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PARAGUAY: POTENTIAL DEMAND FOR CASSAVA

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PARAGUAY: POTENTIAL DEMAND FOR CASSAVA

Macroeconomic Policy and Agriculture

In this section the evolution of the Paraguayan economy, in the light of the set of policies implemented, is analyzed. Emphasis is placed on the role of agriculture and, within it, the role of cassava. As it is well known, Paraguay is by far the largest per capita producer of cassava in the world, with over 750 kilos per year. This singular situation will be discussed in terms of both production and consumption factors influencing this crop.

Economic policy context

Paraguay has had in the past two decades one of the more impressive rates of growth among Latin American countries and the world. Its economy is based on the agricultural sector, which contributes 27% of the gross domestic product (GDP), 50% of employment, and 95% of exports. Agricultural contribution to GDP dropped from 39% in 1960 to 27% in 1984. Of the current share, 16.2% corresponds to crops, 7.8% to livestock, and 2.7% to forestry. Construction, the big winner, grew from 1.5% in 1962 to 7.1% in 1981, and to 6.2% in 1984 (Table 1). Stable policies have been the trademark of this development.

Of the 3.7 million people in the country, 56% still live in the rural areas. Population growth for 1970-85 was 3.2% per year (Table 2). Urban population grew faster at 4.4%. Per capita income was about US\$1,777 in 1985.

Recent growth of the Paraguayan economy can be divided into three distinct periods. From 1950 to 1971, from 1972 to 1981, and from 1982 to present. In 1950 to 1971 the basis for development was laid out and the country's economy expanded at a modest rate (4%).

In 1972 the construction activity was accelerated. Itapúa and the road to Brazil had a great impact on the economy. In the seventies, Paraguay achieved one of the highest rates of growth of Latin America and the world. Specifically, in 1970-80, Paraguay had the highest rates of annual growth of real GDP at 8.6%, of agriculture at 7.3%, and of industry at 10.6% among Latin American countries (Table 3). In 1972-81, the total value of production increased at an annual rate of 7% for crops, 5% for livestock, and 6% for forestry (Ground, 1984).

The seventies also witnessed a rapid expansion of agricultural exports. Two crops were instrumental to this export growth: cotton (a small farmers crop) and soybeans; which expanded in 1972-79 by 470% and 350%, respectively. Total exports grew at 7% per year and imports grew at 12.5% annually. Exports were stable in value and composition (Table 4) while imports were mostly related to the infrastructure development that took place with foreign capital.

The road to Brazil through Puerto Stroessner put an end to trade dependence with Argentina and, in view of the fixed rate policy in effect from 1960 to 1982, illegal trade flourished in Paraguay (Rodríguez, 1984).

Table 1. Structure of gross domestic product by economic sectors.

Economic sector	Year							
	1960	1970	1975	1980	1981	1982	1983	1984
	(% over constant values of 1982)							
Primary production								
Crops		16.1	16.7	14.5	15.3	15.6	15.6	16.2
Livestock		11.0	11.0	7.9	7.4	7.7	7.8	7.8
Forestry		3.2	3.0	2.7	2.6	2.5	2.5	2.5
Wildlife and fisheries		0.1	0.1	0.1	0.2	0.1	0.2	0.2
Subtotal production primary	<u>38.8</u>	<u>30.4</u>	<u>30.8</u>	<u>25.2</u>	<u>25.5</u>	<u>25.9</u>	<u>26.1</u>	<u>26.7</u>
Secondary production								
Mining	0.1	0.1	0.2	0.3	0.4	0.4	0.4	0.4
Industry	17.3	18.4	16.8	17.6	16.8	16.4	16.2	16.4
Construction	2.4	2.4	3.2	6.6	7.1	6.7	6.5	6.2
Subtotal production secondary	<u>19.8</u>	<u>20.9</u>	<u>20.2</u>	<u>24.5</u>	<u>24.3</u>	<u>23.5</u>	<u>23.1</u>	<u>23.0</u>
Total production of goods	<u>58.6</u>	<u>51.3</u>	<u>51.0</u>	<u>49.7</u>	<u>49.8</u>	<u>49.4</u>	<u>49.2</u>	<u>49.7</u>
Production of services								
Electricity	0.6	0.8	1.2	1.8	1.7	2.2	2.1	2.1
Water and sanitary	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4
Transportation and comm.	4.0	3.9	4.6	4.3	4.1	4.2	4.3	4.3
Trade	18.4	26.5	25.3	27.0	27.0	26.6	26.6	26.3
Central government	4.4	5.7	4.3	3.8	4.2	4.5	4.5	4.5
Housing	3.6	3.6	3.3	3.1	3.1	3.0	3.0	2.9
Other services	10.2	8.0	10.1	10.0	9.8	9.8	9.9	9.8
Total production of services	<u>41.4</u>	<u>48.7</u>	<u>49.0</u>	<u>50.3</u>	<u>50.2</u>	<u>50.6</u>	<u>50.8</u>	<u>50.3</u>
Total GDP	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

SOURCES: Secretaría Técnica de Planificación, División de Estadística y Cuentas Nacionales, with data from the Banco Central del Paraguay.

Table 2. Statistical profile of Paraguay.

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Area (km ²)	406.752				
Population: total 1985 (43.9% urban)	3.691.000				
Annual growth rate 1970-85	3.2				
Birth rate (1984)	38.9				
Mortality per 1000 inhabitants (1984)	7.7				
Infant mortality per 1000 live births (1984)	52.9				
Life expectancy at birth (1984)	68.0				
Percentage of literacy (1984)	92.0				
Labor force by sector (1982)	(Percentages)				
Agriculture	49.6				
Mining	0.1				
Manufacturing	13.6				
Construction	7.5				
Others	31.9				
	1981	1982	1983	1984	1985 ^a
Real production					
	(Growth rates)				
Total GDP (market prices)	8.7	-1.0	-3.0	3.1	4.0
Agricultural sector	10.1	0.4	-2.4	5.9	4.6
Manufacturing sector	4.3	-3.7	-4.2	4.5	5.0
Construction sector	16.7	-6.0	-5.7	-2.4	-1.0
Commerce sector	8.4	-2.2	-3.1	1.8	4.8
Central government					
	(Percentages of GDP)				
Current revenues	8.3	9.3	8.0	8.0	7.9
Current expenditures	7.5	8.7	8.9	7.6	7.0
Current savings	0.8	0.6	-0.9	0.4	0.9
Capital expenditures	3.7	2.1	1.7	3.3	2.5
Deficit or surplus	-2.8	-1.5	-2.6	-2.9	-1.5
Domestic financing	2.5	1.5	1.9	1.9	1.8
Money, prices, and salaries					
	(Growth rates)				
Domestic credit	36.9	9.3	23.1	20.0	17.7
Public sector	59.3	77.5	228.8	28.6	42.2
Private sector	15.4	5.4	2.6	17.3	9.2
Money supply (M1)	-14.0	-7.6	22.7	32.0	25.8
Consumer prices (annual average)	14.0	6.7	13.5	20.3	25.2
Real wages	5.3	-2.8	-7.1	-3.5	-2.2
Exchange rate					
	(Annual average)				
Official rate (to the US\$)	126.0	126.0	201.0	240.0	240.0
Real effective exchange rate (Index 1980 = 100)	101.4	105.4	119.0	132.7	168.2
Terms of trade (Index 1980 = 100)	104.6	88.0	83.8	112.7	105.9
Balance of payments					
	(Millions of dollars)				
Current account balance	-374.4	-365.3	-247.4	-313.2	-106.3
Merchandise balance	-373.8	-296.8	-225.3	-287.8	-125.0
Merchandise exports (FOB)	398.6	373.3	326.0	361.3	322.9
Merchandise imports (FOB)	-772.3	-670.1	-551.4	-649.1	-447.9
Net services	-6.4	-73.1	-28.1	-34.7	4.6
Capital account (net)	431.0	319.4	239.3	282.0	70.5
Change in net reserves (- = increase)	-43.4	58.9	-3.1	-14.7	88.7
External public debt					
	(Millions of dollars)				
Disbursed debt	709.2	940.0	1145.1	1286.7	1460.4
Debt service actually paid	70.7	80.7	84.5	117.6	226.8
Interest payments/export of goods and NFS	5.1	6.6	8.9	6.9	9.6
	(Percentages)				

a. Preliminary estimate.

Table 3. Growth of gross domestic product (annual mean rates), Paraguay.

Country	GDP total		Agriculture		Industry	
	1960-70	1970-80	1960-70	1970-80	1960-70	1970-80
Argentina	4,3	2,3	2,4	2,3	5,9	2,0
Bahamas	-. -	-. -	-. -	-. -	-. -	-. -
Barbados	6,3	2,0	-. -	2,5	-. -	1,3
Bolivia	5,6	4,5	3,2	3,2	7,4	3,9
Brazil	6,1	8,8	3,1	5,2	6,0	9,5
Colombia	5,2	5,9	3,8	4,7	5,9	4,9
Costa Rica	6,1	5,6	5,6	2,4	8,0	8,0
Chile	4,5	3,1	2,3	2,2	5,2	1,7
Dominican Republic	5,1	6,3	2,3	3,4	7,2	8,5
Ecuador	5,3	7,6	2,5	4,1	6,9	8,9
El Salvador	5,6	3,0	3,9	2,0	7,5	3,0
Guatemala	5,5	5,6	4,4	4,8	6,9	7,3
Guyana	3,2	4,5	0,9	1,9	4,2	3,1
Haiti	0,6	4,2	0,9	2,2	0,6	7,1
Honduras	5,2	3,8	5,4	1,9	6,2	4,9
Jamaica	5,6	-0,3	1,4	2,8	6,4	-2,2
Latin America	5,7	5,8	3,4	3,3	6,3	6,2
Mexico	7,0	4,5	3,7	2,4	8,6	6,9
Nicaragua	6,9	1,2	6,0	1,3	10,7	1,2
Panama	7,8	3,8	5,3	1,4	10,4	1,5
Paraguay	4,4	8,6	3,0	7,3	6,5	10,9
Peru	5,0	3,1	4,2	-0,6	5,1	3,6
Suriname	7,4	2,9	-. -	6,0	-. -	0,7
Trinidad and Tobago	4,2	4,9	-. -	-0,4	-. -	5,1
Uruguay	1,6	3,2	3,0	0,5	0,9	4,7
Venezuela	6,0	4,5	5,3	3,8	3,9	2,2

SOURCE: ECLAC (United Nations Economic Commission for Latin America and the Caribbean). [In Spanish: CEPAL (Comisión Económica para América Latina de las Naciones Unidas).]

Table 4. Commodity composition, Paraguay.

Commodity for export	Year				
	1960	1970	1975	1981	1985
	(Percent distribution)				
Wooden products	14.9	19.7	15.8	12.3	3.2
Livestock products	35.2	26.7	19.5	2.3	2.3
Tobacco	5.9	9.0	6.8	2.2	2.0
Cotton	1.1	6.3	11.4	43.7	45.5
Soybean	-. -	-. -	9.9	16.1	31.7
Sugar	0.3	-. -	3.8	-. -	1.1
Vegetable oils	5.7	10.9	6.0	7.6	5.5
Essential oils	3.7	3.2	5.5	2.2	1.8
Quebracho extract	10.9	3.1	1.4	1.9	1.3
Other	7.4	21.1	19.9	11.7	3.5
Total	100.0	100.0	100.0	100.0	100.0

Commodity for import	Year	
	1970	1981
	(Percent distribution)	
Food	8.2	6.4
Other consumption items	14.4	21.0
Primary and intermediate goods	39.3	17.0
Fuels and lubricants	16.4	18.8
Capital goods	21.7	36.8
Total	100.0	100.0

The country has now become sensitive to the disequilibriums arising from policies created by its two giant neighbors, Argentina and Brazil.

Unemployment dropped from 5% in 1972 to 2.2% in the first semester of 1982. During this period labor force expanded at 4%, inflation rate was under 14.%, real agricultural wages grew by 3.3% per year, and labor productivity in agriculture increased by 5.5% (Ground, 1984).

Despite the rapid economic growth and expansion of aggregate demand, inflation was controlled by expanding imports and by conducting a fiscal policy that was countercyclical in nature.

However, in 1982 the country entered in its third economic period when the construction sector slowed down and world recession set in. An increased divergence between the official and the free market exchange rate took place. The current account balance has been in the deficit since 1978 (Table 5). This, together with the drying up of capital inflows from hydroelectric projects and with the rapid rise in international interest rates, has led to a sharp reduction of international reserves--dropping from US\$818 million in 1981 to US\$352 million in 1985--and to the accumulation of external payment arrears (USDA Ag. Situation Report).

External public debt reached US\$1.5 billion in 1985. Real GDP decreased for two consecutive years (-1.0% in 1982 and -3.0% in 1983) to resume growth in 1984 and 1985 at 3.1% and 4.0%, respectively (Table 2).

Exchange rate distortions have favored contraband, and it is estimated that over 30% of all trade is illegal (Rodríguez, 1984, EP v. 1, p. 371). The fixed-rate policy, together with acute fluctuations in the general price level and Argentine and Brazilian exchange rates of the last ten years, explains the importance of illegal trade in the country and the changes in flow from one country to the other.

Informal channels are more open to nonperishable products that require little handling and have easy access to both Argentine and Brazilian markets such as soybeans and cattle.

Policy environment

Given the overwhelming importance of agriculture, it is logical that most of the government's action has been directed toward promoting its development. However, direct intervention has been minor. The policies enacted have been directed mainly at colonizing frontier lands, improving land tenancy, developing better infrastructure, and stimulating agricultural exports.

The highlights of the Paraguayan policy direction have been the occupation and development of agricultural frontiers, for example, the infrastructure developments at Iguazu and Yacyreta, the road to Brazil, and the relocation of families in new colonies away from Asunción. The Instituto de Reforma Agraria (IRA) and, from 1963, the Instituto de Bienestar Rural (IBR) have been in charge of relocation, land adjudication, and redistribution of property.

Table 5. Foreign trade: CIF imports and FOB exports (in millions of dollars), Paraguay

	1970	1978	1979	1980	1981	1982
Imports						
Crops	10.0	26.1	37.3	38.3	42.6	35.6
Wheat byproducts	(4.3)	(4.9)	(8.3)	(11.1)	(13.9)	(6.8)
Fruits	(0.1)	(0.9)	(1.0)	(1.1)	(1.7)	(2.2)
Tobacco	(3.7)	(10.7)	(17.3)	(14.3)	(10.0)	(11.7)
Fuel and lubricants	6.1	59.6	87.5	129.5	94.6	154.2
Other	47.7	232.0	312.7	349.2	368.9	391.7
Total imports	63.8	317.7	437.7	517.1	506.1	581.5
Exports						
Crops	26.0	192.6	242.2	229.5	240.6	268.6
Cotton	(4.0)	(100.0)	(98.6)	(105.8)	(129.3)	(122.4)
Soybean	(1.5)	(41.6)	(81.3)	(45.3)	(52.5)	(91.0)
Vegetable oils	(7.0)	(16.8)	(19.1)	(17.0)	(22.4)	(18.8)
Cake and expellers	(2.5)	(3.9)	(8.0)	(21.9)	(14.2)	(12.1)
Tobacco	(5.8)	(9.2)	(8.5)	(10.1)	(6.5)	(5.9)
Vegetables	(0.3)	(2.4)	(3.2)	(8.1)	(4.3)	(8.4)
Coffee	(0.9)	(0.2)	(4.2)	(2.3)	(1.3)	(0.3)
Livestock products	18.0	32.3	11.8	4.4	6.8	9.0
Meat	(15.0)	(23.4)	(15.2)	(1.0)	(0.0)	(2.0)
Leather	(2.4)	(7.9)	(6.2)	(3.1)	(6.6)	(6.8)
Forestral products	19.4	29.3	48.5	74.7	45.6	51.1
Other	0.7	2.8	2.6	1.6	2.6	1.0
Total exports	64.1	257.0	305.2	310.2	295.5	328.8
Agricultural balance						
Agricultural exports	63.4	254.2	302.6	308.6	292.9	328.8
Agricultural imports	10.0	26.1	37.3	38.3	42.6	35.6
Balance	53.4	228.0	265.3	270.3	250.3	293.2
Commercial balance						
Total exports	64.1	257.0	305.2	310.2	295.5	329.8
Total imports	63.8	317.7	437.7	517.1	506.1	581.5
Balance	0.2	-60.8	-132.5	-206.9	-210.6	-251.7

SOURCE: Banco Central del Paraguay.

Another important policy aims to promote exports--a permanent theme since 1956 when the International Monetary Fund (IMF) approved a loan to subscribe to the Stabilization Plan. The Guarani depreciated from 60 to the U.S. dollar in that year to 126 in 1960 and stayed at that official level until 1982. The creation of CEPEX in 1969 was instrumental in promoting exports (Franco, 1984).

Livestock products and essential oils decreased in exports as cotton and soybeans became predominant (Tables 4 and 5). Import composition was related mostly to infrastructure development that used foreign capital.

Fiscal policy is directed mostly at taxing property. The failure to implement significant new tax measures was the basic factor causing current government revenue to slip from 9.3% of GDP in 1982 to an estimated 7.9% in 1985, one of the lowest revenues from tax in Latin America (IDB, 1986 Report, ESPLA).

The present exchange rate policy is weak: it counteracts export promotion efforts, drains government resources, and overvalues the Guarani. While the free market rate was above G600 per U.S. dollar during 1986, the official rate for debt payments is G126 per U.S. dollar and G240 for commercial transactions. Transfers and subsidies paid by the government are equivalent to 25% of government expenditures, largely because of the burden imposed by the implicit subsidy in the payment of foreign debts (IDB 1986 Report ESPLA).

This policy therefore devalues export earnings and stimulates unaccounted exports and higher imports--a difficult situation to handle when the country's reserves are low.

Agriculture in Paraguay

Almost all agricultural production takes place in the eastern region which constitutes 37.5% of the country. The remaining 62.5% produces only 3% of the country's cotton and 2% of sugar. However, 38% of livestock, the predominant activity, is produced by that region (Fletschner, 1984).

Only wheat and soybean are produced in commercial areas larger than 10 ha. The average area for other crops is one ha (Table 6). Food crops grow more slowly than export crops (Fletschner, 1984).

Agricultural production has grown by increasing production areas, but yields have remained virtually stagnant. Cultivated areas increased at the annual rate of 9.4% in 1972-81, remaining constant in 1982-83 and 1983-84 (Table 7). After 1984 agriculture began to recuperate at annual growth rates of 11% and 15%, in 1985 and 1986 respectively (USDA Report).

Although agricultural exports account for over 90% of total registered exports, there is a low degree of export income diversification (Table 4), for example, 47% of agricultural exports are cotton, 33% are soybeans, and 2% are livestock.

After 1978 agricultural prices fell by over 30% with respect to the other products in the economy (Table 8). Internal terms of trade for

Table 6. Crops production, Paraguay, 1981.

	Area harvested (ha)	Total production (t)	Average yield (kg/ha)	Average area (ha)
Cotton	243,952	341,647	1,400	1.8
Rice	23,398	44,478	1,901	1.7
Green pea	2,040	1,632	800	0.4
Sweet potato	11,304	75,053	6,639	0.4
Sugarcane	48,569	2,154,713	44,350	1.2
Onion	2,191	7,789	3,555	0.4
Field bean	8,564	7,377	861	0.6
Maize	290,812	468,227	1,610	1.0
Cassava	178,205	2,012,389	11,293	0.9
Peanut	35,207	36,041	1,024	0.7
Potato	789	3,018	3,824	0.5
Cowpea	49,940	42,184	852	0.6
Soybean	396,125	761,185	1,922	13.5
Tobacco	7,706	11,587	1,504	0.6
Castor oil	13,953	14,829	1,063	1.1
Wheat	49,222	60,911	1,237	16.1

SOURCE: Ministerio de Agricultura y Ganaderia. 1981. Censo Agropecuario.

Table 7. Effects of the occupation of frontier lands on the level of activity and registered exports, 1972-83, Paraguay^a.

	1972- 1981	1973	1974	1975	1976	1977	1978	1979	1980	1981	1981- 1983	1982	1983
(Rates of growth)													
Cultivated land													
Total	9.4	14.2 ^b	14.2 ^b	14.4 ^b	9.1	5.9	5.5	7.9	7.1	7.2	-	-	-
Internal market	3.0	10.1	13.0	14.5	8.1	-4.9	-3.7	-1.4	6.0	-7.0	-	-	-
External market ^c	24.5	38.3	19.6	13.5	13.2	51.4	29.9	20.8	9.0	29.7	-	-	-
Value of agricultural production	8.2	7.9	10.9	3.3	4.7	15.6	6.2	6.5	10.6	8.2	-	-4.4	-6.3
Gross value	8.9	7.4	13.0	2.3	4.7	16.0	4.9	6.2	10.5	16.1	-	-3.7	-6.3
Internal consumption	3.8	1.1	10.7	-0.9	1.7	2.5	1.1	8.7	4.4	5.2	-	5.9	-2.7
Export ^c	26.6	59.1	25.0	16.7	16.7	62.2	13.1	1.2	23.1	35.2	-	-17.0	-12.5
Forest products	7.6	2.5	11.0	9.3	-1.9	9.1	7.9	14.0	12.3	4.8	-	-5.0	-2.0
Production value per ha													
Agriculture	-1.1	-5.3	-2.1	-9.7	-4.1	9.2	0.8	-1.4	3.2	1.0	-	-	-
Gross value	0.5	-5.9	-1.2	-10.6	-4.8	8.2	0.7	-0.2	3.4	0.7	-	-	-
Internal consumption	-0.1	-8.2	-1.6	-13.5	-5.9	-7.7	5.0	7.3	-1.4	12.9	-	-	-
Export ^c	1.8	15.0	4.6	2.9	2.9	7.2	-12.7	-16.3	13.0	4.1	-	-	-

a. Provisional figures only, subject to revision.

b. Estimate

c. Cotton and soybean.

SOURCES: Ministerio de Agricultura y Ganaderia; Banco Central del Paraguay.

Table 8. Index of implicit prices (constant Guaranis 1977), Paraguay.

Year	Total GDP	Agricultural GDP
1958	26.4	23.9
1959	29.6	26.4
1960	34.8	31.9
1961	37.2	33.7
1962	40.5	37.3
1963	41.5	39.0
1964	42.5	40.0
1965	51.6	40.3
1966	45.5	42.4
1967	44.3	39.1
1968	45.1	40.7
1969	46.6	42.7
1970	47.5	44.0
1971	50.3	47.8
1972	54.7	54.1
1973	66.1	72.0
1974	81.7	82.2
1975	87.2	90.1
1976	91.6	91.4
1977	100.0	100.0
1978	110.4	108.6
1979	113.1	133.0
1980	155.5	148.8
1981	181.3	166.1
1982	192.5	165.9

SOURCE: Banco Central del Paraguay.

agriculture have deteriorated. This partially explains the slower growth of the sector in the eighties. Compensatory policies have been directed only to export crops (cotton and soybeans), wheat and sugarcane, and to livestock, leaving food crops unprotected. In the face of growing inflation, this constitutes a dangerous policy to follow.

Before 1960, livestock was the predominant economic activity and the main source of exports. By 1962, crops contributed slightly more than livestock to the agricultural GDP. Today, crops account for two-thirds of the agricultural GDP and have displaced livestock products as the dominant foreign exchange earner (Tables 1 and 4).

Hog production is important, but as a backyard operation. Growth in production has been high, partly because fresh cassava is an important animal feed (Regunaza and Kugler, CIAT). However, there are few industrial-level operations dedicated to derivatives of pork production.

Poultry production is still dualistic, that is, characterized by a scattering of very small-scale rural producers and one industrial company (Pollos Pechugon) supplying 90% of the Asunción market. Growth in production has been high, based on abundant supplies of maize and soybeans.

Within crops, the major economic crops are soybeans, followed by cotton, cassava, and maize in that order (Table 9). Maize and cassava are key products to the settlers of the newly colonized frontier areas. Most of the production of these two crops is consumed onfarm both as food and as feed. Soybeans and cotton constitute cash crops and are also important in the process of capital accumulation necessary for colonization.

Typically, a 20-ha lot located in a new colony starts with subsistence agriculture. About 3 ha are initially cultivated--two ha are used for crops for onfarm consumption (maize, cassava, cowpea) and the other hectare is planted to a cash crop (tobacco, cotton, or petit grain). During the second stage, as deforestation progresses, the farmer cultivates up to 5 ha. Again, 2 ha are for food crops while the other 3 ha are used for cash crops (cotton, tobacco, maize, soybeans). By now, he owns oxens to prepare the land.

The third stage starts with a large investment to deforest about 6 ha. Contract work is employed for land preparation and cultivation--local input intermediaries play an important role here.

In the oldest IBR colonies, a fourth stage has been taking place. Purchases, sales, and rentals of land have taken place, together with more deforestation, to widen the property size. Machinery has also been purchased. Soybeans, rotated with wheat, are a preferred crop in larger areas, together with mechanized maize (World Bank, 1984).

Throughout the settlement process, livestock is acquired and, consequently the land reserved for cassava and maize cultivation for feeding pigs and poultry increases. Cassava becomes a strategic crop, not only because of its resistance to droughts, but also because it is available throughout the year. It is not unusual to find cassava stored in the ground for two to three years, in different plots of the farm.

Table 9. Contribution of agriculture and crops to GDP,
Paraguay, 1984.

<u>Share of GDP</u>	<u>Percentage</u>
Total agriculture	26.7
Soybean	20
Cotton	15
Cassava	14
Maize	6
Sugarcane	5
Other	40

SOURCE: USDA. 1985. Agricultural situation report for
Paraguay.

Specific agricultural policies

In Paraguay, government action has preferred developing an adequate environment for agriculture rather than exerting a marked direct intervention on a product-by-product basis.

Producer prices has roughly followed international prices, reflecting the low degree of government intervention. Cotton and soybean (the main export crops) have a nominal protection coefficient (NPC) close to unity. Wheat, however, receives substantial protection in an effort to promote self-sufficiency in this commodity, as does sugarcane--to substitute local alcohol for imported oil (World Bank, 1984, Appendix tables).

Although there are no measurements of the effective protection coefficient (EPC), use of inputs in agriculture is low; consequently, the NPC should be an approximation of the EPC.

Along with the colonization scheme, other policies have contributed to the vigorous expansion of agriculture in the country. The most relevant are those dealing with price and commercialization, credit, and research and extension.

Colonization. Between the agricultural census of 1956 and that of 1981, the structure of land tenancy underwent profound changes as a result of mobilizing families to the frontier areas of eastern Paraguay.

Over 59% of those farms recorded in the 1956 census, 35% of those farms recorded in the 1981 census and 85% of those farms established between the two censuses had been created by IRA and IBR. In the eastern region, the proportion of the area covered by farms with more than 20,000 ha decreased from 40% to 20% during that period (Ground, 1984).

In terms of population growth, between 1962 and 1982, the traditional area of settlements in the southwest expanded at 1.8% per year; for minifundia it was even lower--at 0.7%--while the rest of the eastern region had a population expansion of 4.0% per year. It is also important to note that urbanization occurred at a slower pace than in other countries of Latin America (Ground, 1984). More than half of the population (54%) still live in rural areas.

Between 1972 and 1981 agricultural area expansion occurred at 9.4% per year, with export crops leading the growth at 24.5% per year. Food crops expanded at 3.0% per year (Table 7).

Price and commercialization policies. In conjunction with industry, exporters, and producers, the government sets reference prices for cotton and soybeans. There are also minimum prices for wheat and sugarcane. The goal is to obtain foreign exchange with export crops and save it through import substitution.

In an effort to compensate export crops from the increasing overvaluation of the currency, export and import taxes affecting soybeans and cotton have been lowered, and a multiple level exchange rate was designed.

Soybean and cotton manufacturers use a form of forward contracting with producers. Producers obtain seeds, chemicals, and money ahead of planting time. The price of the crop is announced by the Ministry of Agriculture (MAG) and is used as a guide in negotiations.

Wheat, which is usually cultivated in rotation with soybeans and mechanized, has been protected by means of import quotas, minimum prices, and directed subsidized credit. The Ministry of Agriculture has silos to clean, dry, and store wheat under a system of credit warrants. However, with an output of 184,000 tons for 1985, imports still amounted to 82,000 tons for that year (USDA Ag. Sit. Report).

The minimum price for wheat in 1985 was G85 per kilo (US\$142 per ton) at the free and fluctuating rate of about G600 per dollar. This price encouraged inflows of wheat from Argentina (about 75,000 tons or 30% of total) and outflows to Brazil (similarly large amounts) where the free market minimum price for wheat is higher.

A new element in the commercialization of perishable crops was the creation of DAMA (Dirección de Administración del Mercado de Abasto) in 1982 near Asunción. It is estimated that over 90% of perishable products reaching Asunción go through this market first. The most important crop in terms of volume is cassava, with over 40,000 tons per year (Table 10).

The arrival of products is monitored and daily listings of volumes; tradings; and maximum, mean, and minimum prices are available for each product. Price and volume data are posted in the market area so traders can also monitor the current prices levels. Daily, weekly, monthly, and yearly reports on volumes and prices will be compiled--which will be an excellent source of information when fully operational.

Cassava is the product with the greatest volume traded in this center--10-12 trucks a day are required to supply the needs of DAMA. Attempts are being made to coordinate their arrivals, since sometimes 15 trucks can arrive at once, causing price falls. The market has also standardized the size of sacks at 50-60 kg of roots per sack. During this year a standard size of 25 kg will also be introduced. This is the usual quantity purchased by small traders and will therefore avoid repacking.

Credit. Agricultural credit has a share of about 27% of the total credit, which coincides with its contribution to GDP. Credit for crops accounts for about 16% of the total while livestock credit accounts for 11% of the total (Table 11).

The major institutions in charge of administering credit are Banco Nacional de Fomento (BNF) and Crédito Agrícola de Habilitación (CAH) for crops, Fondo Ganadero (FG) for livestock, and Instituto de Bienestar Rural (IBR) which makes arrangements for land acquisition. While BNF usually requires property titles as loan collateral, CAH lends to small farmers who are members of associations without requiring collateral. Intermediaries continue to be an important source of credit. The three institutions provide credit at subsidized rates, specify activities for credit (mostly commercial crops and cattle activities), and force financing (50% of private banks' portfolio, at least). In 1985,

Table 10. Volume of cassava (in tons) entering Asunción's
"Mercado Abasto", Paraguay.

Month	Year	
	1982	1983
January	3,203	2,791
February	3,240	3,310
March	3,809	3,878
April	3,545	3,267
May	3,745	4,065
June	3,922	4,762
July	3,914	4,981
August	3,667	5,389
September	3,776	5,205
October	3,890	4,419
November	3,291	3,168
December	3,132	1,787
Total	43,134	47,022

SOURCE: Mercado Abasto. Monthly records. Asunción, Paraguay.

Table 11. Private sector credit according to economic activity (in millions of Guaranis and percentage), Paraguay.

	1960	1970	1980	1981	1982	1983
(In millions of Guaranis)						
Total	4.9	19.1	133.2	159.1	174.6	183.1
Agriculture	1.3	4.5	17.6	21.6	24.1	29.2
Livestock	0.5	3.2	11.3	13.8	18.3	20.0
Industry	1.5	3.4	23.3	28.2	32.4	37.4
Commerce	1.1	4.9	34.4	44.3	47.9	42.1
Export	0.3	2.0	15.2	13.7	12.5	15.3
Construction	--	0.3	20.9	25.1	26.6	27.8
Other	0.2	0.8	10.5	12.3	12.7	11.3
(Percentage)						
Total	100	100	100	100	100	100
Agriculture	27	24	13	14	14	16
Livestock	100	17	8	9	11	11
Industry	31	18	18	18	19	20
Commerce	22	26	26	28	27	23
Export	6	10	11	9	7	8
Construction	-	2	16	16	15	15
Other	4	4	8	7	7	6

SOURCE: World Bank, 1984.

interest for agricultural credit is around 17%, with an inflation rate of 26%. Credit for cassava is seldom available (Carter, 1986).

Research and extension. A clear dichotomy exists between these two activities within MAG: the agricultural research institution (DIEAF) conducts basic research while the Servicio de Extensión Agrícola-Canadera (SEAG) does applied research and extension.

In 1977, MAG evaluated 21 crops under the following criteria: value of production, exports, imports, volume of production, annual rate of growth, value of industrial production, and market perspectives. The resulting ranking by order of importance was cotton, tobacco, soybeans, cassava, wheat, and maize. Of these products, cassava receives least attention from DIEAF which concentrates its efforts on cotton, tobacco, soybeans, and wheat (World Bank, 1984, v. 2, p. 14).

In 1985, SEAG signed an agreement with the International Development Research Centre (IDRC) and Centro Internacional de Agricultura Tropical (CIAT) to conduct cassava research on several aspects of production and utilization. At present, SEAG's main crop programs are cotton, tobacco, wheat, soybeans, maize, rice, and cassava.

Concluding comments

Direct government intervention has been low. However, agricultural policies have a clear bias in favor of export crops, livestock, and import substituting crops, that is, wheat and sugarcane.

To compensate for overvaluation of the Guaraní, export taxes are low and interest rates on credits for those crops are kept low. These measures do not correct the problem and also introduce distortions in the internal resource allocation since the vast agricultural production of food crops is kept at a disadvantage vis-a-vis export crops. A similar experience in Brazil led to lags in the production of food and a significant inflation of food prices took place in the eighties. The same situation may be repeated in Paraguay, where inflation is taking off dangerously and food production is not keeping up with demand.

Status Quo of Cassava in Paraguay: Supply and Distribution

Present status

Cassava is the major crop in Paraguay by volume of production and employment, and third by value of production after soybeans and cotton. As of 1985, its contribution to GDP is 2.8% (Table 9). Paraguay is the world's largest per capita producer of cassava with over 750 kilos and, by total production, is second in Latin America, after Brazil, with 2.5 million tons (Table 12).

Fresh cassava production and consumption. Its per capita consumption is higher in the rural areas, where it reaches 340 kilos per year (Carter, 1986), than in urban areas where it is about 120 kilos per year. Total annual per capita consumption is about 260 kilos (Table 13).

Table 12. Area harvested, production, and yield for cassava during the Agricultural Campaign of 1982-83 and 1983-84, Paraguay.

Department	1982-1983			1983-84		
	Area harvested (ha in thousands)	Production (t in thousands)	Yield (t/ha)	Area harvested (ha in thousands)	Production (t in thousands)	Yield (t/ha)
Paraguay overall	180.0	2,502.0	13.9	182.4	2,533.6	13.9
Concepción	9.6	155.5	16.2	9.7	157.1	16.2
San Pedro	21.8	412.0	18.9	22.1	417.7	18.9
Cordillera	13.6	123.8	9.1	13.8	125.6	9.1
Guaira	12.8	121.6	9.5	12.9	122.5	9.5
Caaguazú	31.1	438.5	14.1	31.5	444.2	14.1
Caazapa	12.8	232.9	18.2	13.0	237.9	18.3
Itapúa	24.5	382.2	15.6	24.8	386.9	15.6
Misiones	3.8	51.3	13.5	3.8	51.3	13.5
Paraguarí	17.1	191.5	11.2	17.4	194.9	11.2
Alto Paraná	12.1	220.2	18.2	12.3	225.1	18.3
Central	5.3	15.9	3.0	5.3	15.9	3.0
Ñeembucú	3.7	25.5	6.9	3.7	25.5	6.9
Amambay	5.2	49.9	9.6	5.2	49.9	9.6
Canendiyu	5.9	83.2	14.1	6.0	85.2	14.2
Presidente Hayes	0.2	3.1	15.7	0.2	3.2	15.8
Alto Paraguay	0.02	0.2	11.5	0.02	0.2	11.6
Chaco	0.01	0.01	12.5	0.01	0.1	12.5
Nueva Asunción	0.001	0.02	15.5	0.001	0.02	15.5
Boquerón	0.4	6.2	15.4	0.4	6.2	15.5

SOURCES: Dirección de Censo, MAG; Estadísticas Agropecuarias.

Table 13. Consumption of major carbohydrates, Paraguay.

Year	Consumption (t in thousands)					Total carbo- hydrates (t in thousands)	Share among carbohydrates (%)				
	Cassava	Sweet potato	White rice	Maize	Wheat		Cassava	Sweet potato	White rice	Maize	Wheat
1968	274.5	61.0	12.2	31.6	32.6	411.9	66.7%	14.8%	3.0%	7.7%	7.9%
1969	274.8	65.3	17.5	31.6	32.3	421.5	65.2%	15.5%	4.2%	7.5%	7.7%
1970	275.3	66.0	26.2	31.6	32.7	431.7	63.8%	15.3%	6.1%	7.3%	7.6%
1971	274.4	65.3	21.7	31.6	32.5	425.6	64.5%	15.4%	5.1%	7.4%	7.6%
1972	273.9	57.4	25.2	30.6	31.2	418.3	65.5%	13.7%	6.0%	7.3%	7.5%
1973	272.4	57.8	28.5	32.8	31.5	423.0	64.4%	13.7%	6.7%	7.8%	7.4%
1974	267.8	53.6	32.3	33.0	31.2	417.9	64.1%	12.8%	7.7%	7.9%	7.5%
1975	263.1	57.4	32.0	36.0	31.0	419.5	62.7%	13.7%	7.6%	8.6%	7.4%
1976	252.1	58.6	38.9	36.6	30.7	416.9	60.5%	14.1%	9.3%	8.8%	7.4%
1977	241.6	58.6	33.3	37.4	31.7	402.6	60.0%	14.6%	8.3%	9.3%	7.9%
1978	235.1	65.4	32.9	37.2	32.2	402.8	58.4%	16.2%	8.2%	9.2%	8.0%
1979	230.0	66.5	33.9	37.0	32.8	400.2	57.5%	16.6%	8.5%	9.2%	8.2%
1980	233.0	37.3	32.1	37.7	33.5	373.7	62.4%	10.0%	8.6%	10.1%	9.0%
1981	231.6	39.1	36.3	37.5	32.6	377.2	61.4%	10.4%	9.6%	9.9%	8.6%
1982	241.3	40.9	37.8	37.6	33.0	390.6	61.8%	10.5%	9.7%	9.6%	8.4%
1983	231.8	41.5	38.9	37.7	37.7	387.6	59.8%	10.7%	10.0%	9.7%	9.7%
1984	257.1	45.8	40.4	37.7	34.1	415.1	61.9%	11.0%	9.7%	9.1%	8.2%

Only about 15% of production reaches the market (400,000 tons) from where it is distributed accordingly: urban consumption (about 215,000 tons); rural consumption (probably for sale as fresh food, 70,000 tons); and processing (about 115,000 tons). Our estimates indicate that of the one million tons or so that are consumed in fresh form, less than one-third is purchased (285,000 tons), while the rest is consumed onfarm.

About 85% of production is destined for onfarm use. It is mainly used as food for the family and as feed for pigs and chicken. Cassava accounts for about 30% of all calories consumed by the farming population (Diagnóstico de la Situación Alimentaria....). It plays a fundamental role in the expansion of frontier land because it is hardy, has a multiplicity of end uses, requires few purchased inputs, is very tolerant to prolonged droughts such as the 1985-86 drought, and can be stored in the ground for several years.

With respect to production figures (Carter, 1986), the 1981 agricultural census recorded 178,937.25 ha of cassava cultivated in a similar number of farms, but did not distinguish between newly sown cassava and cassava plants of one year or more. Data by Lynam (1986) show cassava production areas to be highest in Brazil (1,987,300 ha) followed by Colombia (208,000 ha), and thirdly, Paraguay. Paraguayan yield levels, at about 14 tons/ha, are the third highest in Latin America (Lynam, 1986) after Mexico and Barbados, relatively small producers.

Within Paraguay, production is concentrated in the eastern, wetter, half of the country (Table 12). The area sown to cassava is greatest in the departments of Caaguazú, Itapúa, and San Pedro. These are areas of relatively recent colonization. Areas most recently colonized, with small populations, have smaller areas of cassava, for example, Amambay and Canendiyu. The department "Central" has less cassava than its neighbors, despite its high population.

The proportion of farmers growing cassava in the departments of eastern Paraguay is lowest in Central, and highest in Caazapa. The average area of cassava sown per farm is highest in the departments with the lowest total area, Amambay and Canendiyu. Average area of cassava per farm (in eastern Paraguay) is lowest in Misiones, Central, Paraguari, and Ñeembucú.

The two departments selected for the SEAG-CIAT-IDRC projects, Caaguazú and Paraguari, have the highest proportion of farms (90% and 88%, respectively) growing cassava (Carter, 1986). However, the difference in cassava production area between the two is proportionally larger than the difference in number of farms. This is due to the smaller area per farm sown in Paraguari. Because of the recency of colonization in Caaguazú (30-50 years), soils are more fertile than those in Paraguari, where farming has been long established.

Cassava production for urban consumption is concentrated in the departments of Caaguazú for the Asunción market, and Alto Paraná, also for Asunción and Ciudad Presidente Stroessner.

Econometric analysis of demand for fresh cassava. In the absence of a consumers' household food expenditure survey, only time series data were

used to calculate the effects of changes in incomes, prices, and urbanization trends on per capita consumption of cassava. The period of 1968-83 was analyzed (Table 14).

Total production of cassava grew at a smaller annual rate (2.3%) than that of the population (3.2%) with the consequent drop in per capita consumption. At the same time, the real retail price of cassava increased at an annual rate of 1.4% (Table 15).

Urban population grew at 4.4% per year. Urbanization has a negative effect on cassava demand because it causes increases in marketing costs and therefore higher prices. Because the root is highly perishable, its competitiveness in the urban market place is also reduced, which means lower volumes are being traded.

The model proposed to estimate per capita demand for cassava includes its own real retail price, real retail prices of other carbohydrates, per capita real incomes, and total urban population as independent variables.

Parameter estimates show that important determinants in the reduction of per capita consumption of cassava are the higher price for this root and the reduction in the real price of wheat flour. There has been substitution in the consumption of cassava in favor of wheat (cross price elasticity of 0.07), but it has not been very strong.

Urbanization and rising incomes also were factors in the observed reduction but all elasticities are small in absolute value (Table 16).

Other Uses. Cassava is also used for starch production in eastern Paraguay. Starch is produced on a small scale in many households, as well as in a semi-industrialized form in some places. The quality is generally poor, which limits possibilities for sale.

According to SEAG, 300 farms in the project region also operate the starch-processing plants. Taking a mean of 1500 kg per day capacity and a 20% conversion rate, a total of 300 kg of starch per day is produced. A plant working at a capacity of 1500 kg of roots per day for 20 days a month will require 300 tons of roots per year. The total industry in this region therefore needs $300 \times 300 = 90,000$ tons/year. This is more than double the volume handled by DAMA in Asunción and demonstrates the current size and importance of the starch market to just one cassava-producing region of Paraguay. However, starch manufacture is an important utilization which must be considered in any development project.

Large-scale industrial plants for producing dried cassava chips have been proposed several times in Paraguay but never implemented. However, a small-scale rural industry producing "popi" or sun-dried cassava chips for later milling and use as a flour for human consumption does exist. It remains a small localized industry with little prospect of growth because the apparent preference for cassava starch-based products. A Paraguayan law requires the incorporation of 5% cassava flour from "popi" into all bread, but this is ignored, partly because of quality problems and partly because of the availability of cheap Argentinian wheat through contraband.

Table 14. Summary of annual rate of growth of key agricultural parameters, Paraguay, 1968-83.

Livestock		Crops	
Per capita consumption		Per capita consumption	
Beef	-3.2%	Cassava	-1.5%
Pork	2.7%	Sweet potato	-3.0%
Poultry	3.2%	Rice	2.3%
		Wheat	0.5%
Total production of poultry	3.5%	Maize	1.6%
Real retail prices		Total production of cassava	2.3%
Beef	-0.4%	Real retail prices	
Pork	0.1%	Cassava	1.4%
Poultry	-0.8%	Sweet potato	-0.3%
Relative price		Rice	-1.2%
Beef/Poultry	0.3%	Wheat	-2.1%
		Maize	-1.4%
Other factors			
Total population	3.2%	Relative price	
Urban population	4.4%	Cassava/Wheat	3.5%
Real income per capita	4.0%		

Table 15. Real retail prices (in Guaraní) of carbohydrates, Paraguay.

Year	Cassava	Sweet potato	White rice	Maize	Wheat	Population	CPI
1968	19.31	23.17	111.97	111.97	88.80	2.17	25.9
1969	18.94	22.73	106.06	106.06	87.12	2.23	26.4
1970	19.31	23.17	108.11	108.11	88.80	2.29	25.9
1971	17.79	21.35	99.64	99.64	78.29	2.36	28.1
1972	16.03	22.44	99.36	99.36	67.31	2.43	31.2
1973	21.05	21.05	107.89	105.26	81.58	2.51	38.0
1974	25.32	25.32	111.81	111.81	94.94	2.60	47.4
1975	24.19	34.27	110.89	108.87	86.69	2.69	49.6
1976	23.21	25.15	106.38	85.11	108.32	2.79	51.7
1977	24.35	24.35	95.65	102.61	90.43	2.87	57.5
1978	24.65	24.65	109.40	97.07	75.50	2.97	64.9
1979	30.92	30.92	97.50	90.37	66.59	3.07	84.1
1980	24.00	24.00	82.00	83.00	65.00	3.17	100.0
1981	20.83	20.83	81.52	86.96	63.41	3.27	110.4
1982	20.12	20.12	103.24	83.99	63.87	3.37	114.3
1983	18.89	18.89	96.48	105.92	65.44	3.47	148.2

Table 16. Estimates of demand elasticities for fresh cassava and poultry meat from time series data^a

	Fresh cassava		Poultry meat
Own price	-0.10 (4.62)	Own price	-0.33 (6.39)
Income	-0.13 (7.03)	Income	0.59 (10.73)
Urbanization	-0.13 (5.52)		
Wheat price	0.07 (5.38)	Beef price	-0.15 (3.10)
Rice price	NO (2.78)	Pork price	0.53 (6.49)

a. Values in parentheses are t-statistics.

Problems and opportunities in cassava production. The proposal for the SEAG-CIAT-IDRC Cassava Project (Brun et al., 1985) defines a number of problems of cassava production and suggests some alternatives for research to seek solutions. Primarily, the systematic loss of soil fertility in old established cassava-producing regions around Asunción (Departments of Central, Cordillera, and Paraguari) is identified. Although not stated, this is partly a result of increasing pressure on the land from a growing population and the consequent reduction in farm size and bush-fallow periods.

Cassava production for the Asunción market has therefore shifted to more recently colonized areas, particularly Caaguazú, where soil fertility is higher and therefore yields are higher. However, the same soil problems are likely to develop there, since no change in agricultural practices has occurred. In fact, most farmers in Caaguazú came from the central areas which surround Asunción.

Cassava from Caaguazú is of better quality and cheaper than that from areas nearer Asunción. However, the greater distance to market means greater deterioration of roots before they reach the consumer, and so higher prices. The quality of roots varies greatly and a high proportion is rejected.

Brun et al. (1985) identify opportunities for improving onfarm animal feeding using cassava and for improving starch production and starch quality. They underline the need to characterize and classify the diverse cassava germplasm which Paraguay possesses. The project's broad objective is to make available suitable technologies to increase production, productivity, and the processing of cassava in Paraguay. The project will test available postharvest technology and include studies of actual production processes, onfarm feeding, and socioeconomic conditions.

The project also has an important agronomic research component. Methods of improving actual production systems using technology already developed by CIAT (such as selection of seed, planting densities, and seed storage) will be tested under Paraguayan conditions. Experiments, using legumes as protective cover crops and legume rotations, will attempt to address the soil fertility problem. Successful components will then be extended over larger areas.

Potential demand for cassava. Demand for fresh cassava for human consumption is very strong. This causes a high farm price for the root, making cassava production one of the most profitable crop activities in the country. Moreover, it requires little use of limited resources such as capital, while needing large amounts of available resources such as labor. Its use in feeding pigs makes cassava an indirect source of protein and cash for rural families (World Bank, 1984).

However, the high price paid to farmers means that, at present, dried cassava for the commercial production of animal feed is economically less attractive to both farmers and food manufacturers than fresh cassava and maize. However, dried cassava may become profitable in the future and the country should remain aware of technical advances in this activity.

The prospect for dried cassava as an animal feed depends on technical factors also. The long cold season (May-September), which is also the driest part of the year, makes natural drying in Paraguay a different prospect to that of the tropical regions. A small pilot plant would be required to determine the technical feasibility of drying under these conditions. Possibly, tray drying could be used to take advantage of wind during the colder season, for example, popi is produced by drying on trays.

A possibility does exist for the production of cassava chips for export, although the economics of this are unclear under the present exchange rate policy of Paraguay. The Instituto Nacional de Tecnología (INT) has experience in cassava drying both for human consumption and animal feed and on large (industrial) and small (rural) scales of production. This makes it an obvious cooperating institute in any project.

Carbohydrate foods. Among the five major carbohydrates destined for human consumption in the country, by volume, cassava accounts for two-thirds and supplies one-half of the total calories consumed (Table 13). Per capita rice consumption is still low (11 kg) by Latin American standards, maize, and wheat (about 35 kg each) have increased their share and sweet potatoes have had a substantial decline.

The most notorious change in prices has been the rapid reduction of the real retail price of wheat flour during the period 1968-83, at 2.1% per year, although per capita consumption of wheat did not show a significant increase associated with the important price drop. Among the major carbohydrate foods, cassava was the only one that registered a sustained price increase during the period of analysis, 1968-83 (1.4% per year), implying that production did not keep pace with demand for the root.

The fastest increase in per capita consumption occurred with rice (at 2.3% per year) in response to lower prices (its real retail price had a growth rate of -1.2% per year). This was possible due to the rapid adoption of improved varieties (mainly CICA type), which now cover two-thirds of total area planted to rice (Dalrymple).

Per capita consumption of maize also increased in response to lower prices during 1968-83. Maize production increases (8.5% per year) were mostly the consequence of area expansion (at 6.5% per year); yields have remained low at 1.5 tons/ha (MAG and IICA, 1985).

About 35% of maize produced in Paraguay is destined for human consumption, 25% goes to the food industry, and 35% is fed directly to animals (MAG and IICA, 1985). Maize is favored by creditors because of the ease of credit recovery; storage capacity is sufficient; and profitability is similar to that of soybeans. Given the existence of hybrid varieties which provide an ample spectrum of planting dates, maize can play an important role in the newly colonized areas of eastern Paraguay, especially in the southeast, where soil and climate conditions are good. In that area, maize competes with soybeans and wheat, whereas sweet potatoes have registered the fastest reduction in per capita consumption due to stagnation in production and area planted.

Prospects for cassava production are good, given the important role that the crop plays in the expansion of frontier lands and in view of the renovated interest shown by the government in this crop. Maize is also likely to continue its vigorous expansion should the tendency toward commercialization continue. Incentives for this crop are good and it stands high among official priorities.

Rice production has the potential to develop fast, given the low average national yields at present time (around 2 tons/ha) and a move towards irrigated areas, using improved varieties. A substantial real price reduction could take place under these circumstances. However, increases by volume in per capita consumption will not be important since demand is still low (11 kilos per year).

Wheat is expected to continue its response to the protection it receives, although yield increases have not been as important as area expansion. Further price reductions will be at the expense of higher subsidies or increased contraband from Argentina. Expansion of soybean areas favors wheat production as well. The opportunity cost for wheat under this type of rotation is much lower than in the case of single cropping.

Past trends already observed in carbohydrate consumption are most likely to prevail in the midterm.

Meat consumption. Paraguay has been characterized by a relatively high per capita consumption of meats. However, the change in composition among the three dominant types of meat has been important during the past two decades (Table 17).

In 1968, per capita beef consumption was around 50 kilos, followed by pork (17 kilos), and poultry (3 kilos). By 1984, per capita consumption of beef dropped to 29 kilos, pork increased to 25 kilos, and poultry reached almost 5 kilos. Poultry had the fastest annual growth in per capita consumption at 3.2%.

It is very difficult to establish trends for livestock production. For beef the quality of the data is poor. Pork and poultry production systems are still dualistic in nature, although with only a small segment of producers being industrialized.

Beef products were the main source of exports in the sixties but today these are almost nil. This fact, together with the reduction in per capita consumption at 3.2%, implies a reduction in total beef production. However, this does not seem to be the case: productivity is not high--steers are slaughtered at 4-5 years of age at the weight of only about 350 kilos; there is a 50% conversion to carcass and extraction; and productivity is estimated at about 10% on the basis of 7 million head (or 700,000 head), and yet by 1985 there have been increases in pastures area and improvements in management systems that have created doubts about total production figures.

The World Bank estimates and extraction rate of 13%, which on the basis of about 10 million head (or 1,300,000 head), produces a 600,000 head

TABLE 17. Trends in per capita consumption and relative prices of meats, Paraguay, 1966-83.

Year	Type of meat			Total meat (kg)	Relative retail prices	
	Beef (kg)	Pork (kg)	Poultry (kg)		Beef to poultry	Pork to poultry
1966	49.4	16.7	3.2	69.3	1.62	1.04
1967	45.0	17.4	3.3	65.7	1.69	1.04
1968	46.4	17.8	3.2	67.3	1.80	1.03
1969	44.1	18.1	3.0	65.3	1.68	0.99
1970	45.6	18.5	3.0	67.1	1.73	0.96
1971	42.8	18.8	3.1	64.7	1.60	0.92
1972	38.1	19.2	3.2	60.5	1.89	1.12
1973	31.3	19.5	4.0	54.7	1.99	1.16
1974	33.2	19.8	4.0	57.0	1.62	1.09
1975	28.8	20.4	3.9	53.2	1.76	1.25
1976	27.7	21.2	3.9	52.8	1.99	1.32
1977	30.7	21.6	4.0	56.3	1.23	0.83
1978	27.8	22.8	4.2	54.9	1.39	0.88
1979	32.2	25.2	4.4	61.9	1.78	1.12
1980	31.6	25.6	4.6	61.8	1.93	1.21
1981	29.9	25.3	4.6	59.9	1.90	1.19
1982	28.7	24.9	4.7	58.3	1.56	1.14
1983	28.9	25.2	4.6	--	--	--

difference with official figures. This surplus is believed to go to Brazil, as contraband, on foot. Given the vast, dry, flat frontiers and the favorable policies for beef in Brazil it is easy to maintain this type of activity.

Hog livestock estimates for 1985 are 1.2 million head. There are only a few industrial-level operations dedicated to derivatives of pork production. Pork production in Paraguay is performed by small enterprises and with traditional methods. Almost all farms in the eastern region (80%) have pigs (Regunaza-Kugler, p. VI-18) and 97% of pork production comes from that region. The extraction rate is low (106%) while carcass weight at 1.5 years of age oscillates around 62 kg/head. Efficiency is low and only native breeds are found.

Pig nutrition is based on maize and fresh cassava, complemented with milk whey, leftovers, and "cocotero" (the fruit of a wild palm, Acrocornia selerocarpa, abundant in the region, and an important source of protein). No additives are used to supplement this energy-based nutrition. The system is very low cost since a minimum of management is involved (1.7 hours per day to produce 1-4 kg of pork, and family labor) (Regunaza and Kugler, p. VI-22).

About one-half of pork production is destined for home consumption and the other half is sold. This is therefore another important source of cash, has flexibility, and can be adjusted to meet cash needs as they arise, particularly as cash is an important constraint to small farmers in new settlements (Carter, 1986).

Production of chicken is dualistic in nature with the commercialization of broilers dominated by one company (Pollos Pechugon which has 90% of the Asunción market) and a scattering of small backyard operations that complement food and cash requirements to rural farmers.

Should present trends continue, both pork and poultry will see their market shares expanded at the expense of beef. The animal feed industry may also experience rapid growth what with ensured supplies of maize and soybean meal.

Pork production will be favored by the increasing number of new settlements. Beef prices will increase as a result of growing contraband trade with Brazil.

Projected Demand for Cassava

The potential in Paraguay for the technology of storing fresh cassava in plastic bags is enormous because: the treatment is economic, storage losses are sufficiently large to warrant the adoption of the treatment, and volumes of cassava are traded. Any reduction in waste will have a significant impact on the efficiency of resource use and allocation.

Use of dry cassava in animal feed is not economically attractive at present. The farmer could sell his fresh cassava at G15 per kilo to the drying plant, and at that price, dried cassava from the plant could compete with maize. But the farmer will prefer to either sell the cassava in the

fresh market at about G30 per kilo or grow maize for the feed industry and in both cases will receive better returns than from drying cassava (Table 18).

Assuming that dry cassava enters at 10% in food formulations (substituting 18,200 tons of maize as of 1984) about 45,000 tons of fresh cassava would be needed or 1.5% of total production for one year. This amount is less than half of what has been estimated is being used for starch production.

Use of fresh cassava as animal feed on the farm was estimated at about 835,000 tons in 1984. This figure is impressive and indicates that a major effort should be done to better understand the role of cassava in the system.

It is clear that cassava is of paramount importance in the process of frontier expansion, a process that may continue over a long period of time given that about 90% of land suitable for crops is still unexploited (Fletschner, 1984, p. 52) and that the population growth rate is rapid.

Basic assumptions

Using the model estimated for demand for fresh cassava, total demand is projected to the year 2000. From that projection, additional production is calculated and the amount of new hectares cultivated is also shown, as well as the number of new jobs required.

The following rates of annual growth for 1983-2000 are assumed:

Population growth will continue at 3.0% per year.

Real GNP will grow at a moderate 4.5%, that is, per capita GNP will grow at 1.5%.

The real retail prices of cassava and wheat flour will decrease at 1.0% per year.

It is assumed that, with the adoption of the new storage technology for cassava, this goal is easily attained. Wheat subsidies are supposed to continue, allowing a decrease in its real price too.

It is also assumed that the proportions of fresh cassava that are used for human consumption and to feed pigs remain unchanged. Yields remain at 13.9 tons/ha.

The proportion of waste in the commercialization of cassava is assumed to be reduced from 20% to 10% with the use of the new storage technology which is expected to ameliorate losses and allow an increase in consumption based on those savings.

Fresh cassava consumption. Under these conditions, it was estimated that per capita consumption for the year 2000 will be 242.8 kilos (down from 271.9 kilos in 1983). Given the population increase and the assumption of constant proportions in use, total cassava production will

Table 18. Sources of direct cost segregation in the production of fresh cassava, dried cassava, and maize, Paraguay^a.

Source of direct cost	Total costs	Cost/ton (fresh)	Equ./ton (dried) (2.5 conversion)
Land	18,000	1,295	3,237
Labor	67,400	4,849	12,122
Capital	29,015	2,087	5,218
Total	114,415	8,231	20,578

<u>Dried cassava production</u>			
Source of direct cost	Cost/ton (dried)	Total cost/ton (dried)	
Land	16	3,253	
Labor	3,108	15,230	
Capital	8,705	13,923	
Total	11,828	32,406	
Sale price, 75% price of maize		56,000	
Gross margin per ton of dried cassava		23,594	
Yield of fresh cassava	13,900		

<u>Maize production</u>		
Source of direct cost	Total	Cost/ton
Land	9,000	3,600
Labor	28,925	11,570
Capital	40,100	16,040
Total	78,025	31,210
Sales price	70,000	
Gross margin per ton of maize		38,790
Yield of maize, (ton/ha)	2.5	

a. Costs shown in Guaranis.

Table 19. Projections of fresh cassava needs for year 2000, Paraguay.

Per capita consumption of cassava in 1983	271.9 kilos
Population in 1983	3.5 millions
Annual population growth	3.0 %
Population in year 2000	5.7 millions
Percent human consumption in total	37.7 %
Cassava production	2,505
Annual growth in real price of cassava	-1.0 %
Annual growth in real price of wheat	-1.0 %
Annual growth per capita real income	1.5 %
Per capita consumption of cassava in year 2000	242.8 kilos
Cassava production	3,727
Yield/ha	13.9 tons
Hectares in 1983	182,400
Additional hectares	78,800
Labor per ha (SEAG)	67
New jobs generated per year	21,122

have to increase by 1,095,000 tons, requiring 78,800 new hectares (43% increase) and generating 21,122 new jobs (Table 19).

Savings in commercialization, assuming a waste reduction of 10% in trade of fresh cassava, valued at G35 per kilo and with a free market rate of G600 per U.S. dollar, will reach US\$2.1 million each year by the year 2000.

Conclusions

The importance of cassava in Paraguay is evident even to the outside casual observer: it is found virtually everywhere in eastern Paraguay; it generates more employment than other crops; produces the most, by volume; is the third, in terms of GDP contribution, after soybeans and cotton; it is the most important source of carbohydrates; and, together with maize, constitutes the basic source of animal feed for pigs. Pigs supply 43% of all meat consumed in the country and its consumption has been growing faster than the rate of population growth.

In the colonization process, cassava is fundamental: it is a convenient and reliable staple and can generate cash when sold or, indirectly, by feeding animals. It has always been present in over 90% of those farms recorded in the censuses as the most common of all crops. The farmers continuously cultivate about one ha of cassava, and leave the roots in the ground for periods of two or more years.

The government has not directly intervened very much in agriculture, allowing market forces to dictate the output, and farmer prices for most crops are aligned with world prices. Export and import-substituting crops, however, have been favored through price support and credit policies.

Although cassava has not been directly favored by the prevailing price and credit policies, the colonization policies, together with improvement of infrastructure such as roads and the wholesale market of DAMA have resulted in the expansion of production beyond already high levels. They also resulted in a more efficient system of commercialization for fresh cassava.

The present project signed by SEAG/IDRC/CIAT in 1985 to explore aspects of production and utilization shows the high priority that the crop has for the economy of the country. Two basic aspects of research in cassava demand and use merit close attention: first, the adoption of new storage technology in which cassava is stored in plastic bags, and, second, the role of fresh cassava in animal feed for pigs.

Prospects for production are good, given the important role that the crop plays in the expansion of frontier lands (which is a continual process) and the recently renewed interest that the government has shown in the crop. Demand will continue to grow and if yields remain the same, close to 80,000 new hectares will need to be cultivated by the year 2000 to satisfy this growth.

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