FEED GRAINS AND MEAT PRODUCTION IN VENEZUELA

by

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ABSTRACT

This paper presents a description and analysis of the Venezuela feed grain and meat sectors from 1958 to the present time. Government policies toward these sectors are described and elasticities of supply and demand are estimated in order to provide a basis for predicting the effects of policy changes.

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AN ECONOMETRIC ANALYSIS OF VENEZUELA'S FEED GRAIN SECTOR

I. INTRODUCTION

This paper presents a description and analysis of the Venezuelan feed grain and meat sectors from 1958 to the present time. Factors influencing both the demand and supply of these products in the Venezuelan market are discussed. Government policies toward these sectors are also described and elasticities of supply and demand are estimated in order to provide a basis for predicting the effects of policy changes.

The feed industry in Venezuela is characterized by technological processes similar to those found in some developed countries. From the production of raw materials to the production of the feed itself, it is a highly mechanized capital-intensive industry which uses high value inputs. The Venezuelan government has intervened in this industry a great deal in order to assure a steady flow of raw materials from the grain producer to the feed industry, a steady supply of feed to meat producers, and a steady supply of meat to the final consumers. The government has had three main policy objectives: first, to encourage agricultural production while assuring fair farm incomes; second, to supply cheap calories and protein to urban inhabitants; and third, to achieve these two objectives at the least possible cost for the government (Tolley et al., 1982).

In February of 1989, the Democratic Action party, headed by the Social-Democrat C.A. Pérez, took power and as a general goal decided to reduce the role of the government in the economy, including the feed industry. These policies include the re-adjustment of the minimum price policy for the production of corn, sorghum and other cereals, the gradual elimination of the fertilizer subsidy over a period of five years, the elimination of the preferential exchange rate for importing soybean and feed grains, and the elimination of the consumer subsidy for pork and chicken. The reaction to the above measures was immediate.[1] A quick glance at the written press found the following:

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"Feed industry collapses, sells at *old* prices the feed it has to produce at free market dollar." (El Universal, June 11, 1989)

"The deregulation of the chicken price is a mistake. Consumption falls 40 percent." (El Diario, June 13, 1989)

"Corn and sorghum production will decrease between 20 and 40 percent, according to well-known business man and farmer C. Quijada." (Rodríguez, J. E.; El Universal, June 18, 1989)

Some of the initial effects of the new policies have been evaluated formally. For example, in June of 1989 a group of Venezuelan analysts gathered in Caracas for a symposium on the consequences of the economic adjustment process. With respect to agricultural supply, a decrease in output was expected. On the demand side, a general decrease in per capita consumption of basic products was already apparent because of sharp increases in their prices. All were a direct consequence of the above economic measures, especially the liberalization of the exchange rate, the increase in the interest rate for agricultural credit, a new tariff policy that tended to eliminate barriers to trade, a general increase in the cost of services, and the move towards elimination of the fertilizer subsidy (FUNDAFUTURO, 1989; Medina, 1990). The new measures will place agriculture in general, and the feed grain and livestock sectors in particular, on a substantially different path.

This paper analyzes the history and structure of the feed grain and meat sectors. The feed grain sector and related sub-sectors (pork, poultry, and milk) are a large percentage of the aggregate value of agricultural production. Its final products, chicken and pork, provide an important percentage of the calories and proteins consumed by Venezuelans. The effects that the new policies will have on the sector itself, and the nation are important. This study contributes to the rather small number of analyses of this topic. Venezuela lacks recent studies about the effects of policy changes in the agricultural sector. Conventional policy analysis tools are seldom used to examine the frequent and often superficial declarations on these issues by the media.

In Section 2, the historical performance of the feed grain sector in Venezuela is described from 1969 to the present time. Special emphasis is given to the role and rationale for government policies. Section 3

presents an analysis of the seed grain and meat sectors. Elasticities of supply and demand are presented and compared with results obtained for different time periods and/or different countries.

Data used are presented in the Appendix.

PRODUCTION OF FEED GRAINS AND MEAT IN VENEZUELA

2.1. STRUCTURE AND IMPORTANCE OF THE SECTOR

The feed grain sector in Venezuela is comprised of three components: i) feed grain production, mainly of corn and sorghum; ii) feed manufacturing; and iii) meat production, in which pork and chicken production provide the main demands for processed feeds. Figure 2.1 shows how each component is related through production relations and through various policy interventions. Feed grain production is encouraged through a support price program in order to fulfill the need for raw materials in the feed processing sector, totally in the case of sorghum and partially in the case of corn. Production of pork and poultry is based on feed concentrates, and these meats play an important role in Venezuelan nutrition since their consumption traditionally has been subsidized by the government.

Sorghum and corn are the main cereals produced by Venezuelan agriculture. They account for more than 75 percent of the harvested area for cereals and for a third or more of the total harvested crop area over the last 15 years, as shown in Table 2.1. Feed grains accounted for more than 80 percent of the total value of cereal production in 1986. In terms of total value of crop production, the feed grains share has increased from nearly 15 percent annually in 1978-86 to 25 percent in 1986-1987 (Table 2.2). Over the last five years, the aggregate value of production of these two cereals has surpassed that of traditional crops such as coffee, sugar cane and rice (Table 2.3).

2.2. PRICE AND MARKETING POLICIES[2]

Agricultural policies for the feed grain sector have traditionally been characterized by heavy government intervention. Production has been subsidized through support prices, input subsidies and subsidized credit. More recently, preferential exchange rates for feedgrain imports, subsidized meat production and consumption subsidies through the fixation of retail prices have been among the most important policy in instruments. Traditionally, policies were designed to please both consumers and producers of agricultural products.

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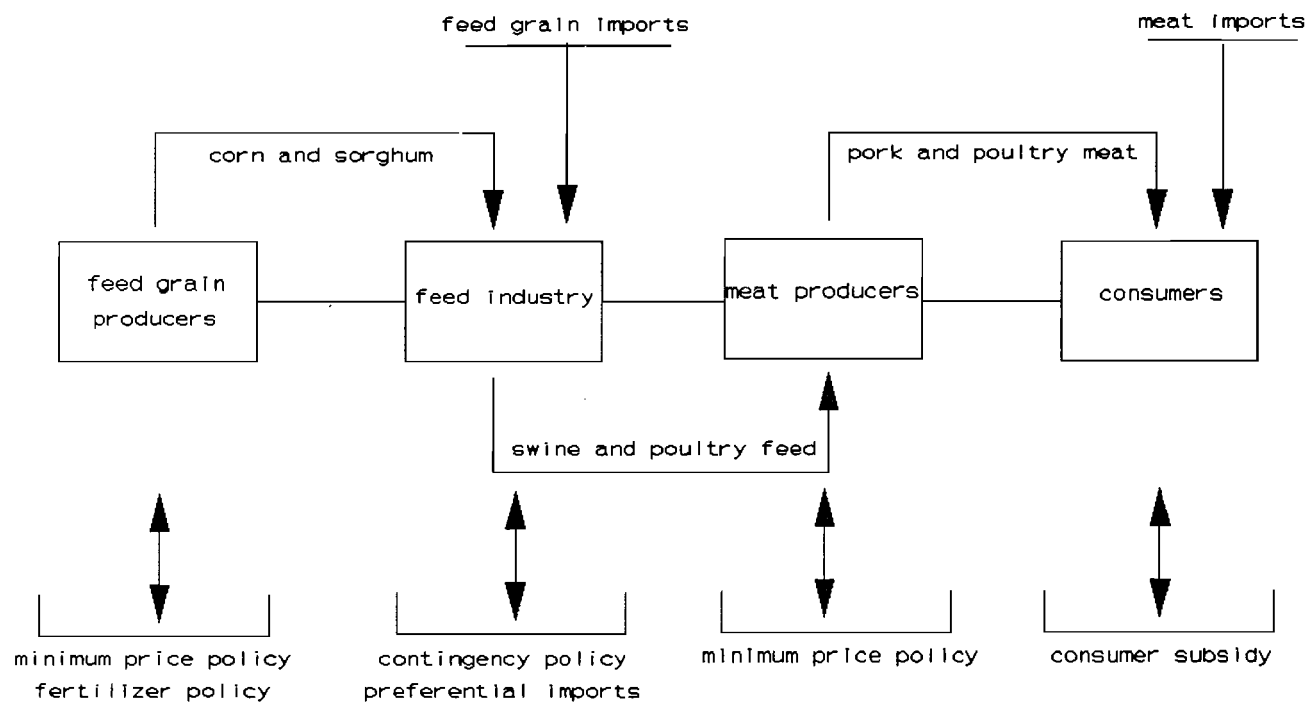
Figure 2.1: The Feed Grain Sector in Venezuela: Related Sectors and Policies Subject to Modification

Table 2.1. Corn and Sorghum as a Percentage of Area Under Cereals and of Total Crop Area.

Year	As Percent of Cereals Area			As Percent of Total Crop Area		
	Corn	Sorghum	Total	Corn	Sorghum	Total
1975	76.1	6.6	82.7	29.1	2.5	31.6
1976	70.9	15.0	85.9	28.6	4.2	32.8
1977	60.3	19.0	79.3	27.3	8.6	35.9
1978	53.9	24.2	78.1	23.3	10.5	33.8
1979	48.2	28.2	76.7	23.3	13.8	37.1
1980	48.8	26.2	75.0	22.8	12.2	35.0
1981	39.7	29.2	68.9	18.6	13.7	32.3
1982	40.5	29.2	69.7	18.4	13.3	31.7
1983	46.2	29.3	75.5	19.5	12.3	31.8
1984	44.5	33.9	78.4	19.7	15.0	34.7
1985	52.0	27.8	79.8	25.2	13.4	38.6
1986	56.2	32.9	89.1	30.3	17.7	48.0
1987	56.5	32.2	88.7	30.0	17.0	47.0
1988	55.8	34.1	89.9	n.a.	n.a.	n.a.
1989	54.5	35.1	89.6	n.a.	n.a.	n.a.

Source: Percentages are calculated on harvested area data from: Statistical Series Agricultural Sector 1978-87, Ministerio de Agricultura.

Table 2.2. Contribution of Corn and Sorghum to the Aggregate Value of Cereal Production and of Total Crop Production.

Year	Cereal Production			Total Crop Production		
	Corn	Sorghum	Total	Corn	Sorghum	Total
1978	40.9	22.4	63.3	9.5	5.2	14.7
1979	37.4	23.0	60.4	9.5	5.8	15.3
1980	36.7	21.5	58.2	9.1	5.3	14.4
1981	30.1	22.0	52.1	7.3	5.4	12.7
1982	33.3	23.9	57.2	8.0	5.7	13.7
1983	37.2	26.5	63.7	7.9	5.6	13.5
1984	38.3	31.5	69.8	8.7	7.1	15.8
1985	47.5	25.2	72.7	12.7	6.7	19.4
1986	52.5	32.3	84.8	15.5	9.5	25.0
1987	52.7	30.9	83.6	16.0	9.3	25.3

Source: Ministerio de Agricultura, 1988.

Two basic characteristics of Venezuela have favored this trend: extreme urbanization, with only 15% of the total population considered rural (World Bank, 1990), and the highest per capita income among Latin American countries, both before and after the debt crisis of the 1980s. The sharp increase in oil prices of the seventies increased government revenues, permitting the continuation of these subsidy programs.

We can divide the agricultural policy environment in Venezuela since 1958 into three sub-periods: from 1958 to 1982; from 1983 to January 1989, and from February 1989 to present. These benchmarks were chosen because 1983 is the beginning of the external debt crisis and 1989 is the year in which new economic measures were implemented in the face of the continuing economic crisis. Even though there have been different parties in power since 1958, the general goals for the development of the agricultural sector have been the same, encompassing three main objectives: increasing production and productivity of different agricultural products, improvement of farmers' economic conditions through increasing incomes, and achievement of a "rational" level of food self-sufficiency (MAC and FAO, 1987). To achieve these objectives in the feed grain sector, a variety of specific policies have been used. These policies are described chronologically.

2.2.1. From 1958 to 1982

This sub-period includes four and most of a fifth in a succession of democratic administrations: R. Betancourt (1959-64); R. Leoni (1964-69); R. Caldera (1969-74); C.A. Pérez (1974-79) and L. Herrera Campíns (1979-84). The whole period was characterized by a steady growth of the general national economy and a relatively constant and encouraging growth of the agricultural sector until 1979 (see Table 2.4).

The sixties can be considered the "import substitution" decade. The key aspect of this general strategy was to encourage production in the agricultural sector to provide the inputs required by agro-industry, while increasing the demand for agricultural inputs such as fertilizers, machinery, etc. Agricultural production was encouraged through policies in which the government absorbed part of the production costs and intervened in marketing channels to guarantee the application of subsidy policies. These policies were given the general

Table 2.3. Value of Production for the Main Crops, Venezuela, 1978-87 (millions of 1978 Bs).

Year	Coffee	Sugarcane	Rice	Corn	Sorghum
1978	555.7	318.7	451.4	503.8	276.3
1979	508.2	336.0	552.2	521.8	321.8
1980	548.1	329.1	557.0	490.2	286.7
1981	561.2	299.1	613.2	385.3	281.8
1982	546.8	345.5	547.7	426.8	306.7
1983	554.5	317.9	404.5	415.6	295.9
1984	573.4	314.0	367.1	466.1	384.1
1985	606.5	374.4	424.6	739.9	391.4
1986	624.0	485.8	289.4	999.2	614.5
1987	661.3	530.4	335.9	1079.7	631.9

Source: Ministerio de Agricultura, 1988.

Table 2.4. Percentage Growth of Agricultural GNP by Administration, 1959-83.

Administration	Growth Rate (percentage)
1959-64	5.6
1964-69	4.4
1969-74	3.3
1970-79	4.7
1979-81	1.0

name of "promotion policies" by the government. Above all, price control policies were the most important.

Several specific policy instruments were used:

i)   a minimum price policy through which the government fixed a producer price above the international price to encourage domestic production.

ii)   a reference price policy, through which the government fixed the prices of raw materials (both imported and domestically produced) used for the production of feed and food.

iii)   regulated or controlled prices of basic consumption goods, services and inputs for agricultural production (Pinto Cohen, 1983).

Within the feed grain sector, production was stimulated through the minimum price policy, subsidized credit, and subsidized inputs (especially fertilizers, as well as machinery and other chemicals). Table 2.5 shows that the support price or minimum price was fixed much higher than the world price, reaching levels of more than 300 percent of the world price as in the case of corn in 1984, and more than 200 percent of the world price for sorghum in 1982 and 1984.

During this period the Comisión Nacional de Mercadeo Agrícola (CONAMAG)[3] was the government institution in charge of fixing minimum prices and disseminating information about them to the producers. After the minimum price was set, the Banco Agrícola y Pecuario (BAP)[4], a state financial institution, bought the harvest for the minimum price and resold the cereals to the feed industry at a lower price (the so-called reference price), absorbing the loss. When domestic production could not meet feed industry requirements, BAP was also in charge of importing the difference and distributing it to feed millers at the reference price. Figure 2.2 shows that nominal producer prices have moved together for both corn and sorghum following an upward trend. Figure 2.3 shows the same relationship for real prices (deflated by CPI). It is evident that in 1985 the real producer price started to decline significantly, reaching levels found at the beginning of the seventies.

It is important to note that a minimum price policy was also gradually established to benefit the animal product sub-sector. In 1959 only eggs were covered; in 1965 it was extended to pork producers; in 1975 to chicken and in 1977, beef. These minimum prices were periodically revised and modified to

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Table 2.5. Comparison of Minimum Producer Prices, Reference Prices and World Prices for Feed Grains.

| Year | ----------------CORN---------------- | | | ----------------SORGHUM---------------- | | |
	Minimum	Reference	World	Minimum	Reference	World
1969	380	420	252	340	300	228
1970	380	420	276	340	300	257
1971	380	276	238	340	300	257
1972	390	435	384	370	364	370
1973	410	435	528	460	364	481
1974	590	435	592	600	447	533
1975	700	700	512	700	582	477
1976	830	636	486	800	528	452
1977	850	636	409	810	510	378
1978	830	636	434	810	459	404
1979	890	636	495	800	450	464
1980	1280	636	542	1030	443	555
1981	1660	1400	563	1170	445	546
1982	1720	1800	473	1430	375	443
1983	1620	1800	585	1850	786	555
1984	2470	1800	585	1740	1481	512
1985	2840	3000	840	2180	1807	773
1986	2880	2880	1276	2220	2220	1204
1987	3390	3390	1102	2500	2500	1051
1988	3860	3860	1552	2800	2800	1436
1989	8000	8000	n.a.	8000	8000	n.a.

Source: Ministerio de Agricultura, 1988. FAO, Production Yearbook, several years.

CORN AND SORGHUM NOMINAL PRODUCER PRICE
Venezuela. 1969-89
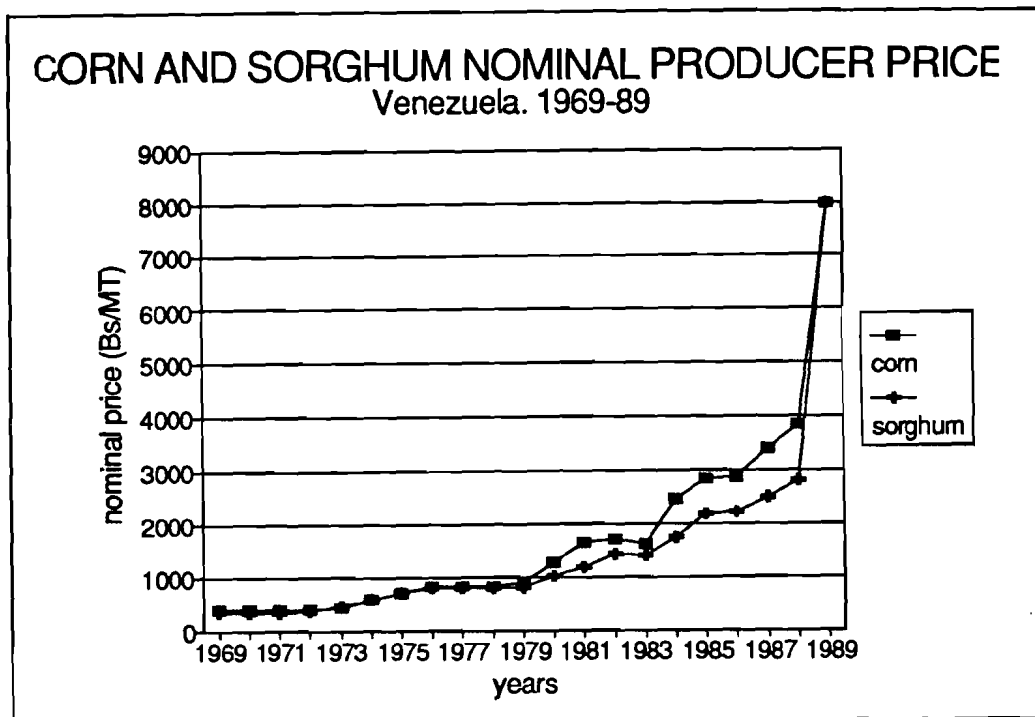
Figure 2.2: Nominal Producer Prices for Feed Grains

CORN AND SORGHUM REAL PRODUCER PRICE
Venezuela. 1969-88
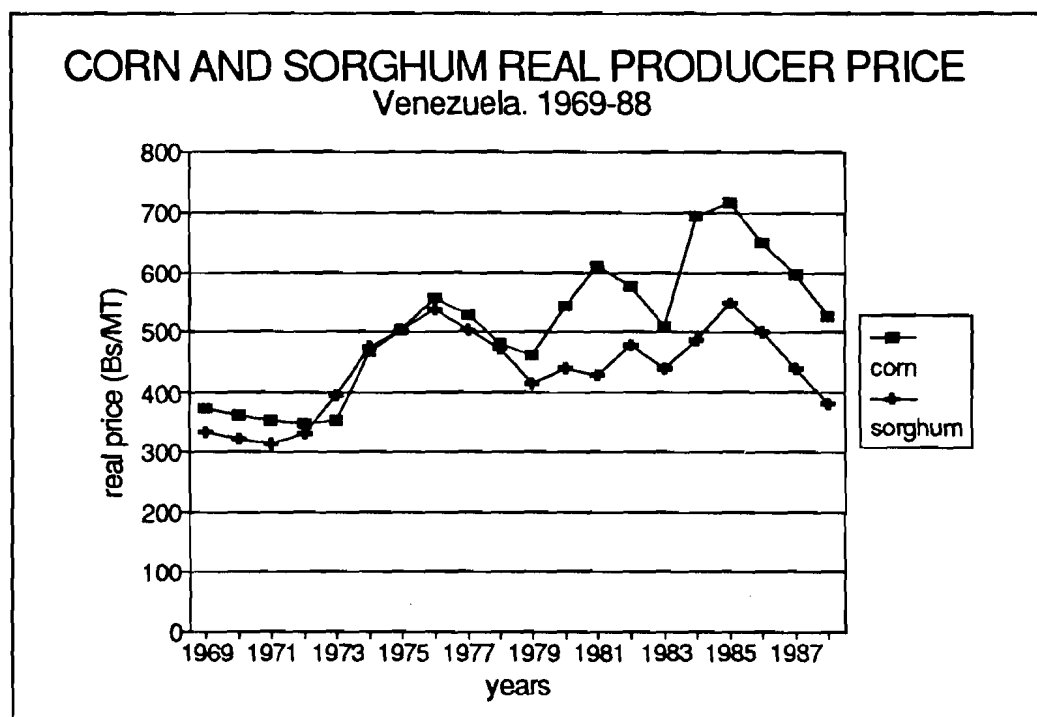
Figure 2.3: Real Producer Prices for Feed Grains

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compensate for increasing production costs. These are shown in Table 2.6 which demonstrates the rise in the price index for inputs purchased by producers.

Another policy applied in conjunction with the minimum price policy was the so-called "contingency policy". This was designed to satisfy the national requirements for feed grains and for pork, chicken and eggs. The government imported these products to fill the difference between domestic demand and supply. In the case of feed grains, the government bought the grains in the international market at the international price, reselling to the feed industry at the reference price, incurring a loss that was absorbed by the government.

Consumer subsidies were implemented through BAP, which acquired the product subject to control and sold it at the maximum price set by the government at the retail level. The institutions in charge of the pricing and distribution of agricultural products to consumers and of importing and exporting were BAP during the 1950's, and CONAMAG during the 1960's. Figure 2.4 shows the variation over time of real retail prices (nominal prices deflated by CPI) of beef, pork and chicken. The evidence clearly shows that chicken prices declined relative to the prices of both beef and pork.

In September 1970, CONAMAG was replaced by the newly created Corporación de Mercadeo Agrícola (CORPOMERCADEO)[5], which had the following objectives:

i)   to buy products at the minimum price;

ii) to assure a normal level of supply for the national market (via imports if necessary);

iii) to stabilize prices and,

iv) to create incentives for producers.

The period from 1974 to 1978 was exceptional because of the remarkable increase in government revenues due to the increase in oil prices (Table 2.7). During these years, the government could afford subsidies and price supports. As a result, in 1974 the list of products covered by the minimum price policy was increased to 24, to include maize, rice, and sorghum, along with chicken, eggs and pork. Also in 1974, animal feeds were declared basic products and their prices were subject to regulation. Consumer subsidies for chicken, eggs, pork, beef and milk were also declared. The burden of these subsidies was absorbed by

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Table 2.6. Index of Prices Paid by Producers, Venezuela 1970-1983 (1968 = 100).

Year	Maize	Sorghum	Poultry	Pork
1970	98.4	109.7	101.6	108.2
1971	111.4	109.7	107.0	100.9
1972	102.9	109.7	111.1	126.7
1973	113.1	129.1	115.1	126.7
1974	142.8	171.1	133.9	149.4
1975	167.5	205.7	148.6	173.4
1976	-	-	-	-
1977	228.7	258.1	151.0	215.9
1978	228.7	258.1	155.2	230.6
1979	281.6	258.1	158.1	250.6
1980	339.8	330.7	182.0	259.7
1981	406.5	403.2	209.0	277.4
1982	457.3	451.6	207.4	283.9
1983	457.3	451.6	238.6	298.2

Year	LIVESTOCK	CEREALS
1984	541.1	421.3
1985	740.3	489.5
1986	-	-
1987	-	-
1988	-	-

Source: Banco Central de Venezuela, 1974, 1978, 1982 and 1986.

Table 2.7. Main Economic Indicators. Venezuela, 1978-1988.

Year	Percent of GDP Growth	Oil Revenues	External Debt
		----------millions of U.S. $-------------	
1978	1.7		16,383
1979	2.4		23,673
1980	-3.1		29,608
1981	-1.0		33,411
1982	-1.3		35,061
1983	-5.6	13,581	35,997
1984	-1.0	14,798	34,853
1985	-1.3	13,144	33,362
1986	6.8	7,592	32,897
1987	3.0	9,054	34,444
1988	4.1	8,402	33,823

Source: United Nations, 1987 and 1988.

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MEAT   REAL RETAIL PRICES
Venezuela. 1969-87
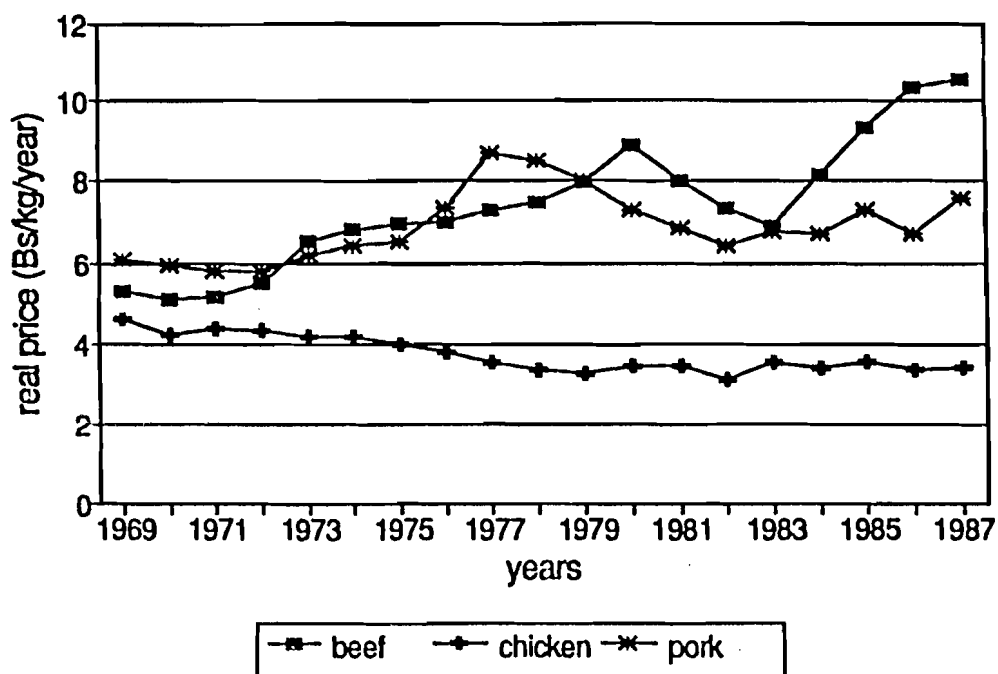
Figure 2.4:   Retail Real Prices for Beef, Chicken and Pork.

the government through CORPOMERCADEO. During the same year a subsidy on the price of fertilizers was initiated. The government sold fertilizers at a price below cost through CORPOMERCADEO and Petroquímica, the state petrochemical company.

The buoyant situation of the Venezuelan economy started to change in 1980 due to decreasing oil revenues, increasing external debt, capital flight, and lack of foreign investment, resulting in a slow and sometimes negative growth of the economy (see Table 2.7). The general goal of the administration which governed from 1979 to 1983 was to target subsidies to producers and final consumers, avoiding or eliminating subsidies to agro-industry as much as possible (Ministerio de Agricultura, 1979). Pinto Cohen (1983) points out that in 1978 the resources allotted for agricultural subsidies amounted to Bs. 859 million or 1.7 percent of the national budget. In 1981 they were equivalent to 3.9 percent of the national budget. The same author reports estimates of the subsidies for June 1981 by category. These are shown in Table 2.8. From this table it is interesting to note that feed grains and fertilizer subsidies accounted for 33 percent of the total amount allotted to subsidies in 1981. After food, feed grains is the most important single category as a recipient of government subsidies.

From 1979 to 1982 the following measures were implemented to minimize the high cost of the subsidies:

i) In 1980, the private industrial sector assumed the responsibility of importing raw materials (feed grains among others) directly from abroad. The government then applied the contingency policy in order to control these imports.

ii) In 1981, the reference price policy was eliminated, and the government decided that CORPOMERCADEO would sell raw materials (e.g., feed grains) to the feed industry at the minimum price plus marketing expenses.

iii) In April 1981, fertilizer subsidies were eliminated. Also in 1981, consumer prices for non-animal goods were deregulated, but some animal-derived goods like chicken, eggs, pork and milk were still subsidized.

iv) Price levels for agricultural and livestock producers under the minimum price policy were adjusted upwards every year.

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2.2.2. 1983 to 1988[6]

By 1983, the burden of the external debt forced the government to take further action. In 1983, the last year of Herrera's administration, the macroeconomic and microeconomic measures which resulted were a consequence of the loss of oil revenues that started in 1979 (Trepido, 1984) and the credit squeeze in international capital markets.

In 1983, the bolívar was devalued to avoid capital flight and to protect foreign exchange reserves. A set of differential exchange rates was established for imports of basic products such as corn, wheat, soybean, sorghum, and other commodities considered basic inputs for agricultural production. Before devaluation, the exchange rate was 4.30 Bs per US dollar, a rate which had been kept fixed by the government for two decades. After the devaluation in February, the bolívar went to an official level of 7.50 Bs per US dollar, compared to 9.95 Bs per US dollar in the free market. A preferential rate for imports of basic goods was maintained at 4.30 Bs per US dollar. (See Table 2.9).

The new President, J. Lusinchi, took power in February of 1984. Lusinchi's was the seventh democratically elected administration since 1958. The three main objectives of the new administration for the agricultural sector recorded in the "Memoria y Cuenta" of the Ministry of Agriculture (1985) were:

i)   to achieve self-sufficiency by increasing food supply, especially of those products from foreign markets that the country was dependent on (e.g., feed grains).

ii)   to promote production of those commodities with comparative advantage to begin an "aggressive" export program.

iii)   to equilibrate living conditions in the rural sector with those in the urban sector.

Lusinchi's administration centered its actions on encouraging domestic production through increasing the support price for basic crops (feed grains among them), controlling input prices (e.g., fertilizer subsidies of 50% were implemented in early 1984) and other incentives such as preferential rates for credit. These measures were combined with consumer subsidies to avoid high prices at the consumer level (Reyes, 1990; Ministerio de Agricultura y Cría, 1985).

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TABLE 2.8. Agricultural Subsidies, by Category, Venezuela. June 1981 (millions of current Bolívares)

CATEGORY	YEARLY AMOUNT	PERCENT TOTAL
FOOD	**3205.4**	65
milk	1,228.0	
sugar, molasses	886.0	
white corn flour	387.6	
coffee	320.0	
vegetable oil (blend)	276.0	
rice	127.0	
FEED GRAINS AND SOY	**933.1**	19
sorghum	455.2	10
soymeal and soybean	314.9	7
sorghum or type 3 corn (imported)	163.0	3
DIRECT USE INPUTS	**650.0**	14
fertilizer	650.0	
TOTAL	4788.5	100

Source: Pinto Cohen, 1983. p. 79.

TABLE 2.9: Evolution of the Exchange Rate.

	------------nominal exchange rate (Bs/US $)-------------------	
YEAR	PREFERENTIAL RATE	MARKET
1969-82	4.29	4.29
1983	5.72	10.59
1984	7.38	13.51
1985	7.50	13.97
1986	7.82	20.26
1987	14.50	27.86
1988	14.50	33.60

Source: United Nations, 1989.

With respect to the feed grain sector, a key factor was the elimination of CORPOMERCADEO in October of 1984. As a consequence, imports by feed millers of raw materials such as sorghum, corn and soybean meal were subject to quotas set according to national production, domestic requirements and foreign exchange availability. Imports were purchased at a preferential exchange rate, intended to compensate for the burden of the minimum price policy. The minimum price policy was maintained but with prices fixed by a government commission composed of representatives from the government, grain producers and feed millers. The feed millers were required to buy their cereal requirements directly from the grain producers at the minimum price. The burden of the price support was thus transferred to the feed millers.

Lusinchi's administration has been known as the creator of the "agricultural miracle." From 1984 to 1987, the agricultural sector grew at an average of 5.4 percent compared to 1.4 percent during the Herrera period. Production increased significantly for many crops but at the expense of government earnings, since growth was based on very high price supports and very strict regulations regarding imports of feed grains.[7] The truth was that by the end of the administration, national production could not keep pace with demand, and trade had to be allowed again. This time, however, the national reserves were almost depleted and the position of the country had become very vulnerable. The World Bank stated:

> . . .by the end of 1988, Venezuela's economic situation had become untenable: inflation was accelerating, operating reserves were depleted, imports were growing fast as it was clear to all that the new government would have to effect a major devaluation. By January 1989, there were substantial shortages of staples in the markets, such as bread, coffee, sugar and rice. (World Bank 1989 and 1990, pp. 480 and 573)

2.2.3. From 1989 to the Present

In February 1989, the government of C.A. Pérez took power, and new economic measures were implemented for the national economy in general and the agricultural sector in particular. Most of the economic measures were implemented in order to fulfill the conditions established in a letter of intent signed

with the International Monetary Fund. A structural adjustment and stabilization program was proposed, and among the goals were (IICA, 1987; FUNDAFUTURO, 1989; Williamson, J., 1990).:

i)   correcting imbalances in the balance of payments (external equilibrium);

ii) reduction or elimination of inflation (internal equilibrium);

iii) elimination of distortions and promotion of macroeconomic efficiency;

iv) promotion of economic growth; and

v)   addressing questions about equity and income distribution.

To achieve these goals, the program was based on four strategies; export promotion, public sector savings, rapid expansion of private investment, and a reorientation of social policies (Abreu et al., 1990). With respect to the feed grain sector, the main measures adopted since 1989 have been (Gaceta Oficial de Venezuela, 1990).:

i)   The minimum producer price for cereals was increased to market levels. Accordingly, the minimum prices for corn and sorghum were modified three times during 1989:

	March 14	April 5	October 19
Corn:	6000 Bs/MT	8000 Bs/MT	9000 Bs/MT
Sorghum:	5500 Bs/MT	7000 Bs/MT	8000 Bs/MT

ii) A unified, flexible and free market exchange rate was established. The private sector was freed from import restrictions. No import license was required in advance, and foreign exchange transactions were allowed to take place at desired amounts at the market rate.

iii) The basic basket of goods and services (those with regulated consumer prices) was reduced from 42 to 18 items . Among the products remaining with regulated prices were: chicken, pork, eggs, pork and chicken feed, fertilizers, and rice.

iv) In March 1989 the feed price was increased by 20 percent, and the price of chicken was increased by 100 percent. The prices of eggs and pork were also increased considerably.

v)   In April 1989 the subsidy on manufactured pre-cooked corn flour was eliminated. This was a very important step, since pre-cooked flour was the fastest growing product in terms of demand during the seventies and eighties.

vi) In June 1989 a program for gradual reduction of the fertilizer subsidy from its 1984 level of 90 percent was implemented. The proposed schedule reduced the subsidy to 50% in 1989, and then gradually to zero by 1993.

vii)   Also in June, pork and chicken were excluded from the basket of basic goods.

viii)   An agreement between producers and importers set the prices of the basic goods not regulated by the government. Among these products were: agricultural inputs, machinery, animal feed, chicken, pork and eggs.

ix)   The interest rate for agricultural sector credit was set 7 points below the commercial rate, but went up from 8.5% in 1988 to 23% in March of 1989 and to 35% in October of the same year.

x)   The elimination in a one-year period of all quantitative restrictions and exemptions was planned. However, the specifications for the reform in the agricultural sector were delayed until March 1991.

xi)   Products in the basic food basket were to be taxed under a plan designed to equalize the prices of imports to the prices of national goods.

xii)   In December 1990, Decree 1212 of the Pérez administration was issued to regulate the minimum price policy for feed grains. The decree established that the minimum price was to be fixed based on a stabilized average of the international market prices, plus shipping expenses and the import tariff in order to protect national production. Only when this price is below the reference minimum price is the reference price guaranteed.

The importance of fertilizer use in feed grain production and the administration of its price as a policy tool justifies further attention. The elimination of the fertilizer subsidy has already had a major impact. Since 1958, when the country started to produce fertilizers, production and marketing of these agricultural inputs has been under government control, and has been heavily subsidized. Different official institutions have carried out the control over production and marketing operations. The Instituto Venezolano de Petroquímica (IVP) was in charge from 1958 until 1977. After the oil industry was nationalized in 1975, Petroquímica Venezolana (PEQUIVEN) was created and two years later, in 1977, took over all the operations relevant to fertilizers until 1981. In 1981, an affiliated company, PALMAVEN, was appointed by PEQUIVEN to oversee all fertilizer operations (Sánchez and Rivero, 1984).

Some immediate effects of the subsidy removal have already been observed. Among others, the cost of fertilizers increased 424 percent after the measure was applied in 1989. As a consequence, sales of fertilizers fell 18 percent the same year. In 1990, two additional increases in prices were authorized, 22 percent in January and 26 percent in July of the same year.

2.3. PRODUCTION OF CORN AND SORGHUM

As mentioned in the Introduction, corn and sorghum are the main feed grains in Venezuela. However, there are important differences between corn and sorghum production in spite of some apparent strong similarities. First, corn is still mostly produced on small farms. Of the 130,534 corn farms registered in 1985, 68.5 percent were of three hectares or less. On the other hand, sorghum is a "new" crop in Venezuelan agriculture. Its introduction was promoted by the feed industry at the end of the 1960s, under the agro-industrial concept of vertical integration. As a consequence, most of the production units are medium or large scale. The 6,529 sorghum farms registered in 1985 had an average size of 60.2 hectares[8]. A second difference, linked to the preceding facts, is that sorghum production, unlike corn production, is a highly mechanized activity. In the case of corn, mechanization and high-value inputs are used only by large producers. Corn is a traditional crop which has been cultivated for centuries and is still considered a subsistence crop by many small farmers.

Referring to Figure 2.5, we can see that production of both corn and sorghum has increased substantially from 1969 to 1988. Sorghum became quantitatively as important as corn in the early 1980s, after being a marginal crop with almost no production during the first six years of the period. There was a notable jump in production for both cereals between 1984 and 1987 compared to slower growth rates in previous years. The average annual growth rate for corn production is 7 percent for the whole period, but from 1984-88 the average is 23 percent annually. In the case of sorghum the average growth for the whole period is greater than the average growth for 1984-88, 47.5 percent as compared to 19.4 percent respectively (Table 2.10). Values for production expressed both in tonnage and harvested area are shown in the Appendix.

Corn and sorghum yields have increased gradually from 1000 kg/Ha to close to 2000 kg/Ha over the past 20 years (see Figure 2.6). Average yields are still below those of the main producing countries in the region (Table 2.11). There are several explanations for this behavior: scarcity of top quality arable land, insufficient daily solar radiation, poor managerial skills among farmers, and inadequate services, infrastructure, and extension and technical assistance (Orta, 1985). Climatic conditions have also been

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CORN AND SORGHUM PRODUCTION
Venezuela. 1969-88
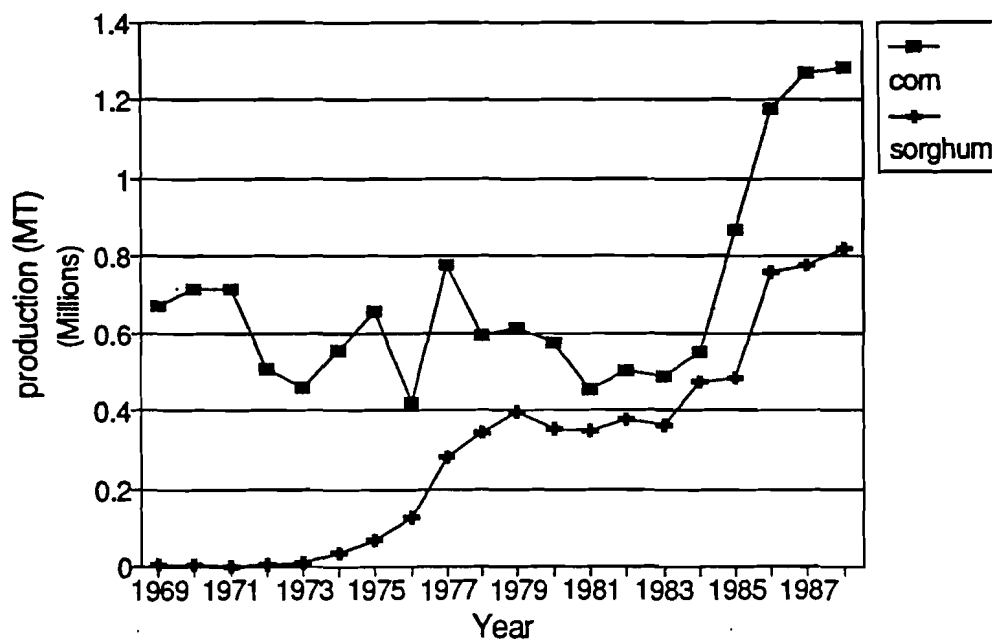
Figure 2.5 : Feed Grain Production in Venezuela

CORN AND SORGHUM YIELDS
Venezuela. 1969-87
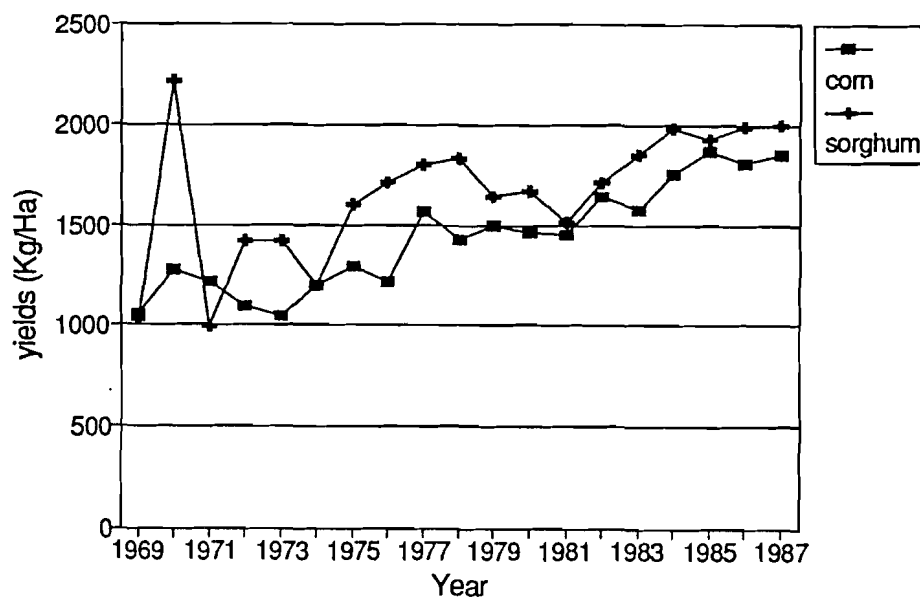
Figure 2.6: Feed Grain Yields Over Time in Venezuela.

TABLE 2.10. Annual growth rates in Corn and Sorghum Production, 1969-88.

PERIOD	CORN	SORGHUM
	(% annual growth)	
1969-70	5.9	18.9
1970-71	0.5	-63.2
1971-72	-29.0	196.4
1972-73	-10.2	21.8
1973-74	21.9	292.2
1974-75	18.0	106.7
1975-76	-36.1	76.3
1976-77	85.5	125.7
1977-78	-23.6	21.4
1978-79	3.6	16.5
1979-80	-6.1	-10.9
1980-81	-21.4	-1.7
1981-82	10.8	8.9
1982-83	-2.6	-3.5
1983-84	12.1	29.8
1984-85	58.7	1.9
1985-86	35.0	57.0
1986-87	8.1	2.8
1987-88	1.1	5.5
Average(1969-88)	7.0	45.7
Average(1984-88)	23.0	19.4

Source: Calculated from Production Data. Ministerio de Agricultura, 1988.

Table 2.11. Corn and Sorghum Yields for Selected Countries, 1981-88.

Year	Argentina	Brazil	Mexico	USA	Venezuela
		Corn Yields (kg/ha)			
1981	3801	1836	1812	6891	1470
1982	3028	1735	1795	7185	1643
1983	2976	1745	1657	5120	1709
1984	3152	1761	1852	6698	1749
1985	3614	1866	1861	7407	1861
1986	3745	1645	1827	7487	1804
1987	3190	1985	1705	7494	1850
1988	3774	1880	1735	5311	2000
AVERAGE	3410	1807	1781	6699	1761

Year	Argentina	Brazil	Mexico	USA	Venezuela
		Sorghum Yields (kg/ha)			
1981	3561	2300	3562	4023	1512
1982	3211	1953	3699	3707	1713
1983	3274	2105	3358	3063	1725
1984	2898	2481	3088	3541	1980
1985	3155	2597	3567	4190	1929
1986	3072	2645	3152	4249	1985
1987	3025	2713	3398	4376	2221
1988	3347	2653	3056	4005	1714
AVERAGE	3193	2431	3360	3894	1847

Source: 1981-83: FAO Production Yearbook, 1983.
           1984-85: FAO Production Yearbook, 1986.
           1986-88: FAO Production Yearbook, 1988.

blamed for this phenomenon. Venezuelan cereal production appears to be quite vulnerable to weather conditions, especially rainfall variation (Hernandez, 1988). It can be said, then, that the increase in production of both corn and sorghum has been achieved more through area increases rather than yield increases.

2.4. FEED GRAIN DEMAND AND FEED PRODUCTION

Feed grains are the main source of energy for animal feed. Jimenez (1989) indicates that for Venezuela a basic feed formula contains 60 percent cereals, 25 percent soybean meal and 15 percent minerals and vitamins.[9] Feed grains are used by the feed industry which consists of approximately 45 firms that manufactured around 4.2 million metric tons of feed in 1988, according to the Asociación Venezolana de Fabricantes de Alimentos Concentrados para Animales (AFACA).

It is important to note that sorghum and corn have evolved in different ways with respect to their importance as raw materials for this industry. Feed grain utilization accounts for 100 percent of available sorghum (domestic production plus imports) in the country, whereas corn has several other uses. Table 2.12 shows how the percentage of available corn used as a feed grain has been dramatically reduced after 1985, from an average value of 24 percent in the seventies to an average of 39.3 percent in the first five years of the eighties. It fell to 27.4 percent in 1985, 7.4 percent in 1986, 3.3 percent in 1987 and 0 percent in 1988. The explanation for this behavior is again related to the "no more imports" policy (import ban on food grains) explained above. This prohibition took effect in 1985 for corn. Thus, 1986 and 1987 were years when there was no corn available for feed production and all domestic production went to satisfy the needs of the food industry. In contrast, all available sorghum was used by the Venezuelan feed industry.

Feed production has increased substantially, averaging a growth rate of 10.7% per year over the last 25 years (AFACA, 1989). This rapid increase started in the sixties and continued steadily through the seventies and eighties. Figure 2.7 shows this trend and also suggests that feed production survived the initial effects of the crisis beginning in the eighties, but did not continue expanding after 1989. In 1989 and 1990 the industry experienced the first two consecutive years of negative growth of the past 20 years.

Table 2.12. Utilization of Corn and Sorghum as Percent of Total Availability 1980-87 (thousands MT).

	1980	1981	1982	1983	1984	1985	1986	1987
TOTAL AVAILABLE	1625	1410	1538	1692	1905	1173	1010	1132
				CORN				
PERCENT USED AS:								
FEED	41.7	31.6	36.5	40.2	46.4	27.4	7.4	3.3
HUMAN USE*	2.5	2.2	.2	.2	1.9	3.1	3.0	3.7
PROCESSED FOODS**	55.7	66.3	61.3	57.6	51.7	69.5	89.6	93.0
				SORGHUM				
TOTAL AVAILABLE	391	964	962	421	798	1327	1336	1633
FEED	100	100	100	100	100	100	100	100

* Refers to direct human consumption.
** Processed food plus see use plus other non-feed use.

Source: Fundación Polar and Instituto Nacional de Nutrición. Caracas, 1980-87.

TOTAL FEED PRODUCTION
Venezuela. 1969-90
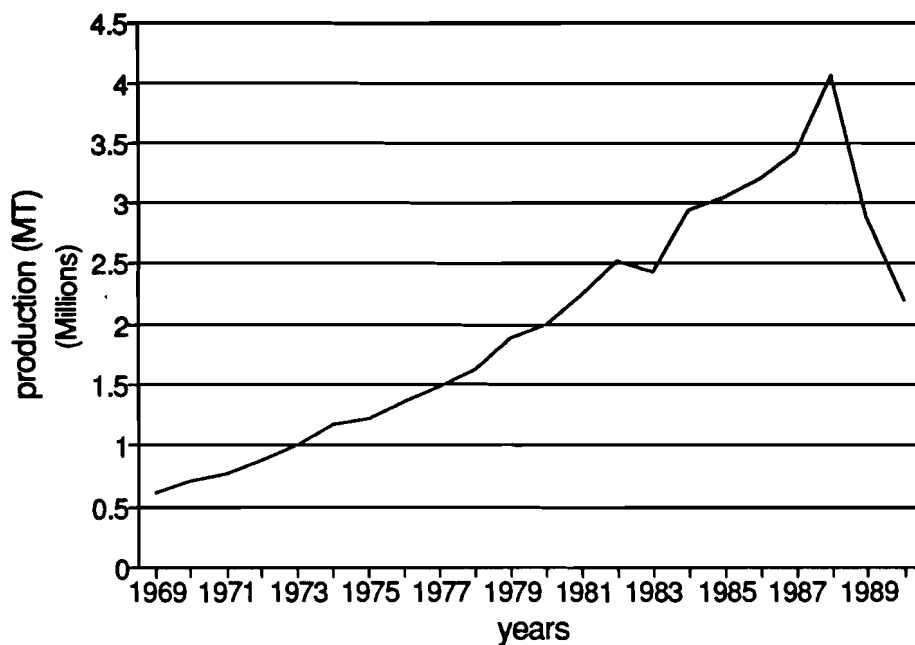
Figure 2.7:   Feed Production in Venezuela

CORN AND SORGHUM IMPORTS
Venezuela. 1969-89
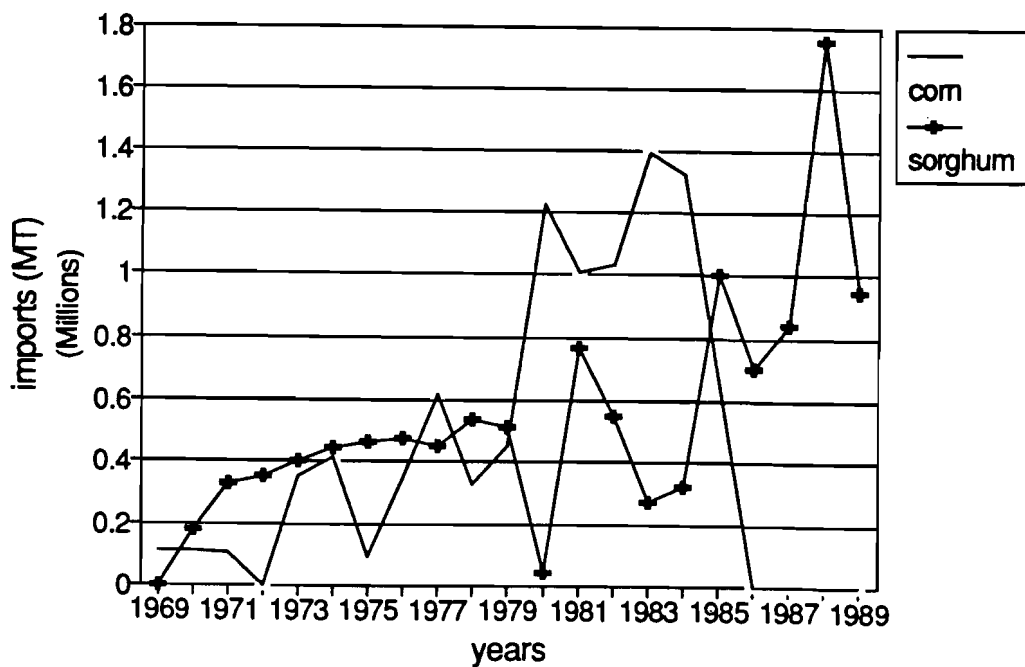
Figure 2.8.   Feed Grain Imports in Venezuela

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Table 2.13 exhibits tonnage of feed consumed by the livestock category. This table shows that most of the feed consumed is pork and poultry feed. Table 2.14 shows consumption in relative or percentage terms. Pork and poultry feed have accounted for more than 80 percent of total feed consumption over the 1969-1990 period. Poultry feed represents the highest percentage of total consumption (more than 50 percent), followed by pork feed (between 25 percent and 30 percent), and then bovine feed, which has recovered since 1986.

2.5. INTERNATIONAL TRADE IN FEED GRAINS

In spite of the high minimum price policy, domestic output typically has not been able to satisfy national requirements, so imports of both corn and sorghum have been important for the entire 1969-89 period. Table 2.15 shows the proportion of imported sorghum of the total available for feed (i.e. domestic production plus imports). It is evident from this table that feed production has relied mostly on imported grains. In the case of sorghum for example, this dependency was close to 70 percent over the whole period. For corn, the dependency on imports is not as evident, but still is important; imported corn averaged 42 percent of the total corn fed in the seventies. Unfortunately, there is no similar information for the eighties because the sources do not differentiate the amount of imported corn that goes to the feed industry from the imported amount that goes to the food industry. Nevertheless, it is important to note that total corn availability is far from being satisfied by domestic production, and imports are still very important.[10]

Figure 2.8 shows that imports have followed a highly variable pattern. According to the contingency policy in effect from 1969 to 1989, increases in authorized imports were expected whenever there was a fall in production and vice-versa. Since crop production is highly variable from year to year, a high correlation between production variation and imports was expected for feed grains. The years 1986 to 1988 in the figure show no imports for corn because these were the years when the official ban on corn imports took place. However, the sharp increases observed for sorghum imports during the same years were to compensate for the lack of availability of corn.

Table 2.13.   Consumption of Feed by Livestock Category 1975-90 (1,000 MT).

Year	Bovine	Swine	Poultry	Others	Total
1975	108	326	777	20.3	1230
1976	103	377	861	22.5	1363
1977	104	411	954	24.6	1493
1978	41.8	500	1056	29.0	1628
1979	46.8	558	1244	42.7	1892
1980	33.1	592	1323	52.4	2000
1981	33.0	686	1485	52.6	2254
1982	30.0	838	1558	58.2	2533
1983	79.4	876	1391	62.7	2422
1984	202	900	1764	71.2	2937
1985	289	943	1775	39.0	3047
1986	378	953	1800	78.2	3210
1987	417	938	1994	73.2	3422
1988	577	1142	2254	82.1	4055
1989	246	754	1820	78.3	2898
1990	242	440	1408	110.0	2200

Source: AFACA, 1989 and AFACA personal communication.

Table 2.14.   Percentage Share of Feed Consumed by Livestock Category (1975-90).

Year	Bovine	Swine	Poultry	Others	Total
1975	8.8	26.5	63.1	1.7	100
1976	7.5	27.7	63.2	1.7	100
1977	6.7	27.5	63.9	1.7	100
1978	2.3	30.7	64.9	1.8	100
1979	2.5	29.5	65.8	2.3	100
1980	1.7	29.6	66.1	2.6	100
1981	1.3	30.4	65.9	2.3	100
1982	3.1	33.1	61.5	2.3	100
1983	3.8	36.2	57.4	2.6	100
1984	6.9	30.6	60.1	2.4	100
1985	9.5	31.0	58.3	1.3	100
1986	11.8	30.0	56.1	2.4	100
1987	12.2	27.4	58.3	2.1	100
1988	14.2	28.2	55.6	2.1	100
1989	8.5	26.0	62.8	2.7	100
1990	11.0	20.0	64.0	5.0	100

Source: Calculated from Table 2.13.

Table 2.15. Percentage of Imported Sorghum in Total Sorghum Available.

Year	Percentage of Imported Sorghum
1980	11
1981	80
1982	59
1983	68
1984	42
1985	77
1986	54
1987	53
1988	90
1989	72
Average 1969-79:	76
Average 1980-89:	61
Average 1969-89:	68

Source: Ministerio de Agricultura, 1989.

Table 2.16. Percent Growth Rates of Meat Production.

Period	Chicken	Pork	Beef
1958-68	9.7	6.6	5.3
1969-79	9.6	3.8	5.0
1980-88	7.6	10.0	-1.2
1969-88	8.6	6.4	2.3

Note: Figures refer to the average for the period.

Source: Ministerio de Agricultura, 1988.

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2.6. LIVESTOCK PRODUCTION

Observers have noted the modern characteristics of pork and poultry production in Venezuela in contrast to traditional extensive beef production methods. Atkinson and Blaich (1983) point to the importance of ready transference and almost immediate adoption of technology from the United States in the fast expansion of the poultry industry beginning in the sixties and continuing in the seventies and eighties. The same authors indicate that modernization in the pork industry took longer because the technology had to be adapted through local research. However, the rapid increase in production and efficiency has been, as in poultry, impressive.

The growth experienced since the sixties (in the case of poultry) and since the seventies (in the case of pork) has been facilitated by vertical integration encouraged by the main feed firms in Venezuela. The use of high-value inputs (e.g. concentrated feed, veterinary products) and large units of production characterize the majority of pork and poultry firms. Nevertheless, there is still a traditional pork production sector, very different from the "modern sector", that accounts for less than 15 percent of the total slaughter of hogs (Sanchez, 1981).

Figure 2.9 shows that beef production lost its leading role to poultry after 1983. The average annual rate of growth for the period is 8.6 percent for poultry as opposed to only 2.3 percent for beef. Pork production has been quantitatively less important than both poultry and beef. However, the growth rate of pork production averaged 6.4 percent annually for the 1969-88 period, which is less than that of poultry but more than twice that of beef (see Table 2.16).

2.7. THE DEMAND FOR MEATS

The rapid growth in poultry production has led to a greater availability of this type of meat, and its relative advantage in terms of price has made chicken the most important meat consumed in the last seven years (that is, since 1983). Figure 2.10 shows the evolution of per capita meat consumption by type of meat. Per capita consumption has changed over time in a fashion similar to that of meat production. Beef

MEAT PRODUCTION
Venezuela. 1969-88
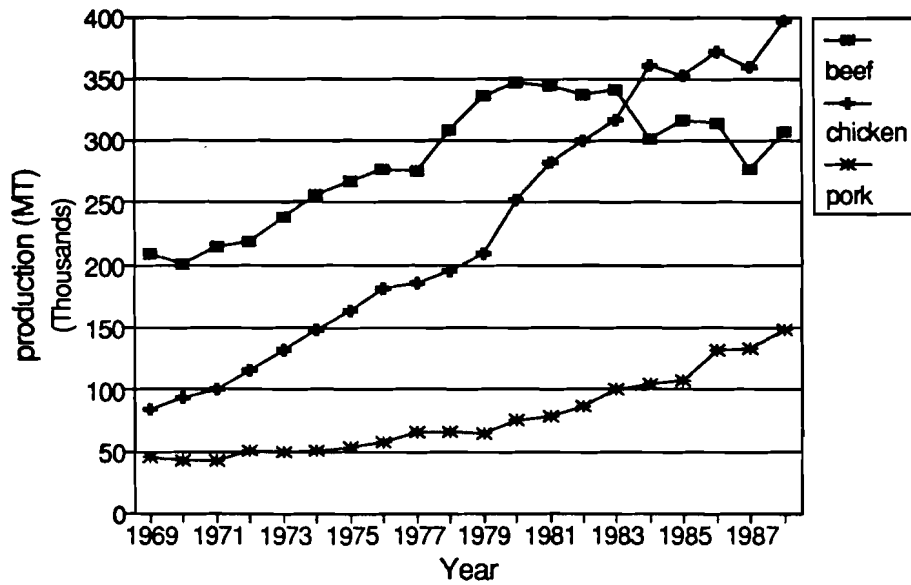
Figure 2.9.   Meat Production in Venezuela

MEAT CONSUMPTION
Venezuela. 1969-88
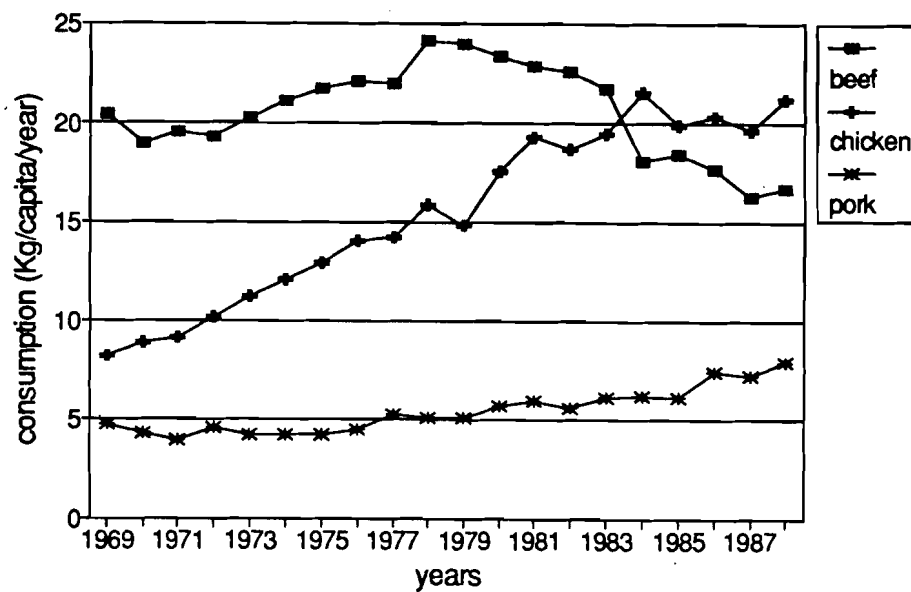
Figure 2.10.   Per Capita Demand for Meats
in Venezuela over Time

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consumption has declined from a peak of 24 Kg per capita in 1978 to a low of 16.5 Kg in 1988. In contrast, poultry consumption grew rapidly to 21 Kg/capita/year in 1988 from 8 Kg in 1969. Pork consumption has moved slowly upwards from 4.5 Kg/capita at the beginning of the study period to 8 Kg in 1988. Figure 2.11 illustrates how the ratio of the retail price of chicken to that of beef and pork has consistently declined during the period 1969 to 1987. International trade for meats followed a trend which was mainly a reflection of the contingency or quota policy which began in 1982. In the case of pork, for example, the contingency policy was eliminated in July of 1970. However, in March of 1973 the government decided to regulate prices of pork at all levels of the marketing chain, from producers to consumers, and imports were authorized to cover the gap between supply and demand. Figure 2.12 shows meat imports over the 1969-88 period.

CHICKEN & PORK PRICES RELATIVE TO BEEF
Venezuela. 1969-87

pork price/beef price

chicken price/beef price

years
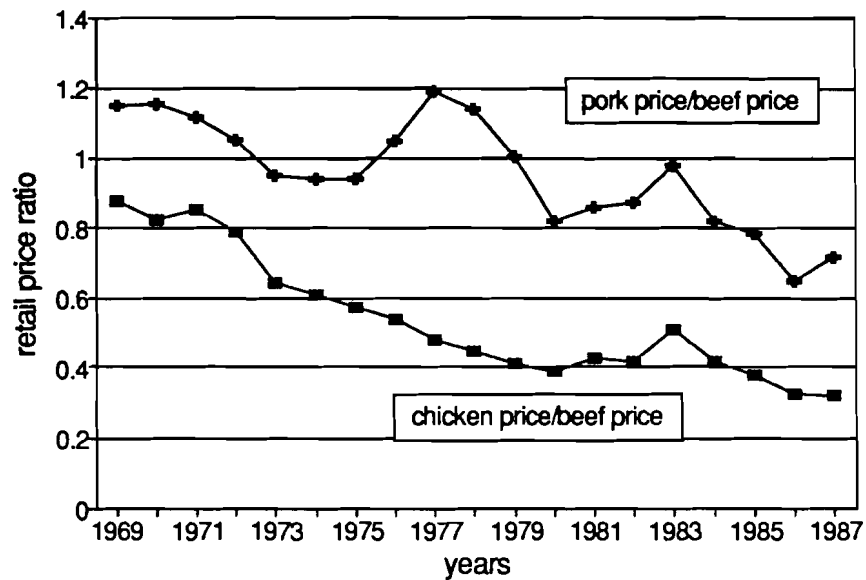
Figure 2.11 : Ratio of Chicken and Pork Retail Prices Relative to Beef

BEEF, CHICKEN AND PORK IMPORTS
Venezuela. 1969-1988

beef
chicken
pork

years
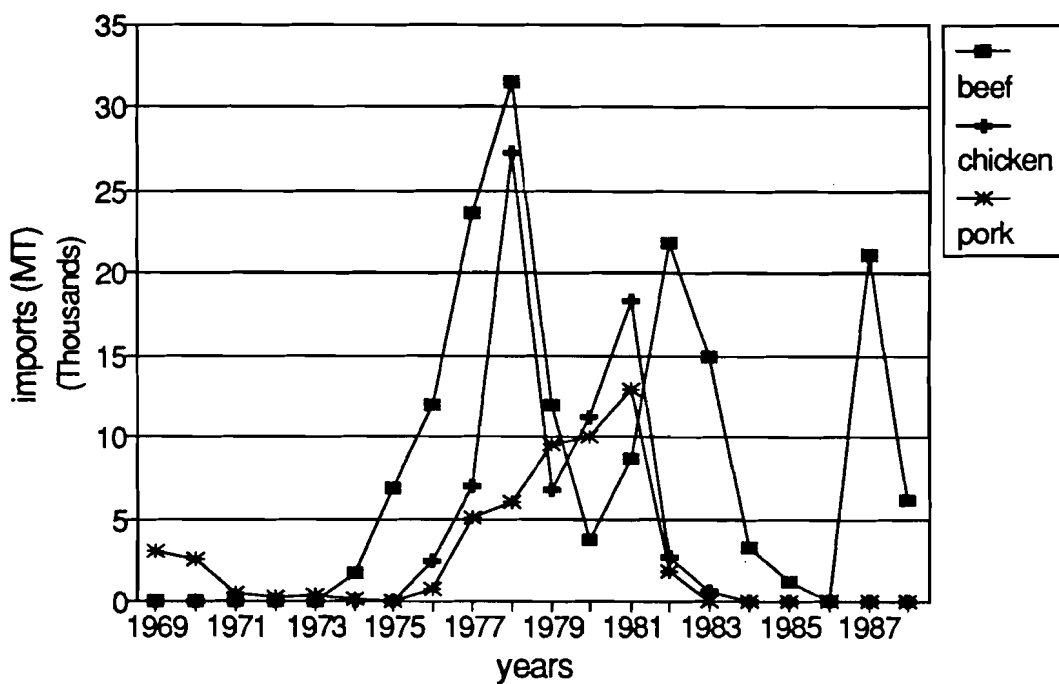
Figure 2.12: Imports of Meat in Venezuela

III. EMPIRICAL RESULTS

Two major parts comprise this section. The first part includes a discussion of the data used in terms of sources, transformations and units. The second part discusses and analyzes the results of the regression models in terms of goodness of fit, statistical and practical significance of the estimated coefficients. A more complete discussion of the econometric issues involved is contained in Marrero, 1992.

3.1. REGRESSION MODELS AND DATA

The base model supply equations for corn and sorghum (and alternative specifications) were specified as standard versions of the basic Nerlove model using production of the grains (dependent variable) as a function of the producer prices, a weather index, fertilizer, a trend variable and one year-lagged production. Meat supply is specified as a function of producer farm price, the price of feed or a ratio of output to input prices and, feed availability.

The models representing the demand for feed grains are intended to represent the derived demand of feed millers. The dependent variable is the quantity of feed grain demanded by the feed industry which is modeled as a function of the feed grain prices and the production of chicken and pork.

The consumer demand equations were specified as quantity dependent per capita demand equations, based on the fixity of prices at the consumer level (see Section 2 on policies). In all consumer demand equations the dependent variable is the per capita consumption or availability of the commodity (either pork, chicken or meat). This quantity is modeled as a function of at least one of the following independent variables: retail price of chicken, pork or beef and per capita income.

Import demand for feed grains is modeled as a function of international prices of corn and sorghum, domestic supply of the grains, chicken retail price, exchange rate and foreign exchange reserves.

Each relation was treated as a single equation and estimated in log-log form using OLS. An alternative estimation method, two-stage least squares (2SLS) was used to estimate the block of equations

where simultaneity is present, but produced nonsensical results (See Marrero 1992 for details). All equations (base models and alternative specifications) were tested for autocorrelation. A Durbin-Watson (DW) test was performed for each OLS equation and additional estimation procedures were run to correct for its presence. Different versions of each model were run considering different combinations of the variables initially specified. The initial models or base models are those described above, and are the beginning point for the specification of alternative models. The main objective in trying different formulations was to test for the stability of coefficients.

Three common aspects of the variables used are worth mentioning before explaining the specifics of each. First, time-series data over the period 1969 to 1989 were used in all cases unless otherwise indicated. Second, only secondary or published data at the national level were used. And third, data were provided mainly by three official institutions: Ministry of Agriculture and Breeding (MAC), the Central Bank of Venezuela (BCV) and the Central Office for Statistical Data (OCEI); and two private organizations: Polar Foundation (FP) and the National Association of Feed Manufacturers (AFACA).

Most of the information on production, international trade and producer prices for the commodities analyzed was obtained from Ministry of Agriculture publications: Anuario Estadístico Agropecuario (AEA) and the Memoria y Cuenta (MYC). The Central Bank provided macroeconomic variables such as CPI (consumer price index), other price indexes (wholesale price index, input price index), and data on oil and exchange rates. OCEI was consulted to check consistency and reliability of the information provided by different institutions and persons. Consistency among institutions was one of the main problems. AFACA was used as the main source of information on feed production by livestock category for the whole series and feed prices from 1983 on. The Polar Foundation provided nutritional information on per capita food consumption through the updated Food Balance Sheets (published using a new methodology in a joint venture with the National Institute for Nutrition). Also, several nationally known consultants were interviewed. Particularly useful insights were given by the consultants at Polar Foundation. All data are shown and sources described in the Appendix.

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3. 2 SUMMARY OF RESULTS

The analysis focused on cross- and own- price elasticities in order to better understand the influence of a regime of administered prices applied to a well integrated multicomponent system such as the feed grain sector in Venezuela. The sorghum production price response was found to be highly significant as were many cross-price elasticities on both the supply and demand sides. Own-price responsiveness of corn was insignificant in various reformulations of the model. Cross-price elasticities are particularly important because they show the strength of substitution possibilities between commodities. Also, cross-price elasticities are important in evaluating the impact of policies aimed at one commodity or substitutes or complements of the target commodity. Table 3.1 shows a summary of results for the most relevant elasticities, both in terms of ranges of estimates and averages.[11]

The results confirmed that strong links exist among sectoral components. For example, strong and statistically significant substitution effects exist between corn and sorghum on the production side, and between pork and beef as well as chicken and beef, on the consumption side. An average cross-price elasticity of corn with respect to sorghum price of -0.32 and an average cross-price elasticity of sorghum with respect to corn price of -0.59 lead to the conclusion that feed grain producers are willing to move resources from one grain to another in response to price incentives. In addition, feed grain production and meat production are highly responsive to the price of their main inputs with significant results obtained for the estimated parameters. A clear illustration of this was given by the fertilizer price elasticity for corn and sorghum which had average values of -0.40 and of -0.60 respectively. Similarly, feed grain prices (particularly sorghum) have a major effect on the domestic supply of pork and chicken. The pork supply elasticity with respect to the price of sorghum was -0.78 and chicken supply response with respect to the price of the same grain was -0.56, both results significant at the five percent level.

On the consumer side, results suggested substitution possibilities between beef and the other two meats. This was demonstrated by the high and significant cross-price elasticity for pork with respect to beef (0.8) and for chicken with respect to beef (0.7). These results imply that strong substitution in consumption can be expected under the new policies for pork and chicken at the retail level.

Table 3.1. Summary of Ranges and Average Values of Elasticities.

	OLS Estimates	Average	Autocorrelation Corrected Estimates	Average
		Corn Supply Elasticities		
Ec,c	0.19 to 0.41	0.28	0.07 to 0.24	0.18
Ec,s	-0.65 to -0.12	-0.32	-0.65 to 0.07	-0.65*
Ec,f	-0.53 to -0.31	-0.40	-0.53 to -0.25	-0.33
		Sorghum Supply Elasticities		
Es,s	0.32 to 2.31	1.77	1.32 to 3.14	2.69
Es,c	-0.14 to 6.43	-0.14*	-1.28 to 1.37	-1.24
Es,f	-1.10 to -0.36	-0.60	-0.49 to -0.29	-0.36
		Pork Supply Elasticities		
Epk,pk	-0.09	-0.09	-0.30	-0.30
Epk,s	-0.70	-0.78	-0.27	-0.27
Epk,c	0.30	----	0.24	---
Epk,rt	-0.11 to 0.61	0.61*	-0.01 to 0.20	0.20*

* The average was calculated considering only the values with sign according to a priori expectations.

Table 3.1. Summary of Ranges and Average Values of Elasticities (continued).

	OLS Estimates	Average	Autocorrelation Corrected Estimates	Average
Chicken Supply Elasticities				
Ech,ch	0.04	0.04	-0.42	----
Ech,s	-0.56	-0.56	-0.55	-0.55
Ech,c	0.58	---	0.88	----
Ech,rt	0.19 to 0.86	0.53	0.05 to 0.33	0.19
Corn and Sorghum Demand Elasticities				
Ec,c	0.86	---	---	---
Ec,s	-1.10	---	---	---
Es,s	0.11	---	---	---
Es,c	-0.92	---	---	---
Pork Demand Elasticities				
Epk,pk	-0.1 to 0.8	-0.1	---	---
Epk,ch	-0.8	---	---	---
Epk,bf	0.6	0.6	---	---
Epk, Y	-0.6 to -0.4	---	---	---

Table 3.1. Summary of Ranges and Average Values of Elasticities (continued).

	OLS Estimates	Average	Autocorrelation Corrected Estimates	Average
		Chicken Supply Elasticities		
Ech,ch	-2.42 to -1.6	-2.01	-0.83 to -0.41	-0.62
Ech,pk	-0.4	---	-0.16	---
Ech,bf	0.7	0.7	0.57	0.57
Ech,Y	-0.2 to -0.10	---	-0.04 to 0.18	0.18[*]
		Beef Demand Elasticities		
Ebf,bf	-0.51 to -0.29	-0.40	---	---
EBf,ch	-0.39	---	---	---
Ebf,pk	0.19	0.19	---	---
Ebf,Y	0.58 to 0.61	0.60	---	---

[*] The average was calculated considring only the values with sign according to a priori expectations.

Note: E= elasticity; c = corn; s = sorghum; pk = pork; ch = chicken; bf = beef; rt = ratio of output to input prices; Y = per capita income; f=fertilizer.

The results are also compared with previous findings as shown in Table 3.2. At first glance this table indicates that the results of this study are close to or within the range of values from previous empirical work. Previous studies have been usually limited to individual markets or individual commodities. Perhaps the most relevant study is Tolley's et al. (1982) because of the thorough analysis of the feed grain sector in Venezuela and its policies. A more exhaustive empirical work is the one by Sullivan et al. (1989). Although narrower in scope, Sanchez's (1981) and Ovelar's (1989) studies can be compared market by market with this study.

3.2. FUTURE IMPLICATIONS

There are two direct lines for future research based on the present study. First, a more basic one, would be a refinement of the econometric techniques utilized in order to improve the quality of the estimates. Second, the use of these results for policy analysis would be perhaps the most useful and direct application. With respect to the first point, the use of distributed lag models to estimate the same relations would check for short- and long-term price responses. Also, tests for structural change over the sample period could be conducted on the basis of a longer data series.

Use of these results for direct policy analysis is probably the most interesting application considering the current changes occurring within the sector. For example, it seems apparent that national production of corn and sorghum will be negatively affected, and feed grain imports should increase. The country will turn to international markets to fulfill its needs for feed grains. Two factors support this conclusion: internally, the strong reliance of domestic feed grain production on price supports and input subsidies which have now been eliminated, and, externally, the current declining trend in the international price for feed grains. Other factors which should also contribute to the fall in domestic production are the increase in the agricultural interest rate and the elimination of the preferential exchange rate for importing agricultural inputs. For example, according to estimated feed grain production response to the price of fertilizers, a fall of 0.4 percent in corn supply and 0.6 percent in domestic sorghum supply is expected for each one percent increase in the price of fertilizer.

Table 3.2. Comparison of Price Elasticities.

	This study	Sullivan	Tolley	Ovelar	Sanchez
Supply Elasticities					
Feed grains					
$E_{c,c}$	0.41	0.5	0.3	1.48	
$E_{s,s}$	2.60	0.55	0.3	0.71-3.69	
$E_{c,s}$	-0.02	-0.10	-		
$E_{s,c}$	-0.10	-0.15	-		
Livestock					
$E_{pk,pk}$	0.20	0.55	4.0		0.83
$E_{ch,ch}$	0.90	0.50	4.0		
$E_{bf,bf}$	-	0.55	-		
Demand Elasticities					
$E_{c,c}$	-	-0.25	5.0		
$E_{s,s}$	-2.50	-0.35	5.0		
$E_{pk,pk}$	-0.24	-1.10	-		-0.35
$E_{ch,ch}$	-1.60	-0.95	-		
$E_{bf,bf}$	-0.49	-0.88	-		
$E_{pk,ch}$	-	0.30	-		
$E_{pk,bf}$	0.80	0.40	-		
$E_{ch,bf}$	0.80	0.34	-		
$E_{ch,pk}$	-	0.25	-		
$E_{bf,pk}$	0.48	0.28	-		

NOTE: E: elasticity; c: corn; s: sorghum; pk: pork; bf: beef; ch: chicken

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On the other hand, feed grain imports purchased without the former preferential exchange rate will cause a considerable increase in the price of manufactured feed.[12] Higher feed concentrate prices, important inputs in pork and chicken production, will boost production costs for pork and chicken producers. Specifically, falls in production of pork and chicken meat are expected due to increases in the price of concentrates because of sorghum price increases. According to the results in this study, pork supply can be expected to fall by 0.27 percent for each percent increase in the price of sorghum. Similarly, production of chicken may fall around 0.55 percent for each percent increase in sorghum price.[13] At the end of the chain, consumers of pork and chicken will experience a price increase because these products have been deregulated. Chicken consumption may fall between 0.41 and 0.83 percent for each percent increase in the retail price of chicken.

Generally speaking, the elasticity estimates have shown that corn and sorghum are substitutes in production and are highly responsive to price (especially sorghum). On the other hand, meat supply depends on the price of feed grains, and meat production (particularly chicken) is a strong determinant of the feed industry demand for feed grains. Consumption relations at the consumer level were also tested and substitution possibilities were encountered as well. For example, both chicken and pork are substitutes in consumption with respect to beef, but did not show clear substitution relations between themselves.

The estimated price elasticities (both own- and cross-price) were rather high in most cases, indicating rapid adjustment of producers or consumers to changes in prices. In a regime of administered prices this has an immediate consequence: policies to increase production or consumption, through higher and lower prices respectively, can be successful. However, detrimental changes in prices forced by difficult economic conditions could place production and consumption on a negative path.

Nevertheless, it should be noted that when analyzing the impact of policies, elasticities are only a first step. Elasticities measure a response at the margin for changes that occur one at a time. In the real world, changes occur simultaneously and often by large amounts, so parameters should be used as a guidance of the most likely outcome in general terms.

NOTES

1. The most immediate reactions were, in fact, the riots in February 1989, when many people died protesting a "starvation" package of macroeconomic measures. But here we are reporting the "technical" reactions of different interest groups.

2. The comments in this section are based mainly on Ministerio de Agricultura et. al. (1987).

3. CONAMAG is the Spanish acronym for National Commission for Agricultural Marketing.

4. BAP is the Spanish acronym for Bank for Agriculture and Livestock.

5. CORPOMERCADEO stands for Corporation for Agricultural Marketing.

6. The comments in this section are based on "Legislación Ecónomica", a monthly magazine that summarizes all of the government legal procedures (e.g. decrees, bills). Volumes from 1983 to January 1989 were reviewed.

7. Imports of corn were banned from 1986 to 1989 and sorghum imports were rationed according to domestic production.

8. This information is based on FUNDADAFUTURO (1989), which cited the last available Agricultural Census in 1985.

9. These technical relations among ingredients are not constant and may vary over time and for a particular feed, but are very close to what could be considered an average for Venezuela (AFACA, personal communication).

10. In personal communication with people from the corn processing industry it has been pointed out that during the eighties domestic corn production was totally absorbed by the food industry. This leaves the feed industry with probably a 100 percent reliance on imported corn.

11. It is important to note that the policy changes proposed imply quite large price increases. For example, the preferential exchange rate for the last year of its application (1988 and beginning of 1989) was 14.50 Bs/US $. After February 1989, the average exchange rate at which imports were traded was 37.50 Bs/US $. In August 1991, the prevalent market exchange rate was 59.00 Bs/US $.

12. At the end of 1989, producer price of sorghum was 8000 Bs/Mt, an increase of 186 percent with respect to 1988's price of 2800 Bs/MT.

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TABLE A-1

Corn Data. (Venezuela 1969-1989)

Year	Area (Has)	Production (MT)	Yields (Kg/Ha)	Farm Price (Bs/MT)	Imports (MT)	Exports (MT)
1969			670304	1046	380	11049
1970			709915	1272	380	10910
1971			713486	1214	380	10519
1972			506316	1089	390	550
1973			454423	1035	410	35007
1974			553761	1198	590	41402
1975			653412	1291	700	93830
1976			417424	1218	830	34437
1977			774419	1561	850	62157
1978			591364	1430	830	32783
1979			612473	1498	890	44788
1980			575400	1460	1280	12271
1981			452220	1451	1660	10080
1982			500966	1643	1720	10333
1983			487838	1573	1620	13927
1984			547072	1749	2470	13228
1985			868431	1861	2840	66623
1986			1172772			2880
1987			1267305			3390
1988			1281371			3860
1989			921195	.	8000	3 3

Source: Ministerio de Agricultura y Cría, Series
Estadísticas, 1988.
Ministerio de Agricultura y Cría, Anuario Estadístico
Agropecuario (several issues from 1970 to 1984)

TABLE A-2

Sorghum Data (Venezuela 1969-1989)

Year	Area (Has)	Production (MT)	Yields (Kg/Ha)	Farm Price Kg/MT	Imports (MT)	Exports (MT)
1969				1026	340	60
1970				2211	340	180718
1971				986	340 3	329611
1972				1415	370 3	352610
1973				1418	460 4	402042
1974				1199	600 6	443890
1975				1600	700 7	462353
1976				1711	800 8	478557
1977			280008	1794	810 8	448757
1978			339819	1832	810 8	540220
1979			395779	1641	800 8	516809
1980			352611	1666	1030 1	42832 0
1981			346558	1512	1170 1	767377
1982			377272	1713	1430 1	549560
1983			364006	1850	1400 1	275614
1984			472451	1980	1740 1	321174
1985			481436	1929	2180 2	1002162
1986			755889	1985	2220 2	702734
1987			777239	1992	2500 2	843036
1988			819838	.	2800 2	1748279
1989			505923	.	8000 8	946493

Source: Ministerio de Agricultura y Cría, Series
Estadísticas, 1988.
Ministerio de Agricultura y Cría, Anuario Estadístico
Agropecuario (several issues, 1970 to 1986)

TABLE A-3

Pork Data (1969-1989)

Year	Production (MT)	Imports (MT)	Exports (MT)	Farm Price (Bs/MT)
1969	45378	3057	0	2630
1970	43232	2558	0	2610
1971	43236	465	0	2760
1972	51827	326	0	2870
1973	49588	348	0	3390
1974	51163	111	0	3820
1975	52926	35	0	4320
1976	57859	757	0	4810
1977	66518	5090	0	5390
1978	65410	6072	0	5670
1979	64248	9492	0	6220
1980	75639	9927	0	6400
1981	78660	12874	0	6820
1982	87071	1812	0	6890
1983	100073	57	0	7190
1984	104529	35	31	9730
1985	106604	10	15	10610
1986	132445	0	361	11530
1987	133273	3	309	18470
1988	148318	0	0	20840
1989	.	.	.	.

Source: Ministerio de Agricultura y Cría, Series
Estadísticas, 1988.
Ministerio de Agricultura y Cría, Anuario Estadístico
Agropecuario (several issues, 1970 to 1986)

TABLE A-4

Chicken Data (1969-1989)

Year	Production (MT)	Imports (MT)	Exports (MT)	Farm Price (Bs/MT)
1969	84552	0	0	2790
1970	93409	0	0	2680
1971	100398	0	0	2850
1972	115645	0	0	2880
1973	131872	0	0	3050
1974	147698	0	0	3460
1975	163738	0	0	3890
1976	181535	2390	0	3890
1977	185846	6936	0	3930
1978	195711	27172	0	4080
1979	209181	6766	0	4100
1980	251398	11181	0	4940
1981	282044	18316	0	5420
1982	300502	2600	0	5520
1983	316524	624	82	6480
1984	360180	0	823	7190
1985	352613	0	5096	8200
1986	370610	0	16088	10140
1987	358671	1	176	11070
1988	396323	0	0	14600
1989		.	.	.

Source: Ministerio de Agricultura y Cría, Series
Estadísticas, 1988.
Ministerio de Agricultura y Cría, Anuario Estadístico
Agropecuario (several issues, 1970 to 1986)

TABLE A-5

Amount of Feed Grains Used for Feed Production and Price Paid by Feed Millers for Feed Grains

Year	Corn Feed (MT)	Corn Price (Bs/MT)	Sorghum Feed (MT)	Sorghum Pce. (Bs/MT)
1969	148295	420	6179	300
1970	139780	420	187250	300
1971	94869	420	332016	300
1972	182144	435	359737	364
1973	114861	435	422435	364
1974	131997	435	477938	447
1975	135402	700	407986	582
1976	159924	636	602047	528
1977	192488	636	727224	510
1978	193401	636	898842	459
1979	210256	636	924999	450
1980	678309	636	378764	443
1981	445085	1400	964223	445
1982	561826	1800	933254	375
1983	679628	1800	408375	786
1984	883231	1800	774202	1481
1985	321260	3000	1300383	1807
1986	74414	2880	1309045	2220
1987	37266	3390	1600493	2500
1988	16201	3860	1950000	2800
1989	0	8000	1325027	8000

Source: Ministerio del Ambiente, 1987.
Personal Communication (for feed grain prices)

TABLE A-6

Feed Production by Livestock Category

Year	Bovine (MT)	Pork (MT)	Poultry (MT)	Other (MT)	Total (MT)
1969	122421	174895	306512	9195	613023
1970	138667	208179	357573	10727	715146
1971	141899	234377	387914	11637	775827
1972	170570	253450	437135	13114	874269
1973	222694	268016	505878	15177	1011765
1974	207751	306004	649542	17715	1181012
1975	108030	325811	776263	20301	1230405
1976	102595	376865	860549	22481	1362490
1977	103757	410552	953977	24633	1492919
1978	41832	500191	1056701	28973	1627697
1979	46837	557888	1244194	42700	1891619
1980	33109	591913	1322615	52348	1999985
1981	30037	686349	1485204	52631	2254221
1982	79355	838252	1557494	58171	2533272
1983	92614	875953	1390756	62683	2422006
1984	202241	899841	1763952	71189	2937223
1985	289434	942947	1775299	38998	3046678
1986	378379	953243	1800475	78233	3210330
1987	416766	937816	1993962	73177	3421721
1988	576959	1141748	2253899	82129	4054735
1989	246227	753592	1820214	78257	2898290
1990					2200000

Source: AFACA, 1989.

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TABLE A-7

Input Prices, Pork and Chicken Concentrate Prices,
Fertilizers Price.

	Concentrate Price		Fertilizer Price		
Year	Pork	Poultry	UREA	12-24-12	AVERAGE
1969	670	704	438	542	490
1970	670	704	438	542	490
1971	670	704	438	542	490
1972	775	875	403	542	473
1973	775	875	403	542	473
1974	750	850	403	542	473
1975	850	1025	403	542	473
1976	900	1025	438	542	490
1977	900	1050	438	542	490
1978	875	1050	476	558	517
1979	900	1050	477	549	513
1980	950	1100	475	589	532
1981	1025	1100	1332	1378	1355
1982	1150	1225	1632	1750	1691
1983	1550	1625	1520	1570	1545
1984	1625	1850	649	700	675
1985	1975	1850	1411	700	1056
1986	2425	2251	1411	700	1056
1987	3025	3050	1411	700	1056
1988	3025	3050	1411	700	1056
1989	.	.	.	.	0

Source: Ministerio de Agricultura y Cría, Anuario
Estadístico Agropecuario, 1970 to 1984.
FAO, 1981, 1984, 1986 and 1988

TABLE A-8

Foreign Exchange Rate, International and Foreign Exchange Availability.

Year	Exchange Rate (Bs/ US $)	Foreign Reserves (US $ x 10^6)	Available Reserves (US $ x 10^6)
1969	4.5	636	399
1970	4.5	891	438
1971	4.5	1773	845
1972	4.5	2110	1014
1973	4.3	2446	1624
1974	4.3	6491	5338
1975	4.3	8825	3505
1976	4.3	8570	4160
1977	4.3	8145	4753
1978	4.3	6438	4514
1979	4.3	7740	6079
1980	4.3	7025	5529
1981	4.3	8619	6957
1982	4.3	10039	5226
1983	4.3	11149	6307
1984	4.3	12469	7605
1985	7.5	13750	8822
1986	14.5	9858	4894
1987	14.5	9376	
1988	14.5	6584	
1989	.	.	

Source: United Nations Organization, 1987 and 1989

TABLE A-9

Per Capita Consumption of Pork, Chicken and Beef

Year	Population	Pork Kg/cap/year	Chicken Kg/cap/year	Beef Kg/cap/year
1969	10247303	4.73	8.19	20.34
1970	10604071	4.32	8.85	18.95
1971	10984195	3.98	9.16	19.49
1972	11383490	4.58	10.16	19.28
1973	11798839	4.23	11.18	20.15
1974	12227127	4.19	12.08	21.05
1975	12665236	4.18	12.93	21.66
1976	13118979	4.47	14.01	22.03
1977	13590433	5.27	14.19	21.93
1978	14070880	5.08	15.84	24.11
1979	14551602	5.07	14.83	23.84
1980	15023880	5.7	17.49	23.28
1981	15484656	5.91	19.28	22.75
1982	15939742	5.58	18.66	22.49
1983	16393726	6.11	19.37	21.66
1984	16851195	6.2	21.47	18.06
1985	17316738	6.16	19.84	18.36
1986	17791411	7.42	20.33	17.59
1987	18272157	7.28	19.57	16.25
1988	18757389	7.91	21.18	16.7

Source: Instituto Nacional de Nutrición and Fundación Polar, 1982 to 1989.

TABLE A-10

Retail Price of Pork, Chicken and Beef.

Year	CPI	Pork	Chicken	Beef
	1968=100	Bs/Kg	Bs/Kg	Bs/Kg
1969	102	6.19	4.71	5.38
1970	105	6.21	4.42	5.37
1971	108	6.24	4.74	5.58
1972	112	6.49	4.87	6.17
1973	116	7.18	4.85	7.54
1974	126	8.07	5.23	8.61
1975	139	9.05	5.52	9.63
1976	149	10.93	5.62	10.44
1977	161	14	5.71	11.78
1978	172	14.68	5.76	12.87
1979	193	15.43	6.34	15.41
1980	235	17.14	8.13	20.92
1981	273	18.75	9.41	21.92
1982	299	19.18	9.23	21.99
1983	318	21.5	11.18	21.99
1984	357	23.9	12.15	29.18
1985	397	28.98	14.04	37
1986	444	29.75	14.96	46
1987	569	43.05	19.33	60
1988	736	43.5	23	.
1989	.	.	54	.

Source: Ministerio de Agricultura y Cría, 1971 to 1986, and 1987.

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TABLE A-11

Total Disposable National Income and Per Capita
Income.

Year	Population	Total Income	Per Capita Income
1969	10247303	44730	4365
1970	10604071	41453	3909
1971	10984195	47496	4324
1972	11383490	52707	4630
1973	11798839	63240	5360
1974	12227127	101192	8276
1975	12665236	110431	8719
1976	13118979	125978	9603
1977	13590433	143766	10578
1978	14070880	156601	11129
1979	14551602	192991	13263
1980	15023880	237447	15805
1981	15484656	270744	17485
1982	15939742	267470	16780
1983	16393726	255612	15592
1984	16851195	311505	18486
1985	17316738	326413	18850
1986	17791411	351907	19780
1987	18272157	456548	24986
1988	18757389	637601	33992
1989	.		.

Source: Banco Central de Venezuela.

1. CROP SUPPLY

Production: The output variable (dependent) corresponds to annual production data of either corn or sorghum, published by the AEA. This variable is expressed in metric tons (MT) of "gross grain," i.e. including impurities and a relatively high humidity level, that is, prior to the cleaning and drying procedure required for storage.

Producer Prices: The producer prices are the national average of the prices paid to producers of feed grains at the reception centers in Bolívares (Bs) per metric ton. The prices are expressed in real terms, that is, deflated by the consumer price index (CPI), published by the BCV. The prices for the first four years of the series were missing and were estimated from a base value for 1970 taken from the Memoria y Cuenta of the Ministry. The base value was successively increased according to the prevailing inflation rate.

Fertilizer Prices: The price of fertilizer, unless otherwise indicated, is a simple average of the two most commonly used fertilizers for cereal production in Venezuela: urea and a formula containing the basic elements NPK (12-24-12). From 1969 to 1984 the values were taken from the AEA and the series was completed from 1985 to 1988 using the FAO fertilizer yearbook.

Weather: The weather variable is an index equal to the absolute value of the deviation of each year's average rainfall (in mm) with respect to the mean for the whole series of 20 years (1969-89):

[each year's rainfall mean(mm) - annual mean for 20 years (mm)].

Rainfall data were provided by the Ministry of Environment for 12 climatic stations around the country representative of the main feed grain producing areas.

2. MEAT PRODUCTION

Meat production: This variable is expressed in metric tons of pork or chicken meat, without bones.

Price of feed: For pork and for poultry this variable is expressed in Bs per metric ton of feed. This is the price reported at the factory level and does not take into account any discounts, credits or other arrangements between the feed mill and the meat producer.

Ratio of output to input price: This variable was created in two different ways according to the input price used. The output price in all cases is the price received by pork and chicken producers at the farm level. The input price, or denominator, is a weighted average of the feed grain reference price.

3. FEED GRAIN DEMAND

Demand for corn (and sorghum): This is the annual quantity of corn (or sorghum) consumed or used by the feed industry expressed in metric tons.

Price of corn (and sorghum): The relevant feed grain prices for feed millers are the reference price for feed grains (from 1969 to 1984) and the minimum price for feed grains (from 1985 on). The reference price is the price the government marketing agency, CORPOMERCADEO, charged to feed millers. This price was usually below the minimum price paid to feed grain producers (defined in point 5.1.1 above). After 1984, feed grain producers and feed millers met directly to sell and buy the grains respectively. The series of reference prices was from Fundación Polar, since they were not found in any official publication. These prices are expressed in Bs per metric ton.

Supply of chicken and of pork): These are the variables representing the final goods which use feed grains as inputs in their production. They are defined in the same way as the dependent variables for meat supply, discussed above (section 5.1.2).

MEAT DEMAND

Pork: This is the per capita availability of pork meat expressed in Kilograms (Kg) of pork per year. This variable is calculated as the total availability of pork meat divided by population. Total availability is calculated as domestic supply plus imports (if any) minus exports (if any) plus or minus change in stocks. This is done for each type of meat.

Poultry: This is the per capita availability of poultry meat in Kg of chicken per year. Total available chicken meat is divided by population to derive this variable. Consumption of other types of birds is negligible. In the same way as pork, total availability of chicken meat is calculated as domestic supply plus imports minus exports plus or minus stock change.

Beef: This is defined as the per capita availability of beef meat in Kg of beef per year. Total availability of beef is calculated the same way as for pork and chicken.

Retail prices: The retail prices for each meat are the prices at the consumer level as published by the Ministry of Agriculture in its statistical yearbook. They are expressed in real terms, that is, deflated by the consumer price index (1968 = 100). The units are Bs per Kg of meat (either chicken, pork or beef).

Income: This variable is defined as the disposable income published by the Central Bank divided by the population. It is expressed in terms of constant 1968 Bs per capita per year.

5. GRAIN IMPORTS

Imports of corn (and/or sorghum): These are quantities expressed in metric tons of imported grain as reported by the AEA of the Venezuelan Ministry of Agriculture.

World price of corn: This variable corresponds to the price in world markets for corn expressed in US $ per metric ton as published by the FAO Yearbook of Production. This variable conforms to the US f.o.b. Gulf price.

World price of sorghum: This variable is defined the same as for corn above, but for sorghum grain. The same observations about sources and definition apply.

Domestic production of corn (and/or sorghum): This is exactly the same as for crop supply, above. These variables were intended to capture the influence of the quota or contingency policy.

Exchange rate: This variable is defined in units of Bolívares (Bs) per US dollar (US $). From the beginning of the study period, 1969, to 1982, this rate was fixed at 4.29 Bs per US $. After 1983, when successive devaluations occurred, the relevant exchange rate for feed grain imports was the preferential rate fixed by the government and published by the Central Bank. From 1989 on the relevant rate is the market rate since preferential rates were eliminated in favor of a unified flexible exchange rate.

International reserves: This variable corresponds to the foreign exchange reserves of the country and is expressed in millions of US dollars.

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