BRAZIL'S WHEAT MARKET - A TRADE MODEL AND POLICY ANALYSIS

By

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PREFACE

It is somewhat ironic to be writing a dissertation concerned with the problem of too much food. Economics, after all, is the science that deals with the allocation of "scarce" resources. For the time being, Malthusian prophecies of food scarcities are wrong, at least from the perspective of the North American wheat farmer, without whom Malthus might have been right. The question today is the same as it was in the time of the mercantilists; what can we do to sell more goods abroad?

I wish to thank Dr. James Osborn and others in the Department of Agricultural Economics at Oklahoma State University for the invitation to become an apprentice in this exciting field of knowledge. The experience has been both stimulating and challenging and has provided the groundwork for what I expect will be a lifelong pursuit. I am particularly grateful to the department for their financial support and office space.

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CHAPTER I

INTRODUCTION

Problem Statement

In 1985 United States wheat growers suffered from unusually low real wheat prices and lower than usual share of world wheat exports. This decline is in part a result of increased world production and the emergence of new major producers. The competition for wheat exports has resulted in an increasingly complex market in which technological and economic efficiency alone do not guarantee market share. Non-price competition involves factors other than price per bushel such as government policies that impact trade in both the exporting and importing countries. In addition, macroeconomic conditions and currency rates play an important role in determining the volume of wheat exports and have affected wheat growers in the wheat producing states.

Oklahoma is one of the major wheat producing states and is highly dependent on exports, especially of hard red winter wheat. Table I shows world wheat exports, U.S. wheat exports and U.S. wheat exports to Brazil.

TABLE I

WORLD WHEAT EXPORTS, U.S. WHEAT EXPORTS AND SALES TO BRAZIL

Year	World Wheat Exports a	U.S. Wheat Exports b	U.S. Wheat Exports to Brazil b	U.S. Share of World Wheat Exports	Brazil's Share of U.S. Wheat Exports
	millions of metric tons			percentage	
1965	63	18	.50	29	2.8
1966	57	22	1.22	39	5.5
1967	52	19	1.29	37	6.7
1968	47	18	1.02	38	5.7
1969	52	14	.92	27	6.7
1970	54	17	.62	31	3.6
1971	52	16	.81	31	5.1
1972	67	21	.54	31	2.5
1973	69	37	1.54	54	4.1
1974	66	25	.90	38	3.6
1975	64	32	1.77	50	5.6
1976	67	28	1.55	42	5.6
1977	63	26	.71	41	2.8
1978	73	36	2.84	49	7.9
1979	72	35	1.53	49	4.3
1980	86	36	2.01	42	5.6
1981	94	44	3.00	47	6.8
1982	101	41	2.55	41	6.3
1983	99	38	2.63	38	6.8
1984	103	42	2.59	41	6.1
1985	106	25	2.04	24	8.2

Sources: a Agricultural Outlook, World Agricultural Situation
b Foreign Agricultural Trade of the United States

Table I shows that world exports and U.S. exports have increased since 1965 with the U.S. maintaining, and slightly increasing its large market share. For the first five years of this period, U.S. share was 34 percent of total world wheat exports, while for the last five years it was 38 percent. However, in 1985 U.S. wheat sales fell to only 24 percent of world wheat sales, the lowest share during this period. Table I also shows that U.S. exports to Brazil increased during this period from 500,000 metric tons in 1965 to over two million metric tons in 1985. Over the same period, the percentage of total U.S. wheat sales accounted for by Brazilian wheat imports increased from 2.7 percent to 8.2 percent. Table I also shows that the volume of United States wheat exports to Brazil have tended to fluctuate from one year to the next. Because of rapidly growing population and economic growth, Brazil will likely continue to be a major market for U.S. wheat exports in the future.

Table II shows average wheat prices paid by Brazil over this period. These prices would also be representative of world wheat prices in general. Table II shows that the real price of wheat peaked in 1974 at 303 dollars per metric ton and that in 1985 the real price of wheat was one of the lowest during this period, 112 dollars per metric ton. This means that in 1985 U.S. wheat exporters had both unusually low wheat prices and an unusually low share of world wheat sales.

TABLE II

AVERAGE BRAZILIAN WHEAT IMPORT PRICES

Year	Average Wheat Import Price Paid by Brazil in Current dollars	Average Wheat Import Price Paid by Brazil in 1980 dollars
	dollars per metric ton	
1965	72.43	174
1966	70.47	164
1967	73.33	165
1968	69.49	150
1969	57.44	118
1970	53.04	103
1971	62.45	116
1972	67.85	121
1973	113.92	192
1974	195.23	303
1975	157.71	224
1976	147.17	198
1977	100.88	129
1978	124.88	148
1979	149.58	163
1980	187.12	187
1981	190.80	174
1982	180.39	155
1983	173.74	144
1984	155.11	124
1985	147.02	112

Source: Banco do Brazil

The Role of Policy in the Wheat Market

Most, if not all, grain importing and exporting countries can be characterized as having some form of governmental intervention in the production, transportation, consumption and international trade of grain. This intervention may take the form of price setting, subsidies, credits, or trade restrictions. In many countries, the government may have a monopoly on all grain purchases and sales. There may be long term agreements with particular grain exporting countries or policies designed to reduce imports and enhance exports. All these forms of governmental intervention in grain markets may be termed "policies".

Policy makers in grain exporting countries may not be able to fully identify export policy variables on both the microeconomic and macroeconomic levels. Often policy is aimed at supply, but not demand, or is not tailored to specific importing countries. The domestic policies of grain importing countries vary widely. Some have centrally planned economies with rigid long-term goals; in others, decisions are decentralized and market oriented. In the market oriented economies, decisions concerning imports are made by private firms. Import policies may vary widely between countries and within the same country over time. Often the policies of the exporting country interact with the policies of the importing country to influence trade.

Most trade models for wheat have focused on the exporting country and export policy in the context of the world wheat market or particular regions of trade. Fewer trade models have focused on the interaction between the policies of a single grain importing country and the policies of the exporting countries. Such a model could help policy makers tailor their grain programs more closely to fit individual trading partners.

Brazil is a major trading partner of the U.S. and a major grain importer, especially of wheat. The U.S. is Brazil's major source of wheat, and over time, Brazil has increased its imports of U.S. wheat. Brazil has a large trade surplus with the U.S. The U.S. share of Brazil's wheat imports has fluctuated considerably from as low as 27 percent in one year to as high as 66 percent (Table XVII).

The volatility of U.S. wheat exports to Brazil may be due to volatility in Brazilian wheat production, to variability in world wheat production and to political factors such as embargoes, cartels and wheat agreements. The variability of U.S. wheat exports to Brazil may also be due to price differences among the major wheat exporters as well as to a combination of U.S. and Brazilian policy variables such as export credit programs, price controls and agricultural credits. Brazil's macroeconomic variables such as levels of financial indebtedness, interest rates, inflation and foreign exchange reserves are other possible factors. Questions for U.S. policy makers are: (1) how

much of this variation may be attributed to policies in the U.S. and in Brazil, and (2) how can this knowledge influence future wheat trade.

Objectives

The purpose of this study is to analyze wheat trade between the U.S. and Brazil, especially with respect to policies in the two nations, and to build a model to explain the effects of policy variables and macroeconomic conditions. The study will examine price and non-price competition among wheat exporters to Brazil. One objective of the study is to explain U.S. share of Brazil's wheat imports. Price policies are policies that affect the price paid for wheat by the importing country while non-price policies are policies that influence wheat sales other than through price. In addition, the study examines the interaction of U.S. policy with policies or conditions in Brazil and the policies of other wheat exporting countries. By focusing on a single major wheat importing country, the study highlights certain trade relationships that are missing in models that attempt to model the whole world or groups of countries. Specifically, this study will:

(1) Describe Brazil's wheat policies, U.S. wheat export policies, and their impact on Brazil's wheat production, consumer demand for wheat and relative share to wheat exporting countries;

(2) Conceptualize wheat import demand in Brazil, including a literature review of previous models of Brazilian wheat imports, models of other countries and models of other commodities.

(3) Estimate the relationships suggested by the conceptual framework; and

(4) Use the estimated relationships to analyze the impact of policies among the countries who participate in Brazil's wheat market.

Procedures to be Used

A model of Brazil's demand for wheat imports based on previous studies in the literature and on the background material in Chapter II will be tested empirically with the data available using regression analysis. The model will attempt to explain what factors determine market shares among the three major exporters.

Organization of the Study

The remainder of the study is divided into four chapters. Chapter II examines Brazilian agricultural policy and macroeconomic conditions, especially as they affect wheat production and consumption. Chapter III examines the export policies of Brazil's three major wheat suppliers: the United States, Canada and Argentina. It

examines policies such as credit, price and market development, especially of the U.S. government. Chapter IV reviews previous studies of U.S. wheat export policies on countries such as Brazil. Chapter V develops the model to explain Brazil's demand for wheat imports and market share to the wheat exporters and gives the empirical results. The final chapter reviews the significant findings of the study, draws conclusions and suggests areas for future research.

CHAPTER II

BACKGROUND ON BRAZIL

Brazil is a major importer of U.S. wheat. In 1985, Brazil's wheat imports accounted for over 8 percent of total wheat exports of the United States (Table I). Brazil has dramatically increased its wheat production since 1967. At the same time, total wheat consumption increased from 2.4 million metric tons in 1965 to a peak of 6.8 million metric tons in 1980, increasing in each of those 16 years, as shown in Table III. One reason for this increase is that per capita wheat consumption increased steadily from 28 kilograms per capita per year in 1965 to 55 kilograms per capita per year in 1980, almost a twofold increase, and then began to decline (Table III). Brazil has historically depended on imports for the bulk of its wheat supply. Although the percentage of total consumption supplied by imports is now 50 to 70 percent, on average, in the 1960's, it was generally over 80 percent. Table III shows that wheat imports increased from 1.9 million metric tons in 1965 to a peak of 4.6 million metric tons in 1980.

TABLE III

BRAZIL'S WHEAT CONSUMPTION AND IMPORTS

Year	Brazilian Wheat Consumption a	Brazilian Wheat Imports b	Imports as Percentage of Consumption	Per Capita Wheat Consumption a b
	1000 Metric Tons		%	kilograms/ year/capita
1965	2376	1902	80	28.42
1966	2447	2467	100	29.56
1967	2665	2433	91	30.96
1968	2866	2417	84	32.71
1969	2908	2307	79	32.04
1970	3039	1680	55	32.48
1971	3207	1727	54	33.42
1972	3578	2749	77	34.19
1973	3746	2062	55	37.43
1974	4200	2165	52	39.46
1975	4422	3070	69	41.41
1976	5052	3163	63	45.98
1977	5694	2844	50	49.47
1978	5694	4200	74	50.27
1979	6072	3780	62	51.00
1980	6802	4599	68	55.00
1981	6098	4000	66	48.00
1982	6035	4105	68	46.00
1983	5987	4291	72	45.00
1984	6327	4503	71	46.00
1985	6200	3468	56	44.00

Source: a Fecotrigo Institute of Brazil
b Tomasini Institute of Brazil

Description of Brazilian Agriculture

Wheat productivity in Brazil is low and varies considerably from year to year. Ecological conditions such as pests and diseases make wheat a difficult crop to produce. Soil conditions do not favor wheat, and flooding is a major problem that contributes to large variations in yield in spite of efforts to encourage production in drier areas. Much of Brazil's wheat growing land is characterized by extreme moisture in the rainy season and extreme aridity in the dry season.

Wheat requires substantial technological inputs and involves high risk. It is an off-season crop and is almost always double-cropped with soybeans where soybeans are the main in-season crop. Since there is some overlap in seasons, double-cropping reduces the productivity of both crops. Some of the high variability in wheat production is explained by this factor since farmers often may choose to exclude wheat and concentrate on soybeans. Therefore, it would be reasonable to expect that wheat production is influenced by soybean prices.

The unique aspects of Brazil's economy, political climate and agricultural policies warrant a detailed analysis of their impact on U.S. wheat imports. Historically, Brazil's agricultural economy has been characterized by a series of booms in a single agricultural commodity. Some examples are sugar, cotton, tobacco, cocoa, rubber, coffee and soybeans. Recently, a boom was

created when the government subsidized sugarcane production to promote alcohol fuel as a substitute for oil imports. Typically, each boom has created a profit advantage for the subsidized crop. This is due to the specialized investments made for the favored crop by the government. These investments may be for equipment, infrastructure, research and producer marketing associations. These specialized investments tend to perpetuate the boom crop until the next boom crop becomes dominant.

Table IV shows the changing mix of Brazil's crop production since the early 1950's.

TABLE IV

MIX OF CROP PRODUCTION

Crop	1952-1954	1966	1973	1977
	percentage of total crop value			
Wheat	3.3	2.5	3.5	2.8
Rice	13.6	14.2	10.2	7.5
Corn	12.6	13.3	11.9	10.0
Manioc	6.4	7.7	8.0	10.7
Oranges	1.3	2.0	3.0	3.5
Bananas	2.3	3.7	2.2	2.6
Soybeans	.2	1.4	12.9	17.3
Cocoa	2.5	1.6	2.3	4.2
Coffee	27.5	10.6	9.3	13.1
Sugarcane	6.2	10.8	7.4	8.5
Cotton	10.9	8.4	9.0	5.3

Source: The World Bank, "Brazil: A Review of Agricultural Policies" (1983)

Table IV shows that, compared with other crops, the value of wheat production was relatively constant. Since the mid 1960's, the trend has been towards export crop production relative to domestic food crop production. For example, while rice and corn became less important, soybeans, a major export crop, became more important. An exception is coffee which fell from 27.5 percent of total crop value in 1952-1954, to 13.1 percent in 1977. Table V shows the indices of real prices received by farmers from 1966 to 1980 for wheat, coffee, sugar cane, manioc, rice, cocoa and corn. Of the major Brazilian crops, wheat is the only crop for which real price received by the farmer fell from 1966 to 1980.

Since 1973, the major economic concerns have been inflation, unemployment and balance of payments. The Brazilian Government has pursued the goal of lower food prices because of the perception that lower food prices will lessen inflation. This goal has resulted in a policy aimed at expanding food production. Subsidization of consumer prices is another method used to lower food prices. Expanding food production is also perceived to alleviate unemployment because farm workers make up a large percentage of the labor force in the Brazilian economy. Import substitution has long been a major policy in Brazil. The objective of import substitution has been to promote Brazilian self-reliance and to promote a balance-of-payments surplus. An example of import substitution

occurred after the 1973 oil price increase. A major program was instituted to encourage sugarcane production on a massive scale. Sugar cane was used to produce more methyl alcohol as a fuel substitute for imported oil. Over half of the cars, trucks, and buses in Brazil were modified to burn methyl alcohol instead of gasoline.

TABLE V

NATIONAL INDICES OF REAL PRICES RECEIVED BY FARMERS, SELECTED CROPS 1966-1980 *

Year	Wheat	Coffee	Sugar Cane	Manioc	Rice	Cocoa	Corn
1966	100	100	100	100	100	100	100
1967	94	86	88	125	101	91	102
1968	90	102	95	123	94	136	87
1969	90	126	99	123	83	175	99
1970	87	187	103	143	74	117	100
1971	79	166	95	180	100	82	104
1972	74	182	93	181	107	106	119
1973	76	254	95	189	98	198	140
1974	91	253	105	195	123	235	142
1975	104	275	129	232	154	165	149
1976	94	518	133	420	101	260	144
1977	87	649	127	542	85	507	113
1978	89	410	124	462	109	367	142
1979	78	350	123	350	124	308	152
1980	66	313	132	326	115	222	156

* Annual averages deflated by General Price Index, 1966=100

Source: Getulio Vargas Foundation

Other import substitution policies include exchange rate controls, export controls and price controls. Exchange rate controls restrict exports by overvaluing the exchange rate on Brazil's monetary unit, the cruzeiro. Export controls include export taxes, quotas and prohibitions. Price supports on food items, such as wheat, tend to encourage food production for the domestic market to reduce food imports. Other policies that help compensate farmers include subsidized interest rates and tax advantages. Policies to expand the agricultural base such as road construction into the frontier and farmer relocation programs also are intended to increase food production.

Subsidized credit and subsidized fertilizer tend to increase agricultural output. Other policies promote imported agricultural inputs such as improved genetic strains and farm equipment. Subsidization of manufactured exports promotes exports of processed agricultural products. Subsidized credit is the primary policy instrument for promoting sectoral growth and redistributing income among sectors.

The oil price increase of 1973 was an exogenous shock to Brazil's economy that accelerated inflation and trade deficits. In response, Brazil's government tightened import restrictions and increased subsidies on manufactured exports to improve the balance of payments. At the same time, price controls on consumer items were widened and

some agricultural exports were restricted to contain the rise of urban living costs. Furthermore, credit subsidies were increased to help compensate the agricultural sector, and minimum price supports appeared on certain crops. These measures resulted in greater government control over which crops were produced and in which areas of the country they were produced (mainly the south and southeast). As a result of some of these policy changes, exports shifted in favor of manufactured goods instead of the agricultural commodities that had been favored in the past.

In the late 1970's, the emphasis shifted back to agricultural commodities because of (1) the fear of rising trade barriers against Brazil's manufactured exports, (2) Brazil's increasing debt burden, and (3) the 1978 and 1979 crop failures. Increasing agricultural output was seen as the best hope for improving export earnings and to decrease domestic inflation in food prices. Increased agricultural output also would help pay off the foreign debt and would reduce oil imports by substituting alcohol from sugar cane grown in Brazil for imported oil.

Another reason for the emphasis on agricultural production in the late 1970's was to create more employment. The Third National Development Plan (1980-1985) emphasized the creation of new employment in agriculture as a way to reduce both rural and urban poverty. Agriculture directly employs 30 percent of

Brazil's labor force. The primary policy tool in this plan was to be through increased use of agricultural credits.

In 1979 most price controls on agricultural products were removed, and minimum price supports were extended to increase incentives. Also, legislation was introduced, and some enacted, to reform land taxes. The purpose of this legislation was to discourage the wasteful use of farm land by large land holders by basing the tax rate on agricultural productivity per hectare.

Agricultural exports have grown an average of 17 percent per year since 1965 and have accounted for two-thirds to three-fourths of total exports since 1945. Most of the increase in agricultural output has come through increasing the land base rather than the yield per acre. However, the marginal cost of increasing the agricultural base rises as the frontier is pushed forward, as distance to markets and agricultural inputs increase and as more infrastructure is required.

The expansion of wheat area harvested in Brazil has been dramatic. The average annual rate of expansion was 15 percent from 1965 to 1979, after which it declined (Table VI). One reason for the expansion is that wheat is commonly rotated with soybeans during the off-season so it is a production complement. As the soybean acreage harvested rapidly increased, so did wheat acreage harvested. Soybean production boomed as it became a principle export crop. During the 1960's and 1970's,

soybean acreage increased an average of 31 percent per year. The wheat crop's dependence on changes in the soybean market resulted in great variations in area harvested and in yield. Another reason for the great variation in wheat yield is the unpredictable variation in rainfall that can cause flood damage.

Table VI shows the fluctuations in Brazil's wheat acreage harvested and yield. The large fluctuation in yield and area harvested explains the large variation in domestic production and consequently may explain some of the large variation in wheat imports. Brazil's wheat crop may be considered a production complement to Brazil's soybean crop. Wheat and soybeans are rotated with each other at six month intervals. The soybean crop fixes nitrogen in the soil, the wheat crop depletes it. Soybeans are a principle export crop, wheat is not exported but is a staple domestic food commodity. Production decisions for wheat may depend on the price and area harvested of soybeans in the previous time period.

Tables VI and VII compare the growth rate of wheat area harvested with soybean area harvested in Brazil from 1965 to 1985. While wheat area harvested grew impressively from approximately .8 million hectares in 1965 to over 2.6 million hectares in 1985, soybean area harvested grew much more rapidly. Table VII shows soybean area harvested, yield and production from 1965 to 1985. Soybean area harvested was less than wheat area harvested in 1965, .4

million hectares. However, by 1973 it had surpassed wheat area harvested, and by 1985 it had grown to over 10.1 million hectares, almost four times the hectares planted in wheat.

TABLE VI

BRAZILIAN WHEAT AREA HARVESTED, YIELD AND PRODUCTION

Year	Wheat Area Harvested	Yield	Production
	thousands of hectares	kg/hectare	thousands of hectares
1965	767	760	585
1966	717	860	615
1967	831	760	629
1968	970	880	856
1969	1407	980	1374
1970	1895	970	1844
1971	2269	886	2011
1972	2320	424	983
1973	1820	1065	1938
1974	2471	1157	2859
1975	2931	610	1788
1976	3548	909	3226
1977	3153	655	2066
1978	2801	956	2677
1979	3831	763	2924
1980	3122	865	2702
1981	1920	1151	2209
1982	2825	644	1820
1983	1879	1190	2237
1984	1742	1139	1983
1985	2658	1598	4247

Source: Food and Agriculture Organization of the United Nations, FAO Production Yearbook, years 1965-1985

Soybeans have a higher and more consistent yield than wheat (Tables VI and VII). This may indicate that they are more suited to Brazil's growing conditions. For these reasons, soybeans may currently be more important economically to Brazil's farmers than wheat.

TABLE VII

BRAZILIAN SOYBEAN AREA HARVESTED, YIELD AND PRODUCTION

Year	Soybean Area Harvested	Yield	Production
	1000 hectares	kg/hectare	1000 metric tons
1965	432	1210	523
1966	491	1210	595
1967	612	1170	716
1968	722	910	654
1969	906	1170	1057
1970	1319	1140	1509
1971	1589	1396	2218
1972	2274	1612	3666
1973	3300	1526	5035
1974	5143	1531	7876
1975	5824	1699	9892
1976	6416	1750	11227
1977	7070	1770	12513
1978	7778	1226	9535
1979	7321	1360	9959
1980	8774	1727	15156
1981	8485	1765	14978
1982	8202	1562	12810
1983	8137	1792	14582
1984	9421	1650	15541
1985	10153	1800	18278

Source: Food and Agriculture Organization of the United Nations, FAO Production Yearbook, years 1965-1968

Brazil's Demand for Wheat

Why does Brazil continue to import so much wheat given the dramatic growth in domestic wheat production? The answer lies in demand. While soybeans are primarily an export crop, wheat is a domestic food crop. Per capita consumption of wheat, as shown in Table III, has increased while that of other staple foods such as corn, rice and manioc has remained the same or decreased. Farm subsidies and price ceilings on retail food have kept food prices stable even though the demand for food has increased with increases in living standards and population. From 1965 to 1985, output of food crops did not keep up with demand. Table VIII shows per capita income and population in Brazil. During the period 1965 to 1985, population grew steadily from 81 million to 136 million while per capita income grew from 703 dollars per capita (in constant 1980 U.S. dollars) to 1900 dollars per capita in 1985. This represents an average annual compound rate of economic growth of 7.47 percent. Table VIII also shows national income in billions of cruzeiros, with no adjustment for inflation. Along with the high rate of economic growth was the high rate of inflation of the cruzeiro.

While per capita income increased, retail food prices were relatively stable. This may be attributed, in part, to the policies described earlier. At the same time, in trying to keep up with demand, the government steadily increased prices received by farmers. Table IX shows the

relative growth of producer prices and retail food prices in Brazil from 1966 to 1980.

TABLE VIII

BRAZIL'S POPULATION AND PER CAPITA INCOME

Year	Brazil's Population	National Income	Per Capita Income *
	in millions	billions of Cruzeiros	1980 U.S. dollars
1965	81.01	42	703
1966	82.93	60	686
1967	85.24	81	668
1968	87.62	115	778
1969	90.07	153	806
1970	95.52	184	746
1971	97.85	245	828
1972	99.92	324	924
1973	102.40	454	1119
1974	104.94	665	1257
1975	104.94	944	1344
1976	107.54	1518	1488
1977	110.21	2323	1550
1978	112.94	3498	1641
1979	115.74	5845	1752
1980	121.29	12125	1897
1981	124.02	23346	1737
1982	126.81	48225	1773
1983	129.66	120268	1787
1984	132.58	386968	1895
1985	135.65	1298248	1900

* Per capita income was calculated by converting column two into 1980 U.S. dollars and dividing by column one

Source: The International Monetary Fund, International Financial Statistics, 1986

TABLE IX

REAL FOOD PRICE INDEX, 1966-1980

Year	Producer prices food crops	Retail food prices Sao Paulo
	1966=100	
1966	100	100
1967	95	96
1968	88	94
1969	99	97
1970	101	95
1971	111	97
1972	114	100
1973	143	104
1974	139	104
1975	150	105
1976	188	100
1977	186	97
1978	175	99
1979	163	101
1980	178	92

Source: The World Bank, "Brazil: A Review of Agricultural Policies" (1983)

Description of Brazilian Policy Variables

The Brazilian economy can be characterized as being heavily influenced by government intervention. Edward Schuh (1983), former president of The World Bank, describes it by writing:

> Brazil represents the epitome of autarchic development, having pursued import-substituting industrialization policies with a particular vengeance for approximately 30 years. As a consequence of those policies it has one of the most closed, if not the most closed economy of the world.

Some of the policies that are most relevant to wheat trade include agricultural credits, wheat subsidies to producers and consumers, fertilizer policies and tax policies.

Agricultural Credit Program

Most of the agricultural credit, 65 percent, is provided by Bank of Brazil. The three categories of credit are short term loans to cover production costs, long term investment loans and marketing loans associated with the minimum price program. These categories represent 45, 29 and 26 percent, respectively, of the total.

Production loans are loans offered to farmers ahead of the planting season to help farmers acquire the necessary inputs such as fertilizer, machinery, seed and fuel to plant their crops. It is one way the government compensates farmers for the effects of price ceilings and export controls as well as providing an incentive for

increasing production. Production loans grew an average of 18.5 percent per year from 1969 to 1979. Table X shows the growth of production loans from 1969 to 1979. As an indication of the size of the agricultural credit program, in 1975 the amount of agricultural credit exceeded the value of agricultural production.

TABLE X

INDEX OF THE GROWTH OF PRODUCTION LOANS AND VALUE OF AGRICULTURAL OUTPUT 1969-1979

Year	Production Loans	Value of Agricultural Output
	1969=100	
1969	100	100
1970	124	100
1971	143	116
1972	178	126
1973	245	159
1974	312	183
1975	445	191
1976	462	213
1977	450	256
1978	430	250
1979	532	268

Source: The World Bank, "Brazil: A Review of Agricultural Policies" (1983)

Until 1979, the level of production credit a farmer could receive was linked to the minimum price support on the crop, P, and derived by the formula:

$$C = AYBP$$

where C = Credit amount

A = Area planted

Y = Average yield for crop and region

B = Policy coefficient

P = Minimum price for crop

Beginning with the 1979/1980 crop year, the amount of production loans was entirely a function of average production cost for the crop and region. Usually the farmer can borrow up to 100 percent of expected production cost. The Bank of Brazil estimates that 31 percent of Brazilian farmers received credit in 1979 as a growing number of farmers were being reached in outlying areas and the number of loan contracts was increased. These changes accounted for the large jump in production loans from 1978 to 1979 as shown in Table XI.

To give an idea of the amount of subsidization on the loans, the interest charged in 1979 was only 13 to 21 percent. This interest rate compares with an inflation rate of 77 percent for the same year. For the 1979/1980 crop, the rate of subsidization was tied to the inflation rate for the first time. The formula used was:

$$F = a \times ORTN + i$$

where F = financial charge

a = coefficient set annually by government as a policy variable
ORTN = inflation index used by government

i = nominal interest rate

The government used the coefficient a as the policy tool for controlling the amount of credit subsidization. For example, in 1980, a was fixed at .45 for agricultural credit. At the same time, the percentage of production costs financed was tied inversely to the income of the farmer, between 60 and 100 percent, and fertilizer credit rates were increased from zero to the same rate as other production credits. Also, subsidies on investment credits were limited to smaller machinery and equipment.

Table XI shows the distribution of production credit by crop as well as the percentage of gross value of crop output in 1977. It is interesting to note that wheat received the largest infusion of subsidized credit relative to value of output of all the crops. In part, this may be due to the fact that wheat farms tend to be larger than, say, manioc or black bean farms. As mentioned previously, the amount of credit offered is partially determined by the amount of land planted. Also, there is an incentive to over report the area planted in crops such as wheat and export crops which have more favorable credit terms and then divert the credit to other crops or to non-agricultural uses. Still, these figures point to the desire of Brazil's government to encourage domestic wheat production.

TABLE XI

DISTRIBUTION OF CROP PRODUCTION CREDITS 1975-1979

Crop	Percentage of production credit by crop					Percentage of total crop value by crop
	1975	1976	1977	1978	1979	1977
Wheat	13	13	11	11	10	3
Rice	18	16	16	13	14	8
Corn	11	11	8	9	10	10
Manioc	0	1	1	1	2	11
Black beans	1	2	3	3	3	6
Soybeans	18	20	20	20	21	17
Cocoa	1	1	1	2	1	4
Coffee	10	11	13	12	13	13
Sugarcane	11	10	9	9	7	9
Cotton	5	7	8	6	6	5
Other	12	8	10	14	13	14

Source: The World Bank, "Brazil: A Review of Agricultural Policies" (1983)

The growth of the crop production credit program has had far reaching consequences for Brazil's economy. The immense size of the subsidies has contributed to monetary expansion and inflation and pushed up interest rates. The World Bank suspects that much of the credit is diverted to other sectors of the economy or lent back to the government at higher interest rates (The World Bank, 1983). The crop production credit program has redistributed income within the agricultural sector since only a minority of farmers

receive the credits. Those who do not receive production credits get lower prices for their crops than they would if the production credit program did not exist. This is because they must compete with farmers who are heavily subsidized by the credits and therefore can sell their products at a lower price.

Finally, the crop production credit program has redistributed resources among the various crops in two ways. First, the crops that receive more credit can bid resources away from crops with less credit. Second, as the output of all crops increases as a result of increased credit, crops with high price elasticity of demand will maintain price at a higher level than more price inelastic crops. For example, wheat is relatively price elastic because of the government's purchasing monopoly which absorbs excess production. The export crops also have a relatively high price elasticity of demand. This is because Brazil is only one among many countries that export agricultural products so excess production in Brazil can be absorbed by the world market. As production increases, these crop prices will fall less than the prices of crops that are relatively price inelastic.

Another effect of subsidized credit is increased land prices. Land prices increase for the following reasons:

(1) To qualify for credit, a farmer must own land; more owned land qualifies the farmer for more credit. This leads to landowners buying

more land than they can productively farm or buying land with marginal farming potential in order to qualify for the production credits. In some cases, this has led to farm land prices which are above their normal economic rent value.

(2) Land is a relatively supply inelastic input. One effect of the subsidized credit program is to increase the demand for factor inputs. Therefore, as the demand for inputs increases, the price of land rises relatively faster than the price of other inputs.

The Minimum Price Program

The minimum price program was designed to increase production by reducing risk and the uncertainties of price variability. It covers 42 commodities but not wheat, sugar, coffee or cocoa.

Wheat Subsidy Program

The Brazilian government buys all domestically produced wheat and all imported wheat. The importing agency is the Junta Deliberative do Trigo (Wheat Board) which is located in the Bank of Brazil. There are no private wheat companies so the government has monopoly control over prices and regularly decides prices to producers and consumers.

Producers usually receive a price higher than the international price. The producer subsidy is defined as the difference between the price received by producers and the international delivered wheat price, including cost and freight (CIF), times the amount domestically produced.

After buying the wheat from the producers, the government sells the wheat at a government set price to privately owned mills. The mills process the wheat and sell it to retailers. The mill price is the price paid by retailers to the mill. The government also sets the margin that the mills charge to process the wheat, usually 15 percent of the price to the retailers. Thus, the government completely controls the price paid by retailers. The mill price tends to be lower than the international price. The consumer subsidy is defined as the difference between the international cost and freight, CIF, price and the amount paid to mill operators by retailers, times the amount processed by the mills. Since the government buys and sells all domestic and imported wheat, these subsidies are clearly defined.

The effect of the consumer subsidy has been to increase quantity demanded which has led to greater wheat imports. One of the stated objectives of the consumer subsidy is to reduce inflation since wheat products make up 13 percent of food costs and 5.5 percent of general living costs. It also is intended to help people on low incomes, to redistribute wealth and to promote political stability.

The producer subsidy is intended to protect wheat farmers from fluctuations in the world price of wheat. It also is intended to protect wheat farmers from low consumer wheat prices and subsidies on other domestic crops and to promote domestic production in order to decrease wheat imports.

Table XII shows Brazil's domestic wheat price per ton including transportation and storage (column 1), the average CIF import price per ton including port and transport costs to the mill (column 2), and the government set price to the mills (column 3). During the study period 1965 to 1985, the producer price exceeded the average import price in every year except 1973 and 1974. In these two years international prices were unusually high because of a wheat shortage caused by large Soviet block imports. In every other year the Brazilian government subsidized their wheat producers. The producer price was over twice the average import price in 1983 and 1985 because of low world prices in those years.

Table XII shows that the real price of wheat paid by Brazilian consumers, as indicated by the mill price, declined steadily from 1965 to 1980 (column 3). Consumers paid a premium for wheat until 1973, paying a price higher than the average import price.

TABLE XII

BRAZIL'S DOMESTIC WHEAT PRICE, AVERAGE CIF IMPORT PRICE AND MILL DELIVERED PRICE 1965-1985 a

Year	Brazilian Producer Price (1)	Average Import Price (2)	Mill Price b (3)	ratios (1)/(2)	(1)/(3)	(2)/(3)
	1980 dollars/metric ton					
1965	285	174	204	1.64	1.40	.85
1966	251	164	198	1.53	1.27	.83
1967	223	166	192	1.34	1.16	.86
1968	227	150	166	1.51	1.37	.90
1969	213	118	150	1.80	1.42	.79
1970	190	103	168	1.84	1.13	.68
1971	176	116	164	1.52	1.07	.71
1972	167	121	154	1.38	1.08	.79
1973	185	192	155	.96	1.19	1.24
1974	271	303	132	.89	2.05	2.30
1975	249	224	101	1.11	2.47	2.22
1976	224	198	96	1.13	2.33	2.06
1977	233	128	108	1.82	2.16	1.19
1978	220	148	93	1.49	2.37	1.59
1979	187	163	64	1.15	2.92	2.55
1980	225	187	42	1.20	5.36	4.45
1981	263	174	97	1.51	2.71	1.79
1982	191	155	113	1.23	1.69	1.37
1983	303	144	87	2.10	3.48	1.66
1984	245	124	92	1.98	2.66	1.35
1985	276	112	95	2.46	2.91	1.18

a The original data was given in 1977 Cruzeiros and converted into 1980 U.S. dollars.

b Price set to mills by the government. The government credited an additional 15 percent of this value to the mills, so the true cost to the mills was 15 percent less than this value.

Sources: 1, 2 Banco do Brasil
3 The World Bank

Table XII shows that the ratio of average import price to the mill price (column 7) was less than one until 1973. After 1973 the ratio stayed above one indicating a consumer subsidy. The consumer subsidy peaked in 1980 with a ratio of 4.45. The consumer subsidy has declined since then because (1) Brazil has implemented austerity measures to control its foreign debt; (2) world wheat prices have been low; and (3) the producer price was still being heavily subsidized leaving less funds to subsidize consumers.

Column 4 shows the ratio of the producer price to the average import price. It shows the ratio was above one, indicating a producer subsidy, in every year except 1973 and 1974. Since 1975 both producers and consumers have been subsidized. Column 5 shows the ratio of the producer price to the consumer price and is a positive indicator of the total subsidy to both producers and consumers. This ratio has consistently been greater than one, with a low of 1.07 in 1971 and a high of 5.36 in 1980.

Comparing columns two and three in Table XII, there is some evidence that when average import prices decreased, consumers paid more, but when average import prices increased, consumers paid less. From 1969 to 1970 the average import price of wheat fell from 118 constant U.S. dollars per metric tons to 103 dollars per metric ton, but the mill price rose from 150 to 168 dollars. Similarly, from 1976 to 1977 the average import price fell from 198 dollars to 128 dollars, but the mill price rose from 96

dollars to 108 dollars. On the other hand, when average import prices rose from 121 dollars in 1972 to 303 dollars in 1974, the mill price fell from 154 dollars to 132 dollars. It seems paradoxical that when international prices are low consumers pay more, but when international prices are high, consumers pay less. A possible explanation is that consumers help subsidize producers when world wheat prices are low. When world wheat prices are high, producers help subsidize consumers.

If wheat can be imported cheaply, the government uses funds saved in consumer subsidies to raise the producer subsidy. Studies have suggested, for example, that P.L. 480 wheat imports had a positive impact on Brazil's domestic wheat production (Hall, 1980). Revenues saved by importing cheap wheat were used to subsidize producers.

One reason why a country, especially a developing country, would encourage the domestic production of a commodity that could be imported more cheaply is because of a policy known as "import substitution". This is a development strategy used by many developing countries (Pearce, 1983). The theory behind import substitution is that a developing industry, in this case wheat production, needs governmental protection in order to grow and eventually be competitive with the more mature industry in the developed countries. This may lead to subsidies and trade barriers to help the domestically produced product. The aim of import substitution is to replace imports and

foster domestic production and hope that eventually the protected industry will be able to survive without government support. Pearce points out that other import substitution policies for manufactured goods tend to accelerate rural-urban migration. In order to redress this problem the Brazilian government may have included agricultural products in its import substitution policies.

In recent years, the Brazilian government has tried to reduce the consumer subsidy for wheat. For example, in 1983 the consumer subsidy was scheduled to be completely removed, but this action was postponed for political reasons until 1985 and again postponed. Table XIII shows the price of wheat flour and wheat substitutes in Brazil on November 4, 1983.

TABLE XIII

RETAIL PRICES OF WHEAT AND WHEAT SUBSTITUTES ON NOVEMBER 4, 1983

Commodity	Cruzeiros/Kg.
Wheat flour	250.00
Corn flour	370.00
Potatoes, White	430.00
Rice, long grain	440.00
Beans, carioquinda	500.00

Source: United States Department of Agriculture, Foreign Agricultural Service, Attache Report No. BR 3368

In spite of the reduction of the subsidy, wheat consumption did not fall. This may be because substitute products are still more expensive than wheat. One result of the consumer subsidy has been an increase in per capita consumption of wheat and a reduction in per capita consumption of wheat substitutes such as black beans, manioc and rice.

Fertilizer Policies

Since 1965, fertilizer consumption has grown 20 percent per year. This rapid growth in fertilizer consumption is due, in part, to the fact that commodity prices received by Brazilian farmers have increased faster than prices paid for fertilizer.

The price of fertilizer is set at the retail level by the government. Much of the volatility of international fertilizer prices is absorbed by the retailer's profit margin. At the same time, the farmer pays, on average, more than the world price and, in this way, helps to subsidize the domestic fertilizer industry. For example, a Brazilian farmer typically will pay from 50 percent to 100 percent more than an American farmer for a given fertilizer. As world fertilizer prices decline, this differential increases, and as world prices increase, the differential decreases. Thus, the Brazilian government keeps domestic prices relatively stable.

Table XIV compares prices paid for fertilizers in Brazil relative to world prices. It shows the ratios between prices paid by Brazilian farmers and import prices for various types of fertilizers during 1978. This gives an idea of the relatively higher costs of domestic fertilizers in Brazil.

TABLE XIV

DOMESTIC COST TO BRAZILIAN FARMERS OF FERTILIZERS AND FERTILIZER INPUTS RELATIVE TO IMPORT PRICES, 1978

A. Fertilizers	Domestic/Imported Price Ratio
Superphosphate Simple	.89
Superphosphate Triple	1.64
Mono-Ammonium Phosphate	1.47
Di-Ammonium Phosphate	1.31
Urea	1.15
B. Fertilizer Inputs	
Phosphoric Acid	1.65
Phosphoric Rock	1.22
Ammonium	1.74

Source: Adapted from Instituto de Pesquisas Tecnologicas do Sao Paulo, Centro de Estudo de Fertilizantes, "Perfil tecnico Economico do Setor de Fertilizantes," Sao Paulo, 1979, p.114.

To compensate farmers for higher-than-world prices, the Bank of Brazil offers zero interest, six-month, fertilizer loans. Given the high rate of inflation in Brazil, the actual cost of fertilizer to the farmer is, on average, 20 percent less than without the loan since the farmers would be repaying the loans with inflated currency. In effect, the government subsidizes both the fertilizer industry and the farmer at the same time.

Tax Policies

Two major taxes, the rural land tax and the income tax are relevant policy variables affecting Brazilian agriculture. The rural land tax was designed to promote the efficient use of agricultural land. As modified in 1979, it exempts smaller farms while taxing at progressive rates as farm size increases. This tax partially offsets the effects of other policies such as the production credit program which, because the credits are based on acreage planted, disproportionately benefit large landholders.

The rural land tax can be increased or decreased according to the degree of land utilization and the efficiency of utilization as measured by yield per hectare. The maximum tax rate is 14 percent of the value of the land. One purpose of the tax is to discourage speculative land buying and thus promote the productive use of farm land. Since the amount of agricultural credit depends on the number of acres planted in a particular crop, and since

the credit interest rate is so heavily subsidized, a lot of agricultural land in Brazil is used inefficiently in order to claim a larger crop area. Another effect of the credit program has been to encourage land speculation, with the credits being used to buy more and more land. It favors farmers who already own large farms. Thus, the rural land tax is seen as both a way to promote the efficient use of farm land and as a way to partially redress the unequal advantages that the agricultural credit programs have given to large landholders.

The income tax is highly favorable to agricultural earnings charging only a flat rate of six percent, compared with 30 percent in other sectors of the economy. In addition, there are so many exemptions that most farmers pay no income tax at all (The World Bank, 1983).

Macroeconomic Variables

Much of Brazil's development has resulted from capital borrowed in international money markets. The larger the debt the more it is influenced by international interest rates and therefore by the macroeconomic policies of other countries. Table XV shows the size of Brazil's foreign debt from 1972 through 1983.

TABLE XV

BRAZIL'S FOREIGN DEBT

Year	Foreign Debt
	millions of 1980 U.S. dollars
1972	$ 8,048
1973	10,083
1974	13,750
1975	17,368
1976	23,828
1977	29,723
1978	40,242
1979	47,522
1980	51,458
1981	67,341
1982	83,205
1983	91,162

Sources: Statistical Abstracts of Latin America and Economist; Quarterly Economics Review of Brazil

Table XV shows that Brazil borrowed heavily in the 1970's and early 1980's. No doubt the rapid economic growth of 7.5 percent per year justified borrowing, especially during this period of rapid industrialization. As shown in Table XVII, the borrowing was also justified because of the increase in exports, especially manufactured exports. These exports would help repay the foreign debt. The reason for the concern over Brazil's increasing debt,

as well as that of other developing countries, was the unforeseen shocks that occurred in the world economy in the late 1970's and early 1980's. In 1979 the price of oil increased sharply. This resulted in more of Brazil's export earnings used to import oil and less available for debt repayment. At the same time, the demand for Brazil's manufactured exports declined as the world economy went into recession. According to the International Monetary Fund (IMF), trade among all countries in the world peaked in 1980 at 1.8 trillion U.S. dollars. World trade fell to approximately 1.6 trillion dollars by 1983, a decline of nearly 12 percent (World Watch Institute, p.18). World economic growth declined from 3.5 percent per year between 1973 and 1979, to only 1.7 percent between 1979 and 1983. This decline led to the decline in demand for Brazil's exports and hence in its ability to repay its foreign debt. At the same time, real interest rates increased during the 1970's and 1980's. This made debt repayment more difficult.

Table XVI shows the Cruzeiro/dollar exchange rate, inflation as measured by the Brazilian consumer price index and national income expressed in Cruzeiros. The high rate of inflation shown in Table XVI may be attributed to Brazil's expansionary monetary policy.

TABLE XVI

BRAZIL'S EXCHANGE RATE, CONSUMER PRICE INDEX AND NATIONAL INCOME

Year	Cruzeiro/ Dollar Exchange Rate	Consumer Price Index 1980=100	National Income in Billions of Cruzeiros
1965	1.90	1.4	42
1966	2.22	2.0	60
1967	2.66	2.7	81
1968	3.40	3.2	115
1969	4.07	4.0	153
1970	4.59	4.9	184
1971	5.29	5.9	245
1972	5.93	6.8	324
1973	6.13	7.7	454
1974	6.79	9.8	665
1975	8.13	12.7	944
1976	10.67	18.0	1518
1977	14.14	25.8	2323
1978	18.07	35.8	3498
1979	26.95	54.7	5845
1980	52.71	100.0	12125
1981	93.12	205.6	23346
1982	179.51	407.0	48225
1983	577.04	984.9	120268
1984	1848.03	2922.5	386968
1985	6200.00	9556.0	1298248

Source: International Financial Statistics
The International Monetary Fund

U.S. - Brazil Agricultural Trade

Table XVII shows the value of total trade and agricultural trade between Brazil and the United States from 1965 to 1985. Most of Brazil's agricultural exports to the United States consisted of coffee, cocoa and sugar; most United States agricultural exports to Brazil consisted of wheat and corn. Table XVII shows that the value of Brazilian agricultural exports to the United States in 1985 was about five times the value of agricultural imports from the United States, 2.3 billion dollars versus .47 billion dollars. At the same time, Brazil's total exports to the United States were approximately two and a half times its total imports from the United States, 7.5 billion dollars versus 3.1 billion dollars.

Brazil's exports to the United States changed fundamentally from being primarily agricultural in 1965, to being largely non-agricultural by 1985. While Brazilian agricultural exports to the U.S. constituted over three fourths of total exports in the late 1960's, they accounted for less than one third in the mid 1980's as Brazil became industrialized and expanded its exports to include manufactured goods.

TABLE XVII

VALUE OF TRADE, U.S.-BRAZIL, TOTAL AND AGRICULTURAL 1965-1985

Year	Brazilian Exports to the United States			United States Exports to Brazil		
	Total	Agricultural	A/T b	Total	Agricultural	A/T b
	millions of U.S. dollars a		%	millions of U.S. dollars a		%
1965	545	413	76	328	59	18
1966	603	484	80	565	101	18
1967	559	461	82	546	110	20
1968	671	564	84	705	88	12
1969	615	499	81	667	69	10
1970	670	536	80	838	68	8
1971	762	582	76	963	90	9
1972	932	660	71	1,235	68	5
1973	1,171	711	61	1,903	271	14
1974	1,672	1,031	62	3,067	240	8
1975	1,448	772	53	3,034	323	11
1976	1,722	966	56	2,780	255	9
1977	2,231	1,385	62	2,412	111	5
1978	2,789	1,537	55	2,953	534	18
1979	3,079	1,503	49	3,407	536	16
1980	3,686	2,019	55	4,306	680	16
1981	4,333	1,905	44	3,753	710	19
1982	4,171	1,495	36	3,380	526	16
1983	4,943	1,655	33	2,528	479	19
1984	7,208	2,111	29	2,599	508	20
1985	7,545	2,333	31	3,070	470	15

a Dollars are unadjusted for inflation

b A/T = percent agricultural exports of total exports

Source: Foreign Agricultural Trade of the United States

Table XVII shows that while Brazilian exports to the U.S. shifted from being predominantly agricultural to being predominantly non-agricultural, U.S. exports to Brazil became more agriculturally based. U.S. agricultural exports to Brazil grew after 1977 to at least 15 percent of total U.S. exports to Brazil. Table XXVII also shows that from 1968 to 1980, the United States had a balance of trade surplus with Brazil, but since then, there has been a widening deficit. This reversal in the balance of trade since 1980 is due, in part, to Brazil's large foreign debt which has caused a shortage of hard currency needed to buy foreign products. Brazil had an agricultural trade surplus with the United States during the entire period.

Table XVIII shows the relative importance wheat has in United States exports to Brazil. On average, wheat accounted for approximately 72 percent of the value of all United States agricultural exports to Brazil from 1965 to 1985 and 83 percent since 1981. Wheat averaged approximately 10 percent of total U.S. exports to Brazil from 1965 to 1985. After 1980, when the total value of U.S. exports to Brazil declined, the relative value of wheat exports increased to approximately 15 percent.

TABLE XVIII

VALUE OF UNITED STATES WHEAT EXPORTS TO BRAZIL RELATIVE TO OTHER AGRICULTURAL AND TOTAL EXPORTS

	Value of U.S. Exports to Brazil			Percentage of U.S. Exports to Brazil Consisting of Wheat	
Year	Total [a]	Agricultural [a]	Wheat [b]	Total	Agricultural
	in millions of U.S. dollars *			percentage	
1965	328	59	34	10.4	57.6
1966	565	101	88	17.9	87.1
1967	546	110	78	14.3	70.9
1968	705	88	75	10.6	85.2
1969	667	69	49	7.3	71.0
1970	838	68	33	3.9	48.5
1971	963	90	58	6.0	64.4
1972	1,235	68	33	2.7	48.5
1973	1,903	271	208	10.9	76.7
1974	3,067	240	214	7.0	89.2
1975	3,034	323	261	8.6	80.8
1976	2,780	255	233	8.4	91.4
1977	2,412	111	65	2.7	58.6
1978	2,953	534	359	12.2	67.2
1979	3,407	536	234	6.9	43.7
1980	4,306	680	321	7.5	47.2
1981	3,753	710	629	16.8	88.6
1982	3,380	526	461	13.6	87.6
1983	2,528	479	423	16.7	88.3
1984	2,599	508	398	15.3	78.3
1985	3,070	470	341	11.1	72.5

* Dollars are unadjusted for inflation

Sources: a Foreign Agricultural Trade of the United States
b Banco do Brasil

The United States is Brazil's largest supplier of wheat. Table XIX shows total Brazilian wheat imports as well as U.S. commercial and non-commercial exports for 1965 through 1985. Table XIX also shows the relative share of Brazil's wheat imports held by the United States. Although Brazil has become less dependent on imports as a percentage of total wheat consumption, the absolute amount of wheat imports substantially increased from 1965 to 1985. Table XIX shows that the U.S. share of Brazil's wheat imports increased from an average of 41.7 percent for the first 10 years of the study period, to 54.7 percent for the last 11 years. However, this share has fluctuated from less than one-third to over two-thirds of total Brazilian wheat imports.

Table XIX shows that the period in which the U.S. had the largest market share occurred in the early 1980's, possibly because of the U.S. grain embargo on the Soviet Union which resulted in Argentina shifting much of its exports from Brazil to the Soviet Union.

The volatility of U.S. wheat exports to Brazil may be due to the interrelationship of policy variables in Brazil, the United States, Argentina and Canada. Some examples are export credit programs, long term grain agreements, price policies and agricultural credits. Other possible factors are Brazilian macroeconomic variables such as levels of financial indebtedness, interest rates and inflation. In

addition, the price of U.S. wheat and the prices of Canadian and Argentine wheat may be important factors.

TABLE XIX

U.S. SHARE OF BRAZIL'S WHEAT IMPORTS

Year	Total Brazilian Wheat Imports	Commercial U.S. Wheat Sales to Brazil	P.L. 480 Wheat to Brazil	U.S. Share of Brazil's Wheat Imports
	------ 1000 Metric Tons ------			%
1965	1902	270	250	27
1966	2467	785	422	49
1967	2433	650	498	47
1968	2417	470	448	38
1969	2307	435	450	38
1970	1680	518	100	37
1971	1727	530	287	47
1972	2749	1189	0	43
1973	2062	1136	0	55
1974	2165	785	0	36
1975	3070	1980	0	64
1976	3163	1238	0	39
1977	2844	1673	0	59
1978	4200	2254	0	54
1979	3780	1255	0	33
1980	4599	2799	0	61
1981	4000	2650	0	66
1982	4105	2720	0	66
1983	4291	2376	0	55
1984	4503	2541	0	56
1985	3468	1683	0	49

Source: Tomasini, CNPT/EMBRAPA

Income Elasticities of Brazilian Food Commodities

Table XX shows the income elasticities for wheat and other staple foods in Brazil.

TABLE XX

INCOME ELASTICITIES OF VARIOUS FOOD COMMODITIES

Commodity	Elasticity
Wheat	0.30
Corn	0.25
Other Grains *	0.50
Rice	0.15
Beans (pulses) **	-0.20
Soybeans	1.40
Other oilseeds	-0.30
Beef	0.60
Poultry	0.80
Pork	0.40
Milk (fresh)	0.40
Eggs	0.50
Apples	0.80
Oranges	0.20
Bananas	-0.10
Manioc	-0.30
Sugar ***	0.20
Tomatoes	0.60
Onions	0.60

* Barley, oats, rye, sorghum

** Mostly black beans

*** For human consumption only

Source: USDA, Economic Research Service. Brazil - An Export Market Profile

Table XX shows that wheat has a relatively low but positive income elasticity of .30. This means that a one percent increase in income will increase wheat consumption by .3 percent. Soybeans have a higher income elasticity of 1.40. A few of the commodities, such as black beans, bananas and manioc have a negative income elasticity; as incomes increase, less of these commodities are consumed.

Summary

This chapter has described Brazil's agricultural sector in general and its wheat production sector in particular. Policy variables in Brazil that influence wheat production and consumer demand were identified. Still to be considered are U.S. policy variables and those of the competing wheat exporting countries, Argentina and Canada. A major area of further study will be credit policies and non-price competition: for example, interest rate competition among wheat exporters. Chapter III examines the export policies of the United States, Canada and Argentina.

CHAPTER III

BACKGROUND ON EXPORT POLICIES OF THE U.S., CANADA AND ARGENTINA

Brazil's three major wheat suppliers are the United States, Canada and Argentina, in order of total metric tons shipped between 1965 and 1985. There were also minor and sporadic wheat shipments from other sources such as France. Each supplier has unique supply characteristics and policy makeups that reflect the various economic, geographic and political idiosyncracies. Price differentials and market shares of the three suppliers vary markedly from one year to the next. These fluctuations are a result of the volatility of grain markets in general, with the random variable of weather conditions in different parts of the world affecting particular markets.

Like weather conditions, political variables are also of a random nature. For example, in 1980 the United States imposed a grain embargo on the Soviet Union. As a result, Argentina became a major wheat supplier to the Soviet Union that year and hence sold less to Brazil. This resulted in the U.S. and Canada selling more wheat to Brazil in 1980.

Furthermore, Brazil's domestic wheat supply is highly volatile. This volatility may influence total wheat imports as well as market share among the exporting countries. Brazil's wheat production and policy variables may have different effects on each of the wheat supplying countries. Also the impact of policies of the wheat supplying countries, such as price, may vary between countries. Price elasticity of Brazilian demand may vary between wheat supplying countries. This means that one supplier may be able to use price more effectively than another to increase market share while another country may be able to use non-price policies more effectively.

Table XXI shows Brazil's wheat imports from 1965 to 1985 and market share of the various wheat exporters. During that period, Brazil significantly increased its wheat imports from 1.9 million metric tons to 3.5 million metric tons, with a record of 4.6 million metric tons imported in 1980.

The principle commercial wheat supplier to Brazil until 1970 was Argentina. During the 1960's a number of different countries sold sporadic but significant amounts of wheat to Brazil's wheat market. Some of these countries included Italy, Spain, France, the U.S.S.R., Australia and Hungary. At that time the United States was supplying large amounts of wheat to Brazil under the Public Law 480 program (P.L. 480). This is a concessional sales program

that provides wheat to countries with low standards of living at low cost to the receiving country.

TABLE XXI

BRAZILIAN WHEAT IMPORTS BY MAJOR EXPORTERS

Year	Total	U.S.	PL480	Canada	Argentina	Other
			imports in thousands of metric tons			
1965	1,902	270	250	0	1,292	90
1966	2,467	785	422	0	1,060	200
1967	2,433	650	498	0	650	635
1968	2,417	470	448	0	1,064	435
1969	2,307	435	450	0	1,000	422
1970	1,680	518	100	300	762	0
1971	1,727	530	287	400	350	160
1972	2,749	1,189	0	300	1,200	60
1973	2,062	1,136	0	400	526	0
1974	2,165	785	0	1,300	80	0
1975	3,070	1,980	0	800	240	50
1976	3,163	1,238	0	810	1,055	60
1977	2,844	1,673	0	655	355	161
1978	4,200	2,254	0	1,221	441	284
1979	3,780	1,255	0	553	1,972	0
1980	4,599	2,799	0	1,800	0	0
1981	4,000	2,650	0	935	205	130
1982	4,105	2,720	0	1,250	0	135
1983	4,291	2,376	0	1,500	415	0
1984	4,503	2,541	0	1,500	462	0
1985	3,468	1,683	0	1,000	685	100

Source: Tomasini Agency, CNPT/EMBRAPA

Table XXI shows that the years 1970 and 1971 marked a major change in the Brazilian wheat market that continues

to the present time. Canada began supplying wheat to Brazil for the first time in 1970 and has remained a major supplier to the present time. Also in 1970, other importers dropped out of the market or became insignificant suppliers. That market situation has also continued to the present. In 1971 Argentina ceased to be the principle commercial supplier; that role shifted to the United States and continues to the present time. Also in 1971, the United States ended concessionary wheat shipments under the P.L. 480 program. Table XXI suggests that U.S. dominance in Brazil's wheat market in the 1970's and 1980's may have been facilitated by the P.L. 480 program. U.S. commercial sales to Brazil increased from 270 thousand metric tons in 1965 to a peak of 2.8 million metric tons by 1980.

Table XXI also reveals some of the effects of wheat agreements and embargoes. In 1979, the U.S. signed a major new wheat agreement with the Soviet Union. This agreement resulted in the diversion of some U.S. wheat from Brazil to the Soviet Union. This created an opportunity for Argentina to sell more wheat that year to Brazil. From 1978 to 1979, sales of U.S. wheat to Brazil fell from 2.25 million metric tons to 1.25 million metric tons, while Argentine sales increased from .44 million metric tons to 1.97 million metric tons. However, in 1980, the U.S. abrogated the Soviet agreement with an embargo. Argentina sold all its wheat that year to the Soviet Union and none to Brazil. From 1979 to 1980, sales of U.S. wheat to

Brazil increased from 1.25 million metric tons to 2.80 million metric tons, while Argentine sales fell from 1.97 million metric tons to 0. This condition continued in 1981 and 1982 with Argentine wheat sales to Brazil in those years only .2 million metric tons and 0 metric tons, respectively.

In 1970, Brazil began to buy wheat from Canada under multi-year agreements. Argentina has also signed long term wheat agreements with Brazil. Brazil has not negotiated long-term purchase agreements with the United States. Table XXII shows market share in the Brazilian wheat market among the United States, Canada and Argentina.

Table XXIII shows prices paid by Brazil in current dollars per metric ton for imported wheat from 1965 to 1985. There were no prices for Canada from 1965 to 1969 because there were no Canadian sales in those years.

Agreements do not account for all of the variation in prices among competitors. Other variables such as lack of storage capacity in Argentina, timing of sales, perceived quality of wheat, speed of delivery and shipping schedules are examples of other factors that can result in price differentials.

TABLE XXII

MARKET SHARE IN BRAZIL'S WHEAT MARKET BY THE UNITED STATES, CANADA AND ARGENTINA

Year	Brazil's total Wheat Imports	U.S. Wheat Exports to Brazil	Canadian Wheat Exports to Brazil	Argentine Wheat Exports to Brazil	Share of Brazil's Wheat Market by Country		
					U.S.	Can	Arg
	imports in thousands of metric tons				%	%	%
1965	1,902	520	0	1,292	27	0	68
1966	2,467	1,207	0	1,060	49	0	43
1967	2,433	1,148	0	650	47	0	27
1968	2,417	918	0	1,064	38	0	44
1969	2,307	885	0	1,000	38	0	43
1970	1,680	618	300	762	37	18	45
1971	1,727	817	400	350	47	23	20
1972	2,749	1,189	300	1,200	43	11	44
1973	2,062	1,136	400	526	55	19	26
1974	2,165	785	1,300	80	36	60	4
1975	3,070	1,980	800	240	64	26	8
1976	3,163	1,238	810	1,055	39	26	33
1977	2,844	1,673	655	355	59	23	12
1978	4,200	2,254	1,221	441	54	29	11
1979	3,780	1,255	553	1,972	33	15	52
1980	4,599	2,799	1,800	0	61	39	0
1981	4,000	2,650	935	205	66	23	5
1982	4,105	2,720	1,250	0	66	30	0
1983	4,291	2,376	1,500	415	55	35	10
1984	4,503	2,541	1,500	462	56	33	10
1985	3,468	1,683	1,000	685	48	29	20

Source: Tomasini Agency, CNPT/EMBRAPA

TABLE XXIII

WHEAT PRICES PAID BY BRAZIL TO MAJOR EXPORTERS *

Year	U.S.	Canada	Argentina	Overall
		dollars per metric ton **		
1965	72.55	np ***	72.51	72.43
1966	71.18	np	69.88	70.47
1967	73.40	np	74.07	73.33
1968	71.33	np	69.25	69.49
1969	55.59	np	58.31	57.44
1970	52.20	59.30	51.70	53.04
1971	61.77	66.02	61.31	62.45
1972	72.27	66.42	66.78	67.85
1973	134.88	85.76	92.81	113.92
1974	197.74	194.42	167.71	195.23
1975	157.79	151.35	155.37	157.71
1976	145.86	157.50	135.62	147.17
1977	108.24	102.82	93.57	100.88
1978	121.14	133.61	123.02	124.88
1979	153.06	191.88	138.94	149.58
1980	177.37	202.67	174.07	187.12
1981	187.09	214.37	173.50	190.80
1982	170.02	205.10	180.88	180.39
1983	161.50	196.83	np	173.74
1984	155.56	167.53	130.25	155.11
1985	153.81	147.72	129.39	147.02

Source: Banco Do Brasil, S.A., Cacex

* calculated by dividing FOB amount paid to exporter by number of tons purchased.

** dollars are not adjusted for inflation

*** np means no price for year in which no sales occurred

U.S. Export Policies

In general, U.S. export policies, or promotional strategies, can be categorized into three groups: price, non-price and credit. The price strategies tend to dominate the non-price because of the homogeneity of bulk grain products. More refined products such as bread, pasta and cereal can benefit from non-price promotional strategies.

Non-price strategies may attempt to change tastes and preferences in the importing country in such a way as to shift the demand for all wheat products or for a particular kind of wheat product. This may result from advertising wheat products or from working with wheat processors and outlets. For example, demonstrating to retail outlets the improvement in bread texture when hard red winter wheat is mixed with soft white wheat could result in a shift in demand for hard red winter wheat.

Credit has become increasingly important in recent years. Two effects of credit are (1) to postpone payment for wheat shipments by countries with hard currency shortages allowing them to import more in the current year and (2) to lower the real price of the wheat by subsidizing the interest rate. The "buy down" is the difference between the market interest rate and the exporting government's interest rate.

Price Policies

Price policies are designed to influence export prices. One example is the International Wheat Agreement signed by wheat exporters in an attempt to keep prices high. Another is Commodity Credit Corporation (CCC) export payments and export payments-in-kind which reduce the price U.S. exporters charge. A past program was the Public Law 320 program, phased out in 1975, that used funds from agricultural import duties to reduce export prices.

An indirect price policy is the domestic loan rate, the amount U.S. farmers pay on loans secured by their commodities. Others are deficiency payments that encourage farmers to produce and maritime legislation that influences shipping rates.

Non-Price Policies

Non-price policies are policies designed to open markets to U.S. commodities by promoting U.S. exports and by removing trade barriers. They can be categorized into (1) export market development, (2) policies to improve market access and (3) barter.

Export Market Development

The main government policy instrument for developing export markets is the Foreign Agricultural Service Industry Foreign Market Development Program, also known as the

Cooperator Program (Harte, 1983). The "cooperators" are producer organizations such as the American Wheat Association or American Hereford Association that work with the Foreign Agricultural Service in planning, evaluating and financing the programs. The purpose of the programs is to promote U.S. farm exports. An economist with the USDA, Paul Harte, identified seven non-price promotional strategies. They are:

1. Trade teams
2. Advertising
3. Point of sale promotions
4. Trade servicing
5. Commodity pull techniques
6. Trade shows, fairs, and exhibits
7. Publicity and public relations

Trade Teams. Trade teams, or trade missions, represent a firm, industry or group of industries. Their effectiveness lies in making personal contacts abroad and getting first hand knowledge of sales opportunities.

Advertising. Advertising is used in foreign newspapers, magazines and television and is tailored to the particular country. It may be the most effective way of reaching masses of consumers and influencing tastes and preferences.

Point of Sale Promotions. Promoters advertise the product at the point of sale using representatives to give out samples, to show how to use the product, and to distribute pamphlets. In the case of wheat, a group of specialists might visit a mill or bakery to demonstrate the advantages of a particular process of milling. They may demonstrate wheat preparation or the uses of a particular variety of wheat. They may introduce new wheat products or help the mill or bakery promote wheat products.

Trade Servicing. Trade servicing includes support services to the importer of the product. Three categories of trade servicing are the following:

(1) Supplying the importer with information about product availability and prices. The use of regular publications and phone calls may create good will and customer loyalty.

(2) Technical information about processing the product and quality control. This information may make the importer more quality conscious and thereby help American exporters.

(3) Marketing assistance to create greater demand for the product such as T.V. and radio commercials.

Commodity Pull Techniques. Commodity pull techniques are used mainly by trade associations to increase sales of a commodity by changing tastes and preferences in overseas markets. The methods may involve cooking demon-

strations, consumer research, recipe promotions, and marketing advice to local business. For example, the United States Feed Grains Council has promoted consumption of livestock products which, in turn, increased demand for feed grains.

Trade Fairs, Shows, and Exhibits. International trade fairs are open to the general public and feature the commodities and products of many countries. In the case of wheat, there may be machinery displayed for mill operators and bakeries or exhibits of wheat products. Trade shows are sponsored by the Foreign Agricultural Service in 21 countries and allow U.S. exporters to meet directly with business people in the host country. The shows focus on individual countries and on facilitating interpersonal exchanges.

Publicity and Public Relations. Publicity and public relations techniques may be used to improve visibility and acceptance of certain commodities. In some cases, there may be social or religious barriers that discourage the use of a commodity. Discovering how to overcome the barriers is essential for a commodity's acceptance. For example, in Japan, the number "four" is considered unlucky, so American golf balls packaged four to a box were repackaged in boxes of three to make them more acceptable in the Japanese market. Wheat is a good example of a commodity that has grown in acceptance and replaced other staples such as rice

and beans through the use of publicity and public relations. In many parts of the world, wheat is a relatively new food commodity which has gained acceptance only in the last 20 or 30 years.

The Cooperator Program that coordinates export market development is relatively new. Table XXIV shows the annual expenditures on the Cooperator program. The program grew in each year between 1979 and 1984 and almost doubled from 16.7 million dolars in 1979 to 31.7 million dollars in 1984.

TABLE XXIV

FAS ANNUAL EXPENDITURES ON THE COOPERATOR PROGRAM

Year	Expenditures in millions of U.S. dollars
1979	16.7
1980	18.8
1981	20.2
1982	20.6
1983	23.4
1984	31.7

Source: Foreign Agricultural Service, USDA

Policies to Improve Market Access

Most of the policies designed to improve market access consist of agreements to reduce restrictive trade practices and are covered under the General Agreement on Trade and Tariffs (GATT). These agreements cover unfair import policies such as quotas and import taxes. Other agreements reduce unfair export practices such as subsidized exports. In addition, there are bilateral trade agreements that work to the mutual advantage of both countries and specify maximum and minimum purchases. In the case of Brazil, import taxes, tariffs and quotas have traditionally been a problem for U.S. exporters.

Barter

The United States Department of Agriculture can sometimes export grain in exchange for a commodity or product when the other country is cash deficient or when a barter agreement would be mutually preferable to either cash or credit. This arrangement can sometimes be used to overcome trade barriers such as taxes and quotas in one country or both.

Credit Policies

Credit may be as important as price in international grain marketing. Many countries do not have sufficient hard currency to import the desired amount of wheat, or

they may prefer to use wheat credits in order to use the hard currency for other imports. Credit may also be offered at less than world interest rates or "blended" with zero interest loans that are guaranteed by the exporting country's government. Credit is blended by offering a fixed amount of zero interest government guaranteed credit for each unit of commercial credit that is approved to the importing country. This produces a package of blended credit that has a lower interest rate than the normal commercial interest rate.

TABLE XXV

EXPORT-IMPORT BANK AND COMMODITY CREDIT CORPORATION AGRICULTURAL EXPORT CREDIT

Year	Eximbank	CCC (1)
	in thousands of dollars	
1971-1972 (Average)	81,800	1,067,300
1976-1980 (Average)	77,600	1,328,400
1981	48,000	1,862,200
1982	60,400	1,386,500
1983	91,700	4,439,900

1 Includes GSM-101, GSM-102, GSM-5 and Blended Credit

Source: United States Department of Agriculture, Economic Research Service, Agricultural Export Programs and Policy, S. Elaine Grigsby and Cathy L. Jabara

Table XXV shows the amount of export credit supplied by the Export-Import Bank as well as the Commodity Credit Corporation, the two U.S. government lending agencies for overseas grain buyers. Table XXV shows that most of the credit came from the Commodity Credit Corporation (CCC) which grew from approximately one billion dollars in 1971-1972, to approximately four and a half billion dollars in 1983. The CCC export credits in Table XXV were allocated under four export credit programs during this period. These programs are GSM-101, GSM-102, GSM-5 and Blended Credit.

U.S government export credit programs are handled by the Commodity Credit Corporation, a branch of the U.S. Department of Agriculture. The programs fall into two categories: commercial sales and concessional sales. Commercial sales fall into three categories:

(1) Short-term credit at below market rates to importers of U.S. commodities.

(2) U.S. government guarantees of loans that U.S. banks make to overseas importers.

(3) Blended credit. This is a combination of (1) and (2) above with the difference that the portion that the government lends the importer is interest free instead of below market. The actual interest rate depends on the ratio of government interest free credit to bank market

rate credit.

Concessional sales fall into two categories:

(1) Long term below market rate credit going to countries with severe food shortages.

(2) Long term below market rate credit whose repayment is channeled through development projects in the same country.

Review of the Credit Programs

GSM-102 is a loan guarantee program started in 1981 as the Export Credit Guarantee Program. Its purpose is to promote U.S. agricultural exports. One effect of GSM-102 is the reduction of risk for U.S. banks and exporters by repaying the bank or exporter if the importing country defaults on any loan. The banks can set a lower interest rate and also lend more credit than they would if they had to assume the risk of loan default. GSM-102 also has the effect of extending the repayment period from six months (the usual term for commercial credit) to up to three years. The actual guarantee of the program is for 98 percent of the loan principle and up to eight percentage points of interest. The government would repay the bank principle and interest up to eight percent in case of non-payment by the importing country. The bank would still be liable for loan interest above eight percent. This

means that when interest rates are above 8 %, banks are at more risk than when interest rates are low.

The credit buy down rate is the difference between a world basis rate such as the London Inter Bank Offered Rate (LIBOR) and the lower actual rate offered a wheat importing country as a result of an export credit program. Harte, (1985), compared the GSM-102 rates to the prime rate over a 19 month period as shown in Table XXVI. During this period, the average interest charged Brazil for wheat import credit was 13.90 percent. This compares with an average prime rate of 14.75 percent, so the interest charged Brazil was .85 percent less than the prime rate. Since the rate charged by commercial banks is normally about two percent above the prime rate, the average buy down was about 2.85 percent in this period.

The buy down effect is offset to some extent by the amount charged the exporter by the Commodity Credit Corporation. The CCC charges a guarantee fee based on the repayment period of the loan and the risk of the loan. According to Kohlmeyer of Cargill (Kohlmeyer, 1982), the guarantee fee can add 3 to 5 cents to the price of each bushel of grain.

GSM-101 was the predecessor of the GSM-102 program. GSM-101 was known as the Non-Commercial Risk Assurance Program. This program operated from 1956 to 1980, was smaller than GSM-102, and guaranteed loans against political risks only.

TABLE XXVI

GSM-102 RATE AND PRIME RATE BY MONTH

Month	GSM-102 Weighted Average Interest Charged Brazil [a]	Prime Rate [b]
8/81	20.00	20.50
9/81	18.48	20.00
10/81	17.17	18.75
11/81	15.75	17.00
12/81	15.46	15.75
1/82	16.25	15.75
2/82	17.60	16.12
3/82	16.71	16.50
4/82	15.37	16.50
5/82	15.37	16.50
8/82	12.19	14.50
9/82	12.87	13.50
10/82	10.81	12.75
11/82	10.62	11.75
12/82	10.30	11.25
1/83	10.76	11.25
2/83	9.37	10.75
3/83	9.00	10.50
4/83	10.00	10.50
Average Monthly Rate	13.90	14.75

a Fiscal Division, Agricultural Soil Conservation Service, USDA

b Economic Indicators, Council of Economic Advisors, September 1984

GSM-5, also known as the Export Credit Sales Program, provides direct government credit to buyers of U.S. agricultural commodities. The rate of interest is

subsidized at 1.5 percent above the current Treasury Bill rate and for up to 36 months. The program started in 1956 as GSM-1. Between 1981 and 1983, all GSM-5 credit was "blended" with GSM-102 guarantees and no interest was charged on the GSM-5 portion.

Blended Credit Program. The blended credit program started in 1982 as a response to the trade practices of other grain exporting countries, especially the European Economic Community (EEC). The program combines interest-free credit from the GSM-5 program with payment guarantees from GSM-102. A typical blend is four parts GSM-102 to one part GSM-5, that is 4:1. The ratio may change for different countries. Table XXVII shows an example of blended credit offered to Brazil during September, October and November of 1983. It shows that one part of GSM-5 interest free credit was blended with four parts of GSM-102 credit whose repayment was guaranteed by the U.S. government.

In one study (Harte, 1985), the buy down effects of the GSM-102 program and the blended credit programs were estimated. In this study, the yearly installment payments were estimated on a hypothetical three-year $30,000,000 loan. Compared with a commercial loan, GSM-102 lowered the repayment installments by 4.46 percent while the blended credit program lowered the repayment installments by 8.39 percent.

TABLE XXVII

BLENDED CREDIT QUANTITIES OFFERED TO BRAZIL *

	GSM-102	GSM-5
	--------- U.S. dollars ---------	
September 1983	$ 8,051,216	$ 2,012,804
October 1983	12,125,804	3,031,451
November 1983	53,601,296	13,400,324

* 3-year loans with equal principal repayments and declining interest payments consisting of 20 percent GSM-5 interest free credit and 80 percent GSM-102 guarantees.

Public Law 480. P.L. 480 is also known as the Food for Peace Program. Titles II and IV deal with commodity donations and international extension programs where government credit is not a factor. Titles I and III cover concessional sales and food for development programs.

Title I, concessional sales, is a subsidized credit program for foreign buyers of U.S. agricultural commodities with long term repayment periods of up to 40 years. Agreements may specify repayment in U.S. dollars or, less commonly, in the local currency. P.L. 480 has been criticized for competing with commercial programs.

Table XXVIII shows the total amount of Commodity Credit Corporation loans and credit guarantees as well as P.L. 480 concessional amounts offered Brazil from 1965 to 1985.

TABLE XXVIII

U.S. EXPORTS TO BRAZIL UNDER CCC CREDIT SALES AND P.L. 480 WHEAT ASSISTANCE PROGRAMS FY 1965-1985

Year	Value of CCC Credit Sales a	Quantity of P.L. 480 b
	thousands of U.S. dollars	thousands of metric tons
1965	0	250
1966	0	422
1967	0	493
1968	15,793	448
1969	0	450
1970	0	100
1971	0	287
1972	0	0
1973	0	0
1974	0	0
1975	0	0
1976	0	0
1977	0	0
1978	0	0
1979	47,344	0
1980	32,926	0
1981	197,935	0
1982	283,244	0
1983	336,015	0
1984	356,369	0
1985	443,435	0

Sources: a Foreign Agricultural Service memorandum, November 1986
b Tomasini, CNPT/EMBRAPA

The Title III, Food for Development program is similar to Title I except that the importing country may use proceeds of P.L. 480 food donations to pay for development

projects to improve agricultural production, marketing and rural life. Like Title I, repayment is often extended up to 40 years at low interest rates or forgiven altogether.

In general, export credit programs of the U.S. and its competitors have increased steadily as credit becomes increasingly important in expanding wheat markets and in maintaining market share. The cost to the importing country may be an increase in debt burden and to the exporting country, uncertainty about repayment. As of June 30, 1984, credit rescheduling to Brazil for the GSM-102 program totaled $218,975,833.

Canadian and Argentine Wheat Exports and Policies

The United States is Brazil's primary source of wheat while Canada and Argentina provide the balance. The EEC is not a wheat supplier to Brazil because its wheat is mostly soft wheat as is Brazil's. Brazilian wheat mills prefer hard red wheat that can be mixed with soft domestic wheats to produce a superior blend for producing bread and other bakery products. Australia is not a source because it is geographically further from Brazil's ports than even Canada and the United States.

Argentina

Argentina's proximity to Brazil is offset by a weak infrastructure and poor port facilities. Also, Brazil

prefers the larger U.S. and Canadian ships because they are faster and easier to unload. Rail transportation from Argentina has to pass through Brazil's major wheat producing areas, so Argentina competes with Brazil's own wheat growers for available rail lines. This causes a political embarassment since Brazil's own wheat growers feel they should get preference over Argentine growers. Even though Argentina shares a border with Brazil and is geographically much closer than the U.S. or Canada, the transportation costs are as high or higher. Also, Argentina cannot compete with the U.S. and Canada in providing loans to Brazil for buying wheat. For these reasons, the main attraction of Argentine wheat may be price and availability.

Table XXIX shows freight charges to Rotterdam, Holland, a major destination point for international wheat shipments. It shows the respective shipping costs for Argentina, Canada and the United States between 1965 and 1985. The average shipping rates to Rotterdam, for the 1965 to 1985 period, were approximately twice as high from Argentina compared with Canada or the United States. Table XXIX shows that these averages were 16.38, 7.58 and 8.20 dollars, respectively. Argentina has a similar shipping cost disadvantage in other markets, such as Japan. For this reason, Argentina has favored Brazil for its wheat exports.

TABLE XXIX

MARITIME FREIGHT RATES FOR WHEAT TO ROTTERDAM

Year	From Argentina River Plate	From Canada St. Lawrence Ports	From the U.S. *
	U.S. dollars per metric ton		
1964/65	10.94	4.59	5.08
1965/66	12.23	4.34	4.89
1966/67	10.02	3.53	3.57
1967/68	10.10	4.00	4.34
1968/69	7.32	5.35	3.35
1969/70	9.77	5.17	5.84
1970/71	10.05	4.84	5.27
1971/72	6.05	2.55	2.74
1972/73	12.46	6.26	6.77
1973/74	26.81	12.92	14.00
1974/75	19.64	6.66	7.46
1975/76	14.08	4.74	5.30
1976/77	16.66	5.22	5.90
1977/78	16.16	5.64	6.38
1978/79	20.26	9.14	9.93
1979/80	29.77	15.63	16.85
1980/81	32.44	16.59	18.52
1981/82	28.44	11.50	11.52
1982/83	17.42	9.04	10.23
1983/84	14.88	9.67	11.75
1984/85	18.50	10.71	12.62
Average	16.38	7.58	8.20

* Atlantic or Gulf Ports, whichever was lowest

Source: Food and Agriculture Organization (FAO), "Trade Yearbook", (p.23).

Argentina would prefer to sell wheat to Brazil since Brazil is the closest major wheat buyer to Argentina.

Exporting to more distant wheat importing countries involves greater cost, insurance and freight (CIF) charges. For these reasons, Argentina has, to some extent, been locked into selling wheat to Brazil, its principle buyer, because freight charges are lowest to Brazil. Brazil, on the other hand, is not locked into buying wheat from Argentina because freight charges from the U.S. and Canada are no higher than from Argentina.

Table XXX shows wheat area harvested, yield and production in Argentina from 1965 to 1985. It shows that Argentine wheat production reached a peak of 14.5 million metric tons in 1982. Unlike Brazil, the wheat harvest area remained relatively constant during this period, increasing from 4.6 million hectares to 5.3 million hectares. Yields are higher and more stable than in Brazil.

Table XXXI shows Argentine wheat exports including exports to Brazil. Table XXXI shows that, in contrast to Argentine production which was relatively stable, Argentine exports fluctuated considerably between years. Argentina exported approximately one million metric tons in 1971, while in 1983 it exported approximately 10 million metric tons. Comparing Argentine wheat exports with production, from tables XXX and XXXI, shows that Argentina exports a substantial portion of its wheat. Table XXXI also shows that Brazil bought a large share of Argentine wheat exports between 1965 and 1985. This was especially true in the years prior to 1973. In 1972 Brazil bought approximately

67 percent of all Argentine wheat exports. However, in the years since 1980, Brazil has bought 6 percent or less of all Argentine wheat exports.

TABLE XXX

ARGENTINE WHEAT AREA HARVESTED, YIELD AND PRODUCTION

Year	Wheat Area Harvested	Yield	Production
	1000 hectares	kg/hectare	1000 metric tons
1965	4601	1320	6079
1966	5214	1200	6247
1967	5812	1260	7320
1968	5837	980	5740
1969	5191	1350	7020
1970	3332	1280	4250
1971	4315	1316	5680
1972	4965	1591	7900
1973	3981	1633	6500
1974	4233	1410	5970
1975	5271	1626	8570
1976	6386	1723	11000
1977	3910	1355	5300
1978	4685	1729	8100
1979	4564	1709	7800
1980	5023	1549	7780
1981	5790	1364	7900
1982	7200	2014	14500
1983	6880	1788	12300
1984	5901	2237	13200
1985	5296	1605	8500

Source: Food and Agriculture Organization of the United Nations, FAO Production Yearbook, years 1965-1968

TABLE XXXI

ARGENTINE WHEAT EXPORTS

Year	Argentine Wheat Exports Value a	Argentine Wheat Exports Quantity a	Argentine Wheat Exports to Brazil b	Column Three as Percentage of Column Two
	ten thousands of dollars	thousands of metric tons		%
1965	37,363	6,676	1,292	19
1966	28,104	5,078	1,060	21
1967	12,229	2,064	650	31
1968	14,016	2,439	1,064	44
1969	14,392	2,462	1,000	41
1970	13,234	2,415	762	32
1971	5,868	987	350	35
1972	11,750	1,784	1,200	67
1973	24,600	3,167	526	17
1974	31,811	1,834	80	4
1975	32,382	1,920	240	13
1976	44,562	3,264	1,055	32
1977	57,528	5,970	355	6
1978	19,420	1,835	441	24
1979	61,856	4,364	1,972	45
1980	82,453	4,538	0	0
1981	70,140	3,788	205	5
1982	68,250	3,837	0	0
1983	148,084	10,232	415	4
1984	98,570	7,406	462	6
1985		9,618	685	7

Sources: a Food and Agriculture Organization of the United Nations, FAO Trade Yearbook, years 1965-1968
b Embrapa

Canada

All Canadian wheat is handled through the Canadian Wheat Board. This contrasts with U.S. wheat which is sold through private firms. The Canadians have traditionally signed long term agreements to sell between 1.0 and 1.5 million metric tons annually to Brazil. Since Canadian sales are set within maximum and minimum ranges by the long term agreements, they tend to be more stable than U.S. sales. Geographically, Canada and the United States have equal distances to ship wheat destined for Brazil because the St. Lawrence Seaway is the closest point for both countries to Brazilian ports.

Table XXXII shows Canadian wheat area harvested, yield and production from 1965 to 1985. Canadian production is highly responsive to falling wheat prices. For example, from 1969 to 1970 production was reduced by a half as a result of low world wheat prices in 1969 and 1970. Table XXXIII shows Canadian wheat exports and Canadian wheat exports to Brazil between 1965 and 1985. Table XXXIII shows that, from 1965 to 1985, Brazil accounted for an increasing percentage of Canadian wheat exports. Before 1974, Brazil bought 3 percent or less of all Canadian wheat exports, but since 1974 it has bought between four and 12 percent of all Canadian wheat exports.

TABLE XXXII

CANADIAN WHEAT AREA HARVESTED, YIELD AND PRODUCTION

Year	Wheat Area Harvested	Yield	Production
	1000 hectares	kg/hectare	1000 metric tons
1965	11453	1540	17674
1966	12016	1870	22516
1967	12189	1320	16137
1968	11907	1490	17686
1969	10104	1840	18623
1970	5052	1790	9023
1971	7854	1835	14412
1972	8640	1680	14514
1973	10020	1708	17112
1974	8934	1488	13295
1975	9487	1800	17078
1976	11252	2096	23587
1977	10114	1964	19862
1978	10584	1998	21146
1979	10500	1690	17746
1980	11098	1738	19292
1981	12427	1996	24802
1982	12591	2194	27620
1983	13697	1935	26505
1984	13158	1611	21199
1985	13688	1746	23900

Source: Food and Agriculture Organization of the United Nations, FAO Production Yearbook, years 1965-1968

TABLE XXXIII

CANADIAN WHEAT EXPORTS

Year	Canadian Wheat Exports Value a	Canadian Wheat Exports Quantity a	Canadian Wheat Exports to Brazil b	Column Three as a Percentage of Column Two
	tens of thousands of dollars	thousands of metric tons		%
1965	84,121	12,729	0	0
1966	106,150	15,640	0	0
1967	74,385	10,303	0	0
1968	68,920	9,954	0	0
1969	52,239	7,339	0	0
1970	71,605	11,494	300	3
1971	87,754	13,616	400	3
1972	97,182	14,463	300	2
1973	126,535	12,891	400	3
1974	215,153	10,690	1,300	12
1975	206,179	11,648	800	7
1976	187,538	11,338	810	7
1977	182,794	14,934	655	4
1978	180,961	15,329	1,221	8
1979	198,167	12,471	553	4
1980	317,499	17,376	1,800	10
1981	328,029	16,212	935	6
1982	356,827	19,643	1,250	6
1983	385,431	22,228	1,500	7
1984	375,356	21,623	1,500	7
1985		16,983	1,000	6

Sources: a Food and Agriculture Organization of the United Nations, FAO Trade Yearbook, years 1965-1968
b Embrapa

Canadian Credit Programs

Canada has recently begun to offer more credit to Brazil after supplying relatively small amounts of credit in the early and mid-1970's. Under Canada's three-year credit program, credit is guaranteed at one quarter percent below the prime rate with a 10 percent down payment required. In one estimate (Harte, 1985), the buy-down rate effect of this program is approximately 3.37 percent, roughly the same as the GSM-102 credit guarantee program.

McCalla estimated the price elasticity for wheat sales to middle income lesser developed countries at about -.2. For every 10 percent decrease in wheat price or decrease in loan repayment, the increase in wheat sales is about 2 percent. Table XXXIV shows the estimated buy down effects of the various credit guarantee programs and the change in sales resulting during a recent period. If McCalla's estimate of price elasticity is correct, the various credit programs do not have a large impact on wheat sales. For example, the GSM-102 and Canadian Credit programs would result in less than a one percent increase in wheat sales, while the blended credit program would result in less than a two percent increase in wheat sales. However, other studies have found greater price elasticities for international wheat sales. This study finds that U.S. wheat sales to Brazil have a price elasticity of -1.87 (Table XLII). Given this elasticity and Harte's (1983) buy down effect of 8.39 percent for the blended credit program,

U.S. wheat sales to Brazil would increase 15.7 cents for each dollar of additional blended credit offered to Brazil.

TABLE XXXIV

WHEAT EXPORT PROMOTION CAUSED BY REPAYMENT BUY-DOWN

Program	Estimated Buy-down Effect	Estimated Change in Sales Based on Price Elasticity of -.2
	percentage	
GSM-102	4.46	.89 **
Blended Credit *	8.39	1.68
Canadian Credit	3.37	.67

Source: Harte, Richard Paul. "USDA Commercial Export Credit - A Market Study of Brazil", master's thesis, University of Missouri-Columbia, August 1985.

* Blended Credit includes GSM-102 and GSM-5

** The change in sales is found by multiplying the buy-down by the elasticity. For example, -4.46% x -.2 = .89%

Summary

This chapter has treated the Brazilian wheat market as a closed market with four major suppliers, including Brazil's own domestic production. The market has a single buyer, the Brazilian government. The model implies an

oligopolistic market. Of course, there are more suppliers in the world than Argentina, Canada and the U.S. There are many other wheat buyers in the world besides Brazil. In fact, the free-on-board (FOB) price is set exogenously on the world market. The CIF price, which includes FOB plus freight, varies according to distance to market and differences in infrastructure and shipping characteristics. Brazil is a price taker for imported wheat from the U.S. and Canada because its influence on world wheat prices is minimal. With respect to Argentina, Brazil may, to some extent, be a monopsonistic buyer. If so, this is due to its geographical proximity compared to other countries that buy wheat from Argentina. This geographical proximity implies lower CIF rates and gives Brazil a buying advantage over other countries that buy Argentine wheat. Chapter 4 will develop a conceptual model for the Brazilian wheat market based on the assumptions developed in this and the preceding chapters.

CHAPTER IV

REVIEW OF LITERATURE

One objective of this research is to examine policies that affect wheat import demand in Brazil, including U.S. wheat export policies. Several studies have examined the effects of wheat export subsidy programs on wheat import demand. Grigsby (1984) measured the effect of the P.L. 480 program on wheat import demand in Colombia. Her study disputes the traditional characterization of P.L. 480 as a food aid or commodity subsidy program. Rather, she hypothesizes that P.L. 480 is a "market export program that results in expanded market demand."

In her demand equation for imported wheat in Colombia, Grigsby hypothesized that import demand, CM, is positively related to the quantity of P.L. 480 (Title I) credit, TIM. Import demand is positively related to the domestic wheat price in Colombia, DP, per capita income, Y, and Colombia's trade balance, TRABAL. Wheat import demand is negatively related to the domestic wheat supply in the previous year, DQ_{t-1}. Equation (1) shows Grigsby's wheat import demand equation for Colombia with hypothesized signs under the independent variables.

$$CM = \underset{(+)}{TIM},\ \underset{(+)}{DP},\ \underset{(+)}{Y},\ \underset{(+)}{TRABAL},\ \underset{(-)}{DQ_{t-1}} \qquad (1)$$

In addition, Grigsby specified an equation for Title I import demand, derived in part, from commercial import demand, Equation (1). She hypothesized that Title I wheat imports, TIM, are positively related to commercial import demand, CM, and domestic wheat price, DP. She hypothesized that credit from Title I would have an income effect that would further increase demand for more Title I demand. This income effect is represented by two variables, trade purchasing power, TPP, which represents an increase in foreign exchange liquidity, and domestic purchasing power, DPP. DPP is non-trade credit which can only be used in Colombia itself and which results in below-market prices for wheat, in increased demand for wheat imports and in a disincentive to domestic production. Grigsby hypothesized that demand for Title I is negatively related to domestic wheat supply in the previous year, DQ_{t-1}, and the financial costs of Title I, PTIF.

$$TIM = \underset{(+)}{CM},\ \underset{(+)}{DP},\ \underset{(+)}{TPP},\ \underset{(+)}{DPP},\ \underset{(-)}{DQ_{t-1}},\ \underset{(-)}{PTIF} \qquad (2)$$

Grigsby also hypothesized an equation for domestic wheat supply in Colombia, DQ, Equation (3). She hypothesized that domestic production, DQ, is positively related to the previous year's price, DP_{t-1}, and quantity, DQ_{t-1}. Domestic supply is negatively related to input

costs, WPIAG (wholesale price index for agriculture), and the prices of the substitute crops, barley and rice, in the previous year, PPB_{t-1} and $PPRI_{t-1}$. Domestic production is also hypothesized to be negatively related to commercial imports, CM, and Title I imports, TIM.

$$DQ = \underset{(+)}{DP_{t-1}}, \underset{(+)}{DQ_{t-1}}, \underset{(-)}{WPIAG}, \underset{(-)}{PPB_{t-1}}, \underset{(-)}{PPRI_{t-1}}, \underset{(-)}{CM}, \underset{(-)}{TIM} \quad (3)$$

In addition to the import demand equations, Grigsby used a separate equation to explain domestic demand for wheat in Colombia, DD, Equation (4). She hypothesized that the sign of domestic wheat price, DP, could be positive or negative, depending on whether the change in price represented a shift in demand, (+), or a shift along the demand curve, (-). She hypothesized that demand for wheat was positively related to the price of rice, WPRI, a wheat substitute, and the income variables, per capita income, Y, and the income effect of Title I credit, TIY.

$$DD = \underset{(+)}{DP}, \underset{(+)}{WPRI}, \underset{(+)}{Y}, \underset{(+)}{TIY} \quad (4)$$

Grigsby used two identities to complete the model, Equations (5) and (6). Imports, M, are identical to commercial imports, CM, plus Title I imports, TIM. Domestic demand, DD, is identical to domestic supply, DQ, plus imports, M.

$$M = TIM + CM \quad (5)$$

$$DD = DQ + M \quad (6)$$

Grigsby's model concluded that "Title I credit and foreign exchange were more influential in expanding import and domestic demand than was domestic income." She also found a "price disincentive effect" on domestic supply of wheat and an increase in commercial imports resulting from Title I. There was little evidence of substitution of Title I for commercial imports. She concludes that, "title I is not a food aid program. It is a market export program that provided trade purchasing power and financial aid."

A similar study was done for Brazil by Hall (1980) with different conclusions on the effects of trade credits. Hall found that, in Brazil, P.L. 480 had a positive impact on domestic wheat prices. Revenues gained from wheat imports were used to support domestic grain producers. Her conclusions also differed from Grigsbys' because she found that, in Brazil, P.L. 480 imports had a negative impact on commercial imports.

Hall's model is based on the pricing policy of CITRIN, Brazil's Marketing Department for National Wheat. Since 1952, CITRIN has bought and sold all domestic wheat and is the sole importer and supplier to Brazilian mills. According to Hall, CITRIN sells wheat to the mills at a uniform price that is low enough to be affordable for the average urban consumer. This price tends to be higher than

the price paid for imported wheat, but lower than the price paid to Brazilian producers. The revenues gained from selling imported wheat to the mills is used for subsidizing domestic producers. Hall hypothesizes that the lower the per unit price paid by CITRIN for imported wheat, the greater the subsidy to producers in the following time period. Alternatively, the lower the imported wheat price per unit, the lower the price to consumers that will maintain the same amount of subsidy to domestic producers. Hall also hypothesizes that the producer and consumer prices are the result of "political balancing of producer and consumer interests". For this reason, consumer and producer wheat prices are, "not completely determinate, but will vary from year to year."

Hall used a simultaneous equation econometric model which included supply and demand relationships for wheat, corn, rice and soybeans. The objective of Hall's model was to measure the impact of P.L. 480 wheat imports on Brazil's grain sector, which includes wheat, corn, rice and soybeans. The study period of Hall's study was 1952 to 1975 which includes the years of P.L. 480 wheat shipments to Brazil.

In her model, Hall used an equation for area harvested to simulate domestic supply for each of the four grains. Area harvested in year t was hypothesized to be a function of area harvested in year t-1, in hectares, A_{t-1}, the producer price of the respective grain and prices of

substitute or complementary grains in the previous year, P_{t-1}. Hall also included the price of fertilizer, FP, to represent input prices in general, the consumer price index, CPI, to represent the impact of "money illusion", and a time trend variable, TR. The superscript, i, refers to the grain, wheat, corn, rice or soybeans with i=1,2,3 or 4; j refers to complementary or substitute grains, j=1,2,3 or 4.

$$A^i_t = f^i(A^i_{t-1}, P^i_{t-1}, P^j_{t-1}, FP_{t-1}, CPI_{t-1}, TR) \quad (7)$$

Quantity supplied, in Hall's model, is explained with an identity equation in which quantity supplied, QS^i, is identical to area harvested, A, times yield per hectare, Y.

$$QS^i_t = A^i_t Y^i_t \quad (8)$$

Per capita demand for grain i, $PCQD^i$, is hypothesized to be a function of own price, P^i, substitute grain prices, P^j, per capita income, PCI and inflation, CPI.

$$PCQD^i_t = f^i(P^i_t, P^j_t, PCI, CPI_t) \quad (9)$$

where

$$PCQD^i_t = QD^i_t/N_t \quad (10)$$

where N is Brazil's population. Brazil's quantity demanded of grain i, QD^i, is identically equal to domestic quantity

supplied, QS^i, plus quantity imported of grain i, M^i, minus exports of grain i, EX^i.

$$QD^i_t = QS^i_t + M^i_t - EX^i_t \qquad (11)$$

In her model, Hall used nominal price data; she argues that, "the absence of money illusion is only a postulate and not a necessary description of reality, the absence of money illusion is too strong a proposition to be known a priori and imposed on the data." Hall used the variable, CPI, to explain the "money illusion" effect of inflation on grain quantity supplied and demanded.

Wheat, according to Hall, is the only grain whose support price differs from the market price. This is because the other three grains are covered by minimum support prices which are rarely reached. The wheat support price, in contrast, is based on "cost of production plus a profit margin considered sufficient to encourage the desired annual production increase."

In addition to the five demand and supply equations for the four grains, Hall used two additional equations that pertain only to wheat. One equation explains commercial wheat imports, M^W. The other explains the wheat support price to Brazilian producers. The amount of wheat import demand, M^W, is a function of domestic wheat supply, QS^W and the amount of P.L. 480 wheat, P.L. 480^W. It is also a function of foreign exchange reserves, FXR, the mill

wheat price, P^m, the consumer price index, CPI, and a trend variable, TR.

$$M^W_t = f^W(QS^W_t,\ P.L.\ 480^W_t,\ FXR_t,\ P^m_t,\ CPI_t,\ TR) \quad (12)$$

The wheat support price, P^W, is hypothesized to be a function of commercial wheat imports, M^W, the quantity of P.L. 480 wheat supplied, P.L 480^W, the international price of wheat, IP^W, the consumer price index, CPI, and a trend variable, TR.

$$P^W_{t+1} = f^W(M^W_t,\ P.L.\ 480^W_t,\ IP^W_t,\ CPI_t,\ TR) \quad (13)$$

In explaining the reasons for Equation (12), Hall argues that import demand in Brazil is influenced more by foreign exchange reserves than by income levels or international wheat prices. She also assumes that imports and domestic production are perfect substitutes. For this reason, QS is hypothesized to have a (-) coefficient. The higher the mill price, P^m, the more revenues the government receives from the wheat it sells to the mills, or alternatively, the less it pays in subsidies when $P^m < IP$. Therefore, the mill price is expected to be a positive determinant of commercial imports. The quantity of P.L. 480 is hypothesized to have a negative effect on commercial imports because it is a substitute for commercial imports.

Hall hypothesized that the Brazilian producer wheat price, Equation (13), is determined in year t+1 by revenues

earned in year t, because, "it is unlikely that the domestic supply schedule is known with great enough accuracy to enable the government to set a price support in time t." For the years covered in Hall's study, 1952 to 1975, revenues from wheat sales to Brazilian mills were positive in most years because the mill price exceeded the international price until 1973 when revenues became negative. Revenues were positively related to the quantity of commercial wheat imports and P.L. 480 wheat imports and negatively related to international wheat prices. The greater the amount of P.L. 480 in total imports, the lower the total cost of imports and the greater the revenues.

Hall found that wheat production in Brazil is positively correlated with the producer wheat price. She also found that soybean production is negatively correlated with the current producer price of wheat. Hall also found that per capita wheat consumption was positively related to per capita income, negatively related to own price and positively related to the price of rice, a consumption substitute for wheat. Commercial import demand for wheat was negatively related to domestic production and P.L. 480 imports and positively related to foreign exchange reserves and the domestic mill price.

Hall's domestic wheat support price did not have the expected coefficients for commercial imports and international wheat prices. Greater imports and lower international wheat prices should have raised more revenues

by selling more wheat to consumers at a higher margin, thereby raising the producer support price. However, the coefficients did not agree with this hypothesis. This seems to contradict her explanation of how the producer support price is determined.

Using the reduced form, Hall estimated the impact of the P.L. 480 program on wheat consumption in Brazil. She found that approximately 19 percent of the P.L. 480 amounts represented increased demand for wheat, while the other 81 percent represented a displacement of commercial imports. Unlike the Grigsby study, P.L. 480 did not displace domestic production. On the contrary it encouraged domestic wheat production through its positive impact on the domestic producer price. Hall found that each additional 1000 tons of P.L. 480 wheat imports had the effect of raising domestic wheat prices by 13 cruzeiros in the following time period.

The results of the Grigsby and Hall studies show that wheat export policies differ between countries. In the case of Brazil, P.L. 480 imports were used in a beneficial way with regards to domestic production, while in the case of Colombia, P.L. 480 imports displaced Colombia's domestic wheat production.

The current study differs from the Hall and Grigsby studies because it examines the effects of commercial credit programs instead of P.L. 480. The Brazilian data are more recent than the data used in the Hall study. The

Hall study examined Brazilian wheat imports from 1952 to 1975; the current study covers 1965 to 1985. The year 1973 represented a large change in Brazilian wheat pricing policy because, prior to 1973, imported wheat prices had been less than the mill price (consumers had not been subsidized). In every year after 1972 consumers were subsidized (the import price of wheat exceeded the mill price). This alters a major assumption of the Hall model which assumed that revenues gained from selling wheat to consumers were used to support the producer price. Because of the change in Brazilian wheat pricing, the assumptions of the current model are different. The mill price, for example, is now assumed to depend on consumer subsidies. Consumer subsidies depend on Brazilian national income and producer prices. The more producers are subsidized, the less is available for consumers. The Hall model explains the producer support price, but not the mill price.

Other agricultural changes since the Hall study have changed the assumptions of the model. For example, soybean production quickly surpassed wheat production after the Hall study. As a result, it may now be the case that wheat production responds more to the price of soybeans than to its own price since the two crops are double-cropped but soybeans are now the principal crop. After 1971 Brazil no longer received wheat under the P.L. 480 program. That program was replaced with commercial credit programs that have different terms but may have some of the same economic

consequences. The current study examines the difference between commercial credit and P.L. 480 on Brazil's wheat market.

The current study also examines market share among Brazil's principal suppliers. The Hall and Grigsby studies did not model the impact of P.L. 480 wheat imports on market share among the wheat supplying countries. Nor did they examine price elasticity differences among the wheat supplying countries.

CHAPTER V

ECONOMETRIC MODEL OF BRAZILIAN WHEAT IMPORTS

The economic characteristics of Brazil's wheat market were developed in previous chapters. Chapter Two examined Brazil's demand for and domestic supply of wheat. Chapter Three examined Brazil's three international suppliers and some policy considerations. Chapter Four reviewed two related studies. This chapter will develop a conceptual economic model to describe more concisely Brazil's wheat market and estimate some of the numerical relationships.

The model will make some simplifying assumptions. Import prices are assumed exogenously determined in the world market for the three exporting countries. Price is determined endogenously, in the model, for Brazilian domestic wheat producers and Brazilian consumers. Market shares of competing suppliers are determined endogenously. Domestic production is determined endogenously while production in the three exporting countries is exogenously determined. Demand is endogenously determined. Imports from other suppliers are not large and are assumed to be exogenous.

Conceptual Model

The objectives of the model are: (1) to explain Brazil's demand for wheat, (2) to explain Brazil's domestic wheat production, (3) to explain market share among the three major wheat exporting countries, (4) to explain the retail price of wheat in Brazil, and (5) to explain the producer price of wheat in Brazil. These five variables are endogenous in the model.

In conceptualizing an economic model for a group of people, such as a country, the quantity variables are expressed on a per capita basis. Otherwise, changes in the number of people could affect the outcome of the model. For example, if wheat consumption in Brazil increases over a 20-year period, much of that increase is attributable to an increase in population. A regression model of the effect of retail price on wheat consumption, for example, is simplified if wheat consumption is on a per capita basis. Whether the quantity variables are on a per capita basis or an aggregate basis, they should be consistently one or the other.

Supply

Brazil produces part of the wheat it consumes. The remainder is supplied by the U.S., Canada, Argentina and other wheat exporting countries. Canada has long term sales agreements with Brazil, so the U.S. and Argentina are residual suppliers whose joint share is determined by

fluctuations in Brazil's production. Brazil does not export or store significant amounts of wheat, nor does it import large quantities from countries other than Canada Argentina and the United States. For these reasons, the total supply of wheat to Brazil in year t is the summation of Brazil's production in year t, BP_t, Canadian imports, CI_t, Argentine imports, AI_t, U.S. imports, UI_t and the imports from other suppliers, OI_t. U.S. imports are equal to commercial sales plus shipments of P.L. 480 wheat, $PL480_t$. Thus, the quantity supplied in year t, Q^S_t, is an identity equation in which each term of the equation is on a per capita basis as shown in Equation (1).

$$Q^S_t = BP_t + CI_t + AI_t + UI_t + OI_t \qquad (1)$$

Per capita quantity of wheat demanded, Q^D_t, is assumed to be identical to per capita quantity of wheat supplied as shown in Equation (2). Equations (1) and (2) can be rewritten as Equation (3).

$$Q^D_t = Q^S_t \qquad (2)$$

$$Q^D_t = BP_t + CI_t + AI_t + UI_t + OI_t \qquad (3)$$

Brazilian Production

Brazilian wheat production in year t, BP_t, is thought to be a function of the price of soybeans in the previous year, P^S_{t-1}. Soybeans are a principle cash and export crop planted six months prior to the wheat crop and grown on the

same land as wheat. The two crops are considered production complements because they are rotated in alternative seasons. The soybean crop helps to fix nitrogen in the soil, while the wheat crop depletes nitrogen. It is expected that Brazilian wheat production is positively related to the price of soybeans lagged one year.

$$BP_t = f(P^S_{t-1}) \tag{4}$$

Demand

Per capita demand for wheat in Brazil in year t, Q^D_t, is thought to be negatively related to the consumer price of wheat, P^C_t (i.e. price set by government to the mills) in year t. Also, wheat demand is either positively or negatively related to per capita income, I_t, depending on whether wheat is a normal or inferior good.

$$Q^D_t = f(P^C_t, I_t) \tag{5}$$

Demand for Imports

Quantity imported from the three major suppliers is modeled with an equation for U.S. imports and an equation for Argentine imports. Canadian imports are represented by an identity equation in which Equation (3) is rewritten with Canadian imports on the left side. Canadian imports equal quantity demanded minus Brazilian production minus

wheat imports of the U.S., Argentina and other countries, OI_t, Equation (6).

$$CI_t = Q^D_t - BP_t - AI_t - UI_t - OI_t \qquad (6)$$

It is hypothesized that demand for U.S. and Argentine wheat depends on the price of U.S. wheat, P^{US}_t, the price of Argentine wheat, P^{AR}_t, per capita income in Brazil, I_t and the real exchange rate, cruzeiros per U.S. Dollar, XR^{cd}. It is expected that the own price elasticities, the change in imports due to a change in own country wheat price, are negative. It is expected that cross price elasticities, the change in imports due to a change in competing country wheat price, is positive. It is expected that wheat consumption in Brazil has a positive per capita income elasticity. The real exchange rate, cruzeiros per dollar, is expected to have a negative coefficient because the greater this exchange rate, the weaker the Brazilian currency.

$$UI_t = f(P^{US}_t, P^{AR}_t, I_t, XR^{cd}_t) \qquad (7)$$

$$AI_t = f(P^{US}_t, P^{AR}_t, I_t, XR^{cd}_t) \qquad (8)$$

Wheat Support Price to Brazilian Farmers

The Brazilian wheat support price, P^*, is set in year t in advance of the planting and harvesting season. It is hypothesized that the Brazilian Government sets the price in response to the price of soybeans in the previous year,

PSO_{t-1}, expenditures on wheat imports in the previous year, EW_{t-1}, the amount of Commodity Credit Corporation wheat allocations to Brazil in the previous year, C_{t-1}, and a trend variable, TR.

It is expected that the price of soybeans in the previous year is positively associated with the wheat price support because the Brazilian Government tries to be even-handed in its crop price supports. If the soybean support price is increased then so is the wheat support price. Expenditures on wheat imports the previous year areexpected to be positively associated with the wheat price support. This variable reflects both the world wheat price and the quantity imported. The policy of the Brazilian Government has been to set the wheat support price above the world price. As the world price increases, so does the wheat support price. Also, as part of its import substitution policy, the Brazilian Government is more likely to institute higher support prices when the quantity of wheat imports rises. Commodity Credit Corporation subsidized credit and credit guarantees are expected to be positively associated with the Brazilian wheat support price. It has been hypothesized in the literature (Hall, 1980) that the P.L. 480 program had a positive effect on the Brazilian producer wheat price. The CCC program could have the same effect because the credit would be indirectly used by the Brazilian Government to support domestic wheat

prices. Finally, Brazilian wheat support prices are expected to follow a downward trend over time.

$$P^*_t = f(P^{SO}_{t-1}, EW_{t-1}, C_{t-1}, TR) \quad (9)$$

Consumer Price

The mill price of wheat, P^C_t, reflects the price consumers pay for wheat and is set by the Brazilian Government. It is hypothesized that the factors that help decide where the government sets this price are the wheat support price, P^*_t, and per capita income, I_t.

The mill price is hypothesized to be positively related to the wheat support price. It is negatively related to per capita income because the mill price depends on consumer subsidies. Consumer subsidies are hypothesized to be greater in prosperous times when Brazilian national income is high. When national income is high, the government is hypothesized to have more revenues to support wheat prices. National income is expressed on a per capita basis.

$$P^C_t = f(P^*_t, I_t) \quad (10)$$

Hypothesized Signs of Model Coefficients

Table XXXV presents the conceptual model based on equations four through ten with the hypothesized signs of the coefficients. The endogenous variables of Equations four through 10 are on the left side of the table and

TABLE XXXV

STRUCTURAL FORM PARAMETERS AND HYPOTHESIZED COEFFICIENT SIGNS

Equation Number and Description		Endogenous Variables							Predetermined Variables								
		CI_t	BP_t	Q^D_t	UI_t	AI_t	P^*_t	P^C_t	P^{AR}_t	P^{US}_t	I_t	P^{SO}_{t-1}	TR	EW_{t-1}	C_{t-1}	XR^{cd}_t	OI_t
1 Identity	CI_t	-1	-1	1	-1	-1											-1
2 Brazilian Production	BP_t		-1									+					
3 Quantity Demanded	Q^D_t			-1				-			+						
4 U.S. Imports	UI_t				-1				+	-	+					+	
5 Argentine Imports	AI_t					-1			-	+		+				+	
6 Producer Price	P^*_t						-1					+	-	+	+		
7 Retail Price	P^C_t						+	-1			-						

Variable Definitions:

Q^D, Q^S	Brazilian wheat quantity demanded and supplied
P^*, P^C	Real Producer and consumer wheat prices in Brazil
P^{AR}, P^{US}	Real Prices of Argentine and U.S. wheat
P^{SO}	Real Producer price of soybeans
XR^{cd}	Exchange rate, cruzeiros per dollar
EW	Brazil's real expenditures on wheat imports
BP	Brazilian wheat production/capita
C	CCC credit allocation amounts to Brazil
I	Real income per capita in Brazil
TR	Time trend
AI, CI, UI, OI	Wheat imports per capita from Argentina, Canada, the U.S. and other countries

represent Canadian wheat imports, Brazilian wheat production, wheat quantity demanded, U.S. wheat imports, Argentine wheat imports, the Brazilian wheat producer price and the Brazilian wheat price to consumers, respectively. The regressors for each of the equations are shown along the top row. Some of the regressors are endogenous (determined by the model) and some are predetermined.

The first equation in Table XXXV, Canadian imports, is an identity equation because Canadian imports are defined as in Equation (6). The coefficient matrix shows the hypothesized signs of the coefficients of the variables. A positive or negative "1" indicates a known identity relationship or the dependent variable in a particular equation. The model in Table XXXV is block recursive because two of the equations, U.S. imports and Argentine imports, are simultaneously determined. The retail price depends on the producer price. Quantity demanded depends on the retail price. Canadian imports depend on U.S. and Argentine imports.

Estimation Results

The hypothesized model from Table XXXV was estimated with three-stage least-squares. Three-stage least-squares is a method that produces efficient and consistent parameter estimates by accounting for correlation of error terms across equations (Pindyck, p. 337). Ordinary least-squares would have resulted in biased and

TABLE XXXVI

STRUCTURAL FORM PARAMETER ESTIMATES AND STANDARD ERRORS

Equation Number and Description		Endogenous Variables							Predetermined Variables									
		CI_t	BP_t	Q^D_t	UI_t	AI_t	P^*_t	P^C_t	P^{AR}_t	P^{US}_t	I_t	P^{SO}_{t-1}	TR	EW_{t-1}	C_{t-1}	XR^{cd}_t	OI_t	Int
1 Identity	CI_t	-1	-1	1	-1	-1											-1	
2 Brazilian Production	BP_t		-1									.15 (.04)						6.1 (3.7)
3 Quantity Demanded	Q^D_t			-1				-.33 (.05)			-.01 (.004)							97 (11)
4 U.S. Imports	UI_t				-1				.12 (.04)	-.12 (.04)	.013 (.002)					-.07 (.05)		-.4 (6.4)
5 Argentine Imports	AI_t					-1			.004 (.08)	-.03 (.07)	-.004 (.003)					.05 (.09)		12 (11)
6 Producer Price	P^*_t						-1					1.17 (.46)	-9.49 (3.05)	12.12 (4.96)	49.91 (12.87)			18883 (5997)
7 Retail Price	P^C_t						.14 (.10)	-1			-.09 (.009)							212 (21)

Variable Definitions:

Q^D, Q^S	Brazilian wheat quantity demanded and supplied
P^*, P^C	Real Producer and consumer wheat prices in Brazil
P^{AR}, P^{US}	Real Prices of Argentine and U.S. wheat
P^{SO}	Real Producer price of soybeans
Int	Intercept
XR^{cd}	Exchange rate, cruzeiros per dollar
EW	Brazil's real expenditures on wheat imports
BP	Brazilian wheat production/capita
C	CCC credit allocation amounts to Brazil
I	Real income per capita in Brazil
TR	Time trend
AI, CI, UI, OI	Wheat imports per capita from Argentina, Canada, the U.S. and other countries

inconsistent estimates. The structural coefficients were estimated using Proc Syslin (systems of linear equations) in SAS (SAS Institute, 1984). Table XXXVI shows estimates of the structural parameters and standard errors (beneath the parameters).

In general, all the coefficient estimates in Table XXXVI, except Argentine sales, had statistically significant t-values (at the p = .05 level) for most or all the coefficients. None of the t-values for Argentine sales were statistically significant at the p = .05 level.

Validation of Model with Root Mean Square Error and Theil's Inequality Coefficient

The t-values derived from Table XXXVI are useful in validating the individual equations of the model. However, the t-values don't measure the overall performance of the system of equations. The root-mean-square simulation error (rms) is a measure of how well the simulated endogenous variables track the historical data series (Pindyck, p.362). The root-mean-square error is defined in equation (11).

$$\text{rms error} = \text{sqrt } E(Ys_t - Ya_t)^2 \qquad (11)$$

where Y^s_t = simulated value of Y_t
Y^a_t = actual value
T = number of periods in simulation
E = expectations operator

The rms error is a measure of the deviation of the

simulated variables from the actual variables. Theil's inequality coefficient, U, is a method of scaling the rms to fall between 0 and 1. A value of 0 indicates a perfect fit in which all predicted values are equal to their actual value. U is defined in Equation (12).

$$U = \frac{\text{rms error}}{\text{sqrt } E(Ys_t)2 + \text{sqrt } E(Ya_t)2} \qquad (12)$$

When U = 0, $Y^s_t = Y^a_t$ for all t which indicates a perfect fit. If U = 1 the model is the worst possible predictor of the endogenous variables. If U>0 it can be decomposed into three proportions of inequality, the bias, U^M, the variance, U^S, and the covariance, U^C (Theil, 1961, pp. 30-37). These three sources of the simulation error add up to one.

$$U^M + U^S + U^C = 1 \qquad (13)$$

U^M is a measure of systematic bias. A value of U^M above .1 or .2 would indicate a serious problem of systematic bias in the model. U^S indicates the ability of the model to replicate the degree of variability in the endogenous variable. A small U^S indicates that the model acurately replicates the amount of variability of the actual data. U^C is a measure of random error. The ideal proportion of error, when U>0, would be $U^M=U^S=0$ and $U^C=1$.

Table XXXVII shows the Theil forecast error statistics. In general, the model provided a good fit with

a U value of .11 or less in all the equations except for Argentine imports. There was no systematic bias in any of the equations with $U^M=0$ for all equations. The variance of the model replicated the variance of the endogenous variables well with U^S less than or equal to .05 except for Argentine imports and Brazilian production. Thus most of the error between predicted and actual endogenous values was from random factors.

TABLE XXXVII

THEIL FORECAST ERROR STATISTICS *

Equation	R^2	RMS Error	U	U^M	U^S	U^C
Pcbrzpro	.56	4.21	.11	0.0	.18	.82
Quandem	.84	3.39	.04	0.0	.05	.95
Pcusimp	.87	2.04	.07	0.0	.04	.96
Pcargimp	.43	2.89	.21	0.0	.14	.86
Prodpr	.71	17.28	.04	0.0	.02	.98
Conspr	.93	10.85	.04	0.0	.02	.98

* Statistics were derived with Proc Simnlin-Theil Procedure in SAS, Version 5

Reduced Form Equations

Table XXXVIII shows the estimated coefficients of the reduced form model. The reduced form equations show each of the endogenous variables expressed in terms of

TABLE XXXVIII

REDUCED FORM ESTIMATES

Endogenous Variables	Exogenous Variables								
	Intercept	PAR_t	pUS_t	I_t	pSO_{t-1}	TR	EW_{t-1}	C_{t-1}	$XR^{cd}{}_t$
CI_t	-478	-.163	.172	.009	-.191	.245	-.34	-1.27	.0298
$Q^D{}_t$	-461	0	0	.018	-.032	.245	-.34	-1.27	0
UI_t	-4.9	.161	-.146	.014	0	0	0	0	-.031
AI_t	16	.002	-.026	-.004	0	0	0	0	.0009
$P^*{}_t$	15801	0	0	0	1.04	-7.96	11	41.24	0
$P^C{}_t$	2474	0	0	-.09	.149	-1.14	1.6	5.91	0
BP_t	5.45	0	0	0	.159	0	0	0	0

Variable Definitions:

Q^D, Q^S	Brazilian wheat quantity demanded and supplied
P^*, P^C	Real Producer and consumer wheat prices in Brazil
P^{AR}, P^{US}	Real Prices of Argentine and U.S. wheat
P^{SO}	Real Producer price of soybeans
XR^{cd}	Exchange rate cruzeiros per dollar
AI, CI, UI	Argentine, Canadian, U.S. imports per capita
BP	Brazilian wheat production per capita
C	CCC credit allocation amounts to Brazil
I	Income per capita in Brazil
EW	Brazil's real expenditures on wheat imports
TR	Time trend

exogenously determined variables only. The system of equations has been solved to remove endogenous variables on the right side of equations. The coefficients on the derived reduced form parameters may be thought of as impact multipliers because they measure the change in each of the endogenous variables from a change in each of the predetermined variables. The reduced form estimates are derived from estimates of the three stage least squares coefficients.

Elasticity Results

The elasticities were estimated from the coefficients of the structural and reduced form equations. Elasticity is defined as the percentage change in the dependent variable caused by a one percent change in the independent variable. Equation 14 shows the elasticity formula. E is elasticity, dY is change of the dependent variable, dX is change of the independent variable, X^m is the mean of the independent variable and Y^m is the mean of the dependent variable.

$$E = \frac{\% \, dY}{\% \, dX} = \frac{dY}{dX} \cdot \frac{X^m}{Y^m} \qquad (14)$$

Table XXXIX shows the mean values of the seven jointly dependent variables and nine predetermined variables used in calculating the structural form and reduced form equations. The elasticity estimates will be derived from these mean values.

TABLE XXXIX

MEAN VALUES OF MODEL VARIABLES

Variable	Mean Value	Units
Quantity demanded	41.51	Kg./capita/year
Brazilian production	16.80	
U.S. imports	12.62	
Argentine imports	6.68	
Canadian imports	6.01	
Producer wheat price	228.79	1980 U.S. dollars/MT
Mill wheat price	127.10	
Price of Argentine wheat	149.93	
Price of U.S. wheat	151.72	
Price of Canadian wheat	167.49	
Per capita income	1298.89	1980 U.S. dollars
Expenditures on wheat imports lagged one year	4.38	1980 dollars/capita
Allocations on the CCC program lagged one year	.44	
Exchange rate cruzeiros per dollar	62.77	Inflation adjusted
Index of Producer prices of soybeans in Brazil lagged one year	75.85	Index 1980=100
Trend	1975	Years 1965 to 1985

Equation 14 can be rewritten using the coefficients from the structural and reduced form regressions. These coefficients represent the change of the dependent variable, dY, from a change in the independent variable dX. Letting these coefficients be represented by B_i:

$$B_i = \frac{dY}{dX} \qquad i = \text{coefficient number} \tag{15}$$

and

$$E = \frac{\% \, dY}{\% \, dX} = B_i \cdot \frac{\bar{X}^m}{\bar{Y}^m} \qquad (16)$$

Table XL shows the structural form elasticities, calculated using the mean values from Table XXXIX and the structural form coefficients from Table XXXVII. Elasticities are estimated for domestic wheat demand as well as for the four supply equations and two endogenously determined prices. The results show that Brazilian consumers have a price elasticity of demand of -1.01. This means that a one percent increase (decrease) in price results in approximately a one percent decrease (increase) in quantity demanded. Wheat is neither price elastic nor inelastic for Brazilian consumers.

The results also show that Brazilian wheat producers respond positively to previous year prices of soybeans with a cross price elasticity of .68. This means that for every one percent price increase (decrease) in soybeans the previous year, Brazilian wheat farmers produce, on average, .68 percent more wheat.

Table XL shows elasticities for U.S. wheat sales to Brazil. U.S. wheat sales have a negative own price elasticity of -1.54. This means that as the price of U.S. wheat increases (decreases), the quantity of U.S. wheat sales to Brazil will decrease (increase). The cross price elasticity of U.S. wheat sales to Brazil from changes in Argentine wheat prices was positive, 1.43. This means that as Argentine wheat prices to Brazil increase (decrease) by

TABLE XL

ELASTICITY ESTIMATES FROM STRUCTURAL MODEL COEFFICIENTS

Endogenous Variables		Exogenous Variables								
		PAR	pUS	I	p^{SO}_{t-1}	EW_{t-1}	C_{t-1}	XR^{cd}	p^*	p^C
	X^m	150	162	1299	76	4.4	.44	63	229	127
	Y^m									
BP	16.80				.68					
Q^D	41.51			-.31						-1.01
UI	12.62	1.43	-1.54	1.34				-.35		
AI	6.68	.09	-.72	-.78				.47		
CI	6.01									
P^*	229				.39	.23	.10			
p^C	127			-.92					.25	

Variable Definitions:

X^m, Y^m	Mean values of independent and dependent variables
Q^D, Q^S	Brazilian wheat quantity demanded and supplied
P^*, p^C	Real Producer and consumer wheat prices in Brazil
p^{AR}, p^{US}	Real Prices of Argentine and U.S. wheat
p^{SO}	Real Producer price of soybeans
XR^{cd}	Exchange rate cruzeiros per dollar
AI, CI, UI	Argentine, Canadian, U.S. imports per capita
BP	Brazilian wheat production per capita
C	CCC credit allocation amounts to Brazil
I	Income per capita in Brazil
EW	Brazil's real expenditures on wheat imports

one percent, U.S. wheat sales to Brazil will increase (decrease) by 1.43 percent.

Table XL shows that U.S. wheat sales to Brazil are positively income elastic and have an income elasticity of 1.34. This means that as Brazilian per capita income increases (decreases) by one percent, U.S. wheat sales to Brazil will increase (decrease) by 1.34 percent.

The Brazilian Government-set retail wheat price depends on the producer wheat price and per capita income. The retail price had a producer price elasticity of .252 and an income elasticiy of -.921. This means that as the producer wheat price increased by one percent, the retail wheat price increased .252 percent, on average. As per capita income increased by one percent, the retail wheat price declined by .921 percent. Finally, the results show that the producer wheat price is related positively to the producer price of soybeans in the previous year, expenditures on wheat imports in the previous year and by the amount of CCC credit in the previous year. These elasticities are .39, .23 and .10, respectively.

Table XLI shows elasticities derived from the reduced form coefficients in Table XXXIX. They differ from the elasticities in Table XL because they measure the impact of predetermined variables given that the interaction within the structural equations take place. Canadian imports show a positive price elasticity of 4.64 for U.S. wheat prices

TABLE XLI

ELASTICITY ESTIMATES FROM REDUCED MODEL COEFFICIENTS

Endogenous Variables		Exogenous Variables								
		PAR	pUS	I	P^{SO}_{t-1}	EW_{t-1}	C_{t-1}	XR^{cd}	P*	P^C
	Y^m X^m	150	162	1299	76	4.4	.44	63	229	127
CI	6.01		4.64	1.94	-2.41	-.25	-.09	.31		
BP	16.80				.72					
Q^D	41.51			.56	-.06	-.04	-.01			
UI	12.62	1.91	-1.87	1.44				-.15		
AI	6.68	.04	-.63	-.78				.008		
P*	229				.34	.21	.08			
P^C	127			-.92	.09	.06	.02			

Variable Definitions:

X^m, Y^m	Mean values of independent and dependent variables
Q^D, Q^S	Brazilian wheat quantity demanded and supplied
P*, P^C	Real Producer and consumer wheat prices in Brazil
P^{AR}, P^{US}	Real Prices of Argentine and U.S. wheat
P^{SO}	Real Producer price of soybeans
XR^{cd}	Exchange rate cruzeiros per dollar
AI, CI, UI	Argentine, Canadian, U.S. imports per capita
BP	Brazilian wheat production per capita
C	CCC credit allocation amounts to Brazil
I	Income per capita in Brazil
EW	Brazil's real expenditures on wheat imports

and a positive elasticity of 1.94 for per capita income in Brazil.

An estimate of the elasticity of the producer price of soybeans in Brazil on Canadian wheat imports was derived from the reduced form. This was possible because the model specified Brazilian wheat production as part of the identity determining Canadian wheat imports. This elasticity was -2.41.

Also Brazilian expenditures on wheat imports in t-1 and CCC loans to Brazil had negative elasticities for Canadian imports. The cruzeiro/U.S. dollar exchange rate had a positive import elasticity for Canadian wheat, .31, but a negative elasticity for U.S. wheat. This means that Brazil buys more wheat from Canada and less from the U.S. when the cruzeiro per dollar exchange rate is high.

The reduced form also reveals that consumers in Brazil pay higher prices for wheat when, in the previous year, the producer price of soybeans is high, when expenditures on wheat imports is high and when CCC allocations are high. These elasticities were .09, .06 and .02, respectively. Elasticity estimates from the reduced form differed from those from the structural form in estimating the income effect on per capita wheat consumption. Instead of an income effect of -.31 as in the structural estimate, the reduced form estimate was .56. This means that as per capita income increases, per capita wheat consumption in Brazil increases rather than decreases. This is because

the reduced form includes the effect of income on the consumer price as is explained in more detail in Chapter VI.

Data Discussion

The data used in the model were yearly observations, 1965 to 1985. All the data used in the model can be found in the appendix of this dissertation. Much of the data was received by written request from several Brazilian agricultural research agencies. The rest was obtained from the Oklahoma State University library from reference materials such as yearbooks of The World Bank and International Monetary Fund. In many cases, more than one source of data was found for a time series. In these cases, all of the time series were included in the appendix. In choosing which time series source to use in the model, the one which produced the best fit was generally chosen. For example, it was found that the best series for the price paid for U.S. wheat by Brazil was from a USDA publication and was on a fiscal rather than calendar year basis (October one to September 30, instead of January one to December 31). This particular series produced more statistically significant results, maybe because of the lagged nature of the data. In some cases, the series were incomplete and two or more series had to be spliced together although most of the data used in the model was from one complete source. Quarterly data would have been

preferable if it had been available. It would have allowed for a larger number of observations and therefore more statistically significant results. In many cases, the data used in a regression or in a table was modified from the original data. For example, some nominal prices were converted to current prices and some aggregate data was converted to per capita data. In these cases, the changes were noted.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Model Conclusions

The purpose of this research has been to examine policies that affect Brazil's wheat imports and that affect market share among the three major exporting countries who compete in the Brazilian wheat market. The model conceptualized and estimated the inter-related events and policies that determine demand and supply in the Brazilian wheat market.

The principal factors determining Brazil's import demand are Brazil's demand for and domestic production of wheat. Domestic demand is determined by per capita income and prices paid by consumers for wheat products. The consumer price of wheat is an endogenous policy variable. From Table XLII, per capita demand for wheat products was found to be relatively income inelastic with an income elasticity of .56. This means that a one percent increase in per capita income would result in .56 percent more wheat product consumed. Another study estimated this elasticity at .30 and found many other Brazilian food commodities to be in the .56 range (Table XX, p.51).

Consumers were more sensitive to changes in the retail price of wheat than they were to changes in per capita income. Table XLI shows that wheat quantity demanded has a price elasticity of -1.01. This means that, on average, a one percent increase in the mill price of wheat would result in a one percent decrease in wheat product sales.

The reduced form of the econometric model was useful in measuring the direct impact of the predetermined variables on the corresponding dependent variables. This was especially true in the case of demand for wheat in Brazil. The demand for wheat in Brazil has two components; an "income" effect and a "price" effect. The income effect is the change in per capita wheat consumption in Brazil attributable to a change in per capita income. The price effect is the change in per capita wheat consumption attributable to a change in the consumer price of wheat. Using the reduced form gives a more accurate estimate of the effect of income on consumer behavior by including the income effect on price. In the model, wheat quantity demanded was determined by the mill price of wheat and by per capita income. However, the mill wheat price was also determined by per capita income. This is because the mill wheat price is a policy variable set by the Brazilian Government. When per capita income is high, the government increases the wheat subsidy to consumers which lowers the mill price of wheat. This may be because tax revenues are higher when per capita income is high and allows the

government to spend more on consumer subsidies. Equations (5) and (6) show that per capita income determines quantity demanded directly through the income effect and indirectly through its effect on the mill wheat price.

$$QD_t = f(PC_t, I_t) \quad (5)$$

$$PC_t = f(P*_t, I_t) \quad (10)$$

Estimating equations (5) and (6) with the structural form resulted in the following equations.

$$QD_t = 97 - .33\ PC_t - .01\ I_t \quad (17)$$

$$PC_t = 212 + .13\ P*_t - .09\ I_t \quad (18)$$

Equation (17) shows a negative coefficient of -.01 on per capita income. This would suggest that wheat is an inferior good because, as income rises, less wheat would be consumed. The structural form income elasticity of wheat consumption is -.31. The advantage of using the reduced form is that the mill wheat price is removed as a regressor on per capita wheat consumption since it is an endogenous variable. This allows an estimation of the direct impact of income on wheat consumption. In the reduced model the income coeffient is .018 and the income elasticity is .56. In this case, wheat would be considered a normal good because more wheat would be consumed as income increases. Equation (19) shows wheat demand in the reduced form.

$$QD_t = -461 + .018I_t - .032P^{SO}_{t-1} + .245TR - .34EW_{t-1} - 1.27C_{t-1} \quad (19)$$

Intuitively it makes more sense that wheat should be considered a normal good. This is especially true in Brazil where average per capita income during the 21 year study period was only 1299 U.S. dollars in constant 1980 terms. Since wheat is considered a staple commodity, more of it would be expected to be consumed as income rises. Consumers would not be expected to easily substitute other staples for wheat since they are more expensive (Table XIII, P. 38).

The study found that domestic wheat production is determined by the price of soybeans lagged one year. Soybeans are a principle cash and export crop. Wheat is double cropped with soybeans in alternate six month growing seasons. Wheat acreage planted and harvested is highly dependent on soybean area harvested and therefore on soybean prices. For every one percent increase in the price of soybeans there was a .72 percent increase in wheat production in the following year (Table XLII, p. 110).

Since the mill price helps determine the level of wheat consumption and is also a policy variable, the model sought to explain changes in the mill price. Producer price and per capita income were found to be the two main determinants of the mill price. When producers are highly subsidized, there is less funding for the consumer subsidy so the mill price is higher. When per capita income is high and the country is prosperous it can afford higher subsidies to consumers. Also tax revenues are expected to

be positively correlated with per capita income. The model shows that for each one percent increase in the producer price, the consumer price increased by .25 percent. For each one percent increase in per capita income, the consumer price decreased by .92 percent.

Since the producer wheat price is also a policy variable and helps determine the mill wheat price, the model sought to explain what determines the producer wheat price. It found that the producer wheat price is set by the Brazilian Government in response to the price of soybeans, lagged one year, the value of wheat imports, lagged one year, and the value of CCC credit for wheat purchases from the U.S., lagged one year. These elasticities were .34, .21 and .08, respectively. It is hypothesized that, since wheat production is highly affected by soybean production, that the Brazilian Government would have to maintain wheat prices at least at parity with soybean prices in order to maintain wheat production at parity with soybean production. Otherwise farmers would substitute more soybean production for less wheat production. This variable was lagged because soybean planting precedes wheat planting by six months.

The producer wheat price was found to be positively correlated with the value of Brazilian wheat imports, EW. This variable reflects both the world price of wheat and the quantity of wheat imported.

$$EW = PW \times QI \qquad (20)$$

The higher the world price, the less the amount of subsidy is required on producers to maintain or increase the producer price. Or, to put it another way, with a fixed amount of subsidy, an increase in the world wheat price would result in an increase in the producer price given the same quantity produced. This is because the producer subsidy is equal to Brazilian production times the difference between the producer price and the world price.

$$PS = BP \times (P^* - pW) \qquad (21)$$

On the other hand, an increase in wheat quantity imported would result in pressure to increase the producer subsidy on wheat because of the policy of "import substitution". An increase in the producer subsidy would increase the producer price given the same wheat quantity produced and the same world wheat price. In general, policy decisions are formulated and implemented following a time lapse during which policy makers realize what is happening, develop a consensus, request the policy change and implement it. For this reason the value of wheat imports, EW, was lagged one year.

Effects of the CCC program

A principle policy of the U.S. government related to wheat exports is commodity credit for wheat sales to wheat importing countries such as Brazil. In a study done to evaluate the impact of such policies on Brazil's wheat

imports (Hall, 1980), Hall found that one effect of P.L. 480 was to induce more Brazilian domestic wheat production. Brazil spent less on wheat imports by receiving wheat through the P.L. 480 concessional program. Brazil was able to spend more to support its own wheat farmers because of the savings provided by P.L 480. This resulted in more domestic production and future reductions in commercial imports. P.L. 480 also competed directly with commercial wheat sales.

The CCC program differs from P.L. 480 in being a credit sales program rather than a food aid program. However, the CCC program may have similar effects on Brazilian domestic production and on wheat imports. By subsidizing the export price of U.S. wheat and delaying repayment, the CCC program helps Brazil to subsidize Brazilian wheat producers. The wheat purchasing credits help justify Brazilian policies which increase incentives to Brazilian wheat producers. This results in some of the same effects on domestic production as P.L. 480 such as increased domestic production and reduced demand for non-subsidized imports.

The results of the current study show that the CCC program had the effect of slightly dampening consumer demand for wheat through its positive effect on producer prices. The model shows that increases in producer prices have a positive impact on consumer prices. As the consumer price increases, less wheat is consumed. In the model, the

value of CCC credits to Brazil was divided by Brazil's population so that this variable would be on a per capita basis since the other variables were on a per capita basis. It was found that for each one percent increase in CCC program expenditures per capita to Brazil, lagged one year, there was a .01 percent decrease in demand for wheat products in Brazil. As previously discussed, there is a lag time for policy implementation. In this case there is a lag between U.S. policy regarding CCC credit amounts and Brazilian policy regarding producer wheat prices. For this reason the CCC regressor was lagged one year. The effect of the CCC program on current year producer prices and hence on wheat consumption was not statistically significant.

Elasticity Results, Demand for Imports and Market Share

The elasticity results tend to measure long term responses since the data are yearly observations. Demand for imports is sensitive to per capita income in Brazil as well as on exchange rates. Per capita income influences quantity demanded directly through the income effect and indirectly through its effect on consumer wheat prices. Market share among Argentina, Canada and the United States is sensitive to own- and cross-price elasticities as well as the cruzeiro/dollar exchange rate. Table XLI shows the income, price and exchange rate elasticities for the U.S.

and Argentina from the structural form of the wheat trade model. Table XLII shows the elasticity results for Canadian wheat sales to Brazil using the reduced form because Canadian sales were not directly estimated. These results show that U.S. and Canadian wheat sales to Brazil were highly responsive to per capita income in Brazil with elasticities of 1.34 and 1.94, respectively. Argentine wheat sales to Brazil had a negative income elasticity for per capita income in Brazil. However, none of the elasticities for the Argentine equation were statistically significant at the p=.05 significance level.

Own-price elasticities were estimated for U.S. and Argentine wheat sales to Brazil. These results were statistically significant at the p=.05 level for U.S. sales but not for Argentine sales. Table XLI shows that U.S. sales had an own-price elasticity of -1.54. This means that as the price of U.S. wheat to Brazil increased by one percent, U.S. sales declined by 1.54 percent. Cross-price elasticities were significant at the p=.05 significance level for U.S. wheat sales to Brazil but not for Argentine sales. Table XLI shows that U.S. sales had a cross-price elasticity of 1.43 for Argentine wheat prices. This means that as the price of Argentine wheat increased by one percent, U.S. sales to Brazil increased by 1.43 percent. In addition, Canadian wheat sales to Brazil had a cross-price elasticity for U.S. wheat prices of 4.64, estimated from the reduced form model.

The real cruzeiro/dollar exchange rate had a negative elasticity for U.S. wheat sales to Brazil, -.35, and a positive elasticity for Argentine sales, .47 (Table XLI). However, neither of these elasticities was statistically significant at the p=.05 significance level. In addition, Canadian wheat sales to Brazil had a positive elasticity for the cruzeiro/dollar exchange rate, .31, derived from the reduced form model (Table XLII).

This model for Brazilian wheat imports shows that changes in per capita income in Brazil are central to explaining wheat import demand and may also affect market share among Argentina, Canada and the U.S. Per capita income was highly significant statistically in explaining per capita wheat consumption in Brazil because of its double affect on consumption, through the income effect, and through the price affect. The model shows that per capita income had a positive influence on U.S. and Canadian wheat sales but a negative influence on Argentine wheat sales. The CCC program had negative impacts on wheat sales to Brazil as a result of its positive effect on domestic producer and consumer wheat prices. Its impact on wheat sales was likely greater on Argentina and Canada than on the U.S. For example, a one percent increase in allocations on CCC credit to Brazil would result in a -.09 percent decrease in Canadian wheat sales to Brazil.

Implications to Policy Makers

The results show that international trade analysis must consider the simultaneous interactions of economic events in several countries. Since the policy makers in the various countries will have different, if not conflicting, goals, the implications of any analysis will depend on the perspective of the policy maker. For example, a current goal of Brazilian policy makers is to reduce imports and expand exports. This study strongly suggests that price subsidies for soybean producers are more effective in increasing domestic wheat production and thus reducing wheat imports than are direct producer price subsidies for wheat production. Wheat producers in Brazil are more influenced by soybean prices than by wheat prices. This is because soybeans and wheat are grown on the same land by the same farmers. These farmers produce soybeans as their main cash crop and grow the wheat in the off-season. As the price of soybeans increases and land planted in soybeans increases, more wheat will also be grown. Since the price of soybeans is set more than six months prior to planting the wheat crop, the farmers are responding to the lagged price of soybeans rather than to the current price.

Brazil could also greatly reduce wheat imports by removing subsidies on the mill price since, for every one percent increase in the price of wheat products to consumers, there is approximately a one percent decline in

consumption. However, there may be other policy considerations such as political stability and social well-being that would prohibit raising prices to consumers.

U.S. policy goals are the opposite of Brazil's because of the current grain surplus. U.S. policy makers would like to encourage Brazil's wheat imports, maintain the traditionally large share of the Brazilian wheat market and reduce some of the volatility of wheat exports to Brazil. The study suggests that credit programs such as the Commodity Credit Program are not successful because, if anything, they encourage Brazilian production and discourage consumption.

U.S. wheat sales are sensitive to changes in U.S. wheat prices and the wheat prices of competing wheat exporting countries. The relatively high U.S. price elasticities suggest that in the event of a price war in which the three exporters aggressively lowered their own wheat prices to increase market share, the U.S. and Canada would tend to increase market share relative to Argentina because of their higher price elasticities of wheat sales to Brazil. For example, a one percent decrease in price among the three exporting countries would result in U.S. sales increasing by 1.54 percent compared to a loss of -.09 percent in Argentine sales. It may be that U.S. policy makers should also concentrate on non-price, non-credit variables. The U.S. is a large, reliable supplier with a large proportion of its wheat production in hard red winter

wheat. Brazilian mills seek hard red winter wheat to mix with the soft Brazilian variety for staple bread products. Argentine policy makers are faced with highly volatile wheat imports from their geographical neighbor. They would prefer to sell wheat to Brazil than to more distant wheat importing countries because of the lower freight charges. Argentina may benefit when the Brazilian cruzeiro is weak relative to the dollar. A one percent increase in the cruzeiro/dollar exchange rate resulted, on average, in a .47 percent increase in Argentine wheat sales to Brazil. Political factors are more of an influence in the case of Argentina than for either the U.S. or Canada. As a result of these vulnerabilities, Argentina has attempted to diversify wheat sales by selling on a more global basis in recent years even though it means greater transportation costs. It was difficult to find a good fit for the data concerning Argentine wheat sales to Brazil. One reason for this may be the effect of hyperinflation in Argentina on price variables which makes it more difficult to consistently translate Argentine pesos into U.S. dollars.

Canada enjoys by far the most stable share of the Brazilian wheat market and receives the highest average price for its wheat. Between 1965 and 1985 Canada received $168 per metric ton versus $162 for the U.S. and $150 for Argentina. It is largely cushioned from fluctuations in Brazilian import demand by its five-year purchase agreements. These agreements set an upper and lower limit

on Canadian wheat sales to Brazil. Canada has an advantage over the U.S. in having a national grain board that can negotiate for all grain producers in Canada and more easily negotiate long term agreements. However, Canadian wheat sales to Brazil are vulnerable to U.S. wheat prices. The cross-price elasticity was an average of 4.64 between 1965 and 1985. This could mean a nearly five percent decrease in Canadian wheat sales following a U.S. price decrease of one percent. Canada is affected more than Argentina or the U.S. by changes in Brazilian per capita income with an income elasticity of 1.94 percent. Canada now has its own version of the U.S. Commodity Credit Corporation Program. It is likely that this program helps to boost Canadian wheat sales in the short run and reduce those of the U.S. and Argentina, but like the U.S. program, it is not likely a long run benefit to sales because of its possible positive impact on Brazilian producer and consumer wheat prices.

Another implication of this study is that soybean prices may be used to predict Brazilian wheat imports the following year because of their positive effect on domestic wheat production. For example, a one percent increase (decrease) in soybean prices resulted in a .72 percent increase (decrease) in Brazilian wheat production.

Limitations

As with most econometric models, it is impossible to capture all possible effects, especially in an international trade model with many interdependent commodities, foreign exchange rates, and macroeconomic variables. For many variables, data are not kept in equivalent time units for different countries. For example, much U.S. data is on a fiscal year basis which does not necessarily coincide with the calendar year data or seasonal year data of other countries. In Brazil, the wheat harvest is at a different time of year than the soybean harvest so a one-year lag may come closer than current year data in estimating cross-price effects but may still be imperfect. In many cases, data series from different sources may differ and the researcher must select the series that seems most reliable. In this study, choices often had to be made between original Brazilian data sources and sources such as The Food and Agriculture Organization (FAO) or The World Bank. The original Brazilian sources seemed more appropriate. In some cases, different sources had to be spliced together to produce a complete time series. Data used in estimating this model may be found in the Appendix.

Some of the variables did not have data for the full 21 years. For example, the CCC program replaced the earlier P.L. 480 program so data for the CCC program were available for only eight years. Canada had no wheat

exports to Brazil for the first five years of the study. Because Brazil and Argentina have experienced hyperinflation in recent years, it is more difficult to accurately convert time series into consistent price units. The point in time within the year in which the currency is converted can make a large difference.

Suggestions for Further Study

The model has been useful in focusing on a single market for wheat as opposed to a regional or global wheat model. The particular factors and policy differences that would help policy makers tailor programs to different countries were revealed. However, it cannot capture the larger scope of a regional or world model. The two approaches complement each other and should both be used in analyzing policy choices. It would be useful to compare Brazil to other wheat importing countries to see if a different set of policy decisions would be warranted given the national differences in wheat import markets.

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APPENDIX

TABLE XLII

BRAZILIAN WHEAT IMPORTS AND SHARE TO MAJOR EXPORTERS

Year	Total	U.S.	Canada	Argentina
	in thousands of metric tons			
1965	1,876	472	0	1,313
1966	2,381	1,235	0	1,024
1967	2,429	1,069	0	802
1968	2,614	1,056	0	1,016
1969	2,346	882	0	1,033
1970	1,958	635	302	1,021
1971	1,710	942	401	205
1972	1,797	454	315	969
1973	2,945	1,544	408	993
1974	2,399	1,081	1,257	62
1975	2,098	1,656	334	45
1976	3,428	1,599	1,044	724
1977	2,624	601	893	881
1978	4,335	2,965	1,276	70
1979	3,654	1,528	352	1,480
1980	4,755	1,807	1,962	986
1981	4,360	3,362	810	50
1982	4,224	2,711	1,236	216
1983	4,182	2,617	1,489	0
1984	4,868	2,558	800	800
1985	3,860	2,217	749	793

Source: Banco Do Brasil, S.A., Cacex

TABLE XLIII

DOLLARS PAID BY BRAZIL TO MAJOR WHEAT EXPORTERS

Year	Total	U.S.	Canada	Argentina
1965	135.899	34.270	0	95.208
1966	167.771	87.906	0	71.577
1967	178.107	78.471	0	59.403
1968	181.678	75.308	0	70.373
1969	134.758	49.022	0	60.217
1970	103.839	33.150	17.913	52.776
1971	106.831	58.196	26.442	12.599
1972	121.918	32.847	20.922	64.697
1973	335.560	208.258	34.995	92.144
1974	468.395	213.731	244.342	10.322
1975	330.858	261.271	50.569	6.936
1976	504.526	233.306	164.381	98.161
1977	264.727	65.030	91.797	82.476
1978	541.335	359.152	170.538	8.618
1979	546.657	233.846	67.476	205.598
1980	889.785	320.533	397.565	171.687
1981	831.892	628.984	173.651	8.675
1982	761.953	460.913	253.548	39.105
1983	726.610	422.696	293.161	0
1984	755.014	397.888	252.882	104.244
1985 *	567.503	341.041	110.612	102.547

Source: Banco Do Brasil, S.A., Cacex

* Jan/Nov

TABLE XLIV

WHEAT PRICE PAID BY BRAZIL TO MAJOR EXPORTERS *

Year	U.S.	Canada	Argentina	Overall
1965	72.55	np	72.51	72.43
1966	71.18	np	69.88	70.47
1967	73.40	np	74.07	73.33
1968	71.33	np	69.25	69.49
1969	55.59	np	58.31	57.44
1970	52.20	59.30	51.70	53.04
1971	61.77	66.02	61.31	62.45
1972	72.27	66.42	66.78	67.85
1973	134.88	85.76	92.81	113.92
1974	197.74	194.42	167.71	195.23
1975	157.79	151.35	155.37	157.71
1976	145.86	157.50	135.62	147.17
1977	108.24	102.82	93.57	100.88
1978	121.14	133.61	123.02	124.88
1979	153.06	191.88	138.94	149.58
1980	177.37	202.67	174.07	187.12
1981	187.09	214.37	173.50	190.80
1982	170.02	205.10	180.88	180.39
1983	161.50	196.83	np	173.74
1984	155.56	167.53	130.25	155.11
1985	153.81	147.72	129.39	147.02

Source: Banco Do Brasil, S.A., Cacex

* Calculated by dividing amount paid to exporter by number of tons purchased.

TABLE XLV

UNIT VALUE OF ARGENTINE WHEAT

Year	Index of Unit Values
in U.S. dollars 1980=100	
1965	30.8
1966	30.5
1967	32.6
1968	31.5
1969	32.5
1970	30.0
1971	32.8
1972	36.7
1973	53.6
1974	106.5
1975	94.2
1976	75.3
1977	52.9
1978	64.9
1979	78.0
1980	100.0
1981	111.7
1982	91.9
1983	79.1
1984	73.4
1985	67.5

Source: International Financial Statistics

TABLE XLVI

BRAZILIAN WHEAT IMPORTS AND SHARE TO MAJOR EXPORTERS

Year	Total	U.S.	PL480	Canada	Argentina	Other
			thousands of metric tons			
1965	1,902	270	250	0	1,292	90
1966	2,467	785	422	0	1,060	200
1967	2,433	650	498	0	650	635
1968	2,417	470	448	0	1,064	435
1969	2,307	435	450	0	1,000	422
1970	1,680	518	100	300	762	0
1971	1,727	530	287	400	350	160
1972	2,749	1,189	0	300	1,200	60
1973	2,062	1,136	0	400	526	0
1974	2,165	785	0	1,300	80	0
1975	3,070	1,980	0	800	240	50
1976	3,163	1,238	0	810	1,055	60
1977	2,844	1,673	0	655	355	161
1978	4,200	2,254	0	1,221	441	284
1979	3,780	1,255	0	553	1,972	0
1980	4,599	2,799	0	1,800	0	0
1981	4,000	2,650	0	935	205	130
1982	4,105	2,720	0	1,250	0	135
1983	4,291	2,376	0	1,500	415	0
1984	4,503	2,541	0	1,500	462	0
1985	3,468	1,683	0	1,000	685	100

Source: Tomasini, CNPT/EMBRAPA

TABLE XLVII

EXPORTS TO BRAZIL UNDER CCC
EXPORT CREDIT PROGRAMS,
FISCAL YEARS 1965-1985

thousands of U.S. $

Year	Value
1965	0
1966	0
1967	0
1968	15,793
1969	0
1970	0
1971	0
1972	0
1973	0
1974	0
1975	0
1976	0
1977	0
1978	0
1979	14,344
1980	32,926
1981	197,935
1982	283,244
1983	336,015
1984	356,369
1985	443,435

Source: Foreign Agricultural Service memorandum, November 1986

TABLE XLVIII

CRUZEIRO/DOLLAR EXCHANGE RATE AND BRAZILIAN WHEAT PRICES

Year	Exchange Rate	Producer Price	Average FOB Import Price
	cruzeiro/ dollar	dollars per metric ton	
1965	**	**	59.64
1966			55.39
1967			62.53
1968	3.713	103.23	57.96
1969	4.258	105.68	56.97
1970	4.813	101.81	60.78
1971	5.579	97.98	62.68
1972	6.122	98.00	78.70
1973	7.435	100.87	137.42
1974	8.640	162.04	192.72
1975	8.674	192.53	155.35
1976	11.723	181.69	132.70
1977	15.327	206.82	107.01
1978	19.965	207.86	125.32
1979	33.567	160.87	162.67
1980	61.574	192.29	184.64
1981	93.374 *		176.96
1982	179.220 *		164.26
1983	573.270 *		157.37
1984	1841.500 *		151.61
1985	6205.100 *		141.04

Source: Tomasini, CNPT/EMPRAPA

* Federal Reserve Bulletin

** Some of the data in this column were not available

TABLE XLIX

BRAZILIAN POPULATION AND WHEAT CONSUMPTION

Year	Consumption	Population	Per capita Consumption
	1000 metric tons	thousands	Kilograms per year
1974	4,200	104,243	40
1975	4,422	107,145	41
1976	4,850	110,123	44
1977	5,694	113,208	50
1978	5,694	116,393	49
1979	6,072	119,670	51
1980	6,802	123,032	55
1981	6,098	126,439	48
1982	6,035	129,920	46
1983	5,987	133,473	45
1984	6,327	137,095	46
1985	6,200	140,797	44

Source: IBGE, SUNAB, Banco Do Brasil, S.A. - CTRIN

TABLE L

PRODUCER PRICE FOR RICE AND INDEX OF FERTILIZER PRICES

Year	Brazilian Producer Price for Rice 1970-1978	Index of Prices Paid for Fertilizer Sao Paulo, Selected Years
	dollars per MT	1966=100
1966	*	100
1967		*
1968		
1969		157
1970	63.8	
1971	79.6	
1972	97.8	259
1973	102.1	342
1974	145.9	850
1975	220.2	583
1976	147.4	612
1977	131.6	1,101
1978	187.3	1,455
1979		2,719

Source: Brazil - A Review of Agricultural Policies The World Bank

* Some of the data in this column were not available

TABLE LI

BRAZILIAN WHEAT AREA, PRODUCTION, YIELD AND PRICES

Year	Brazilian Wheat Area Harvested 1	Brazilian Wheat Production 1	Yield 1	Producer Price 2	Consumer Price 2
	in thousands of hectares	metric tons	Kg/ha	cruzeiros per metric ton	
1962	258,221	255,404	989	43	**
1963	302,122	97,811	324	72	
1964	300,542	213,691	711	149	
1965	354,680	221,576	625	210	
1966	385,028	298,523	775	265	
1967	561,987	364,870	649	317	
1968	845,693	693,598	820	383	
1969	1,299,518	1,146,319	882	450	
1970	1,861,204	1,734,972	932	490	410
1971	2,008,215	2,038,632	1,015	547	484
1972	2,340,431	693,399	296	600	556
1973	1,604,305	1,934,439	1,206	750	612
1974	2,212,643	2,848,040	1,287	1,400	734
1975	3,110,830	1,582,587	509	1,670	734
1976	3,520,709	3,037,864	863	2,130	968 *
1977	3,020,831	2,012,842	666	3,170	1,202
1978	2,794,365	2,700,707	966	4,150	1,391
1979	4,104,144	2,881,186	702	5,400	1,391
1980	3,318,501	2,702,130	814	11,840	2,998 *
1981	2,063,747	2,226,447	1,079	28,500	13,255 *
1982	2,960,010	1,802,337	609	**	
1983	1,890,145	2,180,677	1,154		
1984	1,938,843	1,935,411	998		
1985	2,600,352	4,260,997	1,639		

Sources: 1 CTRIN/Banco Do Brasil
2 DETRIG/SUNAB

* Yearly average
** Data unavailable

TABLE LII

BRAZILIAN WHEAT PRODUCTION, IMPORTS, RESERVES AND CONSUMPTION

Year	Wheat Production	Wheat Imports	Reserve Storage	Consump- tion	Consumption per capita
	in thousands of metric tons				Kg/yr
1965	221.6	1,901.6	30.7	2,376	28.42
1966	298.5	2,467.3	29.1	2,447	29.56
1967	364.9	2,433.0	47.7	2,665	31.17
1968	693.6	2,417.0	71.9	2,866	32.71
1969	1,146.3	2,236.6	117.2	2,908	32.25
1970	1,735.0	1,930.1	166.2	3,039	32.70
1971	1,946.0	1,527.0	225.0	3,207	33.63
1972	692.8	2,000.0	152.5	3,578	34.40
1973	2,031.3	3,011.1	218.5	3,746	37.11
1974	2,858.5	2,165.0	325.0	4,200	40.42
1975	1,659.0	2,300.0	431.9	4,422	43.35
1976	1,536.9	3,527.3	485.0	5,052	46.12

Source: Fecotrigo - DETEC/DIECO, CTRIN

TABLE LIII

PRODUCER WHEAT PRICES IN BRAZIL

Year	Producer Price
	dollars per metric ton
1980/1981	196
1981/1982	228
1982/1983	273
1983/1984	204
1984/1985	224

Source: World Wheat Statistics 1985, International Wheat Council

TABLE LIV

BRAZILIAN WHEAT IMPORTS

Year	Brazilian Wheat Imports	Percentage of total imports	Value in U.S. dollars	Value of Wheat Imports as a Percentage of Total Imports
	1000 MT	%	millions	%
1980	4,755	6.62	890	3.88
1981	4,360	6.81	832	3.77
1982	4,224	6.96	762	3.93
1983	4,182	7.60	727	4.71
1984	4,868	9.02	755	5.43

Source: EMBRAPA

TABLE LV

BRAZILIAN WHEAT AREA AND PRODUCTION

Year	Wheat area harvested	Wheat Production
	1000 hectares	1000 metric tons
1984	1,741	1,956
1985	2,658	4,247

Source: Instituto Brasileiro de Geografia e Estatistica

TABLE LVI

BRAZILIAN WHEAT PRODUCTION, IMPORTS AND PRICES

Year	Domestic Production	Imports	Farm Prices	Average Import Price	Cost at mill	Mill Price
	million metric tons		U.S. dollars per metric ton			
1980	2.74	4.76	247	240	272	43
1981	2.22	4.36	205	242	226	107
1982	1.88	4.14	262	222	288	131
1983	2.19	3.60	170	182	195	104
1984	1.83	4.20	185	177	210	117
1985	2.87	*	245	180	265	101

Source: World Bank (telephone conversation with John Joyce)

* Data unavailable

TABLE LVII

PRICES FOR RICE, SUGAR AND FERTILIZERS

Year	Rice Price Wholesale New Orleans	Price of Sugar Brazil	Price of Superphosphate U.S. Gulf Ports
	dollars/MT	cents/lb	dollars/MT
1965	182.98	3.39	47.25
1966	182.98	3.64	47.25
1967	187.39	3.64	47.00
1968	191.80	4.49	37.50
1969	187.39	4.75	39.00
1970	189.60	5.10	42.50
1971	191.80	5.50	43.00
1972	216.05	7.22	67.50
1973	396.83	8.96	100.00
1974	555.56	25.38	308.00
1975	418.87	29.18	205.00
1976	308.64	11.52	91.50
1977	332.89	8.24	97.92
1978	399.03	7.70	98.04
1979	381.40	8.79	143.34
1980	496.04	21.79	178.04
1981	565.48	16.92	160.87
1982	366.70	9.42	140.04
1983	378.46	9.46	134.04
1984	379.74	9.17	131.25
1985	382.50	6.73	121.38

Source: International Financial Statistics, The International Monetary Fund

TABLE LVIII

BRAZIL'S POPULATION, FOREIGN EXCHANGE, FOREIGN DEBT AND SOYBEAN PRICE INDEX

Year	Brazil's Population	Brazil's Foreign Exchange Reserves	Brazil's Foreign Debt	Soybean Index of Unit Value Exports
	millions	millions of dollars	billions of cruzeiros	1980=100
1965	81.01	421	0	38
1966	82.93	368	0	42
1967	85.24	142	0	38
1968	87.62	200	0	38
1969	90.07	599	2	37
1970	95.52	962	4	37
1971	95.17	1450	6	45
1972	97.85	3836	15	48
1973	99.92	6030	18	109
1974	102.40	4874	29	84
1975	104.94	3653	43	81
1976	107.54	6101	70	85
1977	110.21	6787	110	108
1978	112.94	11406	240	101
1979	115.74	8342	586	111
1980	121.29	5042	1099	100
'1981	124.02	5888	2681	110
1982	126.81	3641	5225	97
1983	129.66	4355	28349	94
1984	132.58	11507	107395	114
1985	135.65	10604	360302	86

Source: International Financial Statistics, The International Monetary Fund

TABLE LIX

CRUZEIRO/DOLLAR EXCHANGE RATE, BRAZIL'S CPI AND BRAZIL'S NATIONAL INCOME

Year	Cruzeiro/ Dollar Exchange Rate	Consumer Price Index	National Income
		1980=100	billions of cruzeiros
1965	1.90	1.4	42
1966	2.22	2.0	60
1967	2.66	2.7	81
1968	3.40	3.2	115
1969	4.07	4.0	153
1970	4.59	4.9	184
1971	5.29	5.9	245
1972	5.93	6.8	324
1973	6.13	7.7	454
1974	6.79	9.8	665
1975	8.13	12.7	944
1976	10.67	18.0	1518
1977	14.14	25.8	2323
1978	18.07	35.8	3498
1979	26.95	54.7	5845
1980	52.71	100.0	12125
1981	93.12	205.6	23346
1982	179.51	407.0	48225
1983	577.04	984.9	120268
1984	1848.03	2922.5	386968
1985	6200.00	9556.0	1298248

Source: International Financial Statistics, The International Monetary Fund

TABLE LX

PRICES FOR WHEAT AND RICE IN BRAZIL

Year	Average Import Price 1 *	Consumer Price of Wheat 2	Consumer Price of Wheat 3	Columns Two and Three Combined **	Consumer Price for Rice 2
1965	72.43	***	***		***
1966	70.47				
1967	73.33	2150		85	
1968	69.49	2100		77	
1969	57.44	1918		73	
1970	53.04	2089		86	
1971	62.45	2045		88	
1972	67.85	1938		86	286
1973	113.92	1880		92	261
1974	195.23	1523		85	411
1975	157.71	1180		71	500
1976	147.17	1080		71	333
1977	100.88	1202	85	85	318
1978	124.88	1010	78	78	428
1979	149.58	766	59	59	368
1980	187.12	625	42	42	519
1981	190.80		106	106	426
1982	180.39		131	131	594
1983	173.74		105	105	380
1984	155.11		115	115	
1985	147.02		125	125	
1986			101	101	

Sources: 1 Banco Do Brasil, S.A., Cacex
2 The World Bank
3 telephone conversation with John Joyce of The World Bank

* Amount paid to exporter divided by number of tons bought

** Years 1967 to 1977 were calculated from column two using CPI and cruzeiro figures on previous page and converting, first to price in current year cruzeiros using CPI figures, and then to current year U.S. dollars using current year exchange rate.

*** Some of the column data were not available

TABLE LXI

WHEAT SUBSIDIES RECEIVED BY WHEAT PRODUCERS AND CONSUMERS, 1968-1979

Year	Producer Subsidy	Consumer Subsidy
	millions of 1977 Cruzeiros	
1968	322	263
1969	501	462
1970	1025	-492
1971	1476	-962
1972	72	1735
1973	-415	3980
1974	-1473	6260
1975	344	7933
1976	758	6036
1977	2145	2542
1978	25	11290
1979	1084	12170

Source: Renato Zandonadi, Observacoes Sobre o Subsidio do Trigo Consumido no Brasil, CFP, Brasilia, 1979

TABLE LXII

GSM-102 AUTHORIZED GUARANTEES AND PERCENT OF VALUE OF U.S. AGRICULTURAL EXPORTS AND AMOUNT OFFERED TO BRAZIL

Fiscal Year	Authorized Guarantees	As percentage of U.S. agricultural Exports
	billions of dollars	%
1981	1.5	3.4
1982		
1983	4.8	13.5
1984	4.0	
1985	5.0	

Source: Paul Harte (Master's Thesis)

TABLE LXIII

GSM-102 GUARANTEES OFFERED TO BRAZIL

Period	Amount
	millions of U.S. dollars
10/1/82-6/30/83	315
10/1/83-6/30/84	460

Source: Paul Harte (Master's Thesis)

TABLE LXIV

BRAZIL: INDICATORS OF ECONOMIC GROWTH

Year	Gross Domestic Product	Agriculture
	percentage change	
1975	5.6	3.4
1976	9.0	4.2
1977	4.7	9.6
1978	6.0	-1.7
1979	6.7	5.0
1980	7.9	6.3
1981	-1.9	6.4
1982	0.0	-2.5
1983	-3.9	2.1

Source: Banco Central Annual Reports

TABLE LXV

YEARLY PERCENTAGE CHANGE IN BRAZILIAN CONSUMER PRICE INDEX

Year	Consumer Price Index
	Percentage change
1970	21.0
1971	18.0
1972	14.4
1973	13.7
1974	33.5
1975	31.3
1976	44.8
1977	43.1
1978	38.2
1979	76.0
1980	86.3
1981	100.5
1982	101.8
1983	177.9

Source: Instituto Brasileiro de Geografia e Estatistica (IBGE) and USDA-FAS Agricultural Situation and Outlook, 1983-Brazil

TABLE LXVI

VALUE OF AGRICULTURAL TRADE, U.S. AND BRAZIL, 1975-1983

Year	U.S. Agricultural Imports from Brazil	Major Tropical Products *	U.S. Agricultural Exports to Brazil	Wheat and Corn
	millions of U.S. dollars	%	millions of U.S. dollars	%
1975	772	81	323	85
1976	963	80	255	88
1977	1,384	84	111	67
1978	1,537	80	534	90
1979	1,503	77	536	79
1980	2,019	86	680	90
1981	1,905	75	710	90
1982	1,438	62	526	82
1983	1,656	65	479	88

* Coffee, cocoa and sugar

Sources: USDA-FAS, Brazil Situation and Outlook, No. Br4603

TABLE LXVII

BRAZILIAN WHEAT AREA HARVESTED, YIELD AND PRODUCTION

Year	Wheat Area Harvested	Yield	Production
	1000 hectares	kg/hectare	1000 metric tons
1965	767	760	585
1966	717	860	615
1967	831	760	629
1968	970	880	856
1969	1407	980	1374
1970	1895	970	1844
1971	2269	886	2011
1972	2320	424	983
1973	1820	1065	1938
1974	2471	1157	2859
1975	2931	610	1788
1976	3548	909	3226
1977	3153	655	2066
1978	2801	956	2677
1979	3831	763	2924
1980	3122	865	2702
1981	1920	1151	2209
1982	2825	644	1820
1983	1879	1190	2237
1984	1742	1139	1983
1985	2658	1598	4247

Source: Food and Agriculture Organization of the United Nations, FAO Production Yearbook, years 1965-1968

TABLE LXVIII

ARGENTINE WHEAT AREA HARVESTED, YIELD AND PRODUCTION

Year	Wheat Area Harvested	Yield	Production
	1000 hectares	Kg/hectare	1000 metric tons
1965	4601	1320	6079
1966	5214	1200	6247
1967	5812	1260	7320
1968	5837	980	5740
1969	5191	1350	7020
1970	3332	1280	4250
1971	4315	1316	5680
1972	4965	1591	7900
1973	3981	1633	6500
1974	4233	1410	5970
1975	5271	1626	8570
1976	6386	1723	11000
1977	3910	1355	5300
1978	4685	1729	8100
1979	4564	1709	7800
1980	5023	1549	7780
1981	5790	1364	7900
1982	7200	2014	14500
1983	6880	1788	12300
1984	5901	2237	13200
1985	5296	1605	8500

Source: Food and Agriculture Organization of the United Nations, FAO Production Yearbook, years 1965-1985

TABLE LXIX

UNITED STATES WHEAT AREA HARVESTED, YIELD AND PRODUCTION

Year	Wheat Area Harvested	Yield	Production
	1000 hectares	kg/hectare	1000 metric tons
1965	20056	1790	35805
1966	20180	1770	35699
1967	23783	1740	41432
1968	22363	1920	42898
1969	19253	2060	39740
1970	17863	2090	37291
1971	19293	2282	44030
1972	19135	2197	42047
1973	21802	2136	46577
1974	26552	1841	48885
1975	28081	2057	57765
1976	28640	2036	58307
1977	26895	2061	55420
1978	23043	2123	48922
1979	25333	2301	58289
1980	28727	2249	64619
1981	32784	2323	76170
1982	31905	2396	76443
1983	24843	2651	65858
1984	27085	2607	70618
1985	26197	2519	65992

Source: Food and Agriculture Organization of the United Nations, FAO Production Yearbook, years 1965-1985

TABLE LXX

CANADIAN WHEAT AREA HARVESTED, YIELD AND PRODUCTION

Year	Wheat Area Harvested	Yield	Production
	1000 hectares	kg/hectare	1000 metric tons
1965	11453	1540	17674
1966	12016	1870	22516
1967	12189	1320	16137
1968	11907	1490	17686
1969	10104	1840	18623
1970	5052	1790	9023
1971	7854	1835	14412
1972	8640	1680	14514
1973	10020	1708	17112
1974	8934	1488	13295
1975	9487	1800	17078
1976	11252	2096	23587
1977	10114	1964	19862
1978	10584	1998	21146
1979	10500	1690	17746
1980	11098	1738	19292
1981	12427	1996	24802
1982	12591	2194	27620
1983	13697	1935	26505
1984	13158	1611	21199
1985	13688	1746	23900

Source: Food and Agriculture Organization of the United Nations, FAO Production Yearbook, years 1965-1985

TABLE LXXI

BRAZILIAN SOYBEAN AREA HARVESTED, YIELD AND PRODUCTION

Year	Soybean Area Harvested	Yield	Production
	1000 hectares	kg/hectare	1000 metric tons
1965	432	1210	523
1966	491	1210	595
1967	612	1170	716
1968	722	910	654
1969	906	1170	1057
1970	1319	1140	1509
1971	1589	1396	2218
1972	2274	1612	3666
1973	3300	1526	5035
1974	5143	1531	7876
1975	5824	1699	9892
1976	6416	1750	11227
1977	7070	1770	12513
1978	7778	1226	9535
1979	7321	1360	9959
1980	8774	1727	15156
1981	8485	1765	14978
1982	8202	1562	12810
1983	8137	1792	14582
1984	9421	1650	15541
1985	10153	1800	18278

Source: Food and Agriculture Organization of the United Nations, FAO Production Yearbook, years 1965-1985

TABLE LXXII

BRAZILIAN WHEAT IMPORTS

Year	Quantity of Wheat Imports	Value of Wheat Imports
	1000 metric tons	10,000 U.S. dollars
1965	1,889	13,697
1966	2,420	17,218
1967	2,480	18,465
1968	2,638	18,418
1969	2,373	16,386
1970	1,994	13,089
1971	1,739	12,722
1972	1,811	14,267
1973	3,015	30,189
1974	2,406	52,391
1975	2,106	33,223
1976	3,435	54,870
1977	2,626	29,564
1978	4,334	60,019
1979	3,658	63,100
1980	4,758	105,196
1981	4,363	96,303
1982	4,225	85,234
1983	4,182	80,488
1984	4,869	84,574
1985	4,041	

Source: Food and Agriculture Organization of the United Nations, FAO Trade Yearbook, years 1965-1985

TABLE LXXIII

ARGENTINE WHEAT EXPORTS

Year	Quantity of Wheat Exports	Value of Wheat Exports
	1000 metric tons	10,000 U.S. dollars
1965	6,676	37,363
1966	5,078	28,104
1967	2,064	12,229
1968	2,439	14,016
1969	2,462	14,392
1970	2,415	13,234
1971	987	5,868
1972	1,784	11,750
1973	3,167	24,600
1974	1,834	31,811
1975	1,920	32,382
1976	3,264	44,562
1977	5,970	57,528
1978	1,835	19,420
1979	4,364	61,856
1980	4,538	82,453
1981	3,788	70,140
1982	3,837	68,250
1983	10,232	148,084
1984	7,406	98,570
1985	9,618	

Source: Food and Agriculture Organization of the United Nations, FAO Trade Yearbook, years 1965-1985

TABLE LXXIV

UNITED STATES WHEAT EXPORTS

Year	Quantity of Wheat Exports	Value of Wheat Exports
	1000 metric tons	10,000 U.S. dollars
1965	19,655	118,539
1966	24,593	153,577
1967	18,811	120,723
1968	17,887	110,069
1969	13,746	83,058
1970	19,085	111,214
1971	17,536	108,954
1972	22,612	145,551
1973	38,445	415,111
1974	26,047	458,891
1975	38,294	529,305
1976	27,552	404,096
1977	25,224	288,257
1978	35,503	453,222
1979	34,703	549,157
1980	36,862	658,731
1981	45,107	807,346
1982	41,621	686,950
1983	41,091	651,264
1984	43,616	669,785
1985	24,810	

Source: Food and Agriculture Organization of the United Nations, FAO Trade Yearbook, years 1965-1985

TABLE LXXV

CANADIAN WHEAT EXPORTS

Year	Quantity of Wheat Exports	Value of Wheat Exports
	1000 metric tons	10,000 U.S. dollars
1965	12,729	84,121
1966	15,640	106,150
1967	10,303	74,385
1968	9,954	68,920
1969	7,339	52,239
1970	11,494	71,605
1971	13,616	87,754
1972	14,463	97,182
1973	12,891	126,535
1974	10,690	215,153
1975	11,648	206,179
1976	11,338	187,538
1977	14,934	182,794
1978	15,329	180,961
1979	12,471	198,167
1980	17,376	317,499
1981	16,212	328,029
1982	19,643	356,827
1983	22,228	385,431
1984	21,623	375,356
1985	16,983	

Source: Food and Agriculture Organization of the United Nations, FAO Trade Yearbook, years 1965-1985

TABLE LXXVI

MARITIME FREIGHT RATES FOR WHEAT TO ROTTERDAM

Year	From Argentina (River Plate)	From Canada (St. Lawrence Ports)	From the U.S. *
	U.S. dollars per metric ton		
1964/65	10.94	4.59	5.08
1965/66	12.23	4.34	4.89
1966/67	10.02	3.53	3.57
1967/68	10.10	4.00	4.34
1968/69	7.32	5.35	3.35
1969/70	9.77	5.17	5.84
1970/71	10.05	4.84	5.27
1971/72	6.05	2.55	2.74
1972/73	12.46	6.26	6.77
1973/74	26.81	12.92	14.00
1974/75	19.64	6.66	7.46
1975/76	14.08	4.74	5.30
1976/77	16.66	5.22	5.90
1977/78	16.16	5.64	6.38
1978/79	20.26	9.14	9.93
1979/80	29.77	15.63	16.85
1980/81	32.44	16.59	18.52
1981/82	28.44	11.50	11.52
1982/83	17.42	9.04	10.23
1983/84	14.88	9.67	11.75
1984/85	18.50	10.71	12.62

* Atlantic or Gulf Ports, whichever was lowest

Source: Food and Agriculture Organization (FAO), "Trade Yearbook", (p.23).

VITA

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Thesis: BRAZIL'S WHEAT MARKET - A TRADE MODEL AND POLICY ANALYSIS

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