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BEEF SECTOR OF BRAZIL

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FOREWORD

Understanding the nature and dimensions of the world food problem and the policies available to alleviate it has been the focal point of the IIASA Food and Agriculture Program since it began in 1977.

National food systems are highly interdependent, and yet the major policy options exist at the national level. Therefore, to explore these options, it is necessary both to develop policy models for national economies and to link them together by trade and capital transfers. For greater realism the models in this scheme are being kept descriptive, rather than normative. In the end it is proposed to link models to twenty countries, which together account for nearly 80 per cent of important agricultural attributes such as area, production, population, exports, imports and so on.

This report presents the results of work on the agricultural production module for Brazil; it is part of the work devoted to building an agricultural policy model for that country. As understanding supply responses to various possible policy instruments is a critical part of much of agricultural policy analysis, this work is a significant element of the IIASA agricultural policy model for Brazil.

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1. INTRODUCTION

This paper presents the results of an analysis of a model devised to describe Brazilian beef production.

The analysis and resulting equations were carried out as part of the model for Brazil, which is one of a series of National Models being developed by the Food and Agriculture Program at the International Institute for Applied Systems Analysis. The model for beef production is highly simplified as it uses only a few variables. A simplified model was developed in line with the overall requirements for the Brazil planning model. This model seeks to cover the whole economy with only minimal manpower available.

The following points should be taken into account when reviewing the analysis and results: (a) the relatively short time (13 years--in comparison to the cattle industry cycle); (b) the regional differences existing in Brazil which may have hidden and/or distorted factors and effects; (c) the short period of time in which the analysis was carried out.

The paper consists of four main parts: (a) The historical background--outlining the development of the cattle industry in different regions of Brazil; (b) the contribution of the cattle industry to Brazil's development and overall economy is discussed; (c) the performance of the cattle industry as a supplier of food and foreign exchange earner and factors/policies affecting their production are analyzed.. (d) a model is outlined to analyse this sector, together with a preliminary analysis

2. HISTORICAL BACKGROUND

Until the end of the 18th century the cattle industry in Brazil had only a secondary role in the economy, supporting other economic activities of greater importance. This was due to the colonial system which concentrated on production and export of tropical products to Europe, Furtado (1977), Prado Junior (1978).

Until the beginning of the 18th century, sugarcane was the main export. This was then superceded by an era of mineral extraction, mainly by gold from the mines in the southeast. The cattle industry played only a supportive role in the economy. During the period of concentrated sugarcane cultivation, fertile soil along the Atlantic coast was used for production resulting in cattle being

pushed inland. With the opening of mines in Brazil's southeast interior during the mining boom, cattle farmers were again forced to move to new grazing lands still further inland taking over the pioneering role of settling and opening up new regions of Brazil. By the end of the 18th century, after the mining boom was over, the cattle industry had become an independent economic industry, and was producing beef for the growing population of the colony.

Social-economic factors and natural resources determined the growth pattern of the cattle industry in the different regions of Brazil. As already mentioned the concentration of sugarcane along the coast in the northeast forced the cattle industry inland. The adverse climate, semi-arid conditions, and the lack of good natural grassland in these regions was responsible for the slow growth of the herd, low levels of productivity and scanty population.

In the southeast, the cattle industry developed rapidly during the mining boom. The tropical and sub-tropical climate, the existence of natural grassland, and a more diversified structure of production all played an important role in the expansion of the cattle industry. in this region.

In the south, the cattle industry developed around the middle of the 18th century. Until that time there were intense disputes between Portuguese and Spanish colonies. The subtropical and temperate climate and the excellent natural grasslands soon led to rapid growth of the herd. The cattle industry became the main economic activity in this region, as the tropical commodities, which were more important to the Portuguese could not be produced in this region.*

The importation of "Bos Indicus" (zebu cattle), at the beginning of this century had a very important impact on the cattle industry in Brazil. This impact was more accentuated in the Central and Northern regions where the breeds imported from Europe were not well acclimatized to the tropical climate.

The Zebu cattle have a greater resistance to hot and humid weather and to some parasites, such as ticks, which enable their adaption to the tropical climate. The introduction of Zebu and cross-breed (Zebu + European) not only facilitated the expansion of cattle grazing along the coast, but also enabled new regions in the interior of Brazil to be opened.

The expansion of the cattle industry in the new areas, particularly in the centerwest (Mato-Grosso and Goias) and the north, was accelerated in the late 1950's and early 1960's when the government encouraged settlement of these regions, by a policy of incentives and infrastructure. This phase of resettlement coincided with Brazilia being made the new capital in the 1960's.

The growth and distribution patterns of the herds differ throughout the regions of Brazil. Table 1, shows the growth of the herd, the contribution of the regions to the national herd and the regional and national growth rates for the period 1960/75.

The southeast and south, where the cattle industry developed more quickly still showed a fast growth from 1960 to 1975. During that period they held over 55% of the national herd, however the size of the herd has been stabilizing due to the percentage of land already occupied and the expansion of crop production. (Brant, 1977).

The northeast and north showed relatively small growth rates, compared to the highest rates experienced in the centerwest region. The trend in the northeast is towards reducing the size of the national herd, in the north herds

* This is discussed in detail by Furtado, C. (1977) and Prado Junior, C. (1978).

have remain more or less constant, and the centerwest herds continues to have the highest growth rate.

In order to understand the total production it is necessary to know how the herds are distributed in terms of beef and dairy cattle. The industry can broadly be divided into the following categories:

- (1) Stockbreeders of pure cattle
 - (1a) beef cattle
 - (1b) dairy cattle
- (2) Commercial breeders
 - (2a) beef cattle
 - (2b) dual purpose cattle
 - (2c) dairy cattle

The first group, "stockbreeders of pure cattle", although having a very important role from the point of view of genetic improvement of the whole herd, represents a small percentage of the industry and will not be analyzed. The second group is the most important.

Based on the number of cows milked it can be assumed that beef cattle comprise about 50% of the total herd. This is concentrated in a few regions in the south, traditionally producers of beef, based on european breeds, in the centerwest and north and in the less populated areas of the south east. With the exception of the european breeds in the south, the herd is composed of various strains of zebu (*Bos Indicus*).

Based on the calculations made by CEPA/MG (1977) for the southeast, it can be assumed that dairy cattle comprise about 20% of the total herd. This is concentrated around the large cities and particularly in the southeast, where about 60% of all milk is produced CEPA/MG (1977). The largest part of the herd is composed of half-breed zebu + european cattle. although there is a tendency towards more specialized breeds, particularly Holstein.

The dual-purpose cattle comprise the remaining 30%. They are used to produce more milk or beef depending on the population density, market structure (cooperatives), price and infrastructure of transport. The herd is composed of zebu and of cross breed (zebu + european) with a significant dominance of zebu.

The trend is progressively changing in most regions from beef towards dual-purpose cattle and from that towards dairy cattle. The density of the population and the consequent demand for more dairy products is a major factor behind this tendency. As a result market and transport infrastructures are improving through the establishment of cooperatives. The areas around large cities tend to specialize on dairy products while those in more remote areas concentrate on dual purpose production.

The data in Table 2 also reflects improvements in productivity but primarily emphasizes the predominant trend towards milk production due to rapid urbanization during the period under review (1956-75).

In the northeast, the levels of productivity for beef and milk are quite low. The significant increases in these levels for the period 1956/75 was largely due to the slow growth of the herd. The tendency towards milk production can be clearly observed, as the growth rate for beef was 2.4% while milk production has increased by 4.1%. This increase in milk per head reflects the rapidly increasing demand in the region for dairy products due to urbanization and the inability to meet these demands locally.

In the southeast, the levels of productivity for milk were always relatively high. This tendency towards increased production of milk is still continuing. However, a small increase in milk production also corresponds to a reduction in beef production per head--a growth rate of 0.83% for milk against -1.43% for beef.

The south is a region which traditionally produces beef. As the demand for milk increased the productivity per head increased rapidly with a corresponding reduction in beef per head-- a growth rate of 3.57% for milk, against 1.66% for beef.

In the centerwest and north the levels of productivity for beef and milk are relatively low. Beef per head has increased faster than milk per head due to the rapid expansion of cattle production in this less populated region.

The data in Table 2 further reflects the effects of the ratio milk/beef prices on production, particularly of milk.

Table 3 shows the ratio milk/beef price for the period 1964/76. From 1971 to 1974 a low ratio can be observed, due to a rapid increase in real prices for beef. Therefore the productivity of milk per head (Table 2) fell in that period for all regions and for the whole country reaching the lowest levels in 1972/73.

3. CONTRIBUTION TO THE ECONOMY

The contribution of the cattle industry and especially the beef sector to the economy has been quite significant in Brazil. Table 4 shows the Agricultural Gross Product and the Cattle Industry Product in 1970 for the country and for the six most important states in terms of agricultural production.

It can be seen that the cattle industry (animals and dairy products) comprised 20.2% of the national agricultural gross product.

An idea of what that contribution has been after 1970 can be seen in Table 5 where the value of the Gross Domestic Product and the contribution of the agricultural sector, and the growth rate for the agricultural and livestock sector are shown for the period 1973/78.

Based on those figures it can be expected that the contribution of the livestock sector to agriculture has increased. Livestock grew at 7.7% per year against 4.6% for the whole agricultural sector. However, two factors have to be considered: (a) the real prices of crops and livestock products and, (b) the growth of the different industries in the livestock sector.

4. PERFORMANCE OF THE CATTLE INDUSTRY

An analysis of the performance of the cattle industry has to take into account the whole context of the agricultural sector and the Brazilian economy. The following short review of Brazil's recent economic development is given as a background to understanding this context.

4.1. Brazil's Economic Development

Brazil's development, from the Second World War until the early 1960's was characterized by Import-Substituting Industrialization policies, which were vigorously pursued.

These policies were responsible for periods of high growth rates and principally for important structural changes in Brazil. However, some policy effects are closely related to the current problems faced by the Brazilian economy.

Furthermore, the Import-Substitution Industrialization Policies neglected agriculture and in some cases discriminated against it, Baer (1977), Schuh

(1970), Paiva and Allii (1973), producing a relatively low rate of growth in the agricultural sector in relation to the industrial sector, as shown in Table 6.

Other consequences of these small growth rates were (a) reduction of the capacity to supply food for internal consumption, thus stimulating inflation and producing social tensions, particularly in large cities, (b) rapid urbanization, creating a "marginal population" which could not find work in the industrial sector, (c) increased poverty in the rural sector as a consequence of transference of capital to the urban sector and income concentration and, (d) increasing political power in the urban area, the population of which was better qualified, organized and informed than the rural sector.

In April 1964, a conservative take-over took place. This led to military intervention in the political field, and in the economic field caused a change towards more conservative monetary and fiscal policies, Mallan, (1977), Campos (1979). Since 1964, most of the policies adopted were primarily oriented towards producing rapid economic growth and increased efficiency with little concern for equity, Baer and Samuelson (1977), Bacha (1977). As a consequence, between 1968 and 1973 the economy reached very high rates of growth. From 1975/76, some changes can be observed showing the increased concern with problems of equity.

In 1974, a period of economic troubles began, delineated by the so-called oil crisis. The Brazilian economy continued to grow, but at a smaller rate and was characterized, as it continues to be, by a disequilibrium in the balance of payments and an increased inflation rate, Tables 8 and 9, which became the most serious problem facing the Brazilian economy.

4.2. The Role of the Cattle Industry

The main role and goals of the agricultural sector and specifically the cattle industry are:

- (1) Supplying food for internal consumption;
- (2) Providing exchange earnings;
- (3) Improving the internal market.

The less important role of agriculture as a supplier of labour and capital to other sectors of the economy will not be included in this analysis. Its role of improving the internal market will also not be included although this is very important for economic development, as it provides a better standard of living for the rural sector and a market for industrialized goods. The present analysis, based on data for 1964/76, concentrates on supplying food for internal consumption and exchange earnings which are more directly related to the most serious economic problems of inflation and balance of payments.

4.2.1. Supplying Food

Production of Beef

Beef production grew at a rate of 3.5% per year in the period 1964/76. Although the overall growth pattern is positive in that period, irregularities occur from year to year. Table 10 shows the carcass production in metric tons and the respective real values.

Rapid increases in production occurred from 1967 till 1970 and a sharp increase again started in 1972, reaching a peak in 1973 of 2.2 million metric tons. In each instance this was followed by a reduction in production, as shown for the years 1971 and 1974.

Table 11 shows the availability of beef in carcass per person for 1960 and for the period 1970/76. The levels of availability in this period are low and practically unchanged if 1960 and 1976 are compared. The increases for 1972, 1973 and 1974 were a consequence of a larger slaughter for exports as shown below.

Domestic Demand

In the period 1964/76 between 89% and 98% of the production was consumed in the country, indicating that the domestic demand is much more important than foreign demand.

The demand for food and specifically for beef is a function primarily of population growth and income growth. From 1960 to 1975, the population grew at a rate of 2.8% per year and average income per capita at 5%. Although average income per capita had grown substantially in the period, income distribution needs to be considered since an uneven distribution would reduce the real demand for beef.

The income elasticity for beef in Brazil is estimated at 0.9%. As the income grows the demand for animal protein grows as well. Additionally the demand for beef seems to be accentuated in Brazil by a number of socio-economic factors. Beef was cheap in Brazil for a long time being the product of an extractive industry based on cheap land and labour and very few investments in capital, Prado Junior (1978). The low prices resulted in relatively high rate of consumption for beef, in all income classes.

The demand for beef grew along with the expanding middle class in the urban sector, and in a completely free market, prices were expected to continue to rise till an equilibrium was met. The increases in prices provoked bad reactions from the urban population, and led to social unrest, resulting in government intervention in the market. Prices were then controlled and beef was stocked for the dry season in order to keep prices down for the consumer and to have a satisfactory supply during the year. This situation of relatively low prices and regular supply, is expected to encourage the habit of greater consumption.

4.2.2. Exchange Earnings

Beef's contribution to Brazil's total exchange earnings is irregular and has not been as large as expected, when the potential production of such large herds is considered. Table 12 shows the total quantity exported, value in U.S.Dollars and the total percentage value of exports.

In that period, 2% to 15% of the total production was exported. This relatively low amount of exports seems to be due to the domestic demand and some limitations related to international sanitary requirements for exports. After 1969/70, when the abattoirs were improved to meet such requirements, Brant (1977) the amount of exports seems to be affected by the domestic demand and strongly by international prices.

Exports peaked in 1972/73 in response to the high prices on the international market. The fall in 1974 when prices were still high seems to be due to a total drop in production which was unable to meet domestic and foreign demand, resulting in the imports of beef in that year being the highest for the period, 52,741 tons.

Exports of beef changed from frozen and fresh beef towards industrialized beef after 1973. Table 13 shows the amount of fresh, frozen and industrialized beef exported for the period 1968/76. Although the totals differ slightly from that of Table 12, they show the same pattern.

To conclude, the domestic production was not large enough to meet the total demand, of either domestic or foreign markets.

5. GROWTH OF BEEF PRODUCTION

Figure 1 shows a simplified model of beef production and some of the factors influencing it.

Production of beef is dependent on the number of animals slaughtered and their average carcass weight. The average carcass weight as a technical rate depends on the production system adopted by the farmers.

The number of animals slaughtered depends on the size and composition of the herd and their availability according to the potential of the herd. It is also affected by some institutional factors, particularly prices of beef, which can lead to an over or under slaughter in short and long term.

The composition of the herd is a function of the technical rates in the previous years which determine the number of animals in the different categories.

The size of the herd is a function of the same technical rates which determine the growth rate of the herd and is affected by the availability of feed which limits the maximum sizes of the herd. The availability of feed also affects the technical rates.

In the case of Brazil, where beef production is heavily dependent on pastures, the availability of feed is a function of the pasture areas and the productivity per hectare. The number of animals slaughtered, also affects the availability of feed in the following years.

The technical rates, including productivity per ha. and carcass weight, and the increase in pastures areas, by a process of geographic expansion, are dependent on the production system adopted by the farmers.

Finally, the decision on which system should be adopted, emphasizing the improvement of productivity or the incorporation of new areas and the efficiency of that system, is a consequence of exogenous factors, which can be classified as (a) institutional factors (prices, credit, technology available, etc.); (b) natural resources; and (c) farmer's management ability.

Some technical rates such as the productivity of forage per hectare can be affected by natural resources out of the control of man, particularly rainfall.

In the case of Brazil, emphasizing that the analysis is at the national level, available data indicates that the production of beef is largely determined by the number of animals slaughtered, the size of the herd, the availability of feed, the development of new grazing areas and improvements in productivity per hectare. It means that the changes in technical rates (birth rate, mortality rate, age of production, age of slaughtering and carcass weight) and in the composition of the herd have had a smaller effect on production.

A more detailed analysis of some of these factors will be presented in the section below.

6. ANALYSIS

6.1. Factors Affecting Production

From Figure 1, the choice of factors is a judicious balance between the salient features and the availability of data. Some intermediate and micro-factors such as birth rate and availability of feed are not considered explicitly, although their effects are embodied in some of the macro factors considered.

6.1.1. Biological Factors

6.1.1.1. Number of Animals Slaughtered and Carcass Weight

Production, in the short term is to a large degree determined by the number of animals slaughtered and carcass weight. The data for production, number of animals slaughtered, and carcass weight together with their indices are given in Table 14.

The number of animals slaughtered shows a steady upward trend except in 1966, 1971 and 1976. The indices suggest that the number of animals slaughtered and production are correlated. Carcass weight shows little change, varying by about 6% over this time period. This increase is low in comparison with other countries, for example in the United States the average carcass weight in 1970 was 221 kg, in Canada, 237 kg, and in France 270kg, Souza and Richter, (1971). This suggests significant potential for the introduction of technical improvements. An explanation for lower average carcass weights seems to be related to regional differences and to the special characteristics of the dual purpose cattle.

An analysis at the regional and sub-regional level may show some improvements as a consequence of more intensive production systems and/or use of pastures established in fertile areas such as the Mato Grosso and Goias regions. On the other hand, expansion in regions of poor natural resources such as the Cerrados and Caatingas regions may have a negative effect on the average carcass weight.

Another factor seems to be a change in dual purpose cattle towards milk production to meet the increasing demand for dairy products. During this period milk production grew at an annual rate of 4.3% against 3.5% for beef, this most likely due to an increase in the number of cows milked (see Table 15).

As the productivity of milk per cow is low, the tendency is to leave inadequate quantities of milk for the calves, particularly the males. As they are not adequately fed with good substitutes for milk, their growth is stunted, which in turn affects the productive and reproductive performance of the herd, and also reflects on the carcass weight.

6.1.1.2. Herd Size and Composition

The size of the herd for the period 1964/76 together with its percentile composition are given in Table 16. The total herd grew at an average rate of 3.12% per year in the analyzed period. A large change is observed from 1971 to 1972 which is more clear in the index column, and a slight reduction is observed from 1975 to 1976.

The composition of the herd is difficult to analyse, since there is little data readily available for the entire period. However, some data suggests that this composition has been more or less constant along the period analyzed, as shown below.

From the composition of the herd in Table 16, it can be assumed that the number of animals available for slaughter is about 12% of the total herd, 7.49% of steers (3-4 years) plus 4.68% of cows culled (culling rate of 15%). If the composition of the herd changes, then the percentage should also change. In this case, a higher rate (over 12%), can be expected as a result of earlier ages for slaughtering and first calving. However, as shown in Table 17, the percentage of animals slaughtered in relation to the total herd remained at about 12% during the analyzed period. This indicates that the composition of the herd has been more or less constant. In other words, the number of animals slaughtered is

basically a function of the size of the herd.

The variations observed in Table 17 do not show a clear tendency of a positive or negative growth. This unstable pattern seems rather to be due to changes in the economic sector, more specifically changes in prices, than to real changes in the composition of the herd. For instance the higher rates observed in 1972 and 1973 coincide with higher prices for beef as shown in Table 20.

6.1.1.3. Technical Rates

Technical rates such as birth rate, mortality rate, slaughtering and first calving age, play an important role. These rates will not be treated extensively but some comments seem appropriate.

The composition of the herd is a direct function of those rates, particularly the ages for first calving and slaughtering. As the age of first calving and slaughtering are lower the two last categories, 3-4 years old males and females cattle tend to disappear and a large number of animals are available for slaughter increasing the rate of offtake. As shown above, that rate (off-take) was more or less constant in the time span. This indicates that the technical rates have not changed very much.

Among the technical rates, the percentage of cows culled becomes important, particularly if a high percentage is observed in a given year or period, since it will affect the growth rate of the herd and production 3 or 4 years later.

In Brazil, an increasing percentage of cows were culled in 1975/76. As this is accentuated at the end of the period analyzed, the factor was not included in the model. However, its effects should be considered in future studies.

6.1.1.4. Availability of Feed

This factor is very important in determining the size of the herd and even the technical rates. However it will not be analysed directly because of the characteristics of the model and the availability of data. Most cattle are range fed and the use of purchased feed is of little significance. The availability of feed therefore heavily depends on the pasture areas and the production of forage per hectare.

Some extrapolations of data were made for 1960 and 1975, based on data for 1970, the results are shown in Table 18. An attempt is made to explain to what extent new pasture areas and improvements in productivity per ha. have contributed to feed production. Using data on the number of heads grazed per hectare it can be estimated that improvements in productivity have been quite significant, even larger than those of incorporation of new areas. Productivity is dependent on the proportion of natural and cultivated pastures, the technology used in the management of the pasture and on the natural resources, basically the soil, fertility and rainfall availability.

6.1.1.5. Production of Beef per Head

This variable was estimated as the production of beef per head in the current year and as an average of the two previous years. Table 19 shows the values for the period 1964/76. The reason for analyzing this variable is that an over or under slaughter in a given year will affect the production in the following years. This variable can reflect some real improvements in productivity. However, it explains a good deal of the variation in production and in the herd as it will be shown later, confirming the initial argument.

6.1.2. Institutional Factors

6.1.2.1. Price of Beef

Table 20 shows prices of beef received by producers for each year and an average of the current plus the two previous years and prices (FOB) of beef exported, with the respective indices, for the period 1964/76.

The sharp fall in domestic prices in 1965 is not clearly explained. After that, prices fell until 1969, reaching the lowest level, followed by the highest prices in 1974, with a subsequent fall again until 1976.

The pattern seems to be very coherent with an analysis made by FUNDACAO Getulio Vargas (1977) which indicates a cyclical pattern as shown in Figure 2. This seems to be related to the availability of beef, and function of the biological cycle of the cattle industry. A clearer analysis of this aspect requires a good data source including the composition and evolution of the herd.

The rapid increase in real prices observed in 1972/74 shows a good correlation with the prices of beef exported as shown in Table 20.

6.1.2.2. Prices of Inputs

Table 21 shows a weighted index for prices of inputs, based on the participation of feed inputs and fuel in the cost of production of beef. A detailed explanation of this index is given in the Appendix. Feed and fuel were chosen because they represent 60% and 20% respectively of the total cost of four basic inputs (feed, fuel, repair of buildings and machinery, and drugs and vaccines). These inputs plus hired labour constitute the effective operational cost. (See Table 2 in the Appendix).

The weight of feed is 0.75 and of fuel 0.25. Real prices of purchased feed tended to be lower therefore the effect of the fuel increases after 1973 was small and the input price index shows a small increase.

6.1.2.3. Ratio Price of Beef Input Cost

This ratio was calculated by dividing the real prices for beef with the real prices for input shown above. Table 22 shows the ratios for the period 1964/76.

As the input price shows small changes, the changes in ratio are heavily dependent on changes in prices of beef. In fact the lowest ratio occurred in 1969 and the highest in 1974.

6.1.2.4. Credit for Livestock

Table 23 shows the values of credit applied by Banco do Brasil in real prices per head for each current year and the average value for the current year plus three previous years. The original data used does not represent the whole amount of credit applied to livestock because data reflects only the credit offered by Banco do Brasil. But as the Banco do Brasil supplied a very large part of the rural sector of Brazil with credit, this data is a good indication of the evolution of credit.

The main point is the steady growth of available credit, growing in real terms at a pace much faster than that of the herd and production of beef. Two major changes can be observed. One from 1969 to 1973 and the other from 1974 to 1975. The choice of a moving average of the previous four years was used to approximate this. The incentives in the cattle industry took some years to produce effects, because of the biological cycle of the cattle herd.

6.1.2.5. Other Institutional Factors

Many other institutional factors such as market and transport infrastructure, available technology and taxation certainly have effects on the production. However they will not be subject of this particular analysis basically due to the lack of readily available data to evaluate their importance in the whole process.

6.1.3. Natural Resources

Two basic natural resources have largely influenced the process of production: (a) land in terms of quantity and soil fertility and (b) rainfall in terms of total quantity and distribution.

6.1.3.1. Land

No data will be presented for analysis, but some comments will be made. The quantity of land has not been a limiting factor for the size of the herd or production growth. This is illustrated by the low cattle population density of about 13 head per square km in the centerwest and 0.6 head per square km in the northern region.

In the traditional cattle producing regions, south, southeast, and northeast the geographic expansion seems to be reaching its limits. But there is a consensus of opinion that the availability of cheap land has been an important factor for the herd and production growth.

6.1.3.2. Rainfall

Table 24 shows data for rainfall as a weighted value for each current year and an average of the current plus the three previous years.

The weights were based on the data from 5 states. In 1970 these accounted for 76% of the total herd. The data for current years shows some discrepancy being worse in 1967 and best in 1972. The idea of calculating an average is the same as for credit, since the effect of bad or good years can be shown some years later. The data indicates slight changes with a tendency for positive growth.

6.1.3.3. Management Ability

This factor, including the aspects of management at the firm level and entrepreneurship, plays an important role in the process of agricultural development. This influences the levels of productivity and production of individual firms and consequently the whole industry.

The basic problem in any empirical analysis is to find a parameter that measures reasonably well such a factor and its contribution to productivity and production. Many authors have discussed concepts, measurements and particularly the importance of this factor and variables related to it, Griliches (1964), Schutz (1964), Nelson (1967), and Everson (1965). While the management ability factor is not included in this analysis some relevant points are now briefly discussed. The farmer's management ability is dependent on his level of qualifications the use of purchased feed is of little significance, and organization. "Farmer's qualifications" are defined as the ability to master the technology and to be informed particularly about the market. Farmer's organization concerns the financial and technical control of the production at "farm level" and the reinforcement of the farmer's unions at "class level".

The level of qualification and organization and consequently the management ability is low for the majority of farmers in Brazil. The argument is not

supported by good empirical data. However, some available data for the State of Minas Gerais can throw some light on the problem.

From a survey carried out in 376 farms of Minas Gerais in 1975, Gomes (1976), Pereira (1976), Fajardo (1976), the years of schooling and level of technical knowledge are used to indicate the level of the farmers' qualifications, while the level of participation in associations available for the farmers indicate their level of organization. The level of technical knowledge was measured by a series of questions on basic technical knowledge necessary for good management of a cattle farm.

The data show that 72% of the farmers had attended less than 4 years of formal school and that 42% of them had a low level of technical knowledge, 34% a medium level and 24% a high level. In respect to organizations, 63% of the farmers had a low level of participation, 24% a medium level and 13% a high level. Although the figures cannot definitely support the argument stated above, they suggest that the levels of qualification and organization are low.

To facilitate the understanding of the situation at the national level indications of the position of the State of Minas Gerais and of Brazil are shown in relation to structure of formal education and training, based on the number of inhabitants per school and farms per extension office. (Table 25).

6.2. The Conceptual Model

The simplified model analyzed in this work suggests that the production of beef in a given year is primarily a function of the number of animals slaughtered. Over the time period covered by this data carcass weight shows small variance indicating its small contribution to production growth. For longer term studies, improvements can be expected due to better technical rates and more intensive systems of production.

The number of animals slaughtered is basically a function of the size of the herd, since the composition of the herd is more or less constant during this period. Additionally it is assumed that some combination of biological and/or institutional factors play a role in stimulating or limiting the number of animals slaughtered and consequently the production of beef.

6.3. The Econometric Model

The basic econometric model assumes a linear input/output relation of the form

$$Y_i = \gamma + \beta_1 x_{1i} + \dots + \beta_n x_{ni} + \varepsilon_i \quad i = 1, 13$$

where

Y_i = dependent variable

γ = constant

$\beta_1 \dots \beta_n$ = regression coefficients

$x_{1i} \dots x_{ni}$ = independent variables

ε = error term which is N.I.I.D.

The method used was the Ordinary Least Square (OLSQ) specifically utilizing the program available in the Time Series Processor (TSP) package of the Harvard University.

6.4. Variables Used

PRODi	= Production of beef at year i in 10 ³ metric tons (dependent variable)
HERDi	= Stock of animals at year i in 1000 heads
HERD1i	= Stock of animals at year i-1 in 1000 heads
PRICEi	= Real price of beef received by producers at year i in CR dollars/mt
PRICE1, PRICE2, PRICE3,	= Real price received by producers lagged of 1,2 and 3 years in CR dollars/mt
PRICEAi	= Average of Price1, Price2 and Price3 in CR dollars/mt value for year i
PEXPi	= Current export price of beef (FOB) at year i in US dollars
COSTi	= Real prices of input index at year i in CR dollar/mt
RATIOi	= Ratio Beef: Input prices at year i
PRHRD1i	= Production of beef per head of cattle at year i-1
PRHRDAi	= Average (2 previous years) production of beef per head--value for year i
CREDi	= Amount of credit per head at year i in CR dollar of 1972
CREDAi	= Average (current + 3 previous years) amount of credit per head--value for year i in CR dollars of 1972
RAINi	= Value of rainfall for the year i in mm. weighed by the participation of the 6 states with the largest herds
RAINAi	= Weighed value of average rainfall (current + 3 previous years) value for year i in mm.

7. RESULTS

The equations for production and herd in their linear as well as logarithmic forms are given below.

$$\text{PROD} = 1026.68 + 0.023 \cdot \text{HERD} + 0.265 \cdot \text{PEXP} - 50.11 \cdot \text{PRHRDA}$$

(798.176) (0.004) (0.167) (36.19)

$$R^2 = 0.92, \text{D.W.} = 1.5715$$

$$\text{LPROD} = -2.673 + 1.022 \cdot \text{HERD} + 0.093 \cdot \text{LPEXP} - 0.609 \cdot \text{LPRHRDA}$$

(2.238) (0.190) (0.085) (0.512)

$$R^2 = 0.92, \text{D.W.} = 1.4662$$

$$\text{HERD} = -35737.4 + 0.825 \cdot \text{HERD1} + 17.43 \cdot \text{RAIN} + 1106.85 \cdot \text{PRHRDA}$$

(8827.17) (0.047) (5.52) (309.91)

$$R^2 = 0.99, \text{D.W.} = 2.4295$$

$$\text{LHERD} = -1.025 + 0.823 \cdot \text{LHERD1} + 0.287 \cdot \text{LRAIN} + 0.299 \cdot \text{LPRHRDA}$$

(0.440) (0.045) (0.099) (0.091)

$$R^2 = 0.99, \text{D.W.} = 2.3182$$

The variables initialized with the letter L indicate the logarithms of the original variables.

B. THE EQUATION FOR PRODUCTION

As indicated earlier in section 6.1, production is heavily dependent on the size of the herd. Figure 3 shows the growth of indices for production, the number of animals slaughtered, carcass weight, and herd size. The close relationship between production and the number of animals slaughtered is clearly shown.

As previously mentioned, the production peak of 1972/74 was due to high export prices which stimulated an increased slaughtering of beef cattle (Figure 4), and the yearly variations in production are related to the number of animals slaughtered in previous years. For example, the fall in production in 1971 when domestic and international prices were rising seems to be a consequence of large production between 1968 and 1970.

In Figure 5 beef production in 1971 per head was relatively high (24.74 kg/head) probably due to the large number of animals slaughtered in the previous two years. The same pattern is seen in production for 1974 when fewer animals were available for slaughter due to heavy slaughtering in the previous two years, resulting in a reduction in production although prices were still high on the international market and rising domestically.

Although not shown in the equation, another factor which may help to explain these falls in 1971 and 1974 is related to expected prices. Although domestic prices, due to greater home consumption of beef, should reflect changes in production more realistically than those of the export prices, the results obtained for these particular equations were always insignificant. This seems to be due to the heavy dependence of production on the growth of the herd and the fact that small falls in prices have little effect on production.

Figure 6 shows that from 1966 to 1969 when producer prices and the ratio price of beef/price of inputs were falling, production was still growing at the rate of 7.9% per year. This would indicate that producers lack short term alternatives. This pattern of production between 1965 and 1969 seems to be related to the quantity of animals slaughtered in the previous years. The average values of production per head in 1967 and 1968 were quite low (22.73 and 22.03 kg/head, respectively) (Figure 5) and indicate that less animals were slaughtered in the previous years and that more animals were available for slaughter in 1968 and 1969.

The low number of animals slaughtered between 1965 and 1967 (Table 19), resulting in an accumulation of animals seems to be explained as follows. When prices started to rise in 1966 (Table 20), farmers expected this trend to continue in the following years and held back beef supplies in anticipation of better prices. When prices started to fall instead farmers were forced to sell their animals to avoid greater losses.

B.1. The Equation for the Herd

The growth of the herd is basically dependent on the stock of animals in the previous year, since the change from one year to another is a function of animals born, dead and sold. Other variables of importance are the rainfall (RAINA) in the previous years and the production of beef per head in the two previous years (PRHRDA).

Although the stock of animals is very important, there are other factors in the previous three or four years, which determine the performance of the herd

in this period, influencing the technical rates and consequently the size of the herd in a given year.

A factor of great importance is the availability of feed, which affects the technical rates and limits the size of the herd. The two other variables (RAINA and PRHRDA) in the equation are related to this factor.

The variable for rainfall (RAINA) would reflect the dependence of forage production on the availability of water. This variable had a statistically significant coefficient. However, this may be due in part to collinearity with other variables.

The contribution of the variable production per head in previous years (PHRDA) to the growth of the herd, is related to a greater availability of feed for the rest of the herd due to a larger number of animals slaughtered in the two previous years. It can be expected that a greater availability of feed in the two previous years will have a positive effect on the herd size, increasing the birth rate and reducing the mortality rate.

Other variables, specifically credit for livestock and producer prices of beef, might be expected to have a positive effect on the growth of the herd. However this was not evident from this particular analysis. Figure 8 shows the curves for herd, average credit (CREDA) and average price (PRICEA).

Credit shows a pattern of growth very different from that of the herd. In Table 16 and 23 indices of growth show that credit per head grew more rapidly than the herd. It indicates that the impact of credit on the growth of the herd has not been very significant. One possible explanation is the concentration of credit in a few hands and the large percentage of credit used to trade cattle among farms. In the state of Minas Gerais in the first semester of 1977 the official credit given through the EMATER-MG (official extension agency, which gives about 20% of the total rural credits), reached 1.7% of the producers. Another example in the same state can be seen between 1970/76 where the number of contracts for rural credits grew at 5.2%, while at the same time total credits grew at 16.9% per annum. In 1976 credits worth 4.6 billion cruzeiros (1975 rate) were applied to 94,692 contracts, (SEPLAN-MG, 1978).

Prices show quite a different pattern, particularly in the period 1966 to 1970, indicating that reductions in real prices had little effect on the growth of the herd.

To conclude, the production of beef during 1964/76 is heavily dependent on the size of the herd. This is due to the little variance occurring in carcass weight and composition of the herd. Therefore production depends on the number of animals slaughtered, which in turn depends on the size of the herd.

An increase in prices, in this case, specifically export prices, stimulates production which in turn is limited by the production in the previous years. A fall in domestic prices does not affect production very much in the short term, indicating a lack of flexibility by producers to adapt quickly.

The herd size is dependent on the previous year's herd, and on factors related to the availability of feed. The small changes observed in the composition of the herd, which is dependent on the technical rates and on carcass weight, indicate that the technical rates have not changed significantly. It suggests that the herd has been growing at a much slower pace than its biological potential.

In addition, the different growth patterns of the main economic incentives (price, credit and ratio of output/input prices) in relation to the herd, suggests that these economic policies have not had the impact necessary to change the technical rates leading to more dynamic growth.

9. CONCLUDING REMARKS

This report reflects the current work in progress. The regression analysis is a preliminary approach to understanding the dynamics of the beef sector for Brazil. A more elaborate model is envisaged which will provide detailed estimations and results and will emphasize the cyclical properties of Brazil beef production. When these results become available they will be documented in detail.

TABLES 1 - 25

TABLE 1 - CATTLE HERD EVOLUTION AND PARTICIPATION OF THE REGIONS - 1960/75.
(1,000 heads)

Year	Brazil	Northeast	% of total	Southeast	% of total	South	% of total	Centre West	% of total	North	% of total
1960	56,041	11,556	20.6	21,040	37.5	11,678	20.8	10,533	18.8	1,235	2.3
1970	78,562	13,806	17.6	26,845	34.2	18,953	24.1	17,252	21.9	1,706	2.2
1975*	1,00,834	17,890	17.7	34,993	34.7	21,421	21.2	24,433	24.2	2,097	2.2
Growth Rate	4.0%	3.0%	-	3.5%	-	4.1%	-	5.8%	-	3.6%	-

Source: FIBGE, Sinopse Estatística do Brasil-1977.
*Preliminary data.

Table 2. Production of Meat (A), Milk (B) and Cattle Products (C)* Per Head of the Total Herd

Year	Brazil			Northeast			Southeast			South			North & Center-West		
	A (kg/ head)	B (lt/ head)	C (lt/ head)	A (kg/ head)	B (lt/ head)	C (lt/ head)	A (kg/ head)	B (lt/ head)	C (lt/ head)	A (kg/ head)	B (lt/ head)	C (lt/ head)	A (kg/ head)	B (lt/ head)	C (lt/ head)
1956	25.0	80.5	205.5	15.4	29.7	106.7	38.2	143.5	334.5	26.0	56.5	186.5	8.6	40.4	83.4
1957	24.2	81.7	202.7	15.9	30.9	110.4	37.4	144.6	331.6	24.3	57.3	178.8	7.9	42.6	82.1
1958	24.1	83.4	203.9	16.4	41.0	123.0	37.0	147.7	332.7	24.0	63.8	183.8	8.2	28.4	69.4
1959	26.6	84.9	217.9	18.7	42.9	136.4	40.8	148.3	352.3	25.6	65.3	193.3	9.9	31.4	80.9
1960	24.3	87.4	208.9	16.9	46.6	131.1	37.0	151.7	336.7	22.8	66.9	180.9	10.1	33.1	83.6
1961	23.6	86.2	204.2	16.4	46.0	128.0	35.9	153.3	332.8	24.3	66.0	187.5	8.9	27.4	71.9
1962	22.6	88.3	201.3	18.7	42.2	135.7	33.2	157.6	323.6	22.9	63.8	178.3	8.0	37.2	77.2
1963	22.0	86.8	196.8	18.9	48.2	142.7	31.7	152.3	310.8	22.2	66.0	177.0	8.2	33.1	74.1
1964	22.4	93.4	205.4	18.6	54.7	147.7	33.5	168.0	335.5	20.8	76.5	180.5	9.3	22.5	69.0
1965	22.6	99.1	212.1	19.7	59.9	158.4	32.7	170.4	333.9	21.9	83.6	193.1	9.6	34.2	82.2
1966	21.2	97.5	203.5	20.7	59.4	162.9	28.7	167.3	310.8	22.0	85.0	195.0	9.5	32.9	80.4
1967	21.2	94.5	200.5	21.5	61.0	168.0	29.8	167.7	316.7	19.9	80.6	180.1	10.2	24.1	75.1
1968	23.1	94.2	209.7	21.7	61.6	170.1	33.5	161.2	328.7	21.7	84.2	192.7	10.6	30.0	83.0
1969	24.1	92.2	212.7	22.5	63.2	175.7	35.1	161.4	336.9	22.0	79.3	189.3	12.0	26.7	86.7
1970	23.5	90.8	208.3	22.7	58.8	172.3	33.9	161.3	330.8	20.5	77.3	179.8	12.6	28.0	91.0
1971	22.8	88.2	202.2	24.0	53.5	173.5	31.7	157.2	315.7	21.3	75.8	182.3	11.8	28.6	87.6
1972	22.1	86.2	196.7	23.7	54.2	172.7	30.2	154.9	305.9	19.9	76.6	172.1	11.7	26.8	85.3
1973	21.9	88.5	198.0	23.9	56.2	175.7	29.7	147.6	296.1	19.5	85.3	183.8	12.0	32.7	92.7
1974	21.8	100.0	200.0	24.4	64.1	186.1	29.4	159.8	306.8	19.3	99.2	195.7	12.2	44.1	105.1
1975	21.6	107.9	215.9	24.8	66.8	190.8	28.7	169.3	312.8	18.9	114.1	208.6	12.5	45.0	107.5
Geo- metric rate	0.77%	1.55%	0.26%	2.41%	4.13%	4.34%	-1.43%	0.83%	-0.34%	-1.66%	3.57%	0.56%	1.89%	0.54%	1.28%

* Cattle products were taken as the sum of milk and meat in litres of milk, calculated in terms of protein aminoacids common to both. (5 litres of milk = 1 kg of meat).

Source: CEPA/MG. (1977)

Table 3

RATIO MILK/BEEF PRICES (REAL VALUES IN CR\$ OF 1966)													
	1964	65	66	67	68	69	70	71	72	73	74	75	76
RATIO	0.23	0.25	0.23	0.26	0.28	0.29	0.29	0.25	0.22	0.19	0.22	0.29	0.29

SOURCE: Data calculated from Table 19., for beef. Milk data were obtained from FAO, Supply Utilization Accounts and deflated according to column 2 - CONJUNTURA ECÓNOMICA - FGV

TABLE 4 - AGRICULTURAL AND CATTLE INDUSTRY GROSS PRODUCT IN BRAZIL AND IN THE 6 MOST IMPORTANT STATES RELATED TO AGRICULTURE - 1970.

	AGRICULTURAL Gross Product(A)		CATTLE INDUSTRY Gross Product				RELATIVE VALUES (%)				
	Cr\$1,000	%	Animals (B)	%	Milk (C)	%	Total (D)	%	B/A	C/A	D/A
BRASIL	24.967.463	100,0	2.185.046	100,0	1.838.086	100,0	5.023.132	100,0	12,8	7,4	20,2
SÃO PAULO	5.201.907	20,8	483.144	15,2	364.298	19,8	847.442	16,9	9,3	7,0	16,3
RIO GRANDE DO SUL	4.137.726	16,6	503.143	15,8	221.350	12,0	724.493	14,4	12,2	5,3	17,5
PAPANÁ	3.082.873	12,3	211.675	6,6	127.826	7,0	339.501	6,8	6,9	4,1	11,0
MINAS GERAIS	2.998.810	12,0	547.545	17,2	498.173	27,1	1.045.627	20,8	18,3	16,6	34,9
BAHIA	1.519.546	6,1	224.479	7,0	70.267	3,8	294.746	5,9	14,8	4,6	19,4
SANTA CATARINA	1.222.022	4,9	64.118	2,0	106.886	5,8	171.004	3,3	5,2	8,7	13,9
OUTROS	6.804.561	27,3	1.151.033	36,2	449.286	24,5	1.600.319	31,8	16,9	6,6	23,5

Source: Censo Agropecuario 1970. Cited by CEPAC/MG (1977)

* CR\$--Brazilian Currency (Cruzeiros)

TABLE 5.

GROSS DOMESTIC PRODUCT, AGRICULTURAL DOMESTIC PRODUCT AT FACTOR COST AND GROWTH RATES FOR AGRICULTURAL AND LIVESTOCK SECTOR
BRAZIL - 1973/78

YEAR	GROSS DOMESTIC PRODUCT (1970 PRICES) million CR\$	AGRICULTURAL DOMESTIC PRODUCT (1970 PRICES) million CR\$	GROWTH RATE	
			AGRICULTURAL	LIVESTOCK
1973	-	-	3.5	4.0
1974	263,275	32,785	8.5	0.0
1975	273,807	33,900	3.4	14.9
1976	323,664	24,893	4.2	12.2
1977	338,756	27,290	9.6	5.3
1978	360,098 ^(a)	26,826 ^(a)	-1.7	9.7
AVERAGE 1973/78	-	-	4.6	7.7

SOURCE: Economic Survey of Latin America - 1976 and 1978. United Nations
(a) Preliminary data

TABLE 6 - RATES OF GROWTH OF THE REAL PRODUCT (GNP) - BRAZIL
(Average of 5 years period) (%)

SECTOR	1950/54	1955/59	1960/64	1965/69	1970/74	1975/77*
Agriculture	3.9	4.4	4.1	4.7	5.7	5.7
Industry	8.2	10.3	6.7	7.2	12.8	7.0
Total	5.8	6.3	5.9	6.2	11.5	6.5

*Period of 3 years.

Source: IBRE - Fundacao Getulio Vargas, cited by ALVES.(1975).

TABLE 7 - URBAN, RURAL AND TOTAL POPULATION TRENDS IN BRAZIL
(millions)

YEAR	Urban Population		Rural Population		Total	Annual Growth Rate in The Periods (%)
	Number	Percentage of Total	Number	Percentage of Total		
1940	12.8	31.2%	28.4	68.8%	41.2	2.8
1950	18.8	36.2%	33.1	63.8%	51.9	3.2
1960	32.0	45.1%	39.0	54.9%	71.0	2.8
1970	52.1	55.9%	41.1	44.1%	93.2	2.8
1975	64.1	59.9%	43.1	40.1%	107.1	

Source: Data for 1940 and 1950 - United Nations (1961)
Data for 1960, 1970 and, 1975 - IBGE (14)
Data for 1975 are preliminary estimates.

TABLE 8 - RATES OF INFLATION - ANNUAL CHANGES

Year	Rates of Inflation		
	(A) (%)	(B) (%)	(C) (%)
1970	19.2	18.7	19.8
1971	19.8	21.3	20.4
1972	15.5	16.1	17.0
1973	15.7	15.6	15.1
1974	34.5	35.4	28.7
1975	29.4	29.3	27.7

Sources: Central Bank, Conjuntura Economica, Fundacao Getulio Vargas
Cited by MALLAN, P.S., and BONELLI, R., (1977)
(A) General Price Index, Conjuntura Economica, column 2.
(B) Wholesale Price Index, Conjuntura Economica, column 12.
(C) GDP Implicit deflation.

TABLE 9

Balance of payments: 1968-75 - summary accounts
(US \$ million)

	1968	1969	1970	1971	1972	1973	1974	1975
I. Trade balance	+ 26	+ 318	+ 232	- 341	- 244	+ 7	- 4,684	- 3,514
Exports (FOB)	+ 1,881	+ 2,311	+ 2,739	+ 2,904	+ 3,991	+ 6,199	+ 7,951	+ 8,655
Imports (FOB)	- 1,855	- 1,993	- 2,507	- 3,245	- 4,235	- 6,192	-12,635	- 12,169
II. Balance of Services	- 556	- 630	- 815	- 930	- 1,250	- 1,722	- 2,463	- 3,450
Non-factor services	- 256	- 299	- 397	- 490	- 649	- 965	- 1,490	- 1,637
Factor services	- 300	- 351	- 418	- 450	- 601	- 757	- 973	- 1,813
-(interest costs)	(- 156)	(- 204)	(- 284)	(- 344)	(- 489)	(- 839)	(- 1,355)	(- 1,776)
III. Current account deficit	- 530	- 312	- 583	- 1,321	- 1,494	- 1,715	- 7,147	- 6,964
IV. Capital account	+ 541	+ 871	+ 1,015	+ 1,846	+ 3,492	+ 3,512	+ 6,235	+ 5,912
Direct investment	+ 61	+ 177	+ 132	+ 168	+ 318	+ 940	+ 887	+ 877
Loans and financing	+ 583	+ 1,023	+ 1,433	+ 2,037	+ 4,299	+ 4,495	+ 6,886	+ 5,177
Amortizations	- 484	- 493	- 672	- 850	- 1,202	- 1,672	- 1,940	- 2,088
Short-term capital	+ 381	+ 164	+ 122	+ 491	+ 77	- 251	+ 402	+ 1,946
V. Overall balance ^a (III + IV)	+ 32	+ 549	+ 545	+ 530	+ 2,439	+ 2,179	- 938	- 1,052

Source: Banco Central do Brasil, for 1975 preliminary estimates.

^aIt is not exactly the algebraic sum of III and IV due to the 'Error and Omissions' item.

Cited by MALLAN, P.S., and BONELLI, R., (1977)

TABLE 10

PRODUCTION OF BEEF AND RESPECTIVE VALUE - 1964/76 YEARS PRODUCTION VALUE - at - 1,000,000 (1,000 MT) (list of 1966) (1)		
1964	1,437	1,063
1965	1,497	464
1966	1,452	990
1967	1,506	867
1968	1,694	864
1969	1,826	918
1970	1,845	987
1971	1,794	1,078
1972	2,095	1,506
1973	2,202	2,036
1974	2,120	2,143
1975	2,157	1,808
1976	2,176	1,569

Source: FAO - Supply Utilization Account - Several Years.

(1) Real prices were calculated using as deflator the index of column 2 of CONJUNTURA ECONOMICA - FGV.

TABLE 11

AVAILABILITY OF BEEF IN CARCASS PER PERSON - 1964/76								
YEAR	1960	1970	1971	1972	1973	1974	1975	1976
AVAILABILITY KG/PERSON/YEAR	19.1	19.8	18.7	21.7	21.7	20.3	20.1	19.8

Source: Data calculated for the period 1970/76 using population estimates of FIBGE. ANUARIO ESTATISTICO DO BRASIL - 1978
For 1960, data taken from: SUBSIDIOS PARA PROGRAMAGAO DA PECUARIA BOVINA MINEIRA - CEPA/MG (1977).

TABLE 12

TOTAL EXPORT OF BEEF, RESPECTIVE VALUE AND PARTICIPATION IN TOTAL BRAZILIAN EXPORTS.

YEAR	QUANTITY EXPORTED (MT) (1)	VALUE OF EXPORTS (CURRENT US DOLLAR) (2)	PARTICIPATION IN TOTAL BRAZILIAN EXPORTS (%) (3)	VALUE PER MT OF EXPORTS (FOB) (CURRENT DOLLARS) per ton (4)
1964	43,957	21,087	-	479
1965	92,541	44,626	-	482
1966	52,294	27,326	-	523
1967	31,087	15,159	-	488
1968	87,687	41,600	-	474
1969	126,947	63,368	-	499
1970	140,477	89,092	3.2	634
1971	171,168	156,354	4.6	914
1972	233,700	231,602	5.8	991
1973	185,790	229,841	3.7	1,237
1974	109,669	129,096	1.4	1,177
1975	105,018	86,634	0.9	825
1976	167,266	145,237	1.2	868

SOURCE: Column 1 and 2 - FAO - Supply Utilization Account - Several Years

Column 3 - BRANT (1977)

Column 4 - Is the result of division of Column 2 by Column 1.

TABLE 13

EXPORTS OF FRESH, FROZEN AND INDUSTRIALIZED BEEF BRAZIL - 1968/76

YEAR	FRESH AND FROZEN BEEF	% of TOTAL	INDUSTRIALIZED BEEF	% of TOTAL	TOTAL
	(TON)		(TON)		(TON)
1968	39,200	34	49,000	56	88,200
1969	77,500	61	49,200	39	126,700
1970	98,300	69	44,000	31	142,300
1971	88,700	50	88,000	50	176,700
1972	155,600	62	94,000	38	249,600
1973	98,500	52	92,300	48	190,800
1974	19,000	17	90,200	83	109,200
1975	5,000	4	106,300	96	111,300
1976	11,500	7	163,000	93	174,500

SOURCE: BRANT (1977)

TABLE 14

PRODUCTION OF BEEF, NUMBER OF ANIMALS SLAUGHTERED AND
CARCASS WEIGHT - 1964/76

YEAR	PRODUCTION		ANIMALS SLAUGHTERED		CARCASS WEIGHT	
	(1,000 MT)	INDEX 1964=100	1,000 HEADS	INDEX 1964=100	KG/ ANIMAL	INDEX 1964=100
1964	1,437	100	7,523	100	191	100
1965	1,497	102	7,843	104	191	100
1966	1,452	101	7,608	101	191	100
1967	1,506	105	7,810	104	193	101
1968	1,694	118	8,732	116	194	102
1969	1,826	127	9,480	126	193	101
1970	1,845	128	9,560	127	193	101
1971	1,794	125	9,284	123	193	101
1972	2,095	146	10,856	141	193	101
1973	2,202	153	11,409	152	193	101
1974	2,120	148	10,500	140	202	106
1975	2,157	150	11,000	146	196	103
1976	2,176	151	10,715	142	203	106

SOURCE: FAO - Supply Utilization Account - Several Years.

TABLE 15

INDICES FOR GROWTH OF PRODUCTION OF MILK AND TOTAL NUMBER OF COWS MILKED - 1964/76 - (1964=100)

YEAR	PRODUCTION OF MILK	COWS MILKED
1964	100	100
1965	107	105
1966	109	113
1967	109	113
1968	114	113
1969	114	116
1970	116	119
1971	116	124
1972	116	125
1973	122	122
1974	142	136
1975	157	157
1976	168	167

SOURCE: FAO - SUPPLY UTILIZATION ACCOUNT - Several Years

TABLE 16

SIZE OF THE HERD AND PERCENTUAL COMPOSITION

YEAR	HERD		PERCENTUAL COMPOSITION (2)	
	(1,000 HEAD)	INDEX (1) 1964=100	ESTIMATES FOR 1978	%
			CATEGORY	
1964	61,733	100	BULLS	1.55
1965	63,832	103	COWS	31.25
1966	66,002	107	MALES UP 1 YEAR	9.53
1967	68,246	111	FEMALES UP 1 YEAR	9.53
1968	70,567	114	MALES 1 - 2 YEARS	8.56
1969	72,966	118	FEMALES 1 - 2 YEARS	8.56
1970	75,447	122	MALES 2 - 3 YEARS	8.02
1971	78,562	127	FEMALES 2 - 3 YEARS	8.02
1972	83,000	134	MALES 3 - 4 YEARS	7.49
1973	85,500	139	FEMALES 3 - 4 YEARS	7.49
1974	90,437	147		
1975	92,495	150		
1976	92,000	149	TOTAL	100.00

SOURCE: (1) FAO - SUPPLY UTILIZATION ACCOUNT - Several Years

(2) MATOSO, J., and FRANCO, H.F., (1977)

TABLE 17

NUMBER OF ANIMALS SLAUGHTERED AS PERCENTAGE OF THE TOTAL HERD - 1964/76

YEAR	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	AVERAGE 1964/76
%	12.2	12.3	11.5	11.4	12.4	13.0	12.7	11.8	13.1	13.3	11.6	11.9	11.6	12.2

SOURCE: DATA CALCULATED FROM FAO - SUPPLY UTILIZATION ACCOUNT - Several Years

TABLE 18 - ESTIMATES OF EVOLUTION OF THE TOTAL AREA OF PASTURE AND CARRYING CAPACITY IN BRAZIL - 1960/75

Year	Total Pasture (Million ha.)	Carrying Capacity (head/ha)	Native Pasture (Mill.ha)	% of total Pasture	Improved Pasture (Mill./ha)	% of total Pasture
1960	130.4	0.43	-	-	-	-
1970	154.1	0.51	124.4	81%	29.7	19%
1975	167.4	0.60	-	-	-	-
Total area Incorporat.	37.0	-	-	-	-	-
Annual Growth	1.7%	2.2%	-	-	-	-

SOURCE: IBGE. For 1970 data were taken from "Censo Agropecuario-Brazil 1970". For 1960 and 1975, data were estimated taking the same proportion of pasture as in 1970.

TABLE 19

PRODUCTION OF BEEF/HEAD - 1964/76

YEAR	UNITS	AVERAGE OF 2 PREVIOUS YEARS
1964	23.30	23.14
1965	23.45	23.04
1966	21.99	23.36
1967	22.09	22.73
1968	24.00	22.03
1969	25.02	23.04
1970	24.45	24.52
1971	22.80	24.74
1972	25.24	23.64
1973	25.75	24.04
1974	23.44	25.50
1975	23.33	24.60
1976	23.65	23.38

SOURCE: DATA CALCULATED FROM TABLE 14 and 16.

TABLE 20

REAL PRICES OF BEEF RECEIVED BY PRODUCERS, CURRENT PRICES OF BEEF EXPORTED AND INDICES

YEAR	PRICES RECEIVED BY PRODUCERS		AVERAGE PRICES CURRENT + 2 YEARS		PRICES OF BEEF EXPORTED	
	VALUE/MT (CR\$ of 1966)	INDEX 1964=100	VALUE/MT (CR\$ of 1966)	INDEX 1964=100	VALUE/MT (FOB) (US Dollar)	INDEX 1964=100
1964	740	100	671	100	479	100
1965	310	42	552	82	482	101
1966	682	92	577	86	523	109
1967	576	78	523	78	488	102
1968	510	69	589	88	474	99
1969	503	68	530	79	499	104
1970	535	72	516	77	634	132
1971	601	81	546	81	914	191
1972	719	97	618	92	991	207
1973	925	125	748	111	1,237	258
1974	1,011	137	885	132	1,177	246
1975	838	113	925	138	825	172
1976	721	97	857	128	868	181

SOURCE: (1) 1961-72 - CURRENT PRICES TAKEN FROM FAO
1973-76 - CURRENT PRICES EXTRAPOLATED BASED ON INDEX OF PRICES RECEIVED BY
FARMERS FOR STEERS - COLUMN 205 - CONJUNTURA ECONOMICA - F.G.V.
REAL PRICES WERE CALCULATED USING INDEX OF COLUMN 2 OF CONJUNTURA ECONOMICA - F.G.V.
(2) PRICES OF BEEF EXPORTED ARE TAKEN FROM FAO SUPPLY UTILIZATION ACCOUNT--several years.

TABLE 21

REAL PRICES OF INPUT PER METRIC TON OF BEEF PRODUCED.

YEAR	VALUES CR\$ OF 1966	INDEX 1964=100
1964	271	100
1965	129	47
1966	224	83
1967	229	85
1968	212	78
1969	262	97
1970	246	91
1971	232	86
1972	249	92
1973	274	101
1974	279	103
1975	280	103
1976	255	94

SOURCE: DATA CALCULATED AS EXPLAINED IN THE APPENDIX.

TABLE 22

RATIO PRICE OF BEEF/PRICE OF INPUTS

YEAR	RATIO	INDEX 1964=100
1964	2.73	100
1965	2.40	88
1966	3.04	111
1967	2.51	92
1968	2.41	88
1969	1.92	70
1970	2.17	79
1971	2.59	95
1972	2.89	106
1973	3.38	124
1974	3.62	133
1975	2.99	110
1976	2.83	104

SOURCE: DATA CALCULATED FROM TABLE 20 AND 21

TABLE 23

VALUES OF CREDIT APPLIED TO LIVESTOCK 1964/76

YEAR	CURRENT YEAR		AVERAGE OF 4 YEARS	
	CR\$ of 1972/head	INDEX 1964=100	CR\$ of 1972/head	INDEX 1964=100
1964	8.52	100	7.48	100
1965	4.56	54	7.04	94
1966	9.18	108	7.29	97
1967	10.58	124	8.21	110
1968	13.26	156	9.40	126
1969	14.55	171	11.89	159
1970	14.59	171	13.25	177
1971	21.18	249	15.90	213
1972	24.73	290	18.76	251
1973	35.68	419	24.05	322
1974	37.56	441	29.78	398
1975	71.48	839	42.36	566
1976	65.15	765	52.47	701

Source: FIBGE, ANUARIO ESTATISTICO DO BRASIL--several years and MENDONÇA BARROS, J.R., and GRAHAM, D.H., (1977). DETAILED EXPLANATION IS GIVEN IN THE APPENDIX.

TABLE 24

WEIGHED VALUE OF RAINFALL FOR BRAZIL AND AVERAGE VALUE OF 4 YEARS

YEAR	CURRENT YEAR		AVERAGE OF 4 YEARS	
	VALUE (mm)	INDEX 1964=100	VALUE (mm)	INDEX 1964=100
1964	1,357	100	1,265	100
1965	1,557	115	1,315	104
1966	1,520	112	1,390	110
1967	1,292	95	1,432	113
1968	1,459	108	1,457	115
1969	1,370	101	1,410	111
1970	1,405	104	1,382	109
1971	1,519	112	1,438	114
1972	1,661	122	1,489	118
1973	1,534	113	1,530	121
1974	1,433	106	1,537	122
1975	1,477	109	1,519	120
1976	1,516	112	1,483	117

SOURCE: ANUARIO ESTATISTICO DO BRASIL - FIBGE - SEE THE APPENDIX.

Table 25. NUMBER OF INHABITANTS PER SCHOOL AND NUMBER OF FARMS PER EXTENSION OFFICE--BRAZIL AND MINAS GERAIS

	Brazil	Minas Gerais
Inhabitants/School of 1st degree (1)	553	650
Inhabitants/School of 2nd degree (2)	9576	9937
Farms/Extension Office (2)	3023	1596

Source: FIBGE: ANUARIO ESTATISTICO DO BRASIL--1978

- (1) Data for 1974. 1st degree = 8 years; 2nd degree = 3 years
- (2) Data for 1975, exclusive Sao Paulo

FIGURES 1 - 8

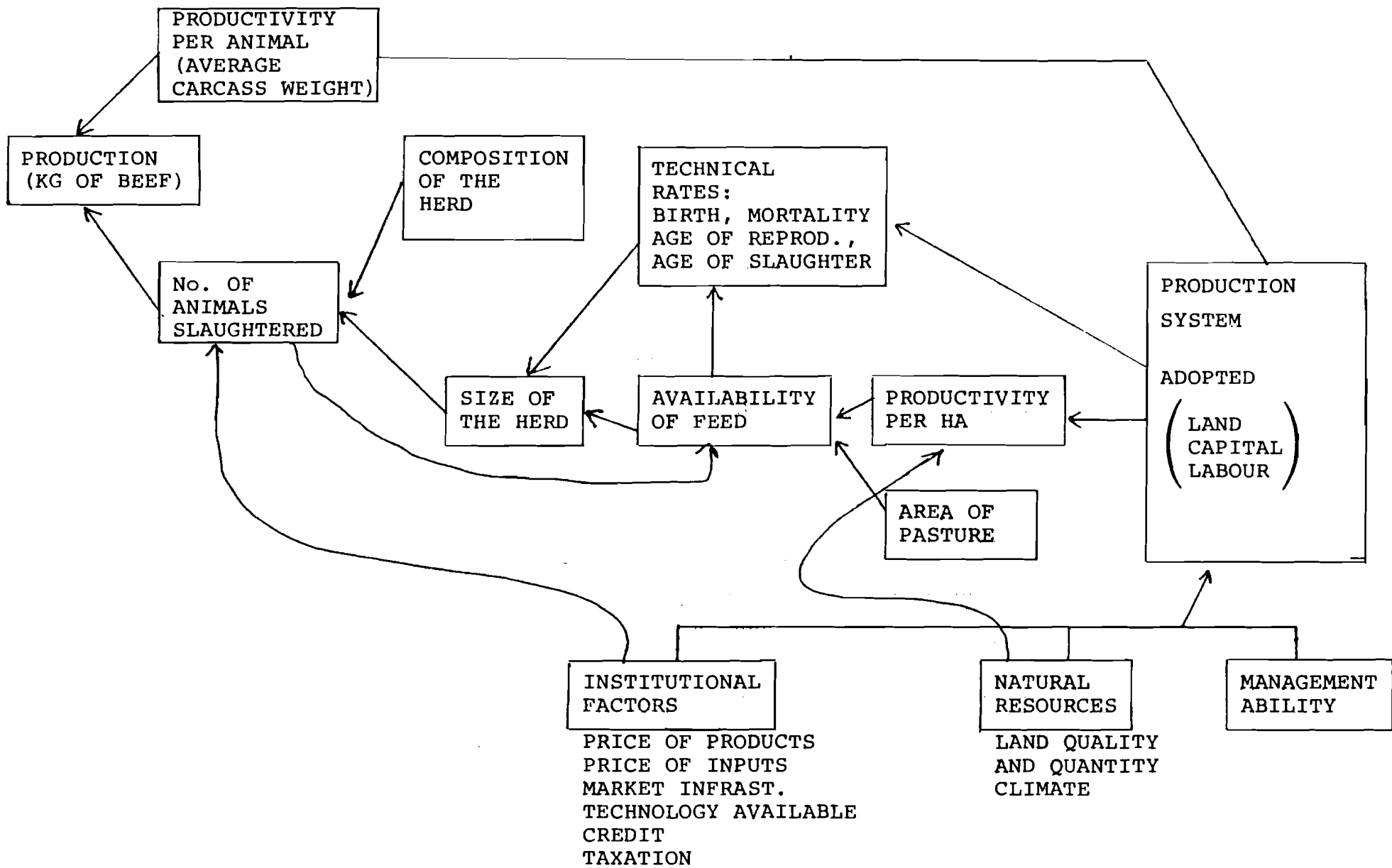
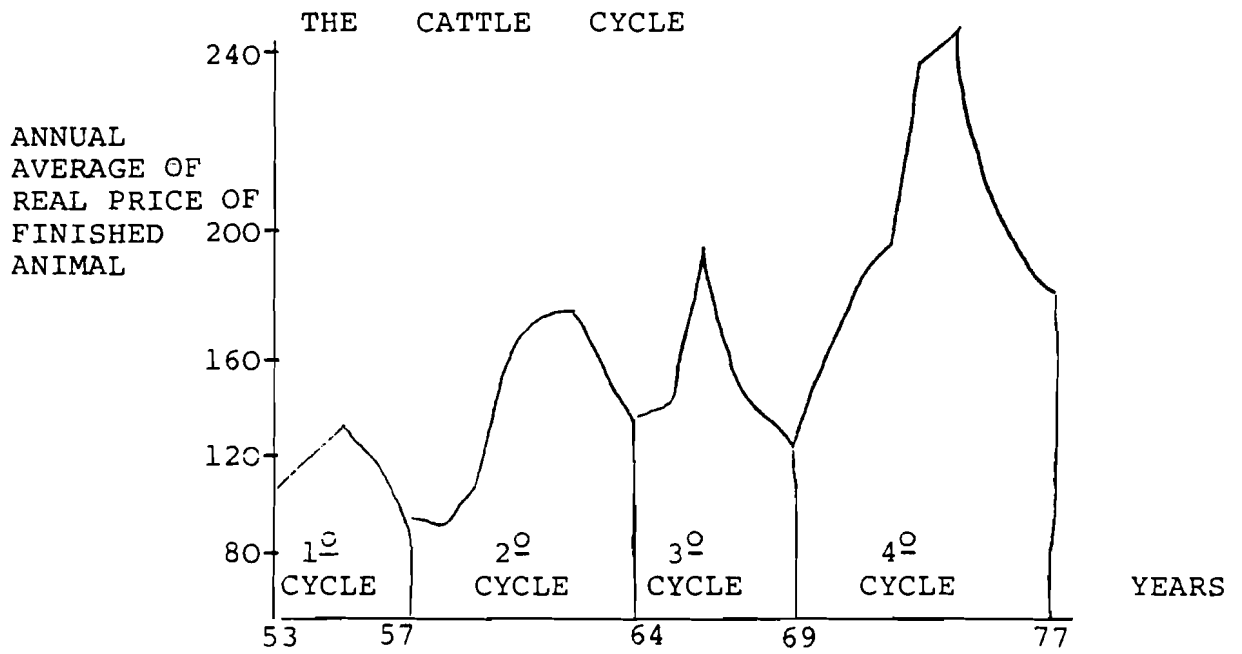


FIG. 1.

Figure 2.



SOURCE: Fundacao Getulio Vargas (Agroanalysis), (1977)

FIGURE 3: INDICES FOR PRODUCTION OF BEEF, NUMBER OF ANIMALS SLAUGHTERED, CARCASS WEIGHT AND TOTAL HERD--(1964=100) (DATA FROM TABLES 14 and 16)

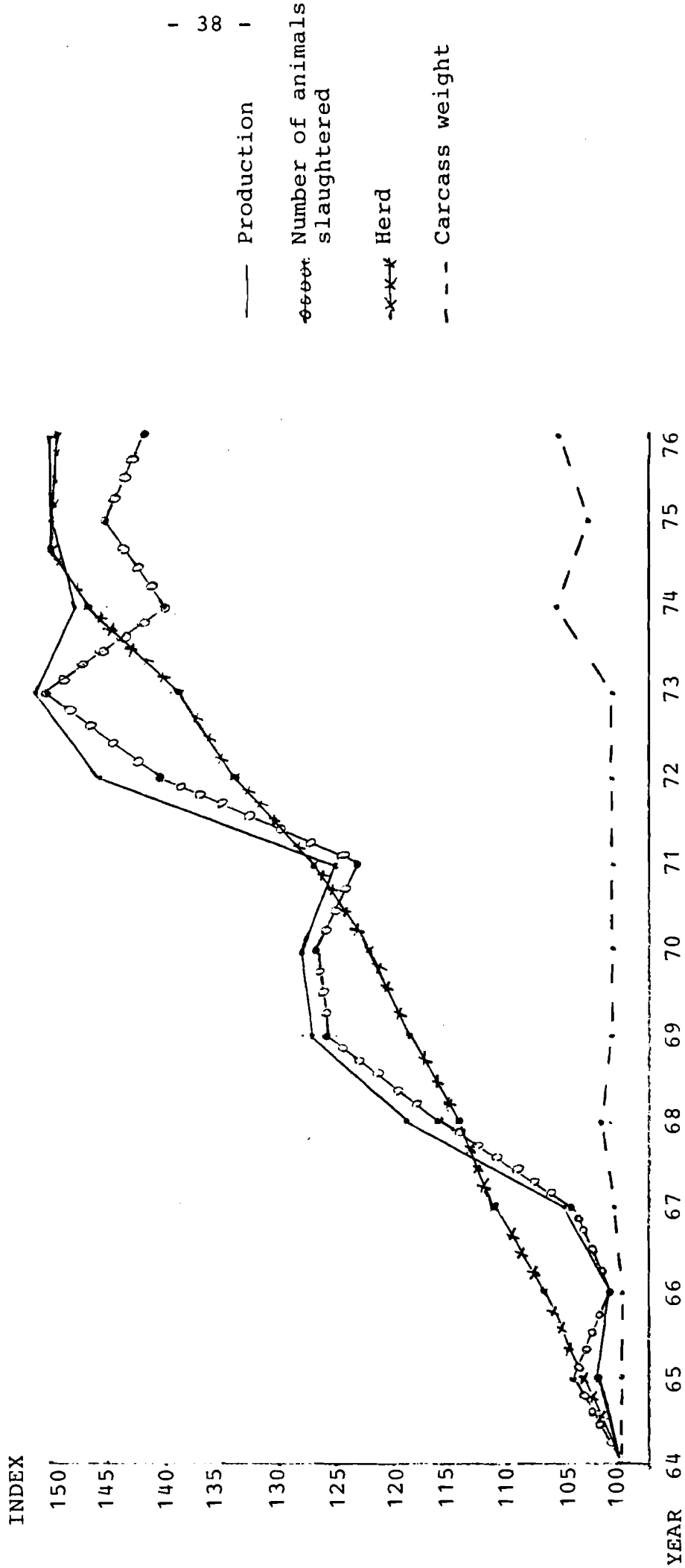


FIGURE 4: INDICES FOR PRODUCTION OF BEEF AND PRICE OF BEEF EXPORTED (DATA FROM TABLE 14 AND 20)

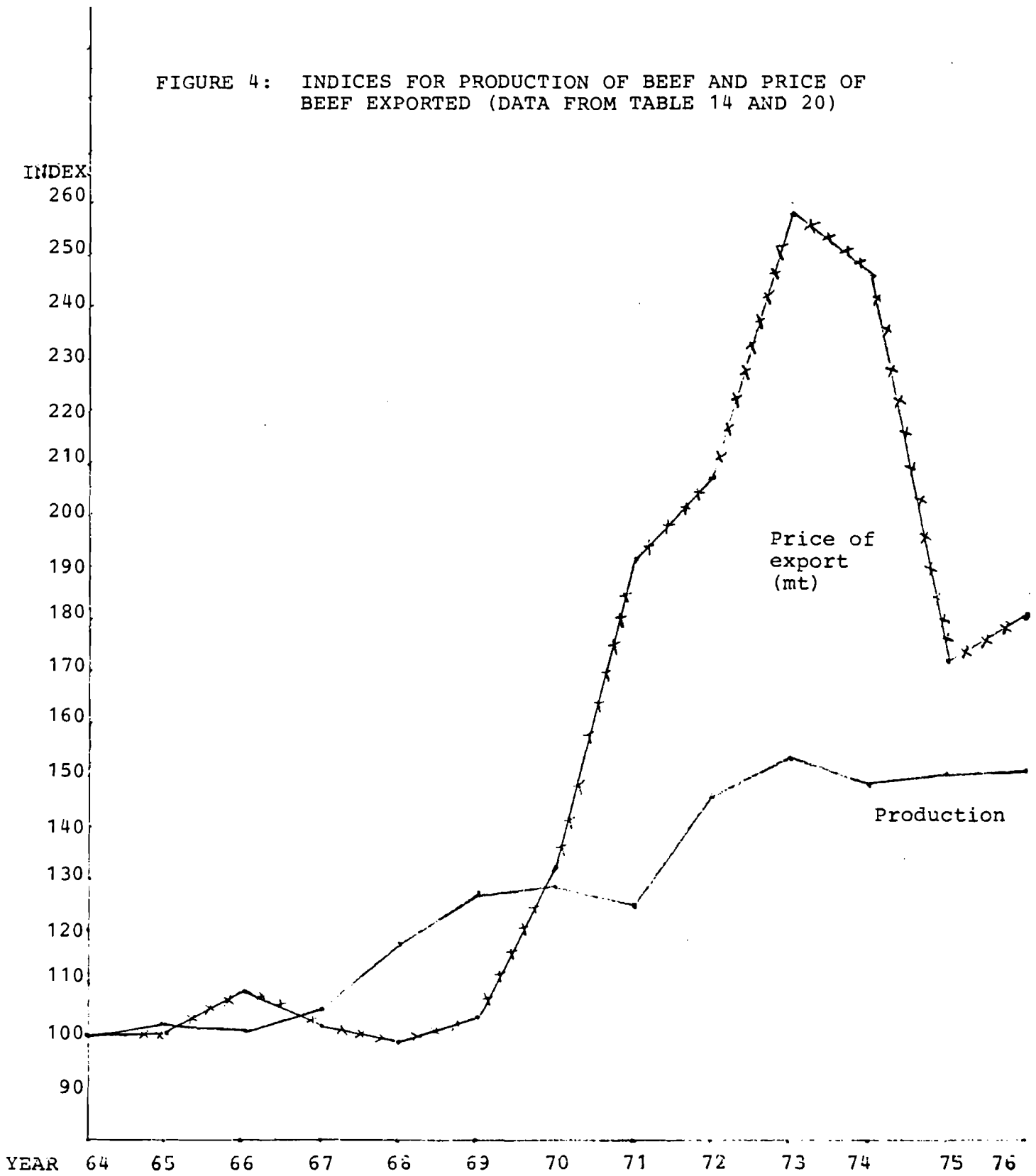


FIGURE 5: TOTAL PRODUCTION OF BEEF AND PRODUCTION OF BEEF PER HEAD OF CATTLE--AVERAGE OF 2 YEARS
 (DATA FROM TABLE 14 AND 19)

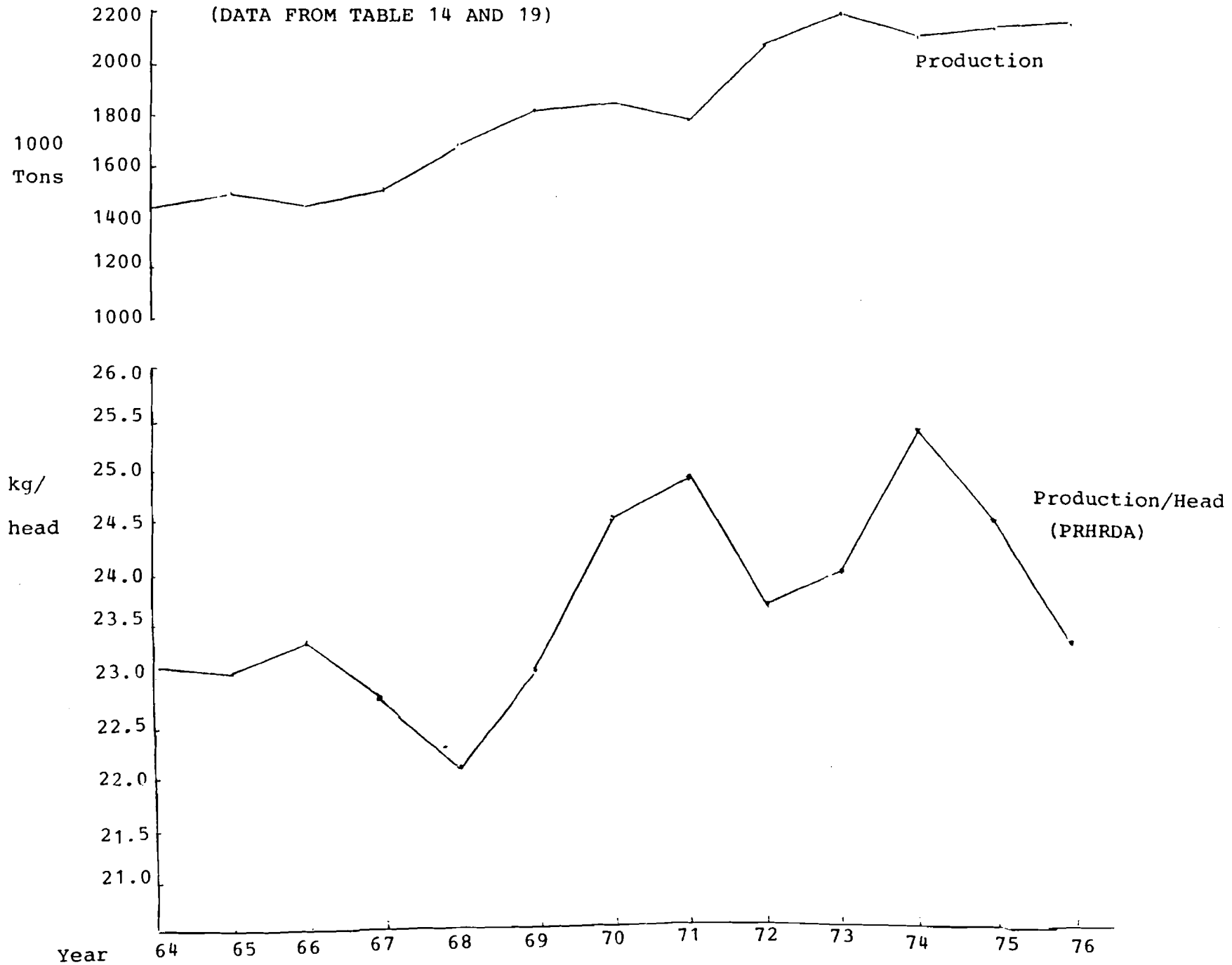


FIGURE 6: INDICES FOR PRODUCTION OF BEEF, REAL PRICES OF BEEF AND RATIO BEEF/INPUT PRICES (DATA FROM TABLE 14, 20 AND 22)

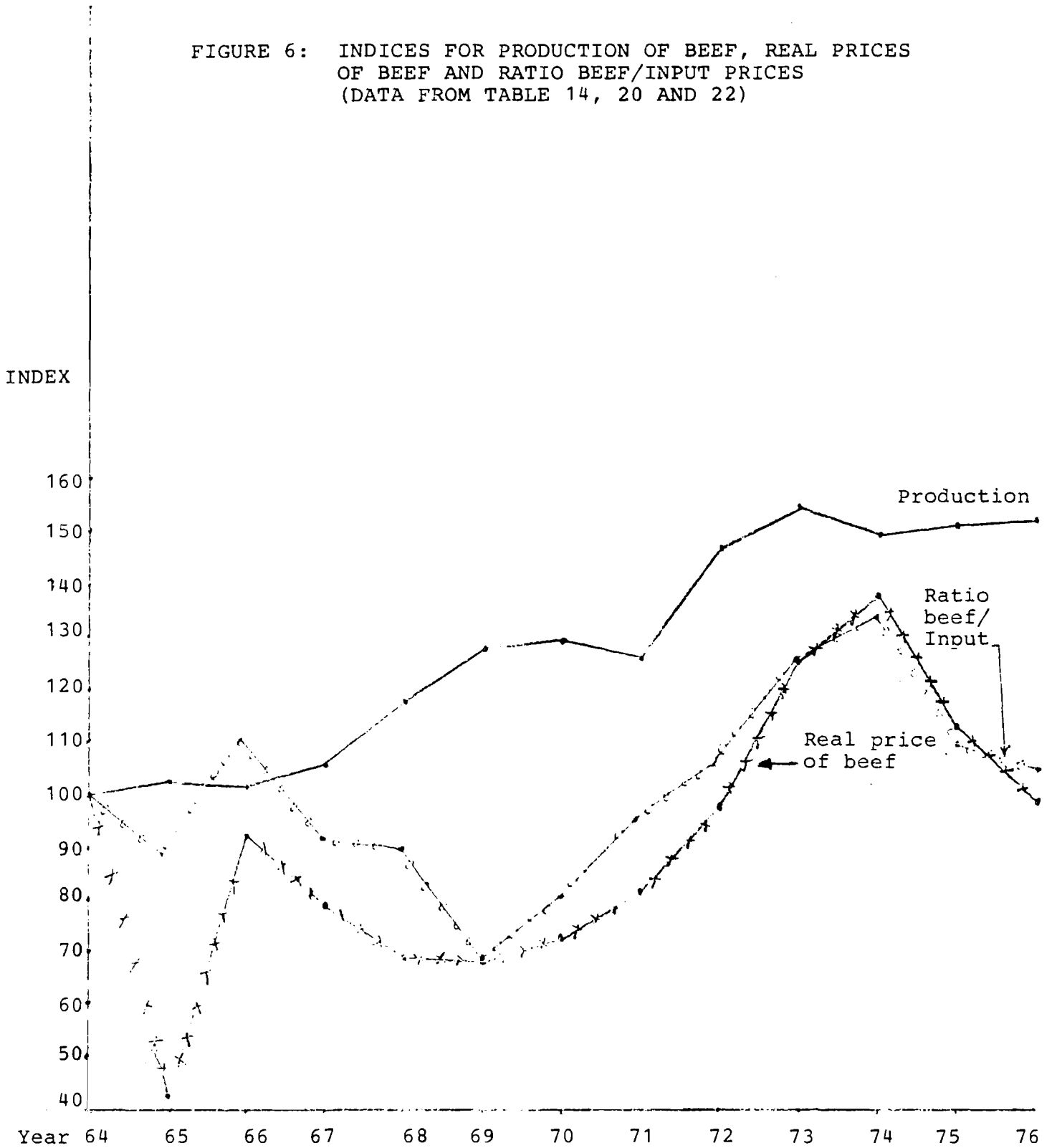


FIGURE 7: INDICES FOR THE TOTAL HERD AND AVERAGE OF RAINFALL IN THE PREVIOUS YEARS (RAINA)

(DATA FROM TABLE 16 AND 24)

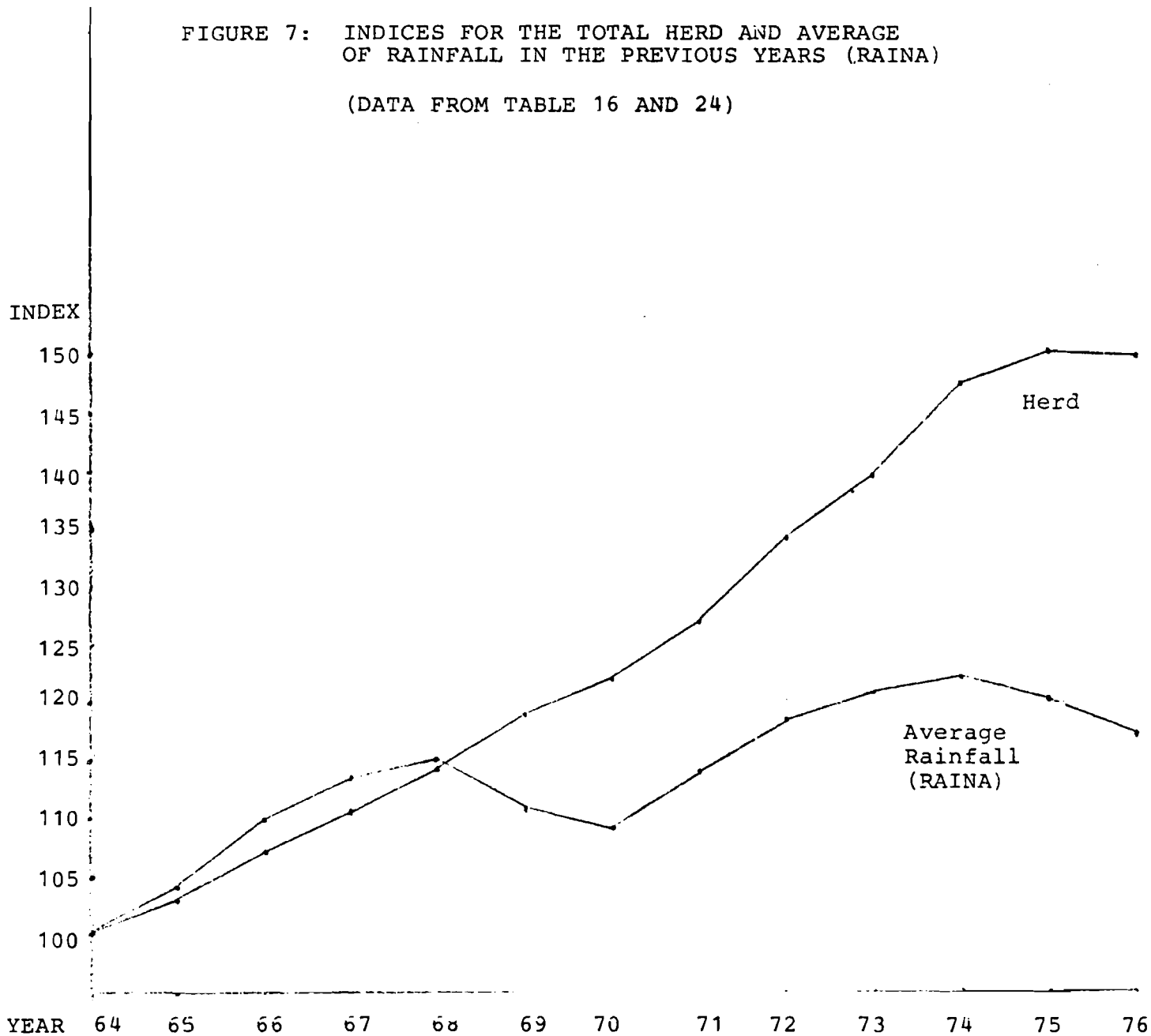
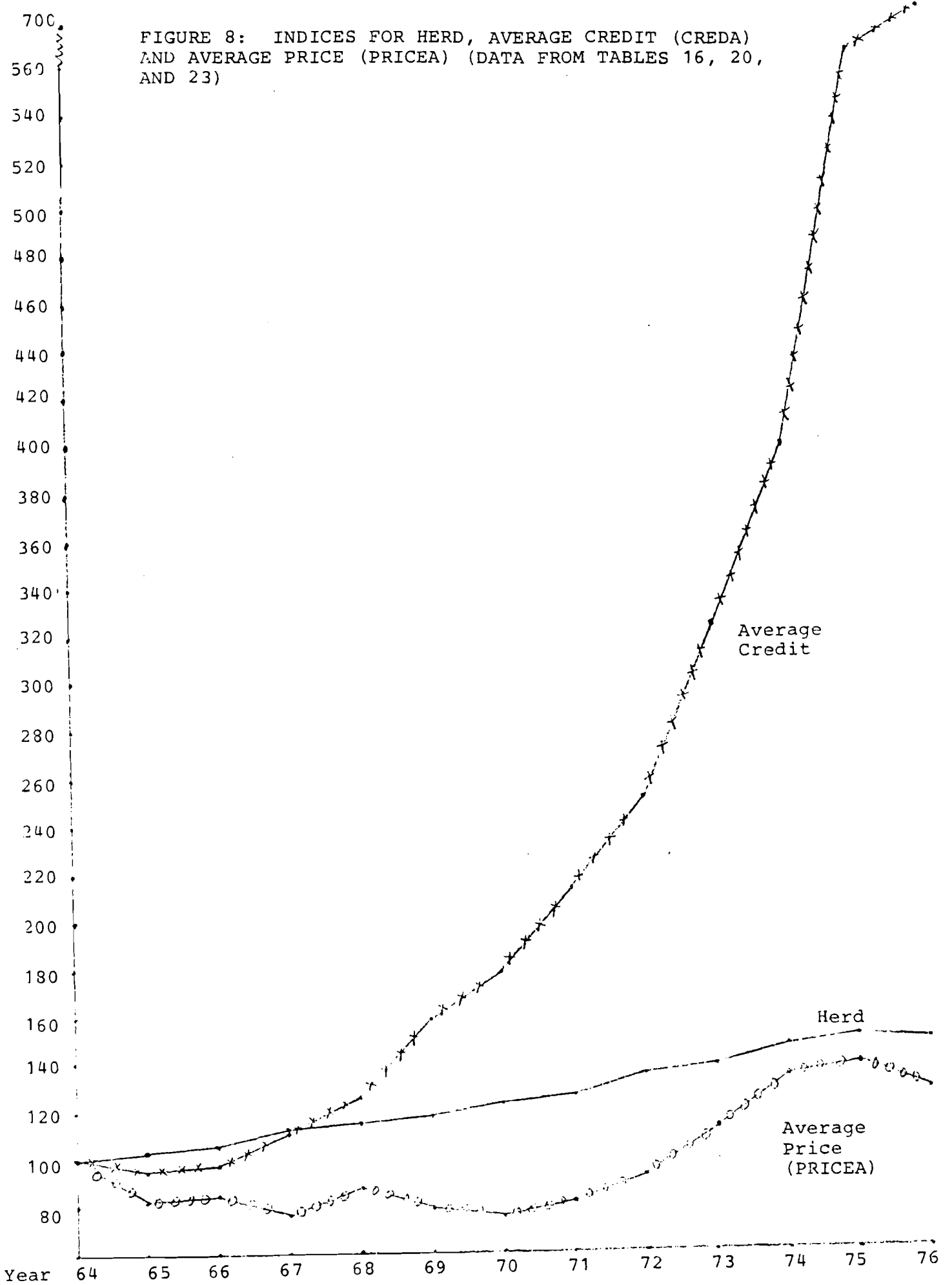


FIGURE 8: INDICES FOR HERD, AVERAGE CREDIT (CREDA) AND AVERAGE PRICE (PRICEA) (DATA FROM TABLES 16, 20, AND 23)



APPENDIX A: SOURCE OF DATA

The basic sources of data were

- a) FAO-SUPPLY UTILIZATION ACCOUNT - Several years.
These data were collected and processed by the
FAP Team of IIASA.
- b) ANUARIO ESTATISTICO DO BRASIL - FIBGE - Several years.
- c) CONJUNTURA ECONOMICA - FUNDACAO GETULIO VARGAS -
Several issues.

APPENDIX B: ESTIMATION OF INDEX FOR INPUT COST

- (1) From the composition of the operational cost (TABLE .) FEED and FUEL were taken to compose a weighed index being Feed = 75% and Fuel = 25%.
- (2) To estimate the cost of feed per kg. of beef for the previous years a FEED INDEX was constructed (TABLE .) based on column 105 of FGV and CURRENT PRICES FOR MAIZE, taken from FAO - Supply Utilization Account - Several years- and using a regression of prices of Maize on the index of the Column 105.
- (3) Based on that index, current prices were calculated for 1964/75*and deflated according to column 2 of FGV, taking 1966=100 (TABLE).
* Starting from the current price for 1976.
- (4) Those real values multiplied by 0.75 produced the weighed value of FEED for input cost (TABLE).
- (5) The cost of FUEL per Kg., of beef was estimated from an Index of current prices based on data of column 20 of FGV (CONJUNTURA ECONOMICA Volume 29, No. 2 - Feb.1975 page 226)and column 78 of FGV, using a regression equation (TABLE)

- (6) Based on that index, current prices were calculated for 1964/75*and deflated according to column 2. of FGV, taking 1966=100. (TABLE).
* Starting from the current price for 1976.
- (7) These real values multiplied by 0.25 produced the weighed value of fuel for input cost (TABLE).
- (8) The sum of weighed value of FEED and FUEL gave the weighed input cost, taken as an input index. (TABLE).

TABLE A

COMPOSITION OF OPERATIONAL COST OF BEEF (1976)

INPUTS	CR\$ /Kg. of beef	PERCENTUAL	PARTICIPATION
		IN SUBTOTAL	FEED + FUEL
REPAIRS (BUILDING AND MACHINERY)	0.44	10.0	
FEED	2.64	60.0	75.0
VACCINES AND DRUGS	0.42	10.0	
FUEL	0.88	20.0	25.0
SUB TOTAL	4.38	100.0	100.0
LABOUR (HIRED)	2.14		
EFFECTIVE OPERATIONAL COST	6.52		
DOMESTIC LABOUR	0.91		
DEPRECIATION (BUILDINGS MACHINERY)	1.22		
TOTAL OPERATIONAL COST	8.65		

SOURCE: Saturnino, M.A.C., "Panorama Geral da Economia Bovina Mineira" (1977) MINEO.

Data were calculated by EMATER-MG for the State of Minas Gerais and refer to cost of rearing, growing and fattening in 1976.

TABLE B

ESTIMATION OF INDICES TO CALCULATE
COST OF INPUTS (FEED)

YEAR	FEED INDEX FOR CURRENT PRICES (1969=100)	CURRENT PRICES FOR MAIZE (CR\$/MT)	INDEX OF CURRENT PRICES FOR FEED- AND SALT (COL. 105)
1964	25	40	-
1965	17	28	-
1966	44	71	-
1967	58	93	-
1968	66	106	-
1969	100	136	100
1970	113	155	113
1971	128	184	128
1972	160	253	160
1973	203	363	203
1974	263	-	263
1975	334	-	334
1976	420	-	420

SOURCE: 1969/76 - Index of Column 105 - CONJUNTURA ECONOMICA FGV.
1964/68 - Index Estimated Based on Regression of Prices
of Maize on the Index. Prices of Maize were taken from
FAO.
The regression was based on 5 years (1969/73).

TABLE C

COST OF FEED TO PRODUCE 1 KG. OF BEEF

YEAR	INDEX OF CURRENT PRICES (1) 1969=100(CR\$/MT)	COST OF FEED/KG. OF BEEF		WEIGHED COST OF FEED FOR INPUT COST (4) (CR\$ 1966/MT)
		CURRENT PRICE (2) (CR\$/MT)	REAL PRICE (3) (CR\$ 1966/MT)	
1964	25	157	340	255
1965	17	107	148	111
1966	44	277	277	208
1967	58	365	285	214
1968	66	415	261	196
1969	100	630	328	246
1970	113	710	308	231
1971	128	800	289	217
1972	160	1,000	309	232
1973	203	1,280	343	257
1974	263	1,650	344	258
1975	334	2,100	343	257
1976	420	2,640	305	229

SOURCE: (1) 1969-76 - Column 105, Conjuntura Economica - F.G.V.

1964-68 - Extrapolated from current prices for
Maize (FAO)

- (2) Based on indices of Column (1) starting
with data for 1976, taken from Table 1.
- (3) Calculated using deflator Index - Column 2 of
Conjuntura Economica - F.G.V.
- (4) Calculated using a weight of 0.75,
the participation of feed in the total cost of
FEED + FUEL (SEE TABLE A).

TABLE D

ESTIMATION OF INDEX FOR FUEL TO CALCULATE COST OF INPUTS

YEAR	FUEL INDEX FOR CURRENT PRICES 1969=100	Index for Current Prices of Oils and Lubrificants	
		Column 78 1969=100	Column 20 1965-67=100
1964	24	-	44.5
1965	43	-	80.2
1966	53	-	99.7
1967	64	-	120.0
1968	82	-	155.0
1969	100	100	195.0
1970	119	119	225.0
1971	146	146	276.0
1972	185	185	350.0
1973	212	212	401.0
1974	338	338	-
1975	464	464	-
1976	737	737	-

(1) 1969-76 INDEX was taken from Column 78 of CONJUNTURA ECONOMICA - FGV.

1964-68 INDEX was estimated based on indices available in column 20 - CONJUNTURA ECONOMICA for 1961/73, (Volume 29 No. 2 FEB of 1975). A regression equation was estimated, taking 5 year time series (1969/73) being $Y=dX + \epsilon$ where Y = FUEL INDEX X = INDEX of Column 20 for FUEL.

TABLE E

YEAR	INDEX OF CURRENT PRICES FOR FUEL (1969=100)	CR\$ OF FUEL/KG OF BEEF -		WEIGHED COST OF FUEL FOR INPUT COST (4) (CR\$ of 1966/MT)
		CURRENT PRICE (2) (CR\$/MT)	REAL PRICE (3) (CR\$ 1966/MT)	
1964	24	29	63	15.8
1965	43	51	71	17.8
1966	53	63	63	15.8
1967	64	76	59	14.8
1968	82	98	62	15.5
1969	100	120	63	15.8
1970	119	140	61	15.3
1971	146	170	61	15.3
1972	185	220	68	17.0
1973	212	250	67	16.8
1974	338	400	83	20.8
1975	464	550	90	22.5
1976	737	880	102	25.5

- SOURCE: (1) 1969-76 Column 78 - CONJUNTURA ECONOMICA - FGV
1964-68 Calculated Based on Indices of Column 20
CONJUNTURA ECONOMICA - Volume 29, No. 2,
Feb. 1975.
- (2) Based on Indices of Column (1) Starting
with Data for 1976, taken from TABLE A.
- (3) Calculated Using Deflator Index - Column 2 of
CONJUNTURA ECONOMICA - FGV.
- (4) Calculated using a weight of 0.25,
the participation of fuel in the total cost of
feed + fuel (see TABLE A).

TABLE F

WEIGHED COST OF INPUTS (FEED + FUEL)

YEAR	PER MT OF BEEF (CR\$ of 66)
1964	271
1965	129
1966	224
1967	229
1968	212
1969	262
1970	246
1971	232
1972	249
1973	274
1974	279
1975	280
1976	255

SOURCE: TABLE C and TABLE E.

ESTIMATION OF AVERAGE VALUES FOR RAINFALL

- (1) Basic Data for the capital of five states were taken from ANUARIO ESTATISTICO DO BRASIL 1961/77. These comprised 76% of the national herd in 1970.
- (2) The participation of each state was estimated as the percentage of the total (TABLE G) and taken as weights to calculate the average (TABLE H) for each year. These values were used as a rainfall index.
- (3) A second value was calculated for each year as the average of the sum of the current year plus the three previous years. (TABLE I)

TABLE G.

WEIGHTS TO ESTIMATE AVERAGE RAINFALL

ESTATES	HERD (1,000 heads)	% ON THE NATIONAL HERD	WEIGHT AS THE % ON THE 5 ESTATES
MG	15,109	19.2	0.25
RS	12,299	15.7	0.21
MT	9,420	12.0	0.16
SP	9,091	11.6	0.15
GO	7,781	10.0	0.13
BA	5,639	7.2	0.10
<hr/>			
TOTAL	59,339	75.7	1.00

SOURCE: FIBGE - ANUARIO ESTATISTICO DO BRASIL (1973).

TABLE H.

WEIGHED VALUE OF RAIN (MM/YEAR)

YEAR	MG ⁽¹⁾	RS	MT ⁽²⁾	SP ⁽³⁾	GO	BA ⁽⁴⁾	TOTAL
1961	353	326	187	217	182	95	1,359
1962	352	149	185	208	189	139	1,222
1963	261	277	175	134	138	139	1,124
1964	399	218	183	207	211	139	1,357
1965	443	219	214	276	221	184	1,557
1966	380	319	170	221	209	221	1,520
1967	330	226	150	210	182	194	1,292
1968	362	237	251	169	190	250	1,459
1969	349	196	160	199	221	245	1,370
1970	276	267	209	249	210	194	1,405
1971	363	236	200	211	228	281	1,519
1972	360	417	237	220	222	205	1,661
1973	346	286	222	215	217	248	1,534
1974	345	237	219	207	170	255	1,433
1975	325	270	204	193	188	267	1,447
1976	289	326	205	318	236	142	1, 16

SOURCE: ANUARIO ESTATISTICO DO BRASIL - FIBGE - Several Years

- (1) Data for 1963 and 1964 were extrapolated regressing the values for GOIAS^(GO) on MG (1961,62,65,66,67,68)
- (2) Data for 1967 was extrapolated regressing values for other states for the average 1966/68 on 1967.
- (3) Data for 1964 were extrapolated regressing the value for Mato Grosso (MT) on SP (1961,62,63,65,66)
- (4) Data for 1972 was extrapolated regressing value for SP on BAHIA (1970,71,73,74,75,76).

TABLE I.

YEAR	AVERAGE RAINFALL (current year + 3 previous years) (mm)
1961	-
1962	-
1963	-
1964	1,265
1965	1,315
1966	1,390
1967	1,432
1968	1,457
1969	1,410
1970	1,382
1971	1,438
1972	1,489
1973	1,530
1974	1,537
1975	1,519
1976	1,483

SOURCE: TABLE H.

ESTIMATION OF CREDIT APPLIED TO LIVESTOCK

- (1) Basic data were taken from ANUARIO ESTATISTICO DO BRASIL (1965/76) as the credit given by the Banco do Brasil to livestock production.
- (2) Real prices in CR\$ of 1972 for 1965/76 were the values deflated according to column 2 of FGV. For 1961/64, figures were estimated using a regression of values of agricultural credit on real value of credit to livestock (TABLE J).
- (3) Values of credit per head were calculated for each year and an average of the current + three last years (TABLE K).

TABLE J.

ESTIMATION OF CREDIT FOR LIVESTOCK FOR THE PERIOD 1961/64

YEAR	CREDIT FOR LIVESTOCK LOANS FROM BANCO DO BRASIL		CREDIT FOR AGRICULTURE ⁽³⁾ (CR\$ 1,000,000 of 1972)
	CURRENT VALUES ⁽¹⁾ (CR\$ 1,000,000)	REAL VALUES ⁽²⁾ (CR\$ 1,000,000 of 1972)	
1961	-	354	3,369
1962	-	472	4,498
1963	-	412	3,929
1964	-	526	5,010
1965	65	291	3,751
1966	186	606	4,652
1967	286	722	5,739
1968	459	936	7,036
1969	629	1,062	11,119
1970	782	1,101	13,003
1971	1,424	1,664	15,122
1972	2,053	2,053	18,669
1973	3,512	3,050	-
1974	5,039	3,396	-
1975	12,522	6,612	-
1976	16,028	5,994	-

SOURCE: (1) ANUARIO ESTATISTICO DO BRASIL - FIBGE - Several Years

(2) 1965-76 Real values calculated using deflator index column 2 - CONJUNTURA ECONOMICA - FGV.

1961-64 Estimated Based on regression of credit for agriculture (column 3) on real values of credit for livestock (column 2).

(3) MENDONCA DE BARROS, J.R., and GRAHAM, D.H., (1977).

TABLE K.

CREDIT FOR LIVESTOCK

YEAR	TOTAL (CR\$ 1,000,000 of 1972)	CR\$ of 1972/Head	Average of 4 Years (CR\$ of 1972/Head)
1961	354	6.31	-
1962	472	8.17	-
1963	412	6.90	-
1964	526	8.52	7.48
1965	291	4.56	7.04
1966	606	9.18	7.29
1967	722	10.58	8.21
1968	936	13.26	9.40
1969	1,062	14.55	11.89
1970	1,101	14.59	13.25
1971	1,664	21.18	15.90
1972	2,053	24.73	18.76
1973	3,050	35.68	24.05
1974	3,396	37.56	29.78
1975	6,612	71.48	42.36
1976	5,994	65.15	52.47

SOURCE: TABLE J AND TABLE 16

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