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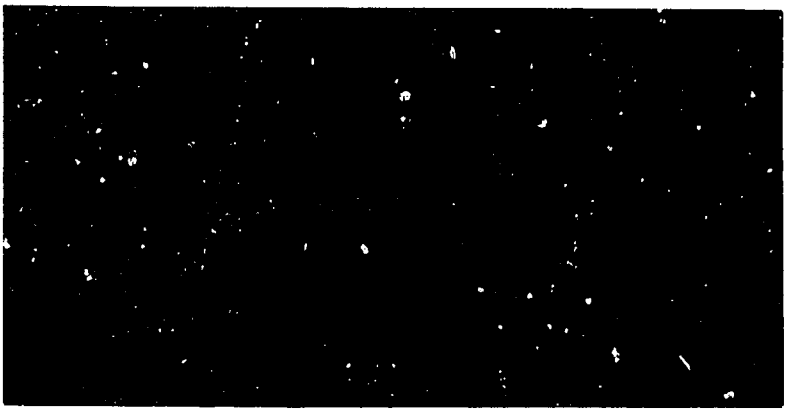

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EXPORT SUPPLY RELATIONSHIPS FOR BRAZILIAN GOAT SKINS

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

PREFACE

This report summarizes the results of the senior author's Master of Science thesis research conducted in the Department of Agricultural Economics, Federal University of Ceara, Fortaleza, Brazil. Dr. Amin was the thesis supervisor and Dr. Gutierrez assisted with the design of the project and also served on the thesis committee. The research was a joint activity between the above department, the EMBRAPA National Goat Research Center in Sobral, and the Winrock International Agricultural Economics project of the Small Ruminant Collaborative Research Support Program. This joint research started in 1981 and the thesis was submitted in 1982.

The research reported here is the result of a coordinated series of activities dealing with economic aspects of small ruminant production, marketing, and policy in Brazil. A companion study by Jose de Souza Neto was produced as Report Number 37 in this series. Both studies deal with aspects of producer supply response with this study focusing specifically on the market behavior of raw goat skins. International market forces are particularly important in this market as a large proportion of skins are exported to Western Europe.

Other factors influencing the disposition of skins has been the rapid development of Brazilian domestic demand for fine leather products, rapid growth of a local leather processing sector, and a trend away from the export of raw skins towards the export of semifinished (wet-blue) skins, leather and leather products. This study focuses on these factors as well as the influence of domestic and international prices of quantities supplied and lag relationships between production of skins (goat slaughterings) and supply of exports.

The authors gratefully acknowledge the contributions of Dr. John De Boer, Principal Investigator of the Agricultural Economics program of the Small Ruminants CRSP for his technical advice on the research, for carrying out the editing of this report, and for providing financial support to the senior author; Dr. Elino Alves, former Director of the National Goat Research Center (CNPC) at Sobral; and Dr. Luis Carlos Freire, Chief, CNPC for his support of our research program in Brazil.

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EXPORT SUPPLY RELATIONSHIPS FOR BRAZILIAN GOAT SKINS[1]

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ABSTRACT

Analysis of export supply functions showed that the price elasticity for quantities of goat skins exported from Brazil is +0.30 which indicates an inelastic response to price. Conversely, the elasticity of goat skins exported relative to the price of sheep skins in the internal market was -1.50, indicating a certain degree of substitution between sheep and goat skins in the internal market for manufacturing products. The quantity of goat skins supplied for export was sensitive to variation in the quantity produced in the previous year. This indicates that the quantity of goats slaughtered did not instantaneously affect the quantity of skins exported. The price of goat skins in the domestic market did not show the expected association with the quantity of goat skins supplied for exportation. To detect the influence of government policies on the export market for goat skins after 1972 a "dummy" variable was introduced. The effects of the policy were found to be significant, indicating a reduction in the total amount of untreated skins available for export. The trend variable was also significant.

Index terms: goats, skins, export supply.

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INTRODUCTION

Meat goats are well adapted to ecological conditions of the semiarid regions (the Sertao) of northeast Brazil. Goats are fed native forages and sometimes supplemented, especially during the dry periods when the abundant forages from the winter growing season become scarce (Freitas, 1951).

Most of the Brazilian goat population is located in the northeast. Goats are distributed throughout the entire region with concentrations in the drier and poorer regions (FIBGE, 1979). With low levels of technology and minimal care goats multiply even during the most severe droughts. Goats are sold for cash or consumed at home. The skins derived from home slaughter are marketed or traded for basic household items.

The lack of slaughterhouses for goats and the prevalence of home consumption results in slaughtering being done by individuals who lack training in the proper preservation of the skins and in the most effective techniques to prevent cuts, scrapes, and tears in the skins. Sores and ectoparasites also cause blemishes. Therefore, a large number of commercial skins have defects that greatly reduce their value (Banco do Nordeste do Brasil, 1974). This presents a serious obstacle to government policies encouraging herd improvement and export expansion of goat skins, leather, and processed leather products (SUDENE, 1978).

Continuing growth of the Brazilian domestic market for quality leather goods lends some stability to the market for the raw-product goat skins (SUDENE, 1978). In spite of the fact that the external market is the main attraction for investors, the Brazilian market also presents a favorable alternative in relation to consumption of treated skins in case the international market demand decreases.

According to Banco do Brasil (1974), goat skins are an important source of raw material for Brazilian tanneries that specialize in exporting semitanned (wet-blue) skins. Brazilian exports are primarily to Western

Europe. In 1966, these countries imported 63% of the skins exported. There are indications that imports will increase even more, considering that the production of nontreated skins in those countries did not significantly increase while population and income levels increased. Brazil's domestic demand is also expected to grow, which will decrease supplies available for export as wet-blue skins. In addition, Brazilian government policy helps to create incentives for further processing of skins into leather and leather products. This policy began in 1972 and has forced the internal market to develop manufactured products and export treated skins, thus improving the domestic value added (SUDENE, 1978).

It is expected that knowledge of supply relationships for Brazilian goat skins will provide support for government policy to allow a better orientation in the allocation of resources to increase skin production and value added to goat skins. This knowledge may also help enlarge Brazil's share of the international market; increase the quantity and quality of finished tannery products; and improve the international balance of payments.

MATERIAL AND METHODS

This section presents a description of data sources and the general theory of supply used to develop the export supply model.

Data Sources

The basic information necessary to achieve the present study was obtained from secondary data sources from 1960 to 1975. The quantity and price of exported goat skins were obtained through the Exterior Commerce Bureau of the Banco do Brasil (CACEX, 1981). The total amount of skins produced, and the prices of sheep, goat, and cattle skins in the Brazilian internal market were obtained from FIBGE (several years); per capita income was obtained from Fundacao Getulio Vargas (1979); and exchange rates from the International Monetary Fund (1982).

Export Supply Model

Figure 1 provides the model of an export supply function for Brazilian goat skins in the two markets. In the world market, Brazil is considered a relatively small supplier of goat skins in terms of total international trade. Thus, Brazil faces an infinitely elastic (horizontal) demand curve. Its total supplies are not large enough relative to the rest of the world market to affect the international price. Domestic market supply and demand functions for Brazil are represented by the SS and DD curves in Figure 1, respectively. If there were no world market, these two functions would determine the equilibrium situation given by the price (P_1) and the quantity (q_1). At price level (P_1), there will be no exportation. At prices higher than p, the export supply curve is generated. It is obtained by subtracting the domestic demand function DD from the domestic supply function SS, and those results are represented as a new function by the export supply curve, EE.

In Figure 1, the world demand function is shown by the horizontal curve $P\bar{+}P\bar{+}$, which reflects the price of the product in the world market faced by Brazilian suppliers. Given this price level ($P\bar{+}$ $P\bar{+}$) facing Brazilian suppliers of goat skins, the export level would be q_3 and domestic consumption would be $q_2' = q_2 - q_3$ (Orihuele, 1977).

The basic assumption, then, is that export supply by the country (QCE) is a country's excess supply over domestic needs at a given level of world prices. Domestic and world prices are equalized. The nature of this function is determined by the shape of the domestic supply functions (production costs) and domestic demand relationships. For goat skins, this is a derived demand based on final product (finished leather products) demand.

In general, surplus supply is defined as the quantity available for export in a certain year depending on the total quantity produced in the country during the cited period (QC). The domestic demand is repre-

sented by per capita income (Y), domestic prices (P), and international prices of the product (PCE). In addition to the variables previously mentioned, it is hypothesized that variations in prices of substitute products such as sheep skins (PO) and cattle hides (PB) will influence the supply of goat skins available for export. New uses of skins and changes in the consumer's preferences through time may also affect export supply. However, in empirical analysis it becomes difficult to determine the magnitude of these changes. In order to solve the problem, several authors suggest introducing a time trend (T) to capture these changes.

We also assume that fresh skins require at least one year in the marketing, processing, and export pipeline. Therefore, the total quantity of skins produced domestically is represented as a lag variable (QC_{t-1}) in the current period export supply equations.

Major attention should be given to the increases in goat skin prices for export since 1972 (Costa, 1982). This phenomenon may be partially explained by an increase in the proportion of treated skins. These realize a price per ton much higher than the raw skins. Thus, a dummy variable (D) was introduced in the model to measure the effects of the government policy (established in 1972) on domestic processing of goat skins.

ECONOMETRIC MODEL

Based on the relationships developed in figure 1 and the factors influencing demand and supply for Brazilian goat skins for export, the following general formulation for the supply of goat skins in Brazil is obtained: $QCE_t = f(QC_{t-1}, PCE_t, PC_t, PO_t, PB_t, Y_t, D, T)$ where it represents the current year in $t-1$ is the previous year.

The econometric model to estimate the goat skin export quantities is defined by the following equation:

$$QCE_t = \alpha_0 + \alpha_1 QC_{t-1} + \alpha_2 PCE_t + \alpha_3 PC_t + \alpha_4 PO_t + \alpha_5 PB_t + \alpha_6 Y_t + \alpha_7 D + \alpha_8 T + \xi$$

where ξ is the stochastic term, α_0 -α_8 are parameters to be estimated, and

QCE = quantity of Brazilian goat skins exported in time period t,
QC_{t-1} = quantity of Brazilian goat skins produced (= number of goats slaughtered) in time period t-1,
PCE_t = world market prices for goat skins in time period t,
PC_t = domestic prices for goat skins in time period t,
PO_t = domestic prices for sheep skins in time period t,
PB_t = domestic prices for cattle hides in time period t,
Y_t = per capita income in Brazil in time period t,
D = dummy variable for government policy; set at zero for 1966-1971 and one for 1972-1975, and
T = time period trend variable over 1966-1975.

The method used for estimation of model parameters was Ordinary Least Squares (OLS), since explanatory variables are all predetermined. The hypotheses about expected signs of the model coefficients based on economic theory are:

$\alpha_1 > 0$ It is expected that as the total quantity of goat skins produced in Brazil during the previous year (t-1) increases, the total skins exported in the current year (t) will also increase.

$\alpha_2 > 0$ A larger quantity is offered for export at higher current prices and vice versa.

$\alpha_3 > 0$ As the domestic price of goat skins increases, the exported quantity will decrease and vice versa.

α_4, $\alpha_5 < 0$ As the price of sheep skins or cattle hides increases in Brazil, processors will switch to goat skins and the supply available for export will decrease.

$\alpha_6 < 0$ As per capita income increases in year t, the quantity of goat skins demanded by the internal market will also increase in the same period, thus decreasing the quantity available for export.

$\alpha_7 \lessgtr 0$ The sign of this coefficient will determine the effect that government policies implemented since 1972 had upon exports of goat skins.

$\alpha_8 \lessgtr 0$ The sign of this coefficient indicates time trends in exports not explained by the above variables.

In order to verify the level of significance of the overall equation, Snedecor's "F" statistic at a level of 5% was used. To test the significance levels of the parameters obtained with the model using OLS methods, the student "T" statistics were used at different levels of significance. To check serial correlation in the residuals of each equation, the Durbin-Watson "d" test was used. The efficiency and predictive power of estimated equations was tested by using the "U Theil" coefficient (Koutsoyannis, 1977).

RESULTS

Based on the empirical model, several equations were estimated in order to represent the Brazilian goat skin export supply function (table 1).

Model I of table 1 shows the behavior of defined variables in the empirical model in relation to the quantity of goat skins supplied for export. In this equation, multicollinearity was present. It was caused by the per capita income variable (Y) being highly correlated with the variables PCE, D, and T (Costa, 1982; table 1B). To solve this problem, the variable (Y) was omitted. This result is shown in model II of table 1.

In Model II the goat skin price paid to the exporters (PCE) was statistically significant. Model II shows that the price of cattle leather in the internal market (PB) is not statistically significant which indicates that goat skins and cattle hides are not strong substitutes in the domestic leather manufacturing sector. In model III, the variable for price of cattle hides (PB) was excluded. This resulted in the variables PC, D, and T becoming statistically significant. In Model III, all the variables were statistically significant and the estimated coefficients had signs in accordance with those hypothesized in the econometric model with the exception of the goat skin price in the internal market (PC). This could be a result of deficiencies in the original data that introduced a bias in the estimation procedures used (Costa, 1982).

The total quantity of goat skins produced in Brazil lagged one period (QC_{t-1}) and the prices for goat skins paid to the exporters (PC_t) were statistically significant at 1% and 10% probability levels, respectively. This can be interpreted as the quantity supplied of goat skins for export not reacting instantaneously to changes in quantity of goat skins produced. Also, the result confirms a direct relation between exported quantity and price paid to the exporters of goat skins. The goat skin price in the internal market (PC) variable was statistically signficiant at the 5% probability level. The variable representing price for sheep skins (PO) was statistically significant at 5% level and its negative sign suggests an inverse relation with the quantity supplied for exportation of goat skins. This can be interpreted as a substitution effect within the Brazilian skin processing sector. The time trend variable (T) appeared statistically significant at the 10% probability level with a negative sign, indicating that the supply of Brazil's goat skin exports suffered a decrease with time. The reason for this trend may be changes in consumers preferences, for instance. The high level of significance (1% probability) attached to the dummy variable (D) indicates that the effects of the government policies established in 1972 influenced the quantities of raw goat skins by decreasing the total exports and quantities of skins.

The coefficient of determination (R^2) was significant at 1% level of probability; the absolute value of the coefficient indicates that 88% of variation of export supply of goat skins is explained by the predetermined variables included in the model. The Durbin-Watson "d" test to measure the existence of serial correlation was inconclusive. The "U Theil" test gave values close to zero (0.0375), indicating that model III was a good predictor of goat skin exports.

The price elasticity coefficient for short-run goat skin exports calculated in model III was 0.30, indicating that other things equal, an increase of 10% in the export price of goat skins would increase the supply of goat skins exported by only 3%. Therefore, the export supply of skins is inelastic with respect to export prices, probably because of price linkages with the domestic market.

The export elasticity of the sheep skin price (PO) in the internal market was -1.50, indicating, ceteris paribus, that a 10% increase in the price of sheep skins in the internal market would cause a short-term reduction in the quantity of goat skins supplied for export of 15%. Conversely, when the price of sheep skins increases in the internal market, an increase in the quantity of goat skins used in the internal market is indicated. This suggests that the two skins have similar uses in manufacturing certain leather items in the processing sector.

SUMMARY AND CONCLUSIONS

The econometric model chosen for the estimation of the export supply function for goat skins in Brazil was defined as a function of the total quantity of goat skins produced in Brazil lagged one period, the goat skin price paid to the exporters, the price of goat skin in the internal market, the price of sheep skins in the internal market, the effects of government policies initiated in 1972, and the trend variable that captures other variables not explicitly included in the model.

The own-price elasticity of goat skin exports in the short term was 0.30, indicating that the quantity of goat skins exported responds directly to export price changes, but in an inelastic manner. The elasticity of exports in relation to the sheep skin price in the internal market was -1.50, indicating some degree of substitution between sheep and goat skins in the internal market for manufacturing certain items in the leather industry.

The quantity of goat skins supplied for export appeared to be sensitive to variations in the total quantity of skins produced in the internal market lagged one year. This indicates that export supply does not react instantaneously to changes in the quantity of skins produced internally. The internal goat skin price did not behave according to the formulated hypothesis. The dummy variable included in the export model of goat skins in order to ascertain the effects of government policies initiated since 1972 was highly significant. This indicated that government policies influenced exports of raw skins. The trend variable was significant.

The statistical data on quantities of skins produced in Brazil tends to underestimate actual production (Banco do Nordeste, 1974). In this work, it is assumed that the percentage of underestimation was constant from 1960 to 1975. Thus, the variation between years, which is the most important factor in terms of the regression analysis, is not heavily influenced by the basic underestimation problems.

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TABLE 1. ESTIMATED COEFFICIENTS OF GOAT SKIN EXPORT SUPPLY MODELS

Models	Constant	Independent variables								R^2	"F"	"d"
		QC_{t-1}	PCE_t	PC_t	PO_t	PB_t	Y_t	D	T			
I	1466.5	0.6368***	0.0901	0.1237**	-0.1696**	0.0197	-120.902	838.131*	-13.2814	0.843**	4.698	2.870
	(1.0528)	(3.1266)	(0.8457)	(1.9370)	(-2.7259)	(0.2586)	(-0.8773)	(1.8528)	(-0.1558)			
II	1212.3	0.6622***	0.1399*	0.0903*	-0.1679**	0.0015	-	1046.82**	-77.8472	0.825**	5.415	2.763
	(0.9030)	(3.3335)	(1.5742)	(1.7877)	(-2.7401)	(0.0210)		(2.7608)	(-1.8354)			
III	1213.5	0.6622***	0.1396*	0.0907*	-0.1677**	-	-	1044.04***	-78.0423*	0.825***	7.1069	2.763
	(0.9594)	(3.5356)	(1.6971)	(2.0675)	(-2.9349)			(3.1179)	(-2.0003)			

Notes: Level of statistical significance: *** 1%, ** 5%, * 10%.

The values in parentheses are "t" values for those respective coefficients.

The expected sign of the coefficient based on underlying economic theory are:

QC_{t-1}	= +	PB_t	= -
PCE_t	= +	Y_t	= -
PC_t	= -	D	= ±
PO_t	= -	T	= ±

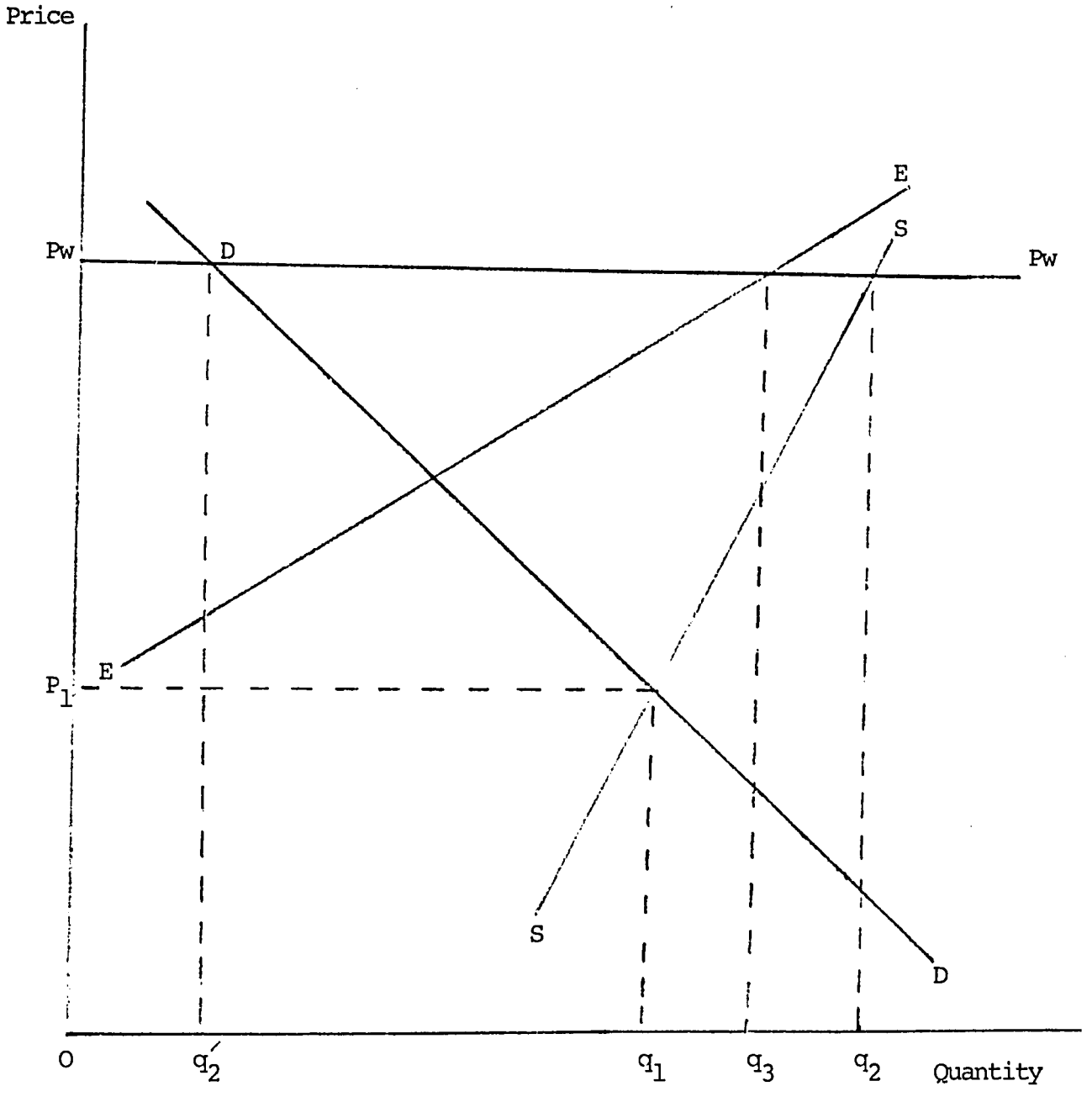

Figure 1. Domestic and Export Market Relationships for Brazilian Goat Skins.

APPENDIX TABLE 1. STATISTICAL DATA USED IN THE MODEL, 1960-1975

Years	Goat[a] skins exported (tons)	Goat[b] skins produced (tons)	Goat skins[a] exportation prices ($US/ton)	Goat skin[b] prices in Brazil	Sheep skin[b] prices in Brazil	Cattle hide prices in Brazil	Per[b] capita income in Brazil	General[c] index of prices, Brazil 1977=100	General[d] index of prices, U.S.A. 1975=100
				(Cruzeiros/ton)					
1960	1,290	1,369	2,283	118	110	33	32	0.5375	54.3
1961	1,933	1,429	1,831	160	154	51	47	0.7364	54.1
1962	1,588	1,460	1,651	219	235	74	75	1.1168	54.2
1963	1,955	1,544	1,292	348	370	106	131	1.9584	54.0
1964	1,501	1,606	1,515	636	683	133	243	3.7307	54.1
1965	2,123	1,579	1,747	985	912	171	454	5.8509	55.2
1966	2,570	1,618	2,270	1,513	1,234	350	620	8.0763	57.1
1967	2,103	1,618	1,869	2,012	1,675	351	826	10.3584	57.2
1968	2,079	1,573	1,836	2,238	2,006	470	1,117	12.8671	58.6
1969	2,312	1,641	2,316	3,025	2,590	499	1,427	15.5019	60.9
1970	1,838	1,643	1,978	3,108	2,763	714	1,795	18.5953	63.1
1971	2,191	1,665	1,956	3,854	2,800	946	2,351	22.2772	65.2
1972	1,764	1,698	4,097	5,145	2,625	1,252	2,999	26.2481	68.1
1973	1,678	1,732	5,940	6,877	4,672	1,659	4,014	30.1611	77.0
1974	1,531	1,766	5,332	9,192	6,005	2,199	5,711	38.8136	91.5
1975	1,445	1,801	4,999	12,385	7,702	2,915	7,921	49.6333	100.0

[a] CACEX 1981 and Banco do Nordeste do Brasil 1974, p 6.
[b] Fundacao Instituto Brasileiro de Geografia e Estatistica 1960-1976.
[c] Fundacao Getulio Vergas 1979.
[d] International Monetary Fund, 1982.