavior of the rice import demand in Senegal during the last two decades. An econometric model is used whereby the demand for imports of rice is presented as the difference between the demand for consumption of rice and the supply of domestic rice. Hopefully, the results of the model would provide important inputs whose considerations may enhance the chances of meeting long-term food self-sufficiency goals in Senegal.

However, the relevancy of the recommendations derived from the model results is closely linked to the accuracy of the procedure used to model the Senegalese rice import demand. As such, a relatively large emphasis will be given on the methodological procedure used to model the Senegalese rice import demand.

Generally speaking, the import demand function of most less developed countries exhibits complex patterns of government intervention which make the simplistic use of traditional import demand variables less warranted. In addition, lack of data and/or frequent inconsistencies between different data series for the same variable make the task even more difficult.

Senegal is not an exception to these data problems. Fortunately, the literature on approaches for import demand estimation for LDCs is fairly voluminous. A large part of that literature will be presented in Chapter 3, while the modeling of the rice import demand will be presented in Chapter 4.

The results and implications of the model will be presented as concluding remarks in Chapters 5 and 6.

CHAPTER 2

BACKGROUND TO THE SENEGALESE RICE IMPORT POLICY

> Peanut production is a necessary evil for the Senegalese economy.
>
> — A former Minister of Rural Development.

Rice imports in Senegal are characterized by heavy government intervention. Both the domestic consumer prices and the producer prices of locally produced rice are set by public authorities. Consequently, the level of imports of rice are, to a large extent, indirectly determined by the government.

In addition, because rice consumption is essentially an urban phenomenon, the high rate of urban migration the country experienced, particularly during the 1970s, should be given close consideration. Urban migration is not an autonomous phenomenon; rather, it is an attempt on the part of migrants to maximize their earnings, given their current rural incomes and their expected urban incomes. Often, one major cause of urban migration lies in the deterioration of the rural/urban terms of trade. Presumably, a deterioration of the rural/urban terms of trade occurs either as a result of a relative decrease in agricultural productivity and/or a relative underpricing of agricultural goods. Since in Senegal, agricultural production is, to a large extent, influenced by government intervention through pricing policies, marketing policies and provision of farm inputs, a description of the Senegalese rice policy becomes meaningful only when it is placed in its broadest context,

4

namely, including the government policies toward the agricultural sector, rice consumption and rice production. Thus, these three elements constitute the sections of this chapter.

2.1 Government Policies in the Agricultural Sector

To a large extent, the Senegalese agricultural policy has reflected the policy of the colonial era, whose main focus was to expand peanut production. As early as the end of the 19th century, about 100,000 tons of peanuts were exported, stimulated by both the use of new land and the conversion of food cropland. The cultivated area for peanuts expanded from an average of 676,000 hectares producing 565,000 tons during 1949-50 to 1,164,000 hectares (about half the country's cultivated area) producing 1,005,000 tons in 1967-68. For the latter year, the share of agriculture in the country's GDP was about 30 percent, while that of industry, construction and public works, to which groundnut oil mills alone contribute about one-fourth, was 21 percent of the GDP. Transportation and commerce, largely related to groundnut marketing, accounted for about 38 percent of GDP.

This early development of the country's peanut sector was largely shouldered by private traders who took over the commercialization of the peanut production, with prices officially set by the government at the beginning of the crop season.[1] At the same time, rice was mainly imported from French Indochina to sustain the small, but rapidly growing urban population.

After the independence of the country in 1960, the Senegalese leaders followed essentially the policy of the colonial era: economic

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[1]Whether or not official prices were actually effective is not clear. However, to a large extent, they affect farmers' production decisions among crops.

growth and government budgetary revenues based largely on the expansion of peanut exports. This situation developed the government's interest in controlling the country's peanut sector.

In 1960, a decree on agricultural cooperation caused the association of farmers into cooperatives. A public agency, the Office de Commercialisation Agricole (OCA) was created for the marketing of peanut production and, to a much lesser extent, of millet, imported rice and wheat. Since, farmers' cooperatives have played an increasing role in the collection of groundnuts, though some private traders were still given licenses to pursue their marketing activities. The establishment of the cooperative system started with the creation of 695 cooperatives and, as early as 1961, those organizations collected about 22 percent of the peanut crop. By 1966, the system totaled up to 1,594 cooperatives with a global membership of 205,000 farmers and by 1968, they controlled 98 percent of the groundnut crop collection. In 1970, producers not belonging to a cooperative were forced to deliver their crops to the cooperatives, except for a few large producers. In July 1969, there were 1,859 cooperatives of which 1,494 were devoted to groundnut production.

A law in June 1966 gave birth to the Development Assistance Office (ONCAD), a public agency provided with a capital of 2.14 billion CFA francs (about $8,669,000). In October 1967, a new Agricultural Marketing Board, the Office de Commercialization Agricole du Senegal (OCAS), was created to replace the old OCA. OCAs took over the commercialization of the ground products collected by ONCAD from the cooperatives, and delivered the products to oil mills for processing. Also, the new Marketing Board was responsible for the imports of essential consumer goods (rice and wheat), as well as for the export of unshelled peanuts.

Most of the government intervention in the agricultural sector is carried out by the Development Assistance Office (ONCAD), with a major emphasis given to the peanut sector. The activities of the Development Assistance Office could be summarized as follows:

(1) Maintenance of groundnut seed stock distributed among over 400 warehouses. From such stock, the Office advanced seeds to cooperatives in May for a reimbursement in kind (peanuts) at the time of the first crop deliveries in December, plus a service charge of 25 percent of the advance. In the late 1970s, in response to total farmers' debts which were close to 10 billion CFA, the service charge was lowered by half.

(2) From estimates of cooperative needs by the Agricultural Development Company, SODEVA,[2] and the Regional Development Centers (CERs), the Office sets the ordering of items necessary for cultivation and the installment of equipment. These items are mostly offered in credit to farmers and the amount of credit granted to cooperatives is based on a formula reflecting the amount of peanuts likely to be marketed by the cooperative.

(3) The Office buys[3] the groundnuts, and to a much smaller degree, the millet and rice from the cooperatives and transports the output to receiving stations for sale to the Marketing Board.

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[2]SODEVA stands for "Société pour le Development et la Vulgarisation Agricole." It is a public agency which provides extension services to farmers.

[3]Producer prices are basically framed by a committee, Le Comité des Grands Products Agricoles and presented to the Prime Minister for final approval.

(4) The Office supervises the running of the cooperative system. To carry out its gigantic task, the Office benefited from large credits granted by local banks (particularly the Development Bank, BNDS). Such credit is used for management and preservation of seed, as well as for the purchase, installation and storage of fertilizers, farm equipment and other cultivation needs. The credit is gradually amortized by payments made by OCAS on receipts of settlements from the oil mills and from exports. When these settlements fell off--as they often did--the Office bore a heavy financial burden. OCAS was responsible for the sale of unshelled groundnuts to local oil mills under a quota fixed before each crop year in relation to mill needs and crop forecasts. In turn, the oil mills (essentially French owned) are responsible for oil sales while OCAS exports the remaining crop in the form os shelled groundnuts. In this process, the delivery of peanuts to the oil mills is given priority.

Until 1963-64, Senegal had benefited from a support price for groundnuts well above the world market, guaranteed by France. The price was set at 52.50 CFA francs per kilogram of shelled peanut for up to 483,000 tons of shelled peanut or oil equivalent, while the average world price was around 46 CFA francs. Nevertheless, producer prices were set at 31 CFA francs. With the French accession in the EEC and under the Yaoundé Convention, France had to drop its price support to Senegal in 1967. However, EEC countries pledged support for the Senegalese groundnut price during the phasing out period until 1967.

The guaranteed price was based on a schedule providing gradual reduction in the price each year, but with the help of EEC subsidies, producer prices remained unchanged until 1967. With the end of the French support price, Senegal had to sell its groundnuts at world prices at a time when the latter dropped by 20 percent in 1968. The world price of shelled groundnuts was set at 38.85 CFA and was below the FOB value of the kilogram of domestic shelled groundnut despite a lowering of producer price by nearly 16 percent; a loss of 4.57 CFA per kilogram resulted, in part, offset by the increase in EEC aid. The total aid was estimated at 1,500 million CFA.

Within the framework of the aid to groundnut production, structural improvement programs were intended to improve cultivation methods to obtain an increase in productivity. With the expiration of the Yaoundé Convention in 1969, the improvement programs were phased out, but were further carried over on a larger scale with financial assistance from the World Bank and IDA. Credits earmarked for the structural improvement program amounted to 4.87 billion CFA. The program emphasized rural extension services and instruction of producers in new farming methods. Execution of the program was done by a French firm, the Societe d' Assistance Technique et de Cooperation (SATEC).

Under a contract signed with the Senegalese Government in 1964 and financed by the Fonds d' Aide et de Cooperation (FAC) and the European Development Fund, SATEC was assigned the many tasks of increasing groundnut productivity by 25 percent within three years and of training the rural instructors required to complete the work in due time. Promotion of millet cultivation, introduction of new food crops and the development of more intensive farming rounded out the list of objectives.

These goals, however, were not met at the end of the third year. In 1968, a Senegalese firm, SODEVA, took over the operations of SATEC, while SATEC limited its activities in providing assistance in management to the new Senegalese firm. Implementation of the structural improvement program depends largely on the Development Assistance Office (ONCAD) for the provision of fertilizers and storage facilities. SATEC was responsible for extension services, distribution of seeds, creation of the Regional Expansion Centers and soil preparation, while financial settlements were made through the Development Bank.

During the period 1964-65 and 1966-67, the implementation ratio averaged 50 percent, with nearly 2.3 billion CFA credits used out of total commitments of over 4.5 billion CFA. This low performance was largely due to the relatively high cost of fertilizer to peanut producers when producer prices of groundnuts were as low as two-thirds of the prevailing world price.

Between 1968 and 1972, the world price of peanuts increased by 119 percent, moving from 27.4 CFA FOB to 60.1 CFA FOB, while producer prices were increased by 27 percent; that is, from 18 CFA to 23 CFA.

Such an increase was not high enough to offset the effects of the decrease in production caused by the drought. In early 1975, the government decided to improve the level of rural incomes and peanut prices were increased from 25.5 to 41.5 CFA, that is by 62 percent, while nominal wages were increased by 47 percent. Nevertheless, the expected increase in peanut production did not take place, possibly reflecting what was called the "Malaise Paysan."[4] After the drought series, farmers seemed to have been more and more concerned about meeting their food needs at

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[4]Malaise Paysan = "peasant's uneasiness."

the relative detriment of peanut production. Thus, their production decisions became more biased towards food crops, despite the new increase in the nominal producer prices of peanuts. This increasing lack of interest of farmers towards peanut production is partly reflected in the figures on yields, as presented in Table 2.1. Even when the drought period is excluded, average yields during the 1970s have fallen short of those obtained during the 1960s.

Nevertheless, the government remained committed to seeking ways to expand revenues from peanut production. In 1974, world prices of phosphate quadroupled, producing large financial surpluses for the country. With a large part of phosphate revenues flowing into the budget, the government inherited a credit outstanding on international financial markets which allowed it to borrow substantial sums of money. The government decided to participate more actively in the commercialization of the groundnut oil and other peanut products. For this purpose, SONACOS[5] was created and the government held 65 percent of the new company's stock. With such involvement in SONACOS, the government put itself in a better position to negotiate and explore new markets for the export of groundnut products.

Despite the government's efforts to stimulate the country's export of peanut products, the Development Assistance Office, ONCAD, faced increasing financial difficulties. By 1979, ONCAD's financial deficit reached its peak and peanut farmers' debts, vis-a-vis the Office, were estimated around 10 billion CFA francs. At that time, public opposition to ONCAD was at its peak and the government finally, after several

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Table 2.1

Average Yields for Peanut Production

Year	Yields (kg/ha)	Averages (kg/ha)
1960-61	913	
1962	970	
1963	880	
1964	878	
1965	941	902.625
1966	1,007	
1967	769	
1968	863	
1969	697	
1970	828	
1971	556	709.2 (drought years)
1972	933	
1973	532	
1974	658	
1975	863	
1976	1,174	
1977	898	
1978	400	855.16[a]
1979	910	
1980	628	
1981	491	

[a]Excluding the drought periods of 1978 and 1981 which would have made the calculated average much smaller.

Source: IMF, BCEA, Ministry of Plan, Ministry of Finance.

attempts to "save" the Office, took the big decision to liquidate the Office and farmers' debts were forgiven.

It is interesting to note that it is only during the late 1970s, a few years before the dissolution of ONCAD, that farmers were allowed to pay part of their debts, vis-a-vis the Office, in the form of millet-sorghum. Soon, the Office found itself with large stocks of millet. Part of the millet was processed into millet flour to be used partly as a substitute for wheat flour in the production of bread. However, the use of millet flour in the production of bread raised heavy opposition on the part of bakers. Considering the cost of wheat flour, millet flour was relatively expensive and its use made the activities of bakers become less lucrative. Today, wheat flour is almost exclusively used in the production of bread.

Clearly, as far as ONCAD was concerned, the production of millet-sorghum for commercial purposes was essentially discouraged. Not only was the amount of credit granted to cooperatives based on the cooperative's ability or willingness to produce peanuts, but also little room was offered to cooperatives for the repayment of their debts in kind, by using millet. Essentially, all debts were paid either in kind, using peanuts or in cash. Unfortunately, it became clear in the second half of the 1970s that farmers were giving more and more priority to their food crops (essentially millet-sorghum) at the relative expense of peanuts. Actually, the Senegalese Sixth Development Plan notes that during the period 1961-80, average yields for millet-sorghum have increased by 1.1 percent a year, while for peanuts, the figure is -1.5 percent a year.

Faced with the precariousness of peanut production as the country's main export crop, the government embarked during the 1970s into a

program to stimulate cotton production in the Eastern and Southern part of the country. Despite the fact that cotton production is a new activity for most farmers, its performance has been relatively satisfactory. For example, between the Fourth Development Plan (1973-77) and the Fifth Development Plan (1979-81), the value of groundnut products in the country's total exports fell from 46.4 to 25.7 billion CFA, while that of cotton fell from 2.5 to about 2.3 billion CFA. Cultivated areas for cotton have expanded considerably from 6,450 hectares in 1968-69 to 39,000 hectares in 1980-81, after a peak of 43,850 hectares in 1976-77. However, the expansion of cotton production in the Southern and Eastern part of the country has led to some concerns that rice production could be discouraged because of the relative profitability of the former activity. If this is so, then the growth of imports of rice can hardly be reduced, unless appropriate policies are carried out to discourage the consumption of rice.

2.2 Rice Consumption Policies

During most of the era described above, the government has attempted to carry out a consumer price stabilization program for rice. Pressures on the government to carry out a price stabilization policy for rice go back to 1951, when Senegal's main supplier--Indochina--suspended rice exports. The official retail price on the Dakar market was set at 40 CFA/kg. Because of difficulties of finding other suppliers, temporary shortages caused the domestic retail price to jump as high as 100 CFA/kg. After import quantities returned to normal, the government faced higher CIF prices than in the past. Pressures developed and trade unions suggested the creation of a rice stabilization fund like the one that existed for peanuts.

In the last two decades, stabilization operations were implemented by a variable levy on imports. Although large increases in world prices were partly reflected in the domestic official price, smaller and temporary fluctuations were absorbed through government taxes and subsidies. A large part of the resources of the stabilization fund were generated from taxes on peanut exports, while taxes on rice imports were levied when world prices of rice were very low.

In 1968, 14 percent of the country's total export earnings were used to purchase rice imports. In spite of such a heavy financial burden, the government stood ready to pursue its price stabilization policy for rice. These subsidies forced the marketing board to pay out well over 700 million CFA francs. This announced the first budgetary crisis of independent Senegal.

From 1968 to the early 1970s, world prices for peanuts increased by 119 percent. Through taxes on the export of groundnut products, benefits to the Fund reached the level of 15 billion CFA in 1974-75, while in the same year, the overall receipts from peanut exports were about 34 billion CFA. Farmers received an estimate of 12 billion CFA. However, world prices of rice increased by 235 percent in 1974 over the average level of 1970 through 1972. Nevertheless, the government continued to subsidize rice and by November 1974, such subsidies caused it to pay out 5.5 billion CFA.

In 1975, the government raised the consumer price of rice and the producer price of millet by 67 percent and 18 percent, respectively. Possibly, this action was aimed at fostering a partial substitution of rice for millet. However, the effect of the increase in the price of millet on the supply of millet was partially mitigated by an increase in

peanut producer prices by 62 percent. At the same time, producer price of rice was increased by 38 percent. Fortunately, rainfall levels in 1975 were very satisfactory, reaching an average of 80 centimeters, as compared with 57 and 55 centimeters in 1974 and 1973, respectively. Rice production increased by 76 percent from the low level of 63,000 tons in 1974. In addition, peanut production increased by 47 percent, while millet production increased by 15 percent. Imports of rice in 1975 reached the level of 102,125 tons, the lowest since 1963. However, one major cause for the decline in imports in 1975 was due to unusually large carry-over stocks of rice. In 1974, imports of rice had reached 207,195 tons, the highest level ever experienced. Actually, after 1975, imports of rice have always exceeded 235,000 tons.

Between 1961 and 1976, rice imports grew at an average of at least 4,000 tons a year or at an annual rate of 2.9 percent a year, while population growth was about 2.8 percent. However, during the second half of the 1970s, the imports averaged about 270,845 tons from an average of 154,275 tons between 1961-75. Most of the increase in rice consumption during the second half of the 1970s was induced by the rapid urbanization the country experienced after the drought periods when urban migration accelerated. The urban population growth rate was then estimated at about 5 percent a year. As Table 2.2 shows, in 1980, approximately one-third of the country's population were living in urban areas, from less than one-quarter in the early 1960s.

The cereal diet of urban consumers is essentially composed of rice. The Cap-Vert region, which has 20 percent of the total population, consumes around 60 percent of imported rice. For example, in 1973-74, 87 percent of all imported rice went to urban areas, 61 percent of which was

Table 2.2

Evolution of the Urban Population in
Relation to the Total Population

Year	Urban Population (1)	Total Population (2)	Ratio (1÷2)
1961	747,270	3,143,000	24%
1970	118,000	4,390,558	27%
1976	1,527,480	5,106,604	30%
1980	1,904,808	5,703,017	33%

Source: Direction de la Statistique; Comptes Economiques.

consumed in the Cap-Vert region where Dakar, the capital city, is located. In contrast, the cereal composition of the rural diet is essentially reduced to millet and sorghum. In spite of the government's efforts to improve the millet/peanut nominal price ratios from .63 in 1975 to .96 in 1979, the substitution of rice for millet in the urban consumer's diet has been very slow, if not insignificant. This reflects lagging productivity in the production of millet. During the last two decades, millet production has grown at 1.5 percent a year, while rural population increased at a pace of 1.9 percent a year. Not least important is the low priority given to the marketing of millet throughout the country.

2.3 Rice Production Policies

Faced with the increasing needs for imports of rice despite government's attempts to boost the substitution of rice for millet, the government started to give greater emphasis on rice production to attain self-sufficiency. In the Fifth Development Plan, the government projects

self-sufficiency in rice for the country in 1985. However, given the

historical level of the country's self-sufficiency ratio[5] in rice

(Table 2.3), the attainment of such objective appears rather doubtful.

Between 1960-64, the mean ratio was .41. After a slight decrease
in 1965-69, the ratio followed a downward trend and reached the low
average level of .28 between 1976-80 at the time when the country's ex-
ternal debts reached over $1 billion in 1978. The rate of urbanization
was estimated at about 5 percent a year in the 1970s, while total popula-
tion growth averaged 2.8 percent. In the Fifth Development Plan, the
government recognized that most of the urban migration is due to the
deterioration of the rural economy, particularly during the drought
periods.

Historically, plans to develop rice production in Senegal date as
early as 1947 as part of government concern for agricultural diversifi-
cation and the long-term goal of food self-sufficiency. By 1948, under
French support, a 120 hectare experimental unit for rice cultivation was
expanded by a factor of 5. Problems due to equipment delivery delays,
pests and disappointing yields made the cost overruns too high.

In spite of further attempts to encourage better farm practices in
the Southern regions of Casamance and Sine Saloum, annual food deficits
ranged between 60,000 to 80,000 tons, while local rice production in-
creased by an average of 7,500 tons during the 1950s.

After independence, government policies toward agricultural produc-
tion were implemented at two stages: at the general level, the govern-
ment affects all agricultural production through its policy tools such

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[5]The self-sufficiency ratio is defined as the ratio of domestic pro-
duction to net rice availability (local production + total imports).

Table 2.3

Average Self-Sufficiency Ratios in Rice

Year	Self-Sufficiency Ratio
1960	.43
1961	.38
1962	.41
1963	.47
1964	.36
1965	.38
1966	.44
1967	.45
1968	.42
1969	.29
1970	.54
1971	.35
1972	.39
1973	.19
1974	.23
1975	.52
1976	.32
1977	.32
1978	.21
1979	.28
1980	.28

Source: The ratios are calculated using data from Ministry of Plan, BCEAO, Ministry of Finance, World Bank, IMF.

as, price setting, provision of infrastructure, etc. At the sector
level, Land Development Agencies affect directly rice production in
specific areas by providing extension services, marketing facilities,
credit, etc.

During the first four years of independent Senegal, little concern
was voiced with respect to increasing domestic rice production. By the
end of the First Four-Year Development Plan during which a large part of
investments were made in social services and in infrastructure, an ex-
ternal event corroborated the fragility of the Senegalese economy whose
major pillar has been groundnut production. France acceded to the
European Economic Community and had to drop its price support for the
Senegalese peanut industry by 1967. This amounted to a loss of about
one-sixth of the country's total export earnings which, obviously, had
serious implications for the entire economy. Agricultural diversifica-
tion themes gained in popularity. Backed by strong external assistance,
the Senegalese government embarked into programs to stimulate domestic
rice production by using Land Development Agencies when, at the same
time, assistance was given to peanut farmers through the establishment
of the Program Agricole in 1964. Curiously, most of the rice production
projects followed irrigation schemes. Up until 1977, a regional LDA did
not exist in the Casamance region when the Societe pour la Mise en Valeur
de la Casamance, SOMIVAC, was created. Casamance is known to be the only
traditional rice growing area in the country and its rainfall levels are
not only the most abundant in the country, but also the most stable.
For example, during the disastrous drought years in 1972 and 1973, rain-
fall in the North of the country dropped by 63 and 56 percent, respec-
tively, while in Casamance, the drops were by 31 and 8 percent. In

spite of continuous efforts to develop irrigated rice in the Northern region of the Fleuve, Casamance produces over 65 percent of domestic rice. The reasons for the government's bias in favor of rice irrigation in the North instead of rainfed schemes in the South are complex. Possibly, authorities might have thought that irrigation projects for rice would be more profitable and that, since the Fleuve was not a peanut growing area in contrast to the upper Casamance and the Sine Saloun regions, the investments in land and labor in the North would not jeopardize production of the country's leading export crop.

So far, rice production schemes under the supervision of LDAs have not met their expectations. ONCAD has been given an official monopoly on the collection, milling and distribution of domestic rice. After harvest, farmers under the supervision of a LDA pay in paddy for services received.

In the supervised projects of the Fleuve, the services charged often amount to 40 percent of the harvest. The remaining paddy, aside from farmers' consumption, is paid for directly if purchased by SODEFITEX[6] or settled several months after if purchased by SAED or the PRS.[7] These latter deficiencies justify the reticence of rice farmers to trade their surpluses through official channels. Between 1965 and 1975, the percent of officially commercialized rice had averaged 2.5 percent of local production of rice.[8] However, the private trade of

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[6]SODEFITEX = Societe pour le Developpement des fibres du Textile is a LDA operating in the Southeast of the country.

[7]PRS = Project Regional de Sedhiou = LDA in Casamance in Sedhiou. SAED = Societe d'Amenagement et d'Exploitation du Delta is a LDA operating in the Fleuve (Northern part of the country) for irrigated cultivation.

[8]See Table 4.1 in Chapter 4.

rice is more developed than is usually thought and the evidence is provided by the usual gap (about 10 percent of rice production) that exists between net production retained by farmers and estimates of on-farm consumption. Also, official trade of paddy is markedly small in Casamance, probably reflecting the fact that Casamance farmers have fewer debts to the LDAs.

In the government supervised projects, production costs are high, making adoption rates very low. At the national level, fertilizer use on rice has been low and the budgetary impact of subsidies on fertilizer has been less than a quarter of a billion CFA between 1966-67 and 1975-76, while investment costs for irrigated rice in the North provided 4.5 billion CFA for SAED between 1975-77. Currently, SAED is facing a serious implementation problem and it is feared that the failure of ONCAD to organize and promote the development of peanut production might be repeated.

At the present time, the construction of the Diama Dam in the Senegal River in the North will, in principle, open thousands of hectares for cultivation of rice. The complexity of irrigated cultivation should, however, warn us that overlooking the implementation problems for rice cultivation in the North could be very detrimental. Even for Africa, as a whole, only Madagascar has a deeply rooted tradition in irrigated rice.

CHAPTER 3

APPROACHES IN MODELING INTERNATIONAL GRAIN TRADE

If you want to be a good shoemaker, it is not good enough
to make good shoes and to know all about making good shoes;
you also have to know a lot about feet. Because the aim of
the shoe is to fit the foot.
                         - George McRobie in <u>Small is Possible</u>.

Because an important theme of this study is to analyze the effects

of rice import policies during the last two decades, the successful out-

come of such a task is crucially linked to accurate estimations of im-

portant parameters.

Up to the early 1970s, questions of approaches to import demand

estimation did not raise much concern and this was, in large part, due

to the nature of the international markets for agricultural commodities.

Since that time, many events--world food crises, increasing government

intervention in trade, etc.--have profoundly changed the nature of in-

ternational markets and, therefore, the old schemes using the spatial

equilibrium framework may be useless, particularly when it comes to

estimating import demand functions of less developed countries. The

trade behavior of many countries is generally known to be by and large

influenced by government policies.

In the case of less developed countries, government intervention in

import demand functions are even greater. However, the nature of govern-

ment intervention in trade varies largely among countries. Some public

interferences in trade rely on quantitative restrictions such as quotas

so that the supply of foreign goods in the domestic market is exogene-
ously determined by government policy. In other cases, government inter-
ventions are channeled through a public determination of domestic prices.
For example, faced with a decrease in foreign exchange earnings, a govern-
ment may choose to increase the domestic prices of imported food in order
to discourage the consumption of imported food goods and/or decrease the
prices of domestic food goods. In this case, unlike when quantitative
restrictions are used, the government determines endogeneously the levels
of food imports through its pricing policy.

In this chapter, a large emphasis will be given to the modeling of
government interventions in import demand functions. The presentation
of our econometric model for the Senegalese rice import demand will fol-
low in Chapter 4.

3.1 Traditional Approaches in Modeling International Grain Trade

During the 1950s and 1960s, the use of spatial equilibrium models
either to measure or to predict the flows of grain in trade was very com-
mon. However, in their analysis of supply and demand relations, spatial
equilibrium models (see Bawden) usually assume perfect market competi-
tion. Not surprisingly, given the constant evolution of certain struc-
tural and behavioral variables that continuously affect the real world,
the usefulness of such models was very questioned. As Hassler pointed
out, "There is little evidence in the spatial studies that were reviewed
that the analysts were very aware or concerned about the logical issues
of operational usefulness of the results. Too frequently, these problems
are sidestepped with the hope that someone else will follow up at a later
date." Similarly, Wallace and Judge reported squared correlations of
less than .5 between actual and predicted prices or price differentials

for each seven empirical spatial studies reviewed. This low performance of those models (for forecasting purposes) can be largely attributed to their behavior of highly simplifying the realities of studied markets. Even though any economic model must of necessity be a simplification of reality, in case where space is a minor component in face of large interferences due to government intervention and complex market structures, some assumptions, unfortunately very critical to spatial equilibrium models, must be altered if the performance of such models is to be improved.

Today, greater government intervention characterizes world wheat markets. Unless those "distortions" are explicitly considered in order to capture their effect on domestic production, domestic consumption, imports and exports, accurate analysis of world trade would not be achieved. Similar market distortions exist in the world market for rice. Developed countries have increased their share in the world rice trade largely through increased concessional sales to some rice importers. Pressured by decreasing foreign exchange earnings, LDC rice exporters like Burma and Thailand could be expected to favor more and more government intervention in world trade for rice to lessen the impact of concessional sales on their export earnings. However, it is unlikely that such policies will not be welcomed by LDC's rice importers, particularly the African food deficit countries. Governments in those latter countries are expected to step in the trade of food grain in an attempt to better allocate scarce foreign exchange resources between food expenditures and other needed imports for the pursuit of their goal of economic development. During the 1970s, the economic performance of most non-oil exporting less developed countries was very unsatisfactory due to

slow growth in food production per capita, rising food imports, lagging

foreign exchange earnings, etc. Since then, studies on agricultural

policies of many LDCs were widespread, many of which focused on food im-

ports by poor countries with major emphasis on government intervention.

The following section reviews the literature on models used to pattern

the food import demand by some selected countries.

3.2 Toward a More Explicit Recognition of Government Intervention in Trade

3.2.1 Exogenous Representation of Government Interventions

In modeling food import demand by less developed countries, ex-

plicit recognition of government intervention has been widespread.

Typically, recognition of government intervention in food import demand

is made through the use of a variable designed to capture the effects

of public interference in trade. In its simplest form, the effect of

government interference is represented by the use of a dummy variable.

Such a scheme is used by Weisskoff in his estimation of import demand

elasticities for Brazil. In addition to a dummy variable used to cap-

ture the effects of changes in the Brazilian regime during the period

1948-75, the model comprises other exogenous variables such as national

income, price and a time trend. He posited that the sign of the trend

variable will reflect successful import substitution when it is negative

and increasing import dependency when it is positive. He used several

different equations. One equation modeled the aggregate imports for

Brazil while a number of other equations relate different classes of

imported goods to the same set of exogenous variables. For the equation

estimating the import of consumer goods, the sign of the estimated co-

efficient for the time trend was negative. In fact, for the period

under consideration, the ratio of self-sufficiency in wheat for Brazil appeared to have followed a slightly rising trend. The share of wheat imports in the Brazilian consumption had dropped to 60 percent in 1972 from 70 percent in 1948. Part of that rise in the trend of self-sufficiency ratio was due to the government policy through which producer prices of wheat were favorably supported (see Alain de Janvry).

The limitation of models using dummy variables to pattern government intervention appears strongly when recommendations for policy alternatives become an important issue. More specifically, all the dummy variable can do is to attest whether change in regime shifts the import demand function or not. A downward shift of a demand for imports can have different causes: both quotas and other policies that stimulate the trading of domestic wheat through incentives to farmers can yield the same result, as far as quantities imported are concerned. Therefore, an explanation of the nature and effectiveness of government policies with respect to food imports goes beyond the capacity of such models.

Because the process of growth and development requires on the part of a poor country a continual adjustment in imports and/or exports to make the trade gap equal the desired gap between investment and saving, a country whose foreign exchange earnings are limited will be expected to link its food import policy with other needed imports to sustain a minimum growth path or other development objectives. Such consideration has probably formed the basis of the proliferated use of a "capacity to import," which has been represented by various variables such as foreign exchange earnings, reserve stocks of gold, etc. In a study of a few

Asian countries'[1] imports of rice, Islam used price income and foreign exchange reserves as explanatory variables. He assumed actual imports-- in contrast to desired imports--to be determined by foreign exchange revenues when the country faces a foreign exchange shortage. The results of his study show that the effects of foreign reserves were significant in all countries but Malaysia. Not surprisingly, Malaysia was the only country that did not experience foreign exchange shortages during the period covered by the study. In addition, his model assumed that policies of domestic price support in those countries are only done for the mere purpose of supporting farm incomes, but not to boost output to reduce imports. Such assumption is quite surprising in that, even if in the short-run rice production is not responsive to price increase, sales of domestic rice by farmers might well increase as long as rural/ urban terms of trade are improved enough. Thus, this effect would reinforce the effects of foreign exchange reserves on imports. Further evidence on this probable effect of producer price on sale of domestic price is provided by Joquero, Duff, Anden-Cacsina and Hayami in their study of rice in the Philippines. They found that the total price elasticity of marketable surplus is clearly positive and averages between .4 to .7. Similar inferences were also made by Krishna and Ehhibler for India. Another study presented by Dutta attempts to estimate the imports demand for India. The author noted that, "In view of the active and extensive participation of the government in the economic activity of the country over the entire time period under study, the traditional practice of treating all such activities as exogenous should be

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[1]India, Korea, Malaysia, Pakistan, Philippines and Sri Lanka.

reconsidered." However, he went on saying that because government activities are based on objectives and considerations of a basic long-term character, they can be considered "given" for the model. Curiously enough, he nevertheless used a variable that sought to reflect the effects of trade barriers erected by the government. As such, he selects the ratio of India's foreign exchange holdings in time t and the imports on private accounts in period t-1 as a proxy for the level of the foreign exchange holdings of the country. The results of his model showed a significant effect of the latter variable on the India import demand. In spite of the relatively good performance of the model, the main short-coming of the study arises from the author's assumption, that government's actions are considered exogenous. Such an assumption is likely to lead the model to miscapture some market distortions caused endogenously by government interventions. This obviously undermines the relevancy of the model as a framework to be used in order to analyze the Indian import demand function.

To sum up, one should note that the studies presented above deserve credit for their attempts to recognize and incorporate explicitly the effects of government interventions in their model of import demand functions. In spite of such credit, we saw that their attempts to include government interventions has been done through the use of numerous variables such as foreign exchange earnings, foreign assets, dummy variables, etc. This leads to the conclusion that the role of government has been so far treated as exogenous to the model. Whether a decrease in foreign exchange earnings leads to an increase in producer price so that local production is stimulated or, alternatively, consumption of food imports is discouraged through increases in domestic consumer prices, the answer

is not provided by any of the above approaches. In other words, when government interventions are treated exogenously, the model results can only tell us what happens to import levels when foreign exchange earnings decrease or increase. The question of how decreases in foreign exchange cause a decrease in imports cannot be answered. Therefore, the necessity to consider the endogenous effects of government intervention in food imports has created a good deal of concern on the part of many other researchers. This will be the main focus of the remaining part of this chapter.

3.2.2 Endogenous Representation of Government Intervention

In his book entitled, <u>Import Demand in a Small Country</u>, Bautista noted that, "The demand function resulting from the inclusion of an exogenous policy variable represents a mixture of an import demand function by consumers of the imported commodity and an import policy function by public policy makers setting the restrictions on imports. A more satisfactory alternative would be to represent separately the underlying structural relations." In his study of food imports in the Philippines, Bautista uses four equations; supply and demand for the imported food and supply and demand for the domestically produced one. Although the two categories contain different commodities, some goods such as rice are common. Both demand functions are assumed to depend on own prices and prices of substitutes as well as on real consumer expenditures. The supply of imports by the government is determined by the domestic price of foreign food, the price of domestic food and the capacity to import for which current and lagged export receipts are used as proxy. Therefore, his approach represents explicitly the endogenously determined imports of food through market intervention by the government.

This latter is seen to struggle between two conflicting objectives: the necessity to minimize on expenditures on food to meet some investments required by development objectives and the political, social and economic needs to stabilize domestic food prices.

The trade-off between conflicting government objectives also under-lies the study by Lattimore and Schuh on the Brazilian beef sector. In their study of the Brazilian beef industry, Lattimore and Schuh present an econometric model to examine the dynamics of beef supply and demand response over the period 1947-71. The model attempts to quantify the effects of government policies and also used a few dummy variables to single out the intervention effects brought about under the different political regimes that compose the period under study. The model is composed of three blocs of equations: policy intervention bloc, domestic supply and demand bloc and export bloc. The first bloc includes two main equations measuring the level of intervention through price-related com-mercial policy--such as export taxes or an overvalued exchange rate--and through quantitative restrictions. For the price-related commercial policy, the process works in the following manner: if there is an in-crease in the quantity of beef demanded by foreigners, then the export price will rise, ceteris paribus. Should the government wish to prevent the domestic price from rising, the only instrument it has available will be to raise the level of trade intervention for beef. To do so, the government will lower the effective exchange rate by means of either export taxes or an overvaluation of the exchange rate for beef exporters. In the second bloc, the model distinguishes between male and female cat-tle, and postulates an investment and slaughter equation for each. The authors assumed that part of the investment in cattle occurs as a hedge

against inflation and the unstable rate of inflation the country exper-
ienced has an impact on slaughter rate. Finally, a crop price variable
is added to reflect the opportunity cost of land in other enterprises.
Domestic demand was simply represented as function of the price of beef,
the price of a substitute in consumption (pork) and total consumer in-
come. The third bloc, denominated export bloc, consists only of an
identity to determine the quantity of beef exports from Brazil given
domestic supply and demand. From the empirical results, the statistical
support for the maintained hypotheses was mixed. The author mentioned,
however, the high level of intercorrelation among the variables and the
paucity of good data. Nevertheless, there was good support for the
hypotheses contained in the intervention bloc. Not all dummy variables
were significant, possibly reflecting a relatively homogenous trade pol-
icy under a few different regimes. Finally, the authors estimated the
welfare effect of a removal of government intervention. They noted that
at the mean values during the period, a complete elimination of inter-
vention policies would have increased the domestic beef price by 81 per-
cent. This would, after full adjustment of the supply sector, yield a
net social gain of 1.001 billion cruzeiros after allowance is made for a
decrease in consumers' surplus by 1.850 billion cruzeiros. Expressed
another way, on the average, government intervention consisted of a tax
on beef producers of 1 cruzeiro to save the beef consumer .45 cruzeiros.
This same trade-off between competing government objectives also under-
lies other studies of Brazilian export trade in soybeans, corn and cotton.

An interesting study by Turnovsky presented a model of aggregate
import demand function for New Zealand over the post-war period (1947-
63) in order to derive estimates of various demand elasticities. He

criticizes the traditional approach in which researchers estimate import demand functions using single equation methods, and by regressing actual imports on explanatory variables--such as prices and domestic income-- and completely disregarding the export market. He first considers the relationships between imports and exports. He argues that even though capital inflows may finance a balance of trade deficit for long periods, from a long-run equilibrium point of view, a country can only purchase as much as it can afford. Hence, imports are recursively dependent on exports. He also recognizes the possibility of a simultaneous causality between imports and exports, but because New Zealand's share of world trade is small, its exports are not dependent on its imports, since the value of its imports represents a small part of its partner's budget needed to purchase its own exports. Moreover, because New Zealand is so distant from its overseas trading partners, the impact of export earnings on imports takes place only after some delay. Hence, the relationship between the country's imports and exports is both recursive and lagged. He also distinguished three concepts, namely the "desired" demand for imports, the "actual" demand for imports and the supply of imports. Desired demand for imports depends on variables determining how much people want to import; among such variables thought to reflect people's desire to purchase from abroad are prices, as well as asset levels. The actual demand for imports is introduced on the ground that people adjust their behavior to their desires only partially within the period, so that actual demand is more a short-term concept than desired demand even though they both depend basically on the same factors. On the other hand, he assumed the supply of imports to be dependent essentially on how much the country can afford to import, so that supply is

largely determined by foreign exchange availability to finance imports.
He also notes the dual effect of foreign exchange on the country's trade
behavior: on the demand side, foreign exchange availability reflect
consumers' desire to purchase imports, while on the supply side, it re-
flects the government's ability to finance the needed imports. To model
the effect of government intervention, the author used as a proxy the
country's net foreign exchange position, which is composed of export
receipts and the country's foreign overseas assets. Obviously, as the
writer notes, when net foreign exchange position is used as an instru-
ment for government intervention, one is assuming that government inter-
vention is carried out as a response to economic factors, and certainly,
this can be misleading since other political factors can shape and even
direct the government trade policy. A good example is provided by the
frequent relaxation of import controls during election years. Another
feature of the model is the mixed use of flow and stock concepts to
trace out the stock adjustment mechanism in the process of the import
demand. For further details on the flow-stock adjustment mechanism, see
Nerlove.

When estimating the reduced form equation of his model, Turnovsky
ran into some problems due to the over-identification of the structural
form of his model and the squeeze in the degrees of freedom caused by
the use of too many variables for a relatively short time series. In
addition, the need to satisfy all the constraints of the structural
model brought about serious computational problems, aggravated by the
unavailability of a computer program to carry out the regression. In
order to get around the identification problem and increase the degrees
of freedom, the author abandoned the idea of stock-flow relationship in

the demand function. He finally used a hierarchy of models (actually three). The first was estimated by the Ordinary Least Squares (OLS), the second by Two-Stage Least Squares (TSLS) and the third by Three-Pass Least Squares (3PLS).[2] The results provided by the three methods seemed to indicate a better performance of Model I, in spite of the simultaneous equation biases that could arise from the use of OLS. Clearly a great merit of the author is his attempt to give an extensive coverage of many of the different factors that influence the import demand function of many countries.

In a comprehensive study of Egyptian wheat imports, Scobie used an approach very similar to the one just described above. Because Egyptian cotton production competes with the production of domestic wheat, he used what he called a "cotton export bloc" and "wheat import bloc." In the cotton export bloc, the two endogenous variables that determine foreign exchange earnings from cotton exports are taken to be the cotton export tax and the area sown. In the wheat import bloc, he used a series of equations to describe the domestic wheat demand and production, foreign aid and the formation of prices. This latter concept traces the effect of government policies on consumer prices and producer prices. Finally, he used another bloc called the balance of payments bloc. Using the product of an interesting work by Hemphill, he states that the allocation of the foreign exchange budget by the government between classes of imports and reserve holdings by the central bank is a central pillar of his econometric model. He argues that Egypt, as well as many

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[2]3PLS was developed by Taylor and Wilson. It is used to estimate equations involving lagged variables and autocorrelated error terms. With this technique, consistent estimates of all regression coefficients are obtained, provided that all other explanatory variables are non-autocorrelated.

countries that follow a regime of a pegged exchange rate, are confronted with the problem of allocating their foreign exchange earnings between expenditures for imports and the need to satisfy a desired level of foreign exchange reserves. Therefore, while exchange receipts correspond to a budget constraint facing imports, fluctuations in the level of reserves make total import expenditures an endogenous variable. In other words, although he recognizes that the level of imports is constrained by foreign exchange earnings between import expenditures and reserves, it is, in turn, endogenously determined through the balance of payments adjustment mechanism. He criticizes the "one sided use" of foreign exchange as one determinant of imports because he said, if import expenditures and reserve holdings are not determined independently, the estimated marginal propensity to spend foreign exchange on imports would be biased. The results of his model showed a low marginal propensity to import food with respect to foreign exchange earnings. A shortfall in foreign exchange of one dollar would cause a reduction in expenditures on wheat of only $.049. He argues that most of the adjustment that is needed when foreign exchange earnings decrease is provided through a squeeze of the imports of nonfood items, which presumably would cause disruption to the import of raw materials and capital goods. In addition, he describes the relationship between the cotton bloc and wheat import bloc in the following manner: a rise in foreign exchange receipts induces an increase in wheat consumption, mostly through imports and that tends to lower the domestic price of wheat, while the domestic cost of wheat production is higher than the world price of wheat. Because of the perceived external position, the real cotton price to producer is allowed to decline. This sets a second round of

reactions whereby cotton producers respond to their production dis-
incentives by reducing planting for cotton in the next season so that
the export earnings from which cotton exports constitute a large part
will decline, reducing the capacity to import. Domestic resources are
thus encouraged to move into wheat production so that domestic wheat
output will rise, reducing the need for imported wheat. Finally he
notes that unlike in EEC countries where both protection and insulation
policies have prevailed through the simultaneous use of the domestic
farm price policy and the setting up of a variable levy on imports, in
Egype, the price transmission elasticity (between world price and con-
sumer price) was found to be .5. In other words, in spite of heavy
government intervention, consumer prices have reflected the variations
in the world price of wheat. In recommendation, the author concludes
that a closer alignment of producer and consumer prices with the cost
of imported wheat would relieve the budgetary pressure of the wheat sub-
sidy for consumers and lessen its destabilizing impact on the importa-
tion of other goods; moreover, a policy aimed at directing wheat sub-
sidies to the poorest Egyptians would alleviate the social and economic
effects of a wheat policy more aligned to the true costs of consuming
additional wheat.

To sum up, we attempted to present in this chapter the evolution of
modeling approaches to import demand by LDCs. From relatively simple
models in which only "traditional demand variables" such as population,
income, prices, etc., are used, researchers have soon recognized the
need to explicitly incorporate the effects of foreign exchange shortages
in food imports. This has caused the widespread use of "import capacity
variables" in food import demand functions in order to reflect foreign

exchange constraints faced by LDCs. Despite the merit of such a move, the resulting coefficient or elasticity of foreign exchange earnings with respect to imports cannot be fully used as a good basis for trade policy purposes. For example, a high foreign exchange elasticity with respect to food import does not tell more than that import levels are heavily influenced by foreign exchange earnings. The question of whether the government discourages the need to import food by raising domestic consumer prices or by raising the prices paid to farmers is not answered when government interventions are exogenously represented.

The need to obtain a more accurate understanding of government policy in food import has then led to the building of models whereby government intervention affects endogenously the levels of imports. As presented above, this is the approach used by Bautista; Lattimore and Schuh; Turnovsky; and Scobie. A good description of this scheme is pre-sended by Abbott.[3] For our econometric model in Chapter 5, the analytical framework will be essentially based on this approach.

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[3]For more detailed information about the approach presented by Abbott, see: Philip Abbott, "The Role of Government Interference in International Commodity Trade Models," American Journal of Agricultural Economics, 61, 1979, pp. 135-142.

CHAPTER 4

THE ECONOMETRIC MODELING OF RICE IMPORT DEMAND IN SENEGAL

Econometric theory is like an exquisitely balanced French recipe, spelling out precisely with how many turns to mix the sauce, how many carats of spice to add, and for how many milliseconds to bake the mixture at exactly 474 degrees--but when the statistical cook turns to raw materials, he finds that hearts of cactus fruit are unavailable, so he substitutes chunks of cantaloupe; where the recipe calls for vermicelli, he uses shredded wheat....

- S. Valvanis (quoted from "A Guide to Econometrics," by Peter Kenedy)

4.1 Toward an Analytical Framework

The framework used for the analysis of rice imports in Senegal is patterned after the work of Philip C. Abbott. A net import demand equation will be estimated and will be defined as the gap existing between the supply of domestic rice and the level of the national demand for rice consumption. Because in Senegal imports of rice are a governmental affair, the effect of public intervention in the imports of rice will be explicitly recognized. Moreover, unlike other schemes in which public interferences are patterned directly in the import demand function through the use of a variable reflecting the country's "capacity to import," government's interference in rice imports are assumed here to endogenously affect the net import demand to be estimated. The process is described as follows: first, the import demand for rice is presented as the difference between two entities: the national demand for rice and the supply of domestic rice. Tha national demand for rice is presented like a simple demand function in which variables such as

population, GNP, domestic consumer prices, appear in the right-hand side. For the supply of domestic rice, besides variables such as weather, the lagged value of domestic consumer price is used as a right-hand variable. The underlying rationale for the use of the consumer prices instead of the producer prices is that, as other studies have shown (see Tuluy and Sene), the sales of domestic rice are more responsive to consumer prices because most of the farmers' sales--particularly in the Southern region of Casamance--occur in private markets where consumer prices rather than producer prices are more likely to prevail. Available data suggest that, except in 1967, official sales of domestic rice (which are based on producer prices) have never reached 6 percent of domestic production (see Table 4.1). Instead, the gap between the production retained by farmers and their estimated consumption requirements has averaged about at least 10 percent of total production. In other words, at least 10 percent of total production are sold without using official channels.

4.1.1 Effects of Government Intervention

The approach used for the development of an import demand function for rice in Senegal considers the effects of government intervention in rice trade as affecting endogenously the quantity of rice to be imported. Unlike alternative schemes whereby government policy variables such as foreign exchange earnings or "import capacity" are directly put together with "traditional" variables such as population, GNP, etc., in the demand function, our present approach represents the effects of government intervention in the following manner.

Table 4.1

Official Sales of Domestic Rice

Year	Rice Production (Metric Tons)	Official Sales of Domestic Rice (% of Domestic Production) (Metric Tons)
1961		NA
1962		--
1963		--
1964		--
1965	109,000	3,173 (2.9%)
1966	125,000	6,269 (5.0%)
1967	125,000	9,642 (7.7%)
1968	135,000	7,215 (5.3%)
1969	59,000	38 (.06%)
1970	141,000	617.6 (.44%)
1971	99,000	599 (.6%)
1972	108,000	653 (.6%)
1973	44,000	427 (.1%)
1974	64,000	1,006 (1.6%)
1975	113,000	3,612 (3.19%)
1976		NA
1977		--
1978		--
1979		--

Source: CRED, University of Michigan, ONCAD.

4.1.1.1 Through World Prices

The first way by which government interventions in the rice trade are provided is through public determination of domestic prices, given a level of world prices. It is assumed here that there is a price transmission mechanism between world prices and domestic ones. Since the use of quotas for imports of rice has never been consistently observed, most of the government intervention in rice import could be expected to be carried out via the setting of domestic prices. Moreover, despite the government's attempts to carry out a consumer price stabilization policy for rice, available data suggest that domestic prices of rice have reflected the ups and downs of world price movements. Nevertheless, domestic prices have not freely followed world prices so that domestic price adjustments to world ones reflect the extent to which government intervention in the trade of rice has taken place.

An equation will be specified in which domestic prices are a function of several variables, one of which is world prices. The magnitude of the coefficient of the world prices will reflect the extent of government intervention. The closer the coefficient of world prices is to one, the more likley it is that free trade has been attempted. Conversely, if government interventions are important, a strong divergence between world price movements and domestic ones would be expected to occur and, thus, the coefficient of world prices would be close to zero. Note that the price transmission mechanism is one-sided, namely that because Senegal is a small country with respect to the world trade of rice, domestic prices cannot be expected to have any effect on world prices. In short, Senegal is a price-taker.

Changes in the domestic price of rice brought about by government intervention in reaction to changes in the world price affect the domestic demand for rice. Since quotas are not used, the extent to which government actions affect rice consumption will be closely related to both incomes and domestic price elasticities of demand. On the other hand, the government intervention on trade through the price adjustment mechanism affects partly the supply of domestic rice. At least theoretically, the higher the domestic prices, the larger should be the amount of local rice sold by farmers so that, imported rice becomes somewhat discouraged.

4.1.1.2 Through Foreign Exchange Effects

As pointed out by Bautista, the direct use of an exogenous variable such as foreign exchange earnings in an import demand function is a mixture of an import demand function by consumers and an import policy function by public policy makers. In this study, it is assumed that the effect of foreign exchange earnings on imports is an endogenous mechanism whereby a decrease in foreign exchange earnings should cause an autonomous increase in domestic prices, vis-a-vis world prices, so that rice consumption is discouraged and, thus, imports lowered. Meanwhile, the same decrease in foreign exchange earnings should, ceteris paribus, foster an increase in the sales of domestic rice.

To sum up, the procedure used to pattern government intervention is as follows: government's interference is essentially reduced to the setting up of the domestic consumer price. This latter affects the level of rice consumption by consumers and the level of the supply of domestic rice. Together, these two components determine the level of imports. The process through which consumer prices are set is twofold.

There is a price transmission mechanism between world prices and domestic ones, through which the government indirectly determines the level of imports. On the other hand, the level of foreign exchange earnings[1] reflect the government's willingness to import rice--as such, when exchange earnings are low, domestic prices are presumably set high enough in order to discourage consumption of rice and, thus, to lessen the need to import rice.

Thus, exchange earnings and world prices do not appear in the net import demand function to be estimated; those two variables are already reflected in the level of domestic prices.

4.1.2 Determination of the Net Import Demand Function

The net import demand function to be estimated will be determined recursively. The model comprises three equations. The first equation presents the domestic consumer price of rice as a function of world prices and the level of foreign exchange earnings. In the second equation, domestic production of rice is positioned as a function of the level of rainfall and domestic consumer price. Finally, the net import demand function to be estimated includes variables such as urban population, demand for consumption of rice, estimates of both domestic consumer price and rice production. The use of urban population instead of the total population is justified by the fact that, as mentioned earlier, the bulk of the consumption of rice occurs in urban areas. As for rural areas, it is only in Casamance--where most of the local rice is produced--that the per capita consumption of rice is high.

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[1]Foreign exchange earnings are defined as the value of the country's total exports deflated by the index of import prices.

Moreover, since rice consumption is known to be essentially an urban phenomenon, the use of the country's GDP is not the most appropriate variable. Rather, an income variable for the urban citizens would be more relevant. Unfortunately, time series data on income for urban citizens are not available. Therefore, the use of the country's total GDP instead of a variable more representative of urban incomes would possibly yield an unreliable estimate of the income elasticity for the import of rice. Nevertheless, since a large part of the country's GDP comes from activities that are carried out in urban areas,[2] the extent of the bias of the income elasticity may not be large.

4.2 An Econometric Model

The econometric model for the Senegalese import rice demand function is based on three features.

First, government interventions are patterned through the setting of consumer prices. Domestic consumer prices are set as a function of world prices and foreign exchange earnings. For the latter, the lagged value of total exports deflated by the index of import prices is used as a proxy. For world prices of rice imported by Senegal, good data are clearly lacking. Although the bulk of the consumption of rice is composed of broken rice, Senegal imports different qualities of rice. Disaggregated data based on different qualities of rice are not known to be available so that the use of one specific world price of rice would not be appropriate. Thus, we use the "implicit world price" of rice obtained by dividing the value of imports of rice by the corresponding

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[2]Urban areas are defined as localities having more than 10,000 inhabitants.

quantities imported. Note that this proxy for world prices of rice underestimates the costs of imported rice since the costs of loading and unloading activities are not included.

Since stabilization of domestic prices of rice has always been a declared government objective, we include a third variable in the consumer price equation, namely, the lagged domestic price of rice. The magnitude and the statistical significance of the coefficient of the latter variable can provide a clue in the assessment of the extent to which government's domestic price stabilization policy has been successful.

Second, the level of rice production is determined essentially by weather variations and the annual rainfall level is used to pattern such variations. In addition, the level of the domestic consumer price of rice affects production decisions by farmers and/or the amount of rice commercialized by farmers for a given level of output. Because farmers' trading decisions are more influenced by domestic consumer prices than by the official producer prices and that agricultural prices in Senegal are usually announced after planting, we use the lagged value of consumer prices instead of the current ones.

The third equation of the model is the total demand for consumption of rice. It is set as a function of urban population, the gross domestic product deflated by the consumer price index and the domestic consumer price.

Finally, from the three equations described above, a derived net import demand can be determined as the difference between the demand for consumption of rice and the local production of rice. Table 4.2 presents the equations of the model. Table 4.3 describes the variable

Table 4.2

The Equations of the Model

(1) $\quad PD_t = \alpha_0 + \alpha_1 PD_{t-1} + \alpha_2 PW_t + \alpha_3 FE_{t-1} + E_1$

(2) $\quad RP_t = \beta_0 + \beta_1 W_t + \beta_2 PD_{t-1} + E_2$

(3) $\quad RC_t = \partial_0 + \partial_1 PD_t + \partial_2 POP + \partial_3 GDP_t + E_3$

(4) $\quad IMP_t = \partial_0 + \partial_1 \hat{PD}_t + \partial_2 POP + \partial_3 GDP_t - \hat{RP}_t$

Table 4.3

Variable Notation

PD $\quad$ = Consumer price of rice (CFA francs/kilogram) deflated by CPI.

$\hat{PD}$ $\quad$ = Estimate of consumer price of rice from equation (1).

PW $\quad$ = Implicit world price of rice (CFA francs/kilogram) deflated by CPI.

FE $\quad$ = Value of exports (millions of CFA) deflated by the import price index.

RC $\quad$ = Domestic consumption of rice.

POP $\quad$ = Urban population.

GDP $\quad$ = Gross domestic product (billions of CFA) deflated by CPI.

W $\quad$ = Average rainfall level in the country.

IMP $\quad$ = Imports of rice.

RP $\quad$ = Local production of rice.

$\hat{RP}$ $\quad$ = Estimate of local production of rice.

t $\quad$ = Time index.

t-1 $\quad$ = Time index lagged by one year.

names. Also, in Figure 4.1, a schematic representation of the model is provided.

In equation (1), the coefficient α_1 should have a value between zero and one. A value of zero would indicate a complete failure of the government price stabilization policy, whereas a value close to one would mean that the government's price stabilization policy has been rather successful. Also, α_2 should be between zero and one; a value close to one would indicate a free trade behavior or a constant per kg tax on rice imports, whereas a value close to zero would mean that domestic price variations are isolated from variation in world prices. As for the foreign exchange variable, the assumption that Senegal has faced foreign exchange constraints for its imports of rice leads us to predict a negative sign for the coefficient α_3. The reason is that if, for example, imports of rice decrease due to a slump in foreign exchange earnings, domestic consumer prices would have to increase in order to clear the market unless rationing--which is not used in Senegal--takes place. Moreover, stock movements which could prevent such an increase in domestic prices are not undertaken in Senegal due to the very low level of publicly held stocks of rice in the country. Thus, foreign exchange earnings and domestic prices are expected to vary inversely.

In equation (2), both β_1 and β_2 are expected to have positive signs. Presumably, a high level of rainfall would, on the average, announce good prospects for rice production. The statistical significance of the coefficient β_1 would reflect the extent to which production levels are dependent on rainfall levels. As for the coefficient β_2, traditional economic theory suggests a positive relationship between

Figure 4.1

Diagrammatic Representation of the Econometric Model
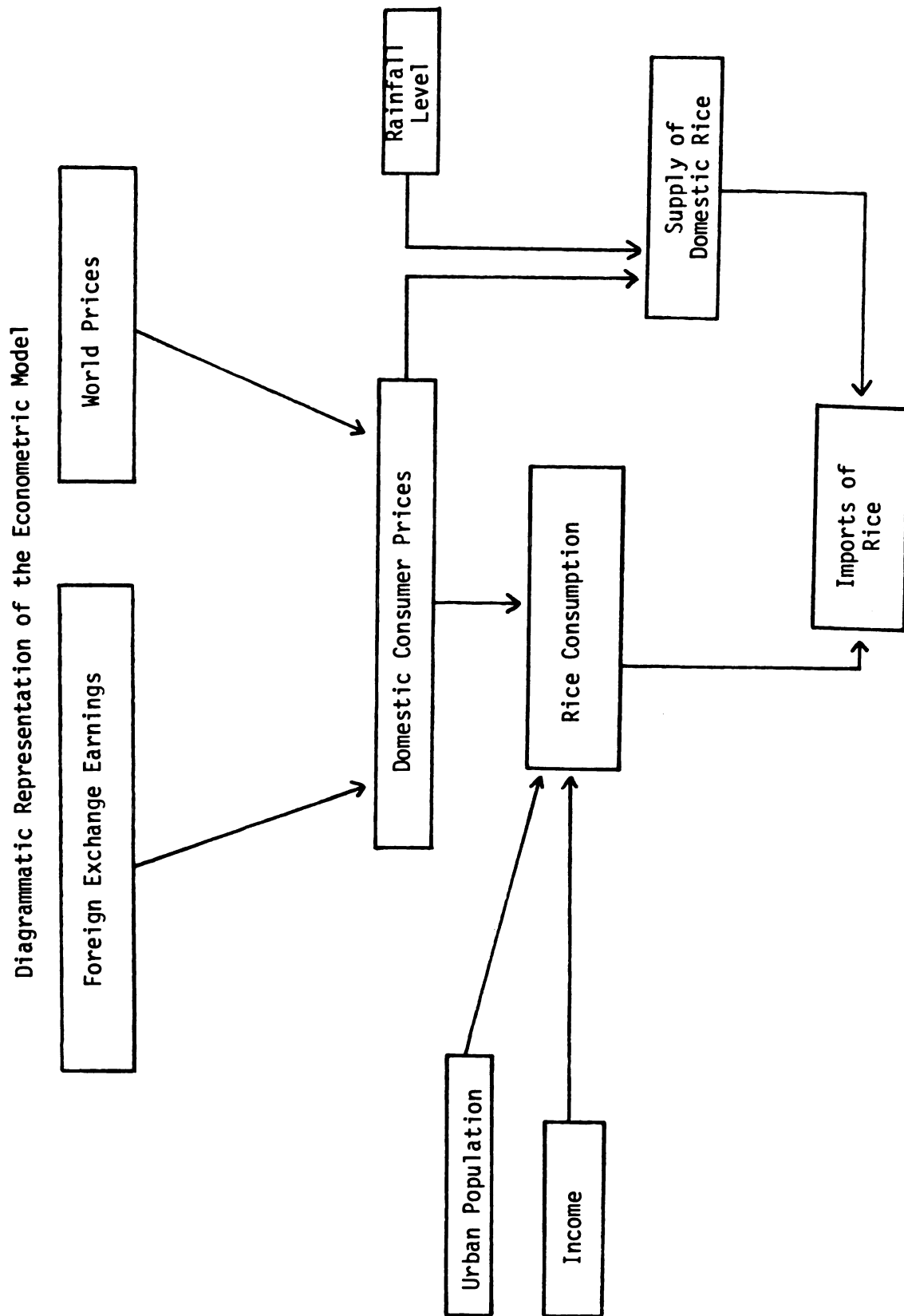
supply and prices. We anticipate that the effects of domestic prices on the supply of domestic rice would be, at best, marginal for two reasons. First, in Senegal, rice production is essentially a subsistence activity. Thus, prices have a limited effect on farmers' production decisions. Second, we mentioned earlier that most of the sales of rice by farmers occurs outside the official channels. Because such transactions are illegal, one should expect that farmers would minimize the risks involved and, thus, their incentives to produce rice for commercial purposes become inhibited. Nevertheless, the coefficient could indicate to what extent rice production is responsive to price increases and, thus, what its impact is on import levels.

For equations (3) and (4), as suggested by economic theory, the coefficients of urban population and gross domestic product should have positive signs, while that one for domestic consumer price should be negative. In the import demand function, equation (4), local production should have a negative coefficient since local rice is assumed to be a substitute for imported rice. Note that the use of rice production as a substitute for imports of rice is not very appropriate. Rather, the sale of local rice by farmers (after their subsistence needs are met) are more likely to affect the levels of imports. However, since no data series for the unofficial trade of local rice are available, the production of local rice is used as a proxy for the sales of domestic rice.

CHAPTER 5

RESULTS AND IMPLICATIONS

The feeling that we have a better understanding of a
social process--even though as is quite conceivable, it could
become more unpredictable as a result--is sufficient justifica-
tion for the enterprise, particularly if, as is often the case,
new ways of influencing the process become available through
that enhanced understanding.
                    - Albert O. Hirschman (quoted from Essays in
                      Trespassing, Cambridge University Press)

5.1 Results

The model developed in Chapter 4 is estimated using OLS for equa-

tions (1) and (2). As for equation (3), the "Instrumental Variable Esti-

mation Technique" is used; the procedure allows the equation to be re-

cursively determined once the domestic consumer price is predetermined

from equation (1). Equation (4) is obtained by a simple arithmetic dif-

ference between equation (3) and equation (2). The empirical results of

the model are presented in Table 5.1. Numbers in parentheses are t-

statistics.

Table 5.1

Empirical Results of the Econometric Model

Equation (1)	$\widehat{PD}_t = 22.06 + .076\ PD_{t-1} + .8\ PW_t - .00003\ FE_{t-1}$ $\quad\quad (3.7)\quad (+.81)\quad\quad (9.2)\quad\quad (-.83)$
Equation (2)	$\widehat{RP}_t = -18233 + 156.21\ PD_{t-1} + 1356.36\ W_t$ $\quad\quad (-.6)\quad\quad (.23)\quad\quad\quad\quad (5.97$
Equation (3)	$\widehat{RC}_t = 11300 + .15\ POP + 423.32\ GDP - 2589.35\ \widehat{PD}_t$ $\quad\quad (.60)\quad (3.09)\quad\quad (.40)\quad\quad (-1.27)$
Equation (4)	$\widehat{IMP}_t = 113000 + .15\ POP + 423.32\ GDP - 2589.35\ \widehat{PD}_t - 1\ \widehat{RP}_t$

5.1.1 Empirical Estimates of the Equations

The results of the estimation of the model are graphically presented on the following page. Figures 5.1.a and 5.1.b seem to indicate a relatively good fit for both equations (1) and (2) of the model. However, the performance of the model for equations (3) and (4) is less satisfactory. It is important to note here that since equation (4) is derived by subtracting equation (3) from equation (2), once the model has not performed very well in estimating rice consumption—that is, equation (3) —it could not be expected to be very successful in estimating rice imports from equation (4). Issues relating to the lack of performance of the model in estimating the last two equations are discussed in Appendix B of this paper. Now, we turn to the discussion of the results presented in Table 5.1.

In equation (1), world prices are by far the most significant variable. They are statistically significant at a 99 percent confidence level. In contrast, export earnings are significant at less than an 80 percent confidence level, while the lagged consumer price variable is not significantly different from zero. For equation (2), unlike the lagged consumer price whose t-statistic is 0.23, weather (rainfall level) is very highly significant with a t-statistic of near 6.0. The latter equation has a R^2 of .70, while that one for equation (1) is .88. For equation (3), urban population is significant at a 95 percent confidence level. The domestic consumer price is significant only at an 87 percent confidence level. With an estimated t-ratio of .40, the gross domestic product is not significantly different from zero. Furthermore, the procedure used to estimate equation (3)—the Instrumental Variable
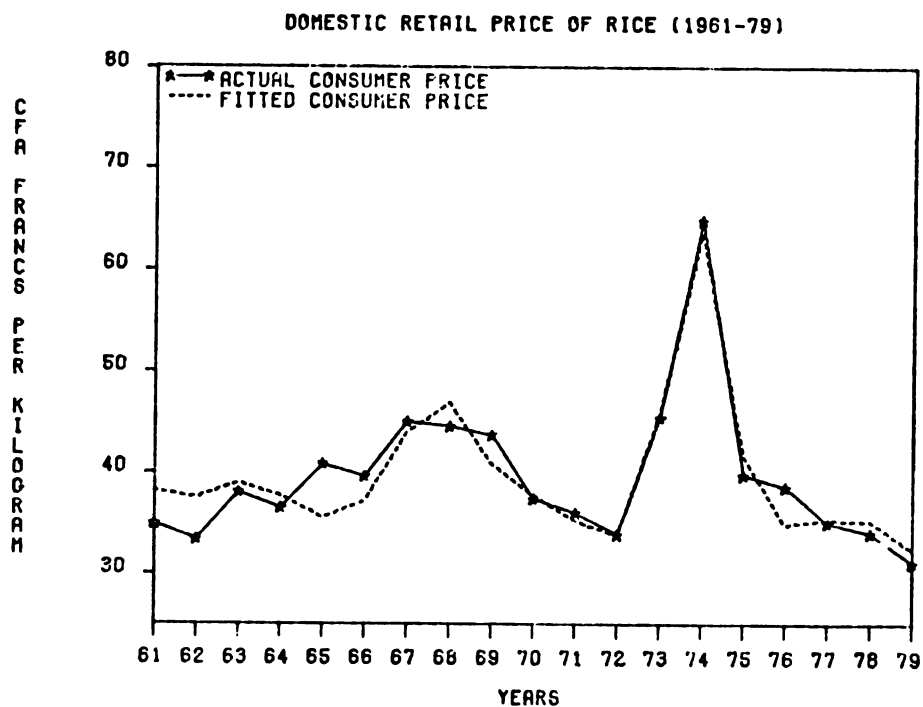
DOMESTIC RETAIL PRICE OF RICE (1961-79)

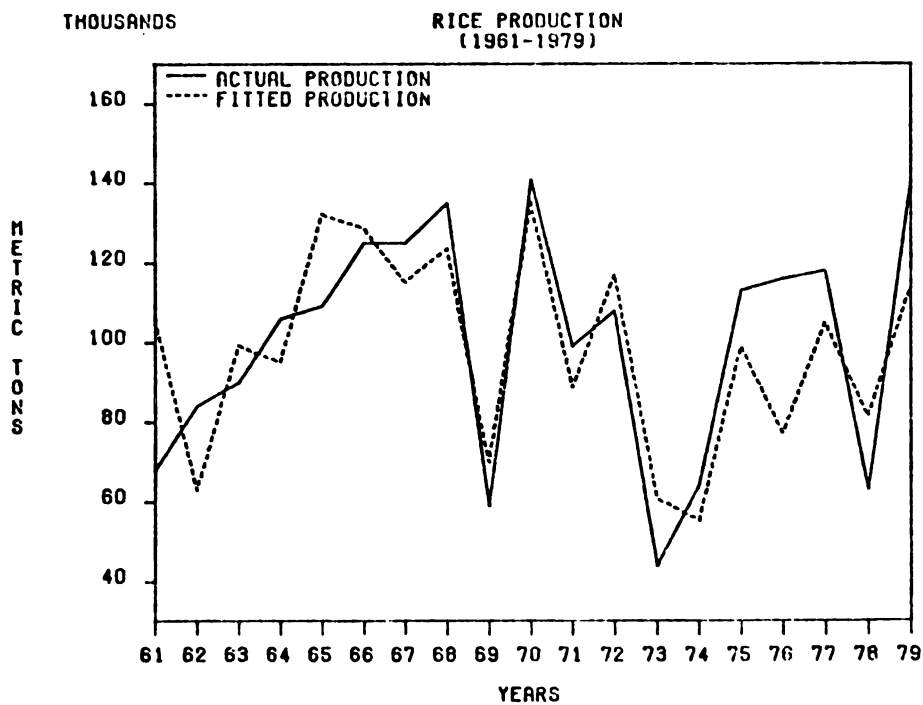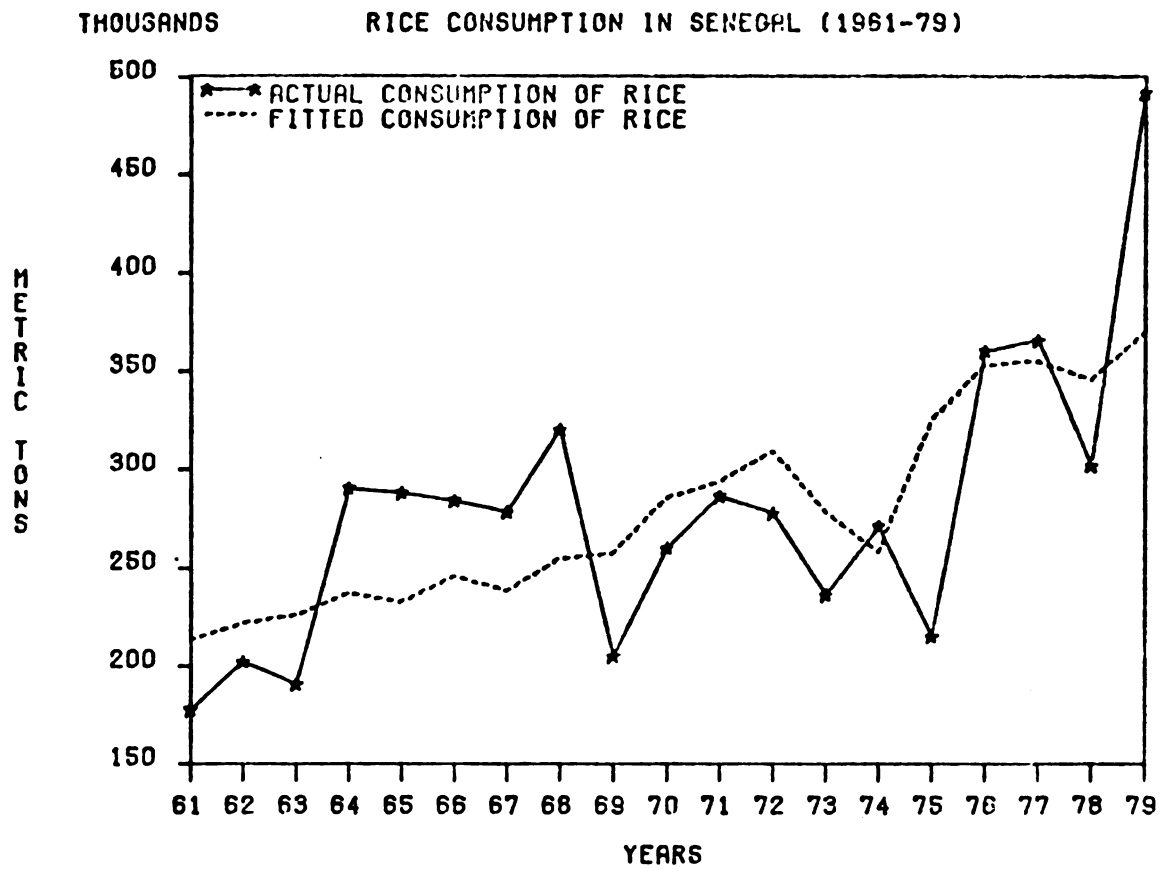Figure 5.1.a

RICE PRODUCTION
(1961-1979)

Figure 5.1.b

Figure 5.1.c

Estimation Technique--does not report any R^2 so that a numerical indication for the fit of the equation is not provided.

Finally, since equation (4) is not directly estimated, but rather is obtained from an arithmetic difference between equations (3) and (2), the goodness of its fit is very much influenced by the results of both equations (2) and (3). This relationship is well displayed by the similarity between Figures 5.1.c and 5.2.

5.1.2 Elasticity Estimates (at Mean Value)

From equation (3) we can derive:

Domestic price elasticity of rice consumption:

$$\frac{\partial RC}{\partial PD} * \frac{PD}{RC} = 2589.35 * \frac{39.62}{279185} = -.38$$

Income elasticity of rice consumption:

$$\frac{\partial RC}{\partial GDP} * \frac{GDP}{RC} = 423.32 * \frac{205.39}{279185} = .31$$

From equation (4) we derive:

Urban population elasticity of rice imports:

$$\frac{\partial IMP}{\partial POP} * \frac{POP}{IMP} = .15 * \frac{1201290}{178817} = 1.007$$

Rice production elasticity of rice imports:

$$\frac{\partial IMP}{\partial RP} * \frac{RP}{IMP} = -1 * \frac{100368}{178817} = -.56$$

5.2 Implications of the Result

In the presentation of the model in Chapter 4, public interventions in the rice sector were patterned through the government's domestic price determination mechanism. The latter was described as a response to changes in world prices and to fluctuations in the level of the country's exports which are used as proxy for the country's foreign exchange
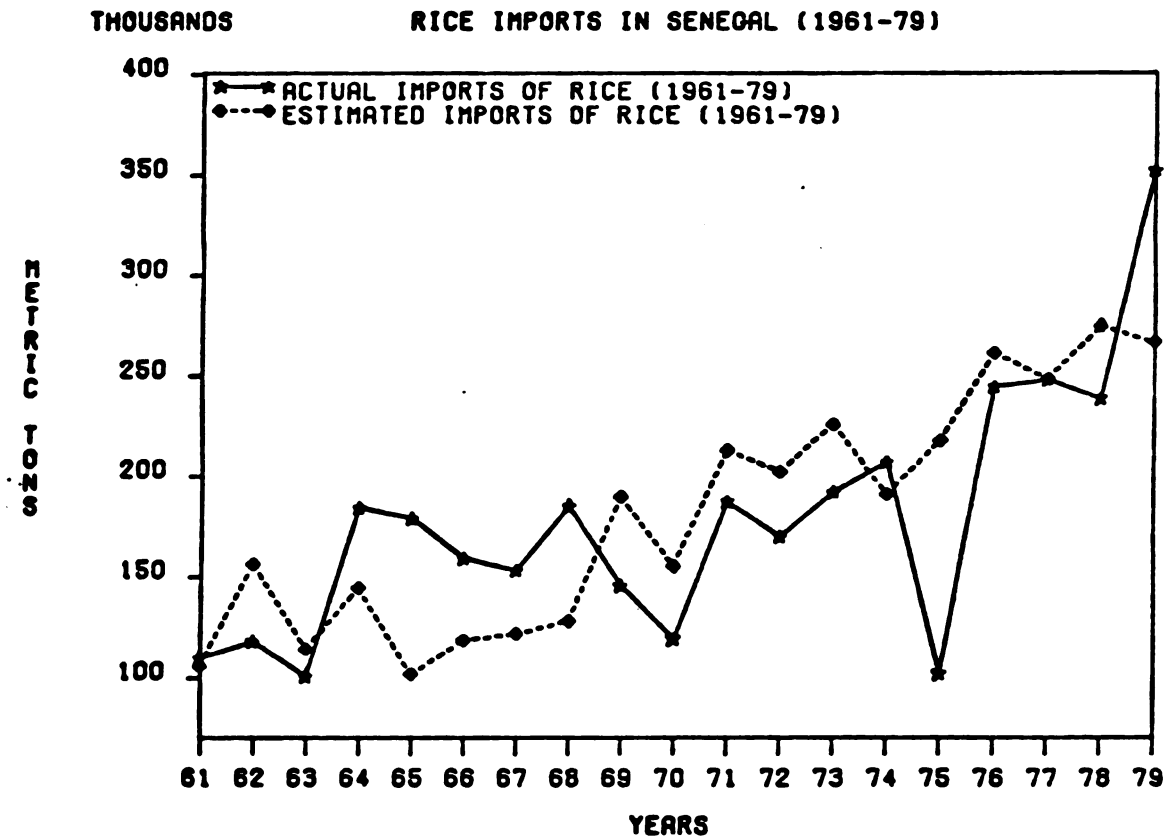
Figure 5.2

earnings. Certainly, the use of exports could underestimate the level of the country's foreign exchange since capital inflows are excluded. In the model presented here, it is assumed that capital movements are in the nature of financing or equilibrating transactions from the point of view of the balance of payments. In other words, the bulk of the capital transactions take place in order to help finance the country's balance of payments deficit, and, therefore, cannot be considered as a measure of the country's import capacity. Another reason for excluding such transactions as part of the country's import capacity arises from the difficulty of having consistent data on capital flows.

As mentioned in Chapter 4, government actions in the rice sector are algebraically described in equation (1). Thus, the analysis of the results of equation (1) constitutes a good starting point from which the nature of the government's policy could be analyzed.

From Table 5.1, the coefficients of lagged consumer prices, world prices and foreign exchange are +.08, +.8 and -.00003, respectively. Since the coefficient of the lagged consumer price variable is smaller than .1, the model seems to indicate that the government price stabilization policy has clearly failed, even though in nominal terms, the reverse seems to be the case. This observation is actually confirmed in Figure 5.1.a, which shows the fluctuating nature of the domestic consumer price. Nevertheless, it is to the credit of the government's stabilization policy that world price variations were higher than the domestic ones. The computed standard deviations for world prices and domestic prices are 8.7 and 7.4, with means of 28.9 and 39.6, respectively.

For the price transmission mechanism between world prices and domestic ones, the coefficient of world price (.8) indicates that most of the

fluctuations in world prices were actually felt domestically. If world prices increase/decrease by 1 CFA franc per kg, domestic prices would be lifted/decreased by .8 CFA francs. Decreases in world prices are then likely to favor the taxing of domestic consumers while world prices increases call for subsidies for imported rice. Again, Figure 5.3 shows the striking similarities between world and domestic price movements. Recall, however, that, as mentioned earlier, the data used for world prices do not include the cost of loading and unloading activities for imported rice. Should such costs be included, the resulting cost for imported rice would be much higher and, for periods in which domestic prices have been subsidized, the cost of imported rice would be higher than that of the consumer price of rice.

For the effect of foreign exchange earnings on imports, the corresponding elasticity--at mean values--is as low as .04. In other words, if foreign exchange earnings decrease by one billion CFA francs, imports of rice would decrease by only 82 tons as compared with an average import of rice of 178,817 tons! Of course, this is not to mean that foreign exchange earnings are "abundant" in Senegal. Rather, imports of rice are given high priority for the country's allocation of import expenditures. For example, when the country experiences shortfalls on its foreign exchange earnings, either expenditures on other imported goods are reduced in order to forego a significant reduction on rice imports or the country's reserves of foreign currencies are drawn down or both. In the near future, it is very unlikely that the government would be able to pursue this above formula to preserve rice imports at very high levels. Already, the country's reserves of foreign currency have seriously deteriorated. In addition, a further squeezing up of other
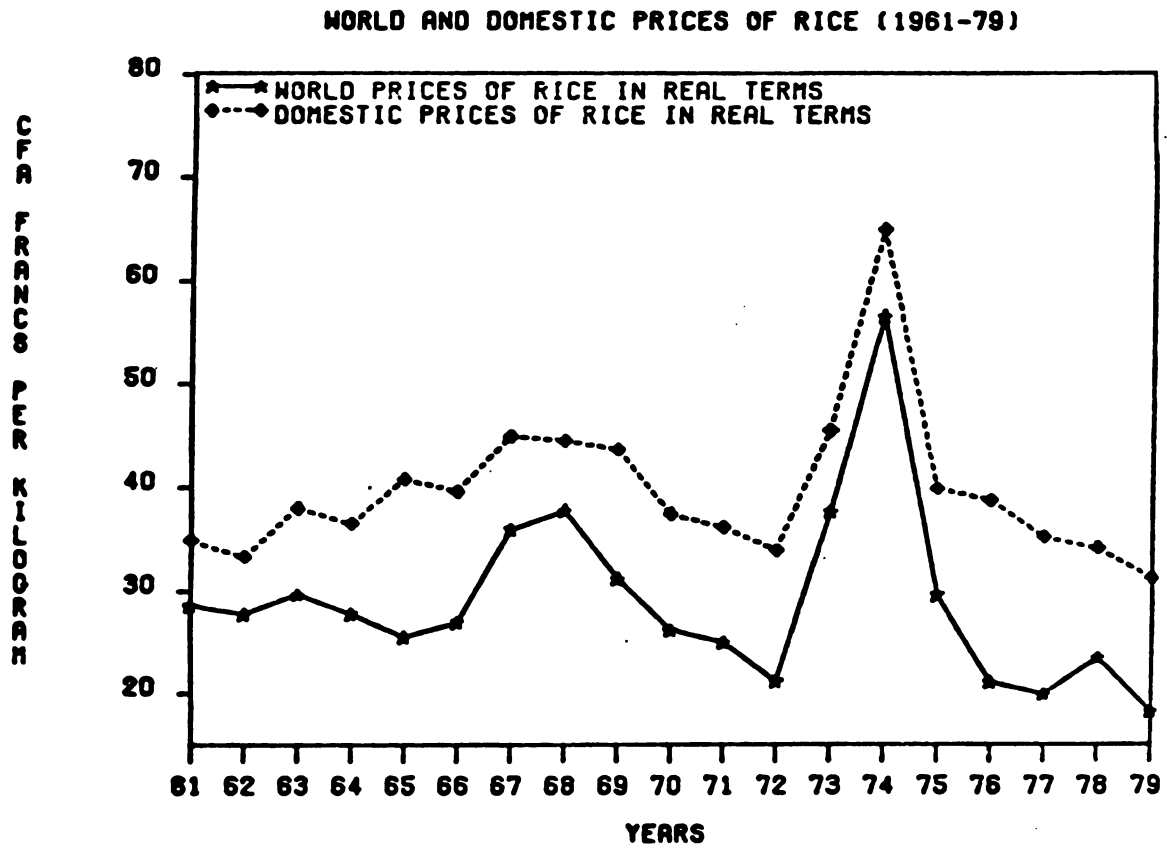
WORLD AND DOMESTIC PRICES OF RICE (1961-79)

Figure 5.3

imported goods may be limited to a few items such as automobiles and other consumer goods since a minimum import of capital goods and raw materials will necessarily have to be met if future economic growth is to be satisfied. Thus, it is very likely that in the near future, the level of foreign exchange earnings will have a strong bearing on the amount of rice to be imported so that shortfalls in exports would cause sensible domestic price increases.

In equation (3), the effects of urban population, GDP and domestic consumer prices on rice consumption are described. The empirical results show that urban population is statistically the most significant variable and is followed by domestic consumer prices. The GDP is not statistically significant. This seems to indicate that the increase in rice consumption results more from the country's high urbanization rate than from an increase in consumer's income. Certainly, caution should be exercised in considering this statement. It was pointed out earlier that, on average, urban people tend to have higher incomes than their rural counterparts. Statistically, that means that the GDP and the urban population are likely to vary closely together and the more it is so, the less efficient would be the coefficients of those two variables.[1] This calles for further research on consumer expenditure patterns, whereby expenditures on rice consumption by urban people would be compared with those of rural people. The different consumer groups to be compared would belong to the same income groups. The results of such a research would give more reliable indication as to where future government policy would focus in order to decrease the growth of imports of rice.

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[1]Table 5.2 (on the following page) shows a correlation of .4 between real GDP and urban population.

Table 5.2

Correlation Matrix

	POPULA	GNP	PD	RICECON
POPULA	1.00000	.406378	.128099E-01	.665300
GNP	.406378	1.00000	.309748	.263957
PD	.128099E-01	.309748	1.00000	-.189809
RICECON	.665300	.263957	-.189809	1.00000
RICEPRO	.968861E-01	.263948	-.305067	.556636
MILPR	-.762357	-.451745	-.122950	-.314651
PRIRAT	.288491	.41292	.916909	-.675722E-01
	1	2	3	4

	RICEPRO	MILPR	PRIRAT	
POPULA	.968861E-01	-.762357	.288491	
GNP	.263948	-.451745	.412922	
PD	-.305067	-.122950	.916909	
RICECON	.556636	-.314651	-.675722E-01	
RICEPRO	1.00000	-.144176	-.222709	
MILPR	-.144176	1.00000	-.502580	
PRIRAT	-.222709	-.502580	1.00000	
	5	6	7	

where:

RICECON = demand for consumption of rice;

RICEPRO = production of local rice;

MILPR = producer price of millet (in real terms);

PRIRAT[a] = price ratio between consumer prices of rice and producer prices of millet.[b]

[a]Note the negative correlations between millet prices and the demand for consumption of rice. This seems to indicate the fact that even though millet has potential as a substitute for rice, for the period covered by the study, a decrease in millet prices does not appear to favor a decrease in consumption of rice.

[b]Data on consumer prices of millet are not available. However, the producer prices of millet are certainly a good proxy for the former.

Nevertheless, the result of the model indicates an urban population elasticity with respect to imports of about 1.007. Since the urban population has been growing at an estimated rate of 4.8 percent, imports on average have been growing at a rate of 4.8 x 1.007 = 4.83 percent. Therefore, it appears that if government's concern is to decrease the growth rate of imports of rice, much attention should be given to the urban population variable.

At this point, two questions should be asked with respect to the urban population. First, why is the rate of urbanization so high as compared to the average growth rate of the country's population and what is needed to slow it down? Second, why urban people seem more inclined to consume rice than their rural counterparts? The answers to these two questions are inevitable parts of the tools policy makers should use if long-term food self-sufficiency is to be achieved.

With respect to the first question, the data show that the rate of urbanization was highest during the 1970s when real rural income decreased by 1 percent a year.[2] That decrease in rural incomes was largely due to shortfalls in peanut production during the drought coupled with decreases in the real prices of agricultural products offered to farmers. Thus, economic difficulties in the rural sector have favored urban migration. In addition, phosphate revenues in the mid 1970s stimulated the government capacity to expand its economic participation policy which has partially boosted activities in the secondary and tertiary sector.[3] This further stimulation of urban based activities increased migrants'

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[2]See the Senegalese Sixth Development Plan.

[3]The secondary sector includes all manufacturing activities. By tertiary sector, we mean service activities.

expected incomes in urban areas. However, this does not mean to imply that urban migration should be stopped by drastic measures such as an erection of tight controls against migrants. The apparent solution lies in a shift for a development strategy more oriented towards the agricultural sector. If phosphates and other government revenues had been put back into agriculture, the development prospects of the rural areas would have been more encouraging and the rate or urban migration would have certainly decreased. For example, in the Casamance region, decreases in rainfall have caused heavy salt water incursion into land growing areas during the late 1970s. This situation has likely reduced rice production potentials in that region, while, if a small dam had been built there, that particular problem might have been lessened.

In the meantime, however, one possible way out of this rice import induced urban population is to focus on the variables that actually seem to favor the urban consumer's biases toward rice consumption. Actually, many hypotheses have been advanced, some of which relating rice consumption to the fact that the staple takes less time to cook, it is easily available, etc. Others even went as far as saying that rice consumption is associated with a feeling of a higher social status. As plausible as some of these arguments may sound, very few of them are actually backed with reliable empirical evidence. By not, it seems very unlikely that income levels are a major cause for the continuous increase in rice consumption. A 1976 study by FAO based on cross-section data found an income elasticity for consumption of rice of .3, the same as the one estimated here. Such a result indicates that, unlike what is commonly assessed, rice is not a luxury good in the Senegalese diet and that other traditional goods could well be substituted for it. Current knowledge

indicates that local cereals (millet, sorghum, corn) are much less a-
vailable in urban areas than in rural areas. Now the question is: Is
the growth of urban consumption of rice due to the lack of availability
of local cereals or rather, local cereals are not available in urban
areas simply because consumers are biased against them? Clearly, the
answer to the question should not be in the form of "either/or;" rather,
if substitutes are assumed to potentially exist for rice, local cereals
would not only have to be available in urban areas, but also would be
processed in such a way as to meet consumer preferences. This raises
the question of the development of technological packages to increase
agricultural productivity, the development of marketing facilities and
the processing of local cereals. Again, the undertaking of these enor-
mous tasks cannot be made overnight through crash program. This re-
quires a new approach of economic development similar to the "New Strat-
egy of Growth" advocated by John Mellor for India.[4] This calls for a
long-term strategy and the intersector linkages must be carefully mas-
tered before the launching of the approach. For example, in the late
1970s, faced with large stocks of millet, the government embarked into
a program of partial substitution of millet flour for wheat flour in the
production of bread. The program came out unsuccessful mainly because
the cost of millet flour exceeded that of wheat flour and, thus, the
final cost of bread was higher. Had a more appropriate trade policy
been undertaken, better farming practices and a more efficient marketing
policy been introduced, the outcome would likely have been more satis-
factory. Mountains cannot be displaced just by faith. As the Guinean

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[4]See Bibliography.

leader SecKou Touré eloquently put it, "Economic development is not a 100 meter race--rather it is a real marathon." These above mentioned policies, particularly the promotion of local cereals, have become, in the past few years, a common topic for policy makers and are strongly reassessed in the Senegalese Sixth Development Plan. It is, therefore, hoped that such a government concern would bring about careful research in the field of farming systems, marketing and trade policies.

The third explanatory variable in equation (3), namely domestic consumer prices, is statistically significant at only 85 percent. The computed elasticity of domestic prices to rice consumption is "less" than -.4. This finding appears to indicate that pricing policy alone is unlikely to be successful as to slow down the growth of consumption of rice. In other words, if all other variables are held constant, maintaining rice consumption at a minimum level would require large increases in the domestic prices. Given the fact that expenditures on rice occupy a large portion of urban consumers' budget, particularly among the lower income consumers, the political pressures that militate against such policy should not be overlooked. This latter remark is clearly a reassessment of the idea that, in order to tackle the steady increase in rice consumption, a broad framework is needed whereby all the different policy directions should be integrated.

Equation (4) presents the import demand for rice as the excess demand for rice over local production. This is graphically shown in Figure 5.4. As mentioned earlier, even though price increases can reduce import needs by encouraging supply of local rice and by discouraging the demand for rice, the effects of lifting prices are likely to be limited, due to the low price elasticity of demand for rice.

Prices

Demand Representation in the Rice Sector

Supply of Domestic Rice

Domestic
Consumer
Price

Imports of Rice

Demand for
Consumption

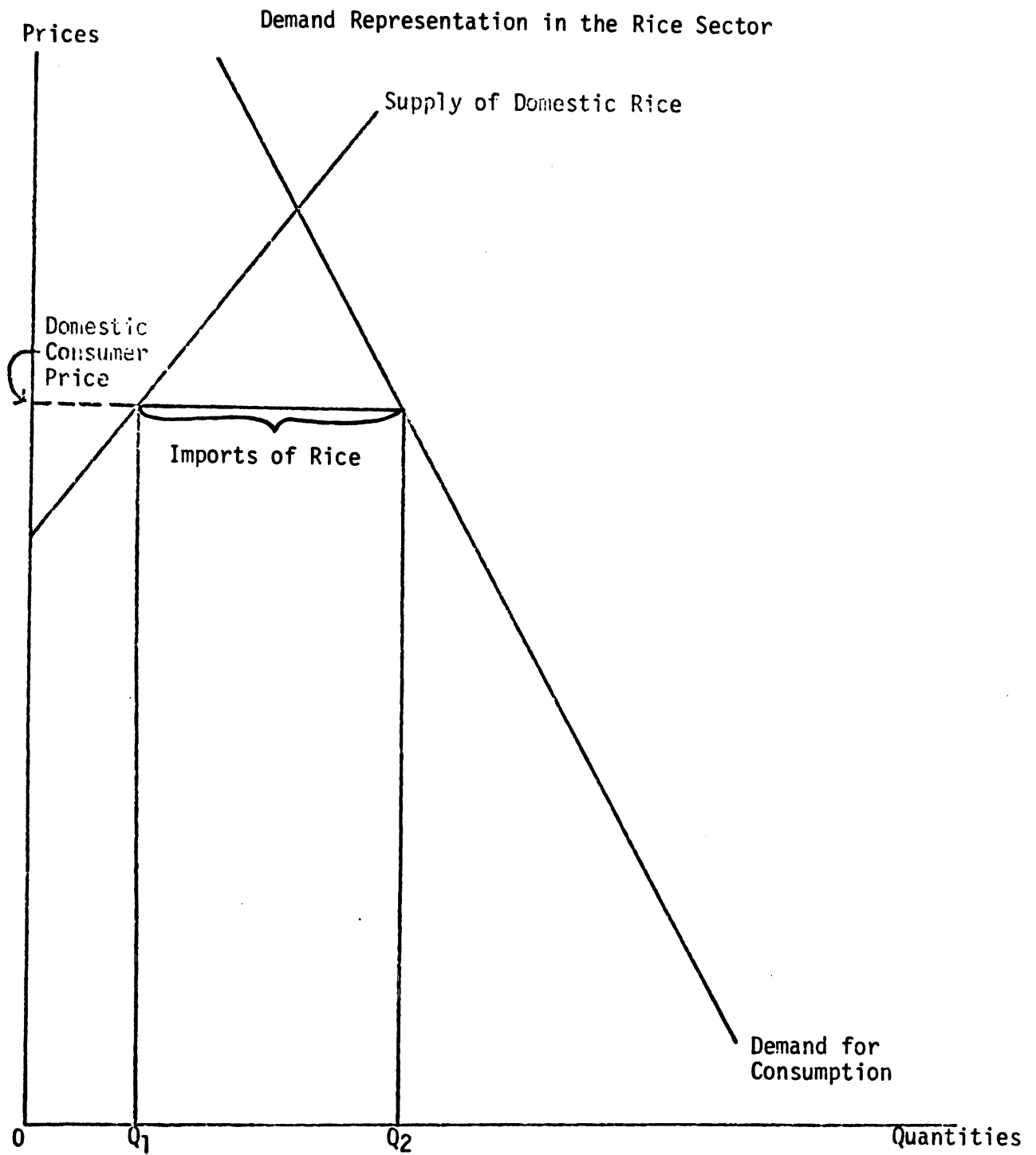0   Q₁   Q₂   Quantities

Figure 5.4

Thus, if imports are to be discouraged, attention should be focused on two directions. On the one hand, the demand for consumption of rice can be moved leftward. The means to be used to achieve such a goal are the policy instruments already described in this section and include the promotion of local cereals, the improvement of marketing facilities and more committed research activities to increase productivity at the farmer level. On the other hand, the reduction of the import gap could be met by moving the supply schedule of rice rightward. Since the supply of rice is presented in equation (2), the analysis of the statistical results of that equation becomes at this point quite warranted.

From Table 5.1, the results for equation (2) show that the level of rainfall is by far the most significant variable. Prices appear to have almost no statistical significance. In the Casamance region where most of the local rice is produced, important inputs such as fertilizer are very marginally used. This attests to the nature of rice production in Senegal as being very primary.

The lack of significance of the price variable should not be interpreted as a lack of responsiveness to price increases on the part of farmers. If we suppose, for example, that farmers sell 15 percent of their production, then an increase in prices by 10 percent would increase their real income by only 1.5 percent. Thus, it seems virtually certain that for the case of rice producing farmers in which a small part of production is marketed, cultivators' incomes will, on the average, move directly with production changes. Incidentally, technological change provides its benefits in proportion to total production not in proportion to marketings and, thus, benefits the small farmers, as well as larger ones.

In the meantime, however, the pricing policy in the rice sector remains to be improved. The data we used show a .6 correlation coefficient between peanut prices and producer prices of rice, while the correlation coefficient between the latter and the consumers' price of rice is .27. Not only that, but also the direct sales of local rice by farmers (using consumer prices) are prohibited by law. This latter situation constitutes an important disincentive for the promotion of local rice. Agricultural agencies are given legal monopoly over the processing of the paddy produced. Since large and inefficient mills are used by the agencies, their use has produced an unnecessary increase in the cost of domestic rice. Unfortunately, it is such costs that, in part, determine the producer price to be paid to farmers.[5]

In spite of all the disincentives encountered by the rice production sector, the rice production elasticity computed from the results of equation (4) is -.56. This result seems to indicate that the local production of rice has a nonnegligible effect on imports. A 1 percent increase in local production causes a decrease in import by .56 percent. Furthermore, the competitiveness of local rice against imported rice is enhanced by the former's quality premium over the imported one, which is essentially broken.

Finally, it is important to note that, given the way the import demand equation is defined, we are implicitly assuming that _before_ orders for imports of rice are established, account is fully taken on the level of local production. Only a thorough documentation about the administrative procedures of imports of rice could shed light on whether

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[5]In setting producer prices, marketing and processing costs are taken as given and are deducted from consumer prices; also, other adjustments, not clearly defined, are made.

such an assumption is realistic or not. If it turns out that the assumption is not plausible, then the computed production elasticity with respect to import could be biased upward.

5.3 Projection of Demand and Import of Rice

Using the results of the model, we now make a medium- and long-term projection for imports of rice in Senegal. To do that, we need to make projections for both the demand for consumption and the local production of rice. For the former, we will use the "FAO Projection Methodology." The corresponding formula for the procedure is as follows:

$$D_t = D_o (1+d)^t$$

where: D_o = base period;

D_t = year for which the projection will be made;

d   = population growth + (income elasticity * income growth rate).

For the local production of rice, we refrain from making any prediction. The reason is that, as many researchers seem to agree, many variables that affect the supply of agricultural commodities cannot be confidently forecasted, particularly in the case of rice in Senegal. For example, variables such as technological progress, rainfall level, the implementation rate of the rice irrigation projects, etc., do not usually provide clues from which an accurate prediction could be made for them. Nevertheless, government and many other agencies publish figures on medium- and long-term demand and supply estimates for certain agricultural commodities.

We will present two projection figures; one is for the import of rice in 1985 and the other is a projection of demand for rice in 1990.

The figure for the import of rice in 1985 would be obtained by the difference between our projected demand for 1985 and the estimate of rice production for 1985 as presented in the Senegalese Sixth Development Plan.

As for the year 1990, a figure for imports of rice could not be presented because we do not have access to any estimate of local production of rice for 1990. Our projection estimate will then be limited to only a consumption figure for 1990. However, on the basis of such a figure, we would be able to draw recommendations as for directions through which the need for imports of rice could be lessened. Table 5.3 presents the results of the projection estimates.

Our projection estimates of rice imports in 1985 is very close to the figure presented in the Sixth Development Plan. It seems, however, that the projected figure for rice production in 1985 is likely to be too optimistic. Past experiences show that projected figures for rice production during the Third, Fourth and Fifth Development Plan have been always off the actual production and were overestimated by at least 50 percent. The 1985 figure for rice production represents an 11.3 percent growth in rice production based on an average production level of 100,600 tons during the 1970s.

We certainly do not mean to be too pessimistic with respect to the growth of rice production that is implicit from the Sixth Plan's figure of 191,000 tons. Rather, we feel more concerned about the costs of an underestimation of the country's needs for food imports.

Rice production could certainly be increased at very high levels. However, our view is that, unfortunately, the time constraint is usually underestimated. It is hard to conceive that an extensive study of

Table 5.3

Projection Estimates of Rice Consumption

Year	Demand for Consumption of Rice		Imports of Rice	
	Our Estimate[a]	6th Development Plan's Estimate	Our Estimate[a]	6th Development Plan's Estimate
1985	535,256 tons	531,000 tons	320,445 tons	344,256 tons
1990	712,416 tons			

[a]For the estimation, we use an urban population growth rate of 4.8 percent which is the observed growth rate during the two decades covered by the data used, i.e., 1961-79. This income elasticity (.31) is given by our model. For the GDP, we use the figure forecasted in the 6th Development Plan for 1981-85, namely a 3.5 percent growth rate. Finally, our model estimate of rice consumption in 1979 is used as a base year consumption, and is equal to 379,800 tons.

farmers' constraints, the finding and introduction of relevant technological packages, their full implementation, the setting up of relevant price, marketing and storage policies, etc., could be carried out within a decade.

The reduction of the country's rice import gap through domestic production increase is a topic more relevant for the next decade. For example, from Table 5.3, one can see that if rice imports for 1990 are to be limited to the 1985 levels, then local production would have to reach 391,971 tons, that is at a rate of almost 15.5 percent a year from an estimate of 191,000 tons in 1985.

Thus, it seems that, in the short- and medium-term, the best prospects for reversing the growth in rice imports lie in the development of substitutes for rice in the urban consumers' diet. So far, the results of our model show that substitutes for rice, even if they potentially exist, have been nevertheless very weak. The price and income elasticities computed from our model were respectively -.38 and .31. Using the Homogeneity Condition or the Slutsky-Schultz Relation,[6] the cross-elasticities (between rice and other substitutes and complements) would be about .07. This means that an increase in the price of rice by 1 percent would, on average, increase the consumption of substitutes, say, sorghum-millet, by .07 percent. Whether such a low response on the part of urban consumers is due to a lack of availability of local cereals in urban areas or to the fact that local cereals do not fit consumers' tastes is clearly an empirical question. Nevertheless, this opens up a need for extensive research in order to promote the industrial processing of local cereals to stimulate productivity increase for local cereals at the farm level.

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[6]The Slutsky-Schultz condition states that the sum of the own and cross-price elasticities and the income elasticity for a commodity is zero. This means that the income effect of an own-price change must be consistent with the cross- and income-elasticities for the commodity. See Tomek and Robinson in Agricultural Product Prices, page 30.

CHAPTER 6

SUMMARY AND CONCLUSIONS

        Much of the work of economists is concerned with the
future, with forecasts and planning. But forecasts are triv-
ial and planning is useless unless they are based on fact;
and facts which are at our disposal are facts of the past....
The purpose of analysis, applied to those facts, is the ex-
planation of what has happened--the explanation that is, of
economic history.... So even if our business is with fore-
casts of what is likely to happen or with probable results of
policies to be adopted now, historical analysis comes first.
                    - Sir John Hicks, in Causality in Economics

In this study, an attempt is made to further our understanding

about the nature and cause of the increasing demand for import of rice

in Senegal. The demand for rice imports is presented as the gap between

the demand for consumption of rice and the supply of domestic rice.

Furthermore, close consideration is given to the effect of government

policies, particularly in the rice sector. An econometric model was

used to study the behavior of the relationships involved; the findings

of the model are summarized as follows.

6.1 Demand for Consumption of Rice

    The model showed that most of the increase in rice consumption ob-

served during the last two decades are, to a large extent, caused by the

growth in urban population. Urban population is, by far, the most sig-

nificant variable in the demand for consumption of rice equation. In

contrast, the effects of incomes and prices were marginal. Moreover,

these two variables have low elasticities with respect to the demand for

consumption of rice (.31 and -.38, respectively). The elasticities of urban population with respect to the demand for consumption of rice and the demand for imports of rice were found to be .65 and 1.004, respectively. The latter result indicates that, unless new actions are taken, in the near future rice imports could grow at a rate of approximately 4 to 5 percent, the same rate the urban population growth experienced during the 1970s. Consequently, focusing on income and price variables to slow the demand for consumption of rice does not seem to be a viable solution. Price and income elasticities of demand are so low that only a large increase in the former and/or a large decrease in the latter could cause the demand for rice to decrease significantly. Therefore, at least from a short-term perspective, incomes and domestic prices, as well as the urban population, offer little success when used as tools to slow the demand for consumption of rice and the need to import rice.

6.2 Supply of Domestic Rice

The results of the model have shown that the level of rainfall is by far the most significant variable in the determination of the supply of domestic rice. Even though a positive relationship is observed between domestic prices and the supply of local rice, statistically, the result is not significantly different from zero. This appears to corroborate the fact that rice production in Senegal is essentially at the subsistence levels, in spite of government's efforts to make the activity more commercialized. So far, rice production is mostly a primary activity; that is, inputs such as fertilizer, pesticides, as well as improved tools are not significantly used. Nevertheless, potentials for improving both rainfed and irrigated rice production are not lacking. But in the short-run, prospects for a large increase in rice production

Table 6.1

Rice Production Techniques in Senegal

Production Technique	Collection	Milling Technique Used	Distribution Center	Net Private Profit-ability	Net Social Profit-ability
Irrigated Agriculture					
Matam Village Holders	None	Hand Pounding	Home Consumption	21.25	24.29
	Public Agency	Large Public Mill	Official Channels, St. Louis	22.47	-13.35
	Public Agency	Large Public Mill	Official Channels, Dakar	22.47	-17.49
Nianga Project	None	Hand Pounding	Home Consumption	16.55	6.36
	Public Agency	Large Public Mill	Official Channels, St. Louis	17.83	-28.71
	Public Agency	Large Public Mill	Official Channels, Dakar	17.83	-32.85
Delta/Boudoum Project	Public Agency	Large Public Mill	Official Channels, St. Louis	4.16	-62.02
	Public Agency	Large Public Mill	Official Channels, Dakar	4.16	-66.15
Rainfed Agriculture					
Improved Swamp Rice	None	Hand Pounding	Home Consumption	16.46	13.40
	Informal Channel	Small Millers	Informal Channels, Ziguinchor	18.02	13.42
	Public Agency	Large Public Mill	Official Channels, Ziguinchor	18.02	-3.59
	Public Agency	Large Public Mill	Official Channels, Dakar	18.02	-12.84
Water Control Swamps	None	Hand Pounding	Home Consumption	33.02	16.67
	Public Agency	Large Public Mill	Official Channels, Ziguinchor	34.57	2.03
	Public Agency	Large Public Mill	Official Channels, Dakar	34.57	-7.21
Rainfed Animal Traction	None	Public Agency	Hand Pounding	32.65	26.55
	Public Agency	Large Public Mill	Official Channels, Ziguinchor	34.21	11.92
	Public Agency	Large Public Mill	Official Channels, Dakar	34.21	2.67
Traditional Swamps	None	Hand Pounding	Home Consumption	-0.42	-4.93

Source: This table is presented by A. Hasan Tuluy.

are very slim. The arguments that increases in price offered to farmers will boost significantly the domestic supply of rice appear to be misleading. As John Mellor[1] nicely puts it, "It is important to keep perspective on the role of price policies.... They are basically a palliative, designed to lessen the unpleasant symptoms of an underlying problem, while constructive policies for fostering a stream of technological change can be brought into play and have their effect." Thus, if the reduction of the need to import rice is to be undertaken through an increase in local production, an important element is to increase agricultural productivity. This calls for long-term agricultural research to improve farming practices, to make available relevant technological packages, etc. Not least important is the need for better management of LDAs which supervise a large number of rice production schemes.

In the medium term, however, giving more priority to rainfed agriculture for rice production--particularly in the Casamance region--could yield good results. Presently, seven rice production techniques exist in Senegal (see Table 6.1), out of which three are irrigated schemes. Using both private and social profitability measures, the rainfed schemes appear to perform better.

This implies that more careful consideration should be given to the allocation of scarce public financial resources between rainfed and irrigated agriculture for rice. Despite the fact that the irrigated schemes in the North could provide greater employment opportunities than rainfed cultivation in the Casamance region, from an economic standpoint, the returns from irrigated rice do not appear to be very attractive.

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[1] John Mellor: "The Functions of Agricultural Prices in Economic Development," Indian Journal of Agricultural Economics, 1968, pp. 23-37.

Because, at least from a long-run point of view, a country can under-take only what it can afford, the social benefits accruing from increas-ed employment possibilities due to the irrigation schemes in the North should be evaluated in light of the economic returns of those projects.

6.3 Government Policies

In the econometric model presented in Chapter 4, the effects of government intervention in the rice sector were patterned through the public determination of domestic prices. The results of the model show that for imported rice, most of the variation in world prices were transmitted domestically. Moreover, in real terms, the government's domestic price stabilization policy has not been successful. Also, the model has shown the foreign exchange demand elasticity of the imports of rice as low as .04. This means that a 1 percent decrease in the coun-try's export earnings would lower the imports of rice by only .04 per-cent. Thus, in case of large shortfalls in the country's foreign ex-change earnings, a relatively high priority is given to the imports or rice, possibly at the expense of other capital goods whose imports are crucial for a sustained economic growth. However, enough evidence is not found for the government's bias against the imports of capital goods, so that the argument that the government's import policy has hindered economic growth cannot be strongly assessed.

From the results of our econometric model, the projected demand for consumption of rice in 1990 is as high as 712,416 tons. Should the government's policy in the rice sector change, this figure could be sig-nificantly reduced.

In the short and medium terms, policies in the rice sector should concentrate on the promotion of potential substitutes for rice, such as

millet-sorghum and corn. Presently, the cost of imported rice for urban consumers seems to be below that of couscous.[2] A study carried out by FAO in 1976 in Senegal[3] had shown that 1,000 calories derived from consumption of broken rice and couscous cost to the urban consumers 28 CFA and 42 CFA, respectively. Moreover, the study reported that 10 grams of protein from consumption of rice and of couscous would cost 10.2 and 16.7 CFA, respectively. These findings could be a major factor explaining the presumed urban consumers' bias in favor of rice consumption. So far, there is no evidence that differences in taste between rice and couscous have a significant impact on consumers' preferences. Thus, the promotion of millet-sorghum and corn can have great prospects as substitutes for rice. This calls for research to increase productivity at the farm level and improve marketing facilities for local cereals. As part of the policy, means should be found whereby farmers' incomes could be stabilized as much as possible.[4] It is interesting to note that in most LDCs, the question of guaranteeing a minimum level of income to farmers is hardly raised; however, in international debates, one major revendication of LDCs' representatives is the stabilization (or a minimum guarantee) of their country's export earnings!

From a long-term perspective, it is likely that a gradual improvement of the agricultural sector could largely slow the current rates of urban migration which, from the results of our model, is the major cause of the high growth of imports of rice.

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[2]Couscous is a traditional consumer good derived from the processing of millet-sorghum or corn.

[3]FAO, Rapport de Mission, Rome, September/October 1976.

[4]See David Trechter on problems and issues of programs designed to stabilize farmers' incomes.

APPENDIX A

Table A.1

Rice Production, Rice Consumption, Imports of Rice, and Rainfall Level

Year	Rice Production (Metric Tons)	Rice Consumption (Metric Tons)	Imports of Rice (Metric Tons)	Rainfall Level (Centimeters)
1960				
1961	68,000	177,785	109,785	95
1962	84,000	202,137	118,137	78
1963	90,000	190,770	100,770	87
1964	106,000	290,490	184,490	86
1965	109,000	288,221	179,221	106
1966	125,000	284,288	159,288	114
1967	125,000	278,438	153,438	102
1968	135,000	320,161	185,161	100
1969	59,000	204,901	145,901	55
1970	141,000	260,237	119,237	110
1971	99,000	286,510	187,510	73
1972	108,000	277,905	169,905	90
1973	44,000	235,968	191,968	55
1974	64,000	271,195	207,195	57
1975	113,000	215,125	102,125	80
1976	116,000	360,508	244,508	60
1977	118,000	366,018	248,018	65
1978	63,000	301,996	238,996	50
1979	140,000	491,860	351,860	90

Source: Direction de la Statistique, Ministry of Plan, Central Bank, Ministry of Finances.

Table A.2

Price Indexes, Nominal Producer Prices of Rice and Peanut,
Consumer Price of Rice, and World Price of Rice

Year	Consumer Price Index	Import Price Index	Producer Price of Rice (CFA/kg)	Producer Price of Peanut (CFA/kg)
1960	.84		18	22
1961	.86	.47	18	22
1962	.90	.48	18	22
1963	.92	.47	20	21.5
1964	.96	.46	20	21.5
1965	.98	.45	21	20.58
1966	1.01	.51	21	20.58
1967	1.00	.54	21	21.68
1968	1.01	.42	21	17.60
1969	1.03	.39	21	17.95
1970	1.07	.37	21	18.40
1971	1.11	.43	21	21.17
1972	1.18	.49	21	23.1
1973	1.32	.64	25	23.1
1974	1.54	.84	30	25.5
1975	2.01	1.00	41.5	41.5
1976	2.07	.96	41.5	41.5
1977	2.28	1.00	41.5	41.5
1978	2.35	1.13	41.5	41.5
1979	2.57	1.22	41.5	41.5

Source: Service de la Statistique generale. Direction de la Statistique. Situation Economique du Senegal. For the import price index, data are taken from IMF, "International Financial Statistics, Yearbook, 1982."

Table A.3

Consumer Price of Rice, Implicit World Price of Rice, Gross Domestic
Product (GDP), and Exports. (All Figures are in Nominal Terms)

Year	Consumer Price of Rice (CFA/kg)	Value of Imports of Rice (Millions of CFA)	Implicit World Price of Rice (CFA/kg)	GDP (Billions CFA)	Exports (Billions CFA)
1960					43.160
1961	30	2,697	24.56	153.58	39.97
1962	30	2,949	24.96	162.37	40.74
1963	35	2,750	27.28	175.23	29.61
1964	35	4,920	26.66	187.99	32.57
1965	40	4,476	24.97	192.31	33.81
1966	40	4,331	27.20	206.56	36.80
1967	45	5,512	35.92	200.83	33.90
1968	45	7,048	38.06	216.53	37.40
1969	45	4,674	32.03	217.36	31.90
1970	40	3,335	27.97	240.10	42.20
1971	40	4,639	27.74	247.20	34.70
1972	40	4,252	·25.02	273.60	54.40
1973	60	9,519	49.59	278.20	43.20
1974	100	18,032	87.03	338.80	94.00
1975	80	6,050	59.24	406.40	99.10
1976	80	10,676	43.66	459.30	122.80
1977	80	11,263	45.41	480.90	163.90
1978	80	13,153	55.03	438.10	105.00
1979	80	16,451	46.75	511.50	133.40

Source: Direction de la Statistique (Senegal). Comptes Economiques.
BCEAD.

Table A.4

Population, Millet Production, and Millet Prices

Year	Urban Population	Total Population	Producer Price of Millet (CFA/kg)	Millet Production (Metric Tons)
1960				
1961	747,270	3,143,000	15	392,000
1962	764,980	3,211,000	16	407,000
1963	782,000	3,279,000	16	424,000
1964	911,000	3,351,000	16	478,000
1965	951,000	3,500,000	17	531,000
1966	993,000	3,576,000	17	554,000
1967	1,034,000	3,656,000	17	423,000
1968	1,082,000	3,738,000	17	655,000
1969	1,130,000	3,822,000	18	450,000
1970	1,180,000	3,956,616	17	635,000
1971	1,232,000	4,045,615	18	401,000
1972	1,286,000	4,137,168	17	583,000
1973	1,342,000	4,222,803	22	323,000
1974	1,401,000	4,430,700	22	609,000
1975	1,463,110	4,956,518	26	703,000
1976	1,527,480	5,085,388	30	621,000
1977	1,594,470	5,217,608	35	507,000
1978	1,664,860	5,381,000	35	421,000
1979	1,738,360	5,518,000	40	803,000

Source: Direction de la Statistique, Ministry of Plan.

APPENDIX B

APPENDIX B

B. Some Data Problems

Uma Lele, in her study, "Food Security for Developing Countries," found a correlation coefficient of less than .5 between two data series that presumably report the same information! There is no a priori reason to believe that data from the East African countries of her study are less accurate than data from West African nations. Therefore, the findings of this study are likely to be affected by a similar lack of accurate data. For this reason, the results should be interpreted as reflecting Senegalese rice import policy derived from available data.

In this study, two major problems were encountered with respect to the data used.

B.1 Incomplete Data

In Chapter V it was mentioned that the domestic consumer prices and the value of exports are deflated by the CPI and the import price index, respectively. For both deflators, the data series are not available for 1961/67.

For the CPI, two data series are published in Senegal. One for "European consumers" and another for "African consumers." The latter was used as a deflator in this study. The CPI for "European consumers" has a more complete data series. To derive CPI estimates for "African

consumers" between 1961/67, a regression was run between the two CPI for 1967/79, the CPI for "African consumers" being the dependent variable. Using the actual values of CPI for "European consumers" between 1961/67 and the coefficients of the regression equation, estimates of CPI for "African consumers" are derived for 1961/67.

For the index of import prices, a five-year moving average was used to substitute for the missing data. For example, the estimate of the import price index for 1965 was obtained by using the average import price index for the period 1966/1970.

Furthermore, lack of complete data precluded the use of the country's GNP as proxy for urban incomes.[1] Instead, the GDP was used; because the latter includes incomes of foreigners, the effect of urban incomes on rice consumption might have been underestimated.

Finally, the data on rice imports are not disaggregated to account for food aid. If the aid component on rice imports is important, then the coefficient estimates in the rice import equation could be biased.

B.2 Inaccurate Data

Because there is not a strong basis to believe that one particular source is more reliable than another, the main criterion for choosing among data sources was to select the most complete data series. The reason is that if, for example, two or more series are mixed, the resulting series is likely to be less accurate than each of its components. In other words, if one series is inaccurate, it might have more chance to be consistently inaccurate than a mixture of different series.

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[1] Recall that urban areas are defined as localities having more than 10,000 inhabitants. It is certainly not clear that in all localities that satisfy this definition, rice consumption patterns are relatively important.

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