

LIVESTOCK IN LATIN AMERICA

Status, problems and prospects

II. BRAZIL



United Nations



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Livestock in Latin America

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EXPLANATION OF SYMBOLS

The following symbols have been used throughout this report:

Three dots (. . .) indicate that data are not available or are not separately reported.

A dash (—) indicates that the amount is nil or negligible.

A minus sign (—) indicates a deficit or decrease.

A full stop (.) is used to indicate decimals.

A comma (,) is used to distinguish thousands and millions.

An oblique stroke (/) indicates a crop year or fiscal year—e.g., 1954/55.

Use of a hyphen (-) between dates representing years—e.g., 1950-54—normally signifies an annual average for the calendar years involved, including the beginning and end years. “To” between the years indicates the full period—e.g., 1950 to 1954 means 1950 to 1954, inclusive.

References to “tons” indicate metric tons, and to “dollars” United States dollars, unless otherwise stated.

Details and percentages in tables do not necessarily add to totals, because of rounding.

EXPLANATORY NOTE

The work programme of the Joint ECLA/FAO Agriculture Division includes a survey on the conditions, problems and prospects of the livestock economy in representative countries of Latin America. The present study on Brazil supplements those already carried out on Colombia, Mexico, Uruguay and Venezuela, and published by the United Nations.*

Only the major technical and economic problems of the livestock industry in Brazil are dealt with in this study, and no attempt is made to embark upon an exhaustive analysis of the complexity and size of the country's livestock population. However, this work should be most useful for the general survey on the Latin American livestock sector now being prepared.

The co-operation offered by a number of Brazilian agencies and experts, from whom valuable written and oral data were obtained, is hereby gratefully acknowledged, in particular the assistance given by Eduardo Silveira Martins, Miguel Cione Pardi, Robinson de Vasconcelos Costa and Luis Carlos Pinheiro Machado.

* See *Livestock in Latin America: status, problems and prospects*, volume I on Colombia, Mexico, Uruguay and Venezuela; United Nations publication, Sales No.: 61.II.G.7.

INTRODUCTION

Brazil, which has the largest area of any country in the Western Hemisphere—847 million hectares—uses a bare 150 million for agricultural activities, i.e., nearly 17 per cent of its total territory. Of its 71 million inhabitants 54 per cent is formed by the rural population. Accordingly, the relation between agricultural land and the rural population is only 4.4 hectares per person, which is less than in other Latin American countries.

Despite the predominance of agricultural activities and the fact that more than half the population lives in rural areas, this sector produces only a quarter of the national income. With the rapid industrial growth recorded in Brazil during the last few years the agricultural sector has tended to contribute less to the formation of the domestic product. Indeed, in real terms, the agricultural product increased as little as 42 per cent between 1949 and 1958 whereas the industrial product expanded from 100 to 235. In 1959 the per capita income of the agricultural population represented no more than a quarter of urban income.

The increasing urbanization of central Brazil, and the juxtaposition of a rapidly developing industrial sector with a lagging agricultural sector, are aggravating the problems created by the wide gap between the purchasing power and living levels of the rural and urban populations respectively. The disparity in their economic development has of course also enhanced certain supply and demand problems in respect of agricultural commodities; on the one hand, farmers and agricultural workers are becoming increasingly discouraged and, on the other, serious difficulties are arising on the supply side in the more crowded urban centres.

It should be remembered that Brazil has a variety of ecological conditions and abundant natural resources which enable it to produce a wide range of foodstuffs and raw materials. Unfortunately agricultural production is not keeping pace with the steady expansion of demand, and its inability to do so has been instrumental in spurring on the inflationary process from which the country is suffering. The agricultural sector is showing unmistakable signs of backwardness and stagnation because of the persistence of an unsatisfactory and obsolete rural structure. With few exceptions it may safely be said that farming and livestock practices are still primitive or semi-colonial, chiefly characterized by land monopoly, extensive land and livestock exploitation, low technical standards and unsatisfactory labour relations. Needless to say, these factors are keeping productivity at a low level, especially in stock farming, as will be made clear in the course of this study which is summarized below.

The Brazilian livestock industry is concentrated in an area of approximately 120 million hectares, 86 per cent of which is natural grassland and only 14 per cent artificial pastures. On this vast stretch of land Brazil

maintains the third largest cattle population in the world, officially estimated at some 74 million head of cattle, a large pig inventory numbering 48 million and nearly 30 million sheep and goats.

According to the figures of the Production Statistics Service in the Ministry of Agriculture (*Serviço do estatística da produção* (SEP), *Ministério da Agricultura*), the cattle population increased by 40 per cent between 1950 and 1960, that is, at a cumulative rate of 3.4 per cent which is considered by some Brazilian experts to be over-estimated. The pig population is estimated to have had a natural growth rate of 6.3 per cent annually, or twice that of population growth. But, in actual fact, livestock production on the basis of these two species increased far more slowly.

Brazilian stock farming may be divided into three types depending on the climate. North of latitude 20°, which crosses the States of Minas Gerais and Mato Grosso in the south and the State of São Paulo in the north, stock farming is of the tropical kind. Further south there is a less tropical type, which is to be found over the major part of central Brazil and is undoubtedly the most progressive. In the State of Rio Grande do Sul there is a third type with many of the characteristics of stock farming in temperate zones.

The principal branch of the livestock industry is beef or dairy cattle farming. The beef cattle herd consists mainly of the Gyr, Nellore, Guzerat and Hindu-Brazil Indian strains and a variety of crosses between these and creole stock. Brazil's zebu cattle, such as those in the central areas of the country and particularly in the Triângulo Mineiro, are some of the best in the world. The native strains are tending to disappear and there is nothing to be gained from farming with pure-bred European dairy or beef cattle in a tropical climate. The largest herd of European cattle consists of specialized dairy strains, such as Holstein, Jersey and Brown Swiss, which are to be found mainly in Rio Grande do Sul. For milk production in tropical zones, a cross between the European and the zebu strains is preferred.

In terms of value, livestock production represents a large proportion of the national product and recently outstripped other basic branches of agriculture. In 1960 its total value was as much as 230,000 million cruzeiros, of which 70 per cent derived from cattle farming.

During the three-year period 1958-60, annual production of red and white meat averaged nearly 2 million tons. This is 31 per cent more than the average for 1949-51, and corresponds to an annual rate of increase of 3.1 per cent or the same as that of population growth. In other words, per capita production remained completely stationary. Seventy-three per cent of the meat consisted of beef, nearly 25 per cent of pork and the small balance of mutton, goat's flesh and poultry.

Milk production, which was 2,403 million litres a year in 1949-51, rose to about 4,950 million in 1958-60, thus increasing from 46 to 68 litres per person. Sixty per cent of the milk is produced in Minas Gerais and São Paulo and 8 per cent in Rio Grande do Sul. The principal dairy-farming areas are those supplying the towns of São Paulo, Rio de Janeiro, Belo Horizonte and Porto Alegre. In the Nordeste the major dairy-farming area is Recife, Brazil's third most important town.

The trends of livestock production can be summed up by saying that between 1948 and 1958 a more or less continuous improvement took place in every branch, milk and eggs showing the biggest increments in output. In 1959 and 1960 a decrease was recorded in the quantum of beef and wool production.

Apart from a small number of high-productivity stock farms, Brazil's livestock sector has a low level of efficiency, and no significant changes took place in average yields per animal and per unit of area during the last decade. To take cattle as an example, the lack of efficiency is reflected in a very low reproduction rate (approximately 50 per cent); high animal mortality, especially among yearling calves; a slaughtering rate of only 10-11 per cent, mainly involving cattle that are over the right age and therefore yield little in terms of carcass meat; and a shortage of milch cows. It should be mentioned, however, that the beef cattle industry in central Brazil is developing rapidly, both its efficiency and productivity being well above the national average. Except for a few that are well organized, the dairy farms are notable for their low output, which averages less than 3 litres daily per cow during the short lactation period. Mean annual productivity for beef cattle is only 30 to 40 kilogrammes of live weight per hectare, which represents as little as 15 to 20 kilogrammes of carcass meat per unit of area. On semi-extensive dairy farms, which are in the majority, average annual output is only 250-300 litres of milk per hectare. On intensive dairy farms the minimum is 800 litres. Production costs are high as a result of the low physical productivity, high price of inputs and large volume of fixed capital characteristic of the livestock sector. The existence of marginal stock farms can be explained by the tendency of certain landowners to hold on to their land in the hope that it will increase in value.

Some of the factors limiting livestock production are:

(a) The difficulty of feeding livestock, owing to the seasonal forage shortages which bring carrying capacity down sharply during the winter and in times of drought, and to defective grazing systems, inadequate fencing of pastureland, the prevalence of badly managed natural grassland, single crop pastures, deficient weed control, lack of interest in the cultivation of forage crops and an insufficient supply of supplementary feed rations, ensilage and concentrated by-products.

(b) Animal diseases and pests which, besides causing a large number of deaths, reduce yields of meat, milk, wool, etc. It is estimated that infectious and parasitic diseases, together with the lack of minerals and of sufficient food, are annually responsible for the death of slightly over 3 million cattle, 10 million pigs and some 2.3 million sheep and goats to a value of approxi-

mately 55,000 million cruzeiros (at 1960 prices), which is equivalent to a quarter of the total value of livestock production.

(c) Breeding limitations also militate against an increase in animal productivity, although not as strongly as the other factors mentioned. The expansion of milk production is hampered by the lack of a dairy cattle strain adapted to tropical conditions, the shortage of good sires and a certain amount of confusion in the genetic programmes followed by stock farmers owing to the lack of a national zoning plan for breeding purposes. Admittedly, there are no really serious obstacles to be overcome as far as the breeding of beef cattle is concerned; genetic improvements are being successfully carried out and there is every prospect of raising the quality of the meat on the basis of the existing inventory with the aid of European strains.

(d) A low level of administrative efficiency, characterized by unimaginative handling of livestock and pastureland within a stock-farming system that is unsatisfactory in general. Modern techniques are difficult to introduce because of absentee landlords and the dearth of persons trained in stock-farming practices.

(e) Some of the land tenure systems also have a cramping effect on production. On the one hand, there are dairy farms on *minifundia* owned or rented by the farmer, whose production costs are high because he works on a small scale and who has virtually no hope of improving his lot, and, on the other, the stock-farming *latifundia*, which are usually run with scant efficiency and productivity. A number of studies have shown that average productivity per hectare of farmland diminishes as the size of the farm or estate increases, once a certain limit has been reached. For instance, in the Rio de Janeiro dairy-farming zone, milk production per unit of area drops considerably on establishments of over 100 hectares. Lastly, the practice of stock farming on rented land, and the marked inelasticity of supply of such land as is held on to in the hope that its value will go up, have an adverse effect on livestock production.

A brief description should be given here of the main improvements and shortcomings in the marketing and processing of livestock products. Market organization has made great progress in central Brazil and Rio Grande do Sul, especially in so far as supplies to the capitals are concerned. The construction of new roads and improvement of those already in existence, the establishment of new abattoirs and processing plants, improvements in quality and the spread of co-operative marketing are all factors conducing to market expansion and rationalization. In some towns in the Nordeste region the supply and distribution of milk and dairy products have also improved. But a number of fairly serious problems, some of which defy solution, still persist in these markets and especially in the less populated centres.

In the Norte, Oeste and Nordeste regions, the conditions in which the livestock are transported from the breeding grounds to the winter-feeding and fattening areas and thence to the slaughterhouses are poor. The long hard treks the animals have to make, the inadequate transport facilities and the ill treatment they

are given lead to enormous losses through death or loss of weight and deterioration in the quality of the meat.

Although there are several meat-packing plants that are properly equipped and organized—generally with idle capacity—at least half the slaughtering is done in municipal abattoirs that have very poor facilities, are not even subjected to the regulation sanitary inspection and usually let the by-products go to waste.

In Brazil, as in most Latin American countries, the conditions of the meat market are as complex as they are uncertain. They are frequently a source of serious disputes and of complaints on the part of consumers.

It is unfortunately in the market that the shortcomings in production, selling, processing and retail distribution crop out, and where the impact of the injudicious adoption of certain measures is felt. The meat trade is often affected by the most varied problems such as the lack of a network of cold storage plants and modern depots to regulate and facilitate supplies; shortcomings in grading standards for livestock and meat, with their highly unfavourable repercussions on producers and consumers; and the speculative and at times monopolistic activities of middlemen and even of the big distributors which, in conjunction with an unwise price control policy, recently led to the emergence of a black market for meat, to soaring prices, and, finally, to a sharp drop in consumption among the lower income groups.

The marketing of milk and dairy products differs widely from region to region and from one market to another. In the densely populated and urbanized centres the marketing is better organized, and is less defective and erratic, especially as regards milk for direct consumption. Most of this is pasteurized in dairies that are well equipped and managed, and the three grades of milk—A, B and C—available on the Brazilian market are comparable to the best in other countries. The milk supplied to São Paulo, Rio de Janeiro, Belo Horizonte and Porto Alegre is submitted to strict bacteriological tests.

In the less developed markets the milk is sold directly to the consumer or retailer without any processing beforehand, and often in a deplorably insanitary state as a result of unsatisfactory methods of milking, handling and transport, even when it has not actually been adulterated or altered in any way.

However, steps are being taken in the principal dairy-farming areas and population centres in Brazil to intensify the integration of the market for fresh milk and for milk used in the manufacture of dairy products. As greater progress is made in this respect some of the maladjustments on the supply side will be smoothed out and milk marketing will become more regular and economic both at times of surplus and between seasons.

The low productivity of the livestock sector, the inelasticity and limited nature of supplies and marketing difficulties are all factors that keep down consumption of livestock products which, in Brazil, is entirely dependent on domestic production. Another reason for the low level of consumption is the meagre purchasing power of the working classes, particularly in rural areas. In these social groups personal income would have to increase substantially before it could be translated into real demand for such foodstuffs as meat,

milk, dairy products and eggs that are usually expensive. As things are, people in the lower income groups and at the subsistence level have no possibility of replacing the cheap food that they normally eat by better quality and higher priced items like those mentioned above.

The inadequacy of per capita consumption is clearly apparent from the figures for the daily intake of animal protein based on the above-mentioned foodstuffs, which, in 1957-59, barely averaged 21 grammes in Brazil. This is only a quarter of the intake in Argentina, Canada, the United States and Uruguay and is also less than in various other countries.

Total consumption of red and white meat increased from an annual average of 1.5 million tons in 1949-51 to 1.9 million in 1958-60, the average rate of growth during that period being 2.9 per cent annually. This was a little lower than the rate of population growth (3.1 per cent), which means that a slight decrease took place in per capita consumption during those years. It dropped from 27.9 to 27.6 kilogrammes, a figure which is of course far below the level of more than 100 kilogrammes in Argentina and Uruguay, 86 kilogrammes in the United States and 72 kilogrammes in Canada, etc. In fact, meat consumption in Brazil would have to be doubled to satisfy nutritional requirements.

There has been a marked improvement in consumption of milk and milk products during the last decade. Total apparent consumption, in terms of fluid milk, rose from an annual average of 2,379 million litres in 1949-51 to 4,935 million litres in 1958-60, thus raising per capita consumption from 46 to 68 litres, three-quarters consisting of milk products and the remainder of fluid milk. From these data it is clear that per capita consumption is still at a low level; it amounts to only 15 and 22 per cent of consumption in Canada and the United States respectively and to a third of the intake in Argentina, the United Kingdom and Uruguay. The increases achieved have been in milk products rather than in milk itself. Daily consumption of fresh milk is known to have dropped from 138 to 130 grammes in the capitals between 1950 and 1960. In the last eight months of 1960 per capita consumption in São Paulo decreased by 12 per cent following a sharp increase of 66 per cent in prices. Both the drop in consumption when prices rose, and the substantial expansion that took place earlier when prices were more or less stable and the Brazilian economy was developing steadily, can be ascribed to the great income and price elasticity of milk demand.

It should not be forgotten that the principal supply problems in Brazil's urban markets—São Paulo and Rio de Janeiro for example—were largely caused by the steep upward trend of population growth at a time when marketing and distribution channels were not equipped to cope with the requirements of a sharp rise in demand.

With respect to the influence of prices on consumption of foodstuffs of animal origin, no clear correlation can be discerned between these two variables in the period analysed. This is obviously due to the effect of price controls and to factors, such as the volume and inelasticity of supplies, unstable marketing conditions and increased consumption in the big towns, which

produced serious disequilibria between supply and demand in certain markets. However, except in a few cases, the items that showed the great increments in consumption were precisely those available to the consumer at relatively lower prices in 1950-60, i.e., milk, milk products and eggs.

It should also be noted that an imbalance was created between supply and demand in respect of products subject to price controls, owing to the distortions and disequilibria between the prices paid to the producer and those paid by the consumer. The truth is that the policy adopted in Brazil for fixing meat and milk prices did not further the interests of producers and consumers alike, its tenor and application were open to criticism in many respects and, before prices were stabilized and their upward spiral checked, it introduced or favoured irregularities in market conditions. Price controls eventually began to exert a stranglehold because of the attempt to pay high prices to the producer while holding them down at the consumer level without the help of subsidies or direct compensation. Brazil's experience in this respect, in common with that of many other countries, proves that unless the question of price controls is entrusted to a purely technical organization, which is immune from interference by political, personal and entrepreneurial interests and is responsible for both buying and selling the products subject to controls, the only alternative that can be recommended is a free market.

When consumption trends and the outlook for demand were analysed it was concluded that per capita consumption of meat might well drop by 10 per cent (about 3 kilogrammes) towards 1970 if the trend recorded during 1948-60 were to continue. This suggests that special measures should be adopted to encourage production at lower costs with a view to enhancing the prospects of a higher real income for stock farmers by raising productivity instead of prices. The potential demand of the Brazilian market is enormous, not only for meat and milk but also for many other livestock products; if these were reasonably priced the foreseeable increases in population and income would naturally be translated into a substantial rise in consumption. At the end of ten years, total consumption might well have doubled, thereby making for an annual increase of 5 kilogrammes in per capita consumption. Potential milk demand, on the other hand, might go up about 50 per cent in the capitals and, if so, would lead to a per capita consumption of 186 grammes daily. Given this combination of circumstances, per capita supplies

of meat and milk would come close to the nutritional targets recommended. If these targets are to be attained on the basis of domestic production alone, as Brazil hopes to do, the cattle population will have to be expanded by 75 per cent and the inventories of minor livestock more than doubled, while a substantial increase will also be required in yield per animal and in the productivity of the livestock sector as a whole.

In view of the country's natural resources and its great stock-farming potential, the prospects for the livestock industry are encouraging in the extreme. The immense livestock potential derives not only from the possibility of substantially increasing production with the same resources as at present but also from the existence of vast tracts of land that could easily be taken over for stock farming. The State of Mato Grosso alone could accommodate more than 30 million head of cattle and there is ample scope for the expansion of cattle farming in Pará, Maranhão, Piauí, the south of Bahia, Paraná and Santa Catarina. Milk production could also be considerably increased in many parts of the country, through the use of impoverished crop lands or pastureland previously kept for grazing beef cattle, the intensification of activities on existing dairy farms and the opening up of new areas.

In order to spur on the livestock industry to avail itself of the great opportunities open to it in Brazil and to meet the increasing demands of the population, an integrated and co-ordinated national development plan, applied in accordance with regional priorities and supplemented by measures to improve the marketing, processing and distribution of livestock products, must be put into effect. The country has already made noteworthy progress in technical assistance, research and agricultural extension services, and both the Federal Government and State authorities have taken steps to pave the way for the launching of a large-scale livestock development programme. This would necessarily entail heavy public and private investment, certain changes in the agricultural structure, the reorientation of various institutions, the training and expansion of technical staff as part of a plan to provide greater incentives, and many other measures that need not be detailed here. Without an integrated long-term plan for livestock development Brazil will clearly be unable to make full use of its enormous natural resources, or of the relative advantages it undoubtedly possesses which should enable it to become one of the world's great meat exporters, a reasonable ambition that Brazil is well justified in harbouring.

I. AVAILABLE RESOURCES

1. LIVESTOCK AND POULTRY INVENTORIES

For want of complete information on the findings of the 1960 census, the livestock statistics used in the present study are the 1950 census data and the estimates periodically prepared by the Production Statistics Service (SEP). Those aspects of the livestock economy that are considered in relation to demographic growth

are studied on the basis of the preliminary population data obtained at the last census and recently published.¹

In 1960, Brazil possessed approximately 74 million head of cattle, 63,000 buffaloes, 48 million pigs, 18

¹ According to the findings of the 1960 census, the rate of population growth between 1950 and 1960 was 3.1 per cent instead of 2.5 per cent, as it appears in a number of studies.

million sheep and 11 million goats. Inventories of horses, mules and asses were officially estimated at 8, 4 and 2 million respectively. The total for poultry was calculated to be about 184 million, which implies a sizable increase during the preceding five years (see table 1).

Table 1
Brazil: Livestock and poultry inventories, 1950, 1955 and 1960
(Thousands of head)

Species	1950	1955	1960
Cattle	52,655	63,608	73,962
Buffaloes	63
Pigs	26,059	38,606	47,944
Sheep	14,251	18,484	18,162
Goats	8,526	9,879	11,195
Horses	6,937	7,564	8,273
Mules	3,101	3,390	4,086
Asses	1,572	1,774	2,175
Poultry	...	154,209	184,133

Source: Ministry of Agriculture, Production Statistics Service (SEP); for 1950, census data; for 1955 and 1960, estimates prepared by SEP.

Brazil's cattle population is one of the largest in the world, being exceeded only by those of India and the United States, which in 1956 and 1960 numbered 159 and 101 million, respectively. Its pig inventory also ranks third—together with that of the Soviet Union—after the total of 180 million registered for mainland China and 58 million for the United States.² As far as sheep are concerned, however, Brazil is outstripped by Australia, the Soviet Union, mainland China, Argentina, New Zealand, India, the United States, Turkey, the United Kingdom and Uruguay. With respect to its goat inventory, it comes sixth after India, mainland China, Turkey, Nigeria and Ethiopia.³

An analysis of the evolution of the livestock population, in the light of SEP estimates, reveals a steady upward trend, except for horse, mule and ass inventories, which have had a fairly low average annual rate of increase. Between 1950 and 1960, cattle inventories increased by 40 per cent, that is at a cumulative annual rate of about 3.4 per cent.⁴ Their rate of natural increase would seem to have been higher between 1954 and 1957 (see table 2), a turn of events which official sources attribute to the impetus given to stock breeding by favourable price levels.

It is clear that the increase in cattle inventories did not in reality exceed that of the population, whose annual growth rate over the same period averaged 3.1 per cent. Needless to say, if a persistent effort were made to promote the livestock industry, Brazil could

Table 2
Brazil: Evolution of the cattle population, 1950-60
(Thousands of head)

Year	Cattle population	Index	Annual rate of increase
1950	52,655	100.0	...
1951	53,513	101.6	1.6
1952	55,854	106.1	4.4
1953	57,626	109.4	3.1
1954	60,700	115.3	5.4
1955	63,608	120.8	4.8
1956	66,695	126.7	4.9
1957	69,548	132.1	4.3
1958	71,420	135.6	2.6
1959	72,829	138.3	2.0
1960	73,962	140.5	1.6

Source: Statistical annex, table I.

quickly expand its cattle inventories. Brazilian experts contend, and have every reason for so doing, that the cattle population could be doubled within twelve years if inventories of dams were to increase at the cumulative annual rate of 6 per cent. Such an increment would give Brazil a more favourable cattle-population ratio, which at the time of writing is barely 1.04 head of cattle per person as against 2.8 in Uruguay, 2.6 in New Zealand, about 2.0 in Argentina and 1.7 in Australia.

Between 1950 and 1960, the pig population is thought to have increased by 83 per cent, at a cumulative annual rate of about 6.3 per cent, which was a good deal higher than the demographic growth rate. However, there was no corresponding acceleration in meat production. Less progress was made in respect of sheep inventories; in fact, in 1959, they were actually smaller by about 1 million head than in 1957 and 1958, and, in 1960, they were reduced again by approximately 800,000 head (see Statistical Annex, table I). Goat breeding and production figures seem to have remained stationary during the second half of the decade, and the annual increment in the inventories of horses, mules and asses was distinctly small.

Full information on the present composition of the cattle population by sex and age is unobtainable—except for what can be gleaned from the 1950 census data and a dairy-farming sample taken in 1953 (see table 3), and the same is true of cattle inventories classified into beef and dairy herds. The 1960 census is expected to furnish the statistics required. It should, however, be pointed out that farming for meat production predominates, and that experts from the Ministry of Agriculture are of the opinion that dairy herds may represent 20-30 per cent of total cattle inventories and number some 10 million cows. Given that the composition of the cattle population is much the same at the time of writing as in 1950, which is presumably the case, the proportion of serviceable dams (heifers over two years of age and cows) should be about 48 per cent of the total, a figure which affords an excellent basis for speeding up the rate of natural increases of available stocks of cattle by means of an improvement in the birth rate and a reduction in the mortality rate.

² Commonwealth Economic Committee, *Meat*, 1961.
³ FAO, *Production Yearbook*, 1960.
⁴ In the opinion of some Brazilian experts, cattle inventories and their rate of increase may have been over-estimated. This view will apparently be confirmed by the 1960 census, since data available so far show 2.545 million head for the Norte, Sergipe and Espírito Santo, as against the estimate of 2.879 million; in other words, the census figure is 18 per cent less.

Table 3

Brazil: Percentage breakdown of cattle population
(Based on the 1950 census)

Type of cattle	Norte	Nordeste	Este	Sul	Centro Oeste	Total
Steers 1-2 years	10.0	9.7	9.7	9.3	10.6	9.7
Steers over 2 years.....	12.5	12.5	11.5	16.1	10.9	13.2
Bulls	2.2	1.8	1.7	1.8	2.3	1.9
Cows and heifers over 2 years.	50.3	49.8	48.6	45.2	48.5	47.5
Heifers 1-2 years ^a	10.3	9.8	10.8	9.6	11.3	10.3
Calves under 1 year.....	14.7	16.4	17.7	18.0	16.4	17.4
	100.0	100.0	100.0	100.0	100.0	100.0

Dairy cattle, according to a 1953 sampling

	Guanabara	Niterói	Belo Horizonte	São Paulo	Aggregate figure for sample universe
Milk cows	28.3	25.5	27.1	27.5	27.7
Dry cows	18.6	20.5	19.8	22.9	20.9
Heifers over 16 months.....	13.9	17.1	12.9	13.3	13.6
Heifers under 16 months.....	10.9	9.6	10.4	9.3	10.1
Yearling cows	13.7	12.1	13.5	13.5	13.5
Total:					
Females	85.4	84.8	83.7	86.5	85.8
Bulls	2.0	1.8	2.1	1.9	1.9
Steers	12.6	13.4	14.2	11.6	12.3
	100.0	100.0	100.0	100.0	100.0

Source: National Dairy Farming Commission (CNPL).

^a The percentages of animals 1-2 years old ought to be smaller than those of calves of under a year.

To judge from the findings obtained from an extension of the sample, the dairy herds would seem to contain an unduly high proportion of males to the detriment of milk production.

As regards geographical distribution, cattle farming is carried on in virtually every State (see Statistical Annex, table II), but the largest herd concentration is to be found in the stock-farming area of central Brazil, where the cattle population in 1960 is estimated to have been 47 million head, or 64 per cent of the total. The State of Minas Gerais comes first, with approximately 16 million cattle, followed by the States of São Paulo and Mato Grosso, with 10 million each, and Goiás, with 6 million. Other States possessing sizable cattle inventories are Rio Grande do Sul (9.6 million) and Bahia (6 million). The main characteristics of both beef and dairy farming in these States will be discussed later.

Of the total pig population, which is also distributed throughout the country, central Brazil possesses a little over one-third. The largest group (9 million pigs) is to be found in the State of Minas Gerais,⁵ and the next largest in descending order in Rio Grande do Sul (5.7 million), São Paulo (5 million), Paraná (5 million), Santa Catarina (4 million), Bahia (4 million) and Goiás (3.5 million), etc.

The biggest concentration of sheep is in Rio Grande do Sul, where in 1960 they numbered 10 million, and

represented about 60 per cent of the total. Bahia would appear to rank second, with about 2 million head, although its flocks are suitable for meat production only, and then come the Nordeste States, with 4 million altogether.

The Nordeste region has the largest share of the goat population—6 million head, or 54 per cent of the total Brazilian inventory. It is followed by the State of Bahia with about 3 million head.

2. STOCK-FARMING AREA

There are no recent data on the area used for stock farming (comprising large and small stock) in Brazil. The only figures available are those of the 1950 agricultural census, which gives the total number of hectares under grass as 107.6 million, of which 92.6 million were natural grassland and about 15 million artificial pastures (see Statistical Annex, table III). At that time, natural grassland represented 86 per cent of the total grazing area. As the cattle population density was two hectares per head, a rough estimate, based on the assumption that the ratio at the time of writing is more or less the same⁶ and that the size of the cattle population may have been over-estimated, suggests that Brazil can reckon on at least 110-120 million hectares of pastureland.

⁵ Pig farming in Minas Gerais is less advanced than in São Paulo, Paraná, Santa Catarina or Rio Grande do Sul.

⁶ Excluding other species, and assuming the continuation of the traditional pasture cultivation and management systems.

II. STOCK-FARMING AREAS AND THEIR ECOLOGY

The vast extent of Brazil's territory, and the diversity of its climates, microclimates, topography and qualities of soil, combine with the effect of technical and economic factors to make stock breeding vary widely in trends and characteristics from one part of the country to another and even within one and the same area. Nevertheless, there are stock-farming areas which, in a general way, and particularly as far as ecological factors are concerned, can be grouped together in accordance with a number of classification criteria.

As regards temperature, the stock-farming zones in Brazil can be said to fall into two broad sub-divisions—tropical and temperate. The livestock activities carried on in these two zones are, of course, sharply differentiated, especially in respect of breeds of livestock, kind and quality of pasture, and animal pests and diseases. As far as other mesological factors are concerned, the equatorial and north-eastern stock-farming areas (Amazonia and the Polígono das Secas or drought zone, respectively) should be singled out as presenting fairly marked distinguishing features. Between the first two areas mentioned, there is a third that ought also to be taken into consideration, namely, the subtropical zone; here, too, the type of stock farming has certain features that are peculiar to it.

Broadly speaking, the domain of tropical stock farming lies north of latitude 20°, which crosses the southern part of the States of Minas Gerais and Mato Grosso and skirts the State of São Paulo to the north. This region comprises most of the territory of Brazil. Its average annual temperature is higher than 22°C, and never drops below 18°C even in the coldest months. The high temperature and other adverse factors preclude economic farming on the basis of purebred European stock; hence the predominant breeds are the "ordinary" types of livestock (creole strains and crosses of these with the zebu) best suited for intensive farming in unfavourable environments.

South of latitude 20° cooler temperatures prevail, as, for example, in the State of São Paulo, the south of Mato Grosso and Minas Gerais and the northern half of the State of Paraná, where livestock activities are carried on in a less tropical setting. This is the scene of most of the stock farming done in central Brazil. Although the environment is less propitious than in the temperate area to the south, from the technical standpoint the cattle farming at the time of writing is more progressive there than anywhere else in Brazil.

The temperate stock-farming area proper lies mainly in the State of Rio Grande do Sul, where there are four clearly-marked seasons and the climatic conditions and quality of the pasture are such that purebred European stock can be used.

The different characteristics of stock farming in Brazil can be more accurately described in the light of the following physiographical divisions:⁷

Norte: Amazonas, Pará and Territories;

Nordeste: States of Maranhão, Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco and Alagoas, and Territory of Fernando de Noronha;

Este: States of Sergipe, Bahia, Minas Gerais, Espírito Santo, Rio de Janeiro and Guanabara;

Centro Oeste: States of Mato Grosso, Goiás and Brasília, DF;

Sul: States of São Paulo, Paraná, Santa Catarina and Rio Grande do Sul.

1. NORTE

The Norte comprises about 40 per cent of the national territory. Influenced by the Amazon system, it is notable for its high temperatures and humidity. The average temperature is about 26°C and the maximum 38.1°C, relative humidity ranges from 74.1 to 91.7 per cent and total precipitation from 2,136.3 to 2,735.2 millimetres.⁸

This densely forested and sparsely inhabited region has a cattle population estimated by SEP to be 1.4 million head in 1960, but which the census for the same year proved to be only 1.2 million, the vast majority being ordinary breeds of cattle. It is here that Brazil's biggest herds of buffaloes (73 per cent of the total) are to be found, mainly on the island of Marajó (State of Pará), which has about 45,000. In this part of the country, the livestock runs wild and is practically uncared-for, and the want of organization in the stud farms, their vast acreage, the lack of fencing and the shortage of good perennial pastures, as well as floods and communication difficulties, make the development of stock farming a slow and arduous process.

Of the six grazing areas in Amazonia (Continente, Marajó, Amapá, Conceição do Araguaia, Baixo Amazonas, Rio Branco and Acre), only Acre and Campos Altos de Macapá in the Continente area have some artificial pastures of jaragua grass (*Hyperrhenia rufa*). Elsewhere there is nothing but natural grazing usable for part of the year only (less than six months) because of floods, which make it necessary for the cattle to be moved to other zones.

2. NORDESTE

This region stretches from the lower reaches of the river Tocantins to the lower reaches of the São Francisco, and covers an area of 969,736 square kilometres, i.e., 11.39 per cent of the whole territory of Brazil. The Nordeste proper falls within the area of open scrub known as the Caatingas, on account of its xerophytic vegetation, and is usually sub-divided into two clearly differentiated zones, namely, the Sertão or "backwoods"—and the Litoral or Mata-seaboard. The Sertão is characterized by a semi-arid climate with minimum precipitation and high temperatures, and by the absence of forest and pastureland as a result of the scanty amount of rainfall and its uneven distribution. The droughts last for five to six months in this area, rainfall being confined to the rest of the year. There

⁷ Classification made by the Brazilian Institute of Geography and Statistics (IBGE).

⁸ Ministry of Agriculture, *A criação de Búfalos para Fomento de Produção Leiteira na Amazonas*, 1958, p. 30.

have been disastrous droughts that have persisted for eighteen months to two years. But for the spineless cacti, which have been widely planted, the shortage of water would make any form of livestock activity impossible in this part of the country. As so little forage is available, the animals have to walk long distances in search of nourishment; hence they lose weight, their yield deteriorates and they become vicious. Feeding and watering problems will have to be solved before cattle farming can make any progress in this area on the basis of grazing.

The seven Nordeste States possess barely 10 per cent of Brazil's total cattle inventory, but rather more than half the goat population, since these animals' hardiness makes them better fitted to withstand the rigours of the environment. The savannah or extensive type of stock farming predominates, and is based on creole cattle, crosses between these strains and the zebu, and a relatively large proportion of purebred European dairy cattle, or mestizos based on this stock, which are used for milk production, mainly on the Litoral.

In the State of Maranhão, which has a hot and humid continental climate, the preponderant types are under-developed creole cattle and creole-zebu crosses.

A semi-arid environment is common to Piauí, Ceará and Rio Grande do Norte, but their livestock activities differ in some respects. In Piauí there are few zebu; in Ceará the creole cattle are degenerating, but the zebu and the black and white and red and white varieties of Dutch cattle are making good progress. In the Caatingas and Sertões of Rio Grande do Norte creole cattle are the commonest, while the Holstein, Brown Swiss and Simmental breeds thrive on the Litoral. The breeding of goats is much more important in Piauí and Ceará, which, together with Pernambuco, possess 70 per cent of the goat population of the seven Nordeste States.

As stated before, dairy farming is making progress in Paraíba, Pernambuco and Alagoas, as well as in Ceará, owing to the expansion of milk demand in large urban centres such as the capital cities of Recife (797,000 inhabitants), Fortaleza (515,000), Maceió (170,000), Natal (163,000) and João Pessoa (155,000).

Research conducted by the Supply Co-ordination Council shows that there is little pastureland in the Recife dairy-farming area—as is the case, broadly speaking, throughout the Nordeste. Hence, it is necessary, particularly in the Mata, to grow elephant grass, Guatemala grass, etc., to be cut for hay, as well as other species, such as manioc, to be used for fodder. In the Agreste or agricultural belt, the usual practice is to feed the cattle on cultivated cacti, including certain species of prickly pear, such as the Indian fig and cochineal fig (the Mill and Salm Dyck varieties of *Opuntia ficus indica* and *Nopalea cochenillifera*, respectively). Very little wild cacti is fed to the animals. In the Sertão of Pernambuco, creole cattle are the dominant breed, and on the Litoral, *turino* cattle (Dutch cattle crossed with zebu), purebred Holsteins and a few Brown Swiss. Dairy farming is carried on by intensive methods, as in the other milk-producing areas of the Norte and Nordeste, the cows being kept in byres all or part of the time. The treatment of the cattle still leaves much to be desired, and their diet

is completely unbalanced, consisting of small amounts of bulk fodder (about 10 kilogrammes per cow/day on the Recife dairy farms), and excessive quantities of concentrates, especially oil cake or oilseed meal.

Alagoas has excellent dairy herds based on purebred European stock and crosses between these and the zebu (mainly Holstein-zebu hybrids of varying proportions). In the Sertão of Alagoas there is a shortage of water, and cacti are therefore widely cultivated. In the São Francisco valley, the Mata and the Litoral, water supplies are less problematic, feeding conditions better, and the practice of ensilage is making good headway. Milk yields are relatively high.

Two important dairy-farming areas are to be found in the State of Paraíba: the first is that of João Pessoa, with herds on the Litoral and in the Mata, Agreste and Brejo (swamp) zones, where rainfall is less unevenly distributed, occurring over eight months of the year, and the soil is extremely fertile, so that grain, fruit, artificial grasses, etc., can be grown; and the second lies in the Caatinga Central, Agreste and Cariris Velhos areas, with Campina Grande as its economic centre. As precipitation is scanty and unevenly distributed, crop farming makes little progress in this part of the country, and stock farming on the basis of grazing is limited. Cactus and cotton are widely grown, and their by-products are used for fattening beef cattle and as fodder for cows, in combination with other feeds.

Paraíba also has some modern dairy farms, based on European breeds and crosses between these and zebu of the Guzerat, Nellore and Hindu-Brazil strains. Of the European breeds, Holsteins are the most plentiful, Brown Swiss, Jersey and Guernsey cattle being found in smaller quantities. The bulk of the animals consist of cows that are half or three-quarters European and the remainder zebu. Animal sanitation is relatively satisfactory; for instance, in some parts of the Nordeste, neither ticks nor torsalo (*Dermatobia hominis*) give trouble.

As far as beef cattle are concerned, the Nordeste has a production deficit which has to be supplied by imports of jerked beef from central and southern Brazil and by cattle on the hoof from Bahia, to the extent of approximately 500,000 head.

Official development programmes are based on the region's livestock potential, especially that of Bahia and Maranhão. They provide for the breeding of stud bulls on the coastal belt (Mata), the cultivation of trees and shrubs for browsing, as well as of cacti, and the improvement of water supplies in the Agreste and Sertão. The last-named areas would then purchase stud bulls from the Mata.

3. ESTE

This region occupies nearly 15 per cent of the territory of Brazil, but the cattle population density is higher than in the Norte or Nordeste, and it possesses one-third of the country's total cattle inventory. In Sergipe and the western part of Bahia and Minas Gerais the prevailing climate, according to the Blair classification, is of the tropical savannah type, as in the Nordeste; it has a mean annual temperature of 22.5°C, with fluctuations of 3° to 7°C, and precipitation ranging

from 1,143 to 1,778 millimetres. The south central part of Bahía, the east of Minas Gerais, the west central area of the State of São Paulo, and the States of Rio de Janeiro and Espírito Santo all have the so-called tropical high-altitude climate which is proper to the mountain ridges lying parallel to the Litoral. It is characterized by a mean temperature of between 18° and 20°C, with 5°-7°C fluctuations, and precipitation varying between 1,016 and 2,022 millimetres. Both climates are marked by yearly droughts that last for three to five months or even longer, during which time the precipitation is less than 60 millimetres.

The principal stock-farming areas are in the States of Minas Gerais and Bahía. In Guanabara, Rio de Janeiro and Espírito Santo, milk production, although less significant in quantitative terms, is of vital importance as a source of supply for the region's large industrial centres (especially the towns of Rio de Janeiro, Niterói, Vitória, São Gonçalo, Volta Redonda and Friburgo), and also as raw material for large milk-processing plants.

(a) Minas Gerais

Area	583,248	square kilometres
Population (1960)	9.8	million inhabitants
Cattle (1960)	16.2	million head
Pigs (1960)	8.8	million head
Horses (1960)	1.46	million head

This State is the leading producer of cattle, pigs and horses. Its livestock zones are distributed as follows:

North-east: Rio Doce, Macurí, Médio Baixo Jequitinhonha and part of the Médio Jequitinhonha;

North: Médio São Francisco, Alto Jequitinhonha, Itacambira, Montes Claros and part of the Médio Jequitinhonha;

West: Oeste, Paranaíba, Rio Grande and the Triângulo;

Sertão: Alto São Francisco and Urucuia;

South central area: Metalúrgica, Sul, Mata and Campos da Mantiqueira.

The breeding and grazing of fat stock are the predominant activities in the Alto and Médio Jequitinhonha and the Médio São Francisco areas, Urucuia, parts of Mucurí and Oeste, and Itacambira. These areas supply the cattle-fatteners operating in Norte and Rio Doce.

Cattle-fattening is mainly carried on in the Montes Claros, Rio Doce and Alto São Francisco areas, part of Mucurí and Oeste. Every year, Montes Claros, Governador Valadares and Curvelo send over 220,000 head of fat stock to Rio de Janeiro and Belo Horizonte. In Oeste, the most important cattle concentration points are the municipalities of Bambuí, Dorés de Indaiá, Campo Belo and Abaeté. Most of the stock reared in the Triângulo Mineiro, Paranaíba and Rio Grande is sent to the winter pastures of São Paulo for fattening.

The Triângulo Mineiro is Brazil's principal zebu-breeding area, where intensive selection and improvement of the zebu strains is practised; it has farms famous for their purebred Gyr, Guzerat, Nellore and Hindu-Brazil specimens.

Other important centres of improved stock farming are to be found in the municipalities of Cássia, Passos, Curvelo, Ubá, etc. In Uberaba the Federal Government Institute of Zootechny is forging ahead with its work of obtaining by selection a Gyr strain for dairy-farming purposes, and is planning to do the same with the Guzerat.

In the Paranaíba and Ituiutaba valleys, the land is particularly suitable for crop farming and the cultivation of artificial pastures, especially of molasses grass (*Melinis minutiflora*) and jaragua; the latter's carrying capacity in this part of the country averages two head of cattle per hectare.

In the north-east of Minas Gerais there are first-class artificial pastures, made up of guinea grass (*Panicum maximum*), which accounts for 80 per cent of the total, Angola grass (*Panicum spectabile*, var. Nees), jaragua and Texas grass (*Panicum maximum*, Jacq., var. *gongylodes* Doel). These pastures provide grazing for approximately four-fifths of the cattle population of the area, their carrying capacity being 0.64 head per hectare. The largest tract of pastureland is in the Pedra Azul district.

In the centre and south of the State the main livestock activity is dairy farming. This is also making rapid headway in Minas Gerais, which indubitably ranks first among the Brazilian States as a producer of milk for processing. Most of the dairy farms lie south of latitude 19°. There are two major dairy-farming areas: the first is in that part of the centre of the State known as the Quadrilátero Ferrífero, and supplies the State capital, Belo Horizonte, while the second falls within the south central and south-eastern (Mata) zones and helps to serve the cities of São Paulo and Rio de Janeiro. In the Belo Horizonte dairy-farming area the prevailing breeds are zebu mestizos and Holsteins crossed with zebu, especially Gyr and Guzerat. The purebred European stock comprises a large number of black and white Holsteins and some Brown Swiss and Guernseys. In the second area, rather more than 50 per cent of the dairy-cattle inventory consists of European-zebu hybrids, with differing degrees of cross-breeding, ranging from quarter-strains to almost purebred European herds. The remainder is made up of zebu and zebu-creole hybrids.

Pig breeding and fattening is also important, especially in the south, the Mata and the west of Minas Gerais.

(b) Bahía

Area	559,921	square kilometres
Population (1960)	5.99	million inhabitants
Cattle (1960)	5.95	million head
Pigs (1960)	3.83	million head
Sheep (1960)	2.16	million head
Goats (1960)	2.68	million head

Environmental conditions in this State display a variety of characteristics and contrasts that are naturally reflected in the livestock activities, for which Bahía is the second most important State in the Este. Thus, in the south and along nearly the whole length of the coastal belt the climate is extremely humid, whereas in the Sertão it is dry and semi-arid. Precipitation

indices vary widely, from parts of the Polígono das Secas such as the Sertão Médio, where the dry season lasts for most of the year, to areas like the Litoral and Médio Sul, where the rainfall is abundant and evenly distributed. The fertility of the soil also differs greatly. Some of the land—in the south of the State, for example—is rich and fruitful, clothed with exuberant vegetation, and suitable for crop farming and the cultivation of artificial pastures. In the Médio Sul, thanks to the favourable ecological conditions, good pastureland is available with a greater carrying capacity than is found in many other parts of the country, and, consequently, with a high cattle population density of 38 head per square kilometre, as compared with 3 head per square kilometre in the Sertão of Bahia.⁹ Between the river Jequitinhonha in the south and the river Contas in the north lies the real stock-breeding and fattening area, which stretches as far as the Litoral; it comprises eleven municipalities and covers 9 per cent of the total area of Bahia. The Sertão Médio has good soil, but its semi-arid climate is a great handicap to the development of livestock activities; its stock-farming potential would be considerable if the water supply were better and grasses and forage plants adapted to local conditions were cultivated on a larger scale. The north-east of Bahia has poor soil and is very dry, lending itself to the breeding of sheep and goats rather than cattle. In fact, most of the goatskins exported by Brazil come from this State, of which the so-called Curaçá and Naná types are characteristic. In the Recôncavo area, on the other hand, conditions are favourable for increasing the carrying capacity of the pastureland through improvement of the grass.

4. CENTRO OESTE

This embraces the States of Mato Grosso and Goiás, and its area is equivalent to 22 per cent of the territory of Brazil. Its meteorological conditions, which resemble those elsewhere in the interior of Brazil, are reflected in a tropical savannah climate similar to that in the Nordeste. As a rule, precipitation ranges from 1,000 to 2,000 millimetres and the average temperature varies from 19° to 22°C. Lower precipitation and higher temperatures are found in certain parts of the region.

(a) Mato Grosso

Area	1,231,549	square kilometres
Population (1960) ...	0.91	million inhabitants
Cattle (1960)	10.06	million head
Pigs (1960)	1.78	million head

Geographically and economically, this State falls into two clearly differentiated sub-divisions—the north central and the south central zones. The former takes up some 870,147 square kilometres, or 68.89 per cent of the total area of the State, and falls between latitudes 8° and 16°. The fact that the soil is clayey and very dry and that much of the land is forested combines with the poor quality of the cattle and the over-extensive type of farming practised to detract from the importance of livestock activities.

⁹ Ministry of Agriculture, *Pecuária Bahiana*, Agricultural Information Service, Publication No. 22, 1958, pp. 6 and 7.

The south central zone, with an area of 392,428 square kilometres, lies between latitudes 16° and 24°, and can be sub-divided into the Planalto and the Pantanal. Except in the Serra Amambai, altitudes in the former range from 600 to 700 metres, with an average temperature of 24°C and a precipitation of 1,256 millimetres. The main stock-farming centres are Poconé in the north, Campo Grande in the centre and Aquidauana, Nioaque and Maracaju in the south. In the south-east, bordering upon Goiás, Minas Gerais and São Paulo, there are large tracts of pastureland under jaragua grass. More common, however, are sandy soils with relatively poor natural pasture.

The Pantanal zone measures approximately 185,855 square kilometres (15.09 per cent of the total area of the State), and is bounded by latitudes 16° and 22° and meridians 56° and 58°. The average altitude is about 100 metres above sea level and the mean temperature 28°C. The Pantanal has been described as a complex of waterways, forest and fertile land under grass of excellent quality.¹⁰ Topographically, it is a low-lying plain, broken here and there by hills and undulating ground, and irrigated by the tributaries of the river Paraguay, which during the rainy seasons overflow their banks and flood the lower parts of the Pantanal, driving the cattle towards the dry land. These rains and floods, however, alternate with periods of drought, when precipitation is sometimes less than 60 millimetres, lasting from June to August in Coxim, Corumbá and Aquidauana, and from May to September in Cuiabá and the surrounding districts.¹¹ The well-known grasslands of the Mato Grosso Pantanal are entirely composed of natural grasses such as the species of fingergrass, bristlegrass and bluestem known locally as the common *capim mimoso* (*Digitaria*), the *capim mimoso de talo* (*Setaria geniculata*) and the *capim vermelho* or *capim vermelho do Pantanal* (*Andropogon littoralis*). These grasses grow on land subject to flooding, the fingergrass and bluestem being the commonest. Balm-scale and barn grasses of which the local names are *capim carona* (*Elyonurus viridulus*) and *capim flexa* (*Echinochloa inflexa*)¹² thrive on dry soils. The farmlands are the habitat of a natural grass called Tio Pedro not yet classified by the botanists but greatly esteemed by stock farmers.

The splitting up of *latifundia* in the Pantanal¹³ is giving a new impetus to stock farming in this area, where, according to estimates, 12 million hectares afford pasturage for some 3 million head of cattle. Herd management is much more efficient nowadays, and the quality of the cattle has improved; zebu-creole crosses are increasing in number, and experiments have already

¹⁰ José Monserrat and Carlos Annes Gonçalves, *Observações sobre a Pecuária no Brasil Central*, published by the Department of Agriculture, Industry and Trade of Rio Grande do Sul, 1954, p. 48.

¹¹ Virgílio Correa, *Fazendas de Gado no Pantanal Mato Grossense*, published by the Ministry of Agriculture, 1955, p. 5.

¹² *Excursão Técnico-científica do Departamento da Produção Animal do Secretariado de Agricultura de São Paulo ao Pantanal de Mato Grosso*, 1959.

¹³ An old estate called "Descalvados", formerly consisting of 861,527 hectares; another known as "Firme", with an original area of 176,853 hectares; the *latifundia* of Antonio José da Silva, etc.

been carried out with pure breeds such as the Aberdeen Angus, Hereford and Devon. Some farms have their own landing-strips.

To sum up, stock farming is making steady progress in Mato Grosso, and its livestock surpluses supply other fattening and consumer centres. Thanks to its huge stock-farming potential, it is one of the States that offer the best prospects for the expansion of the livestock industry. Partly owing to favourable mesological conditions and partly because the development of crop farming is in full swing, there is a considerable dairy-farming potential in the extreme south of the State.

(b) *Goiás*

Area	642,036 square kilometres
Population (1960)	1.95 million inhabitants
Cattle (1960)	6.36 million head
Pigs (1960)	3.48 million head

This State lies south of latitude 15°, and four-fifths of its river system fall within the Amazon basin, which includes the Araguaia and Tocantins valleys; the remainder forms part of the basin of the river Paraná and its main tributary, the Paranaíba. Except in the Serra Geral, the altitude varies between 300 and 600 metres. A tropical savannah climate prevails, with no seasons and a mean annual temperature of 22°-28°C.¹⁴ According to the Brazilian Institute of Geography and Statistics (IBGE), Goiás comprises the following ecological zones: *cerrados*, or tracts of scrub (81.37 per cent); *campos* or open grassland (10.15 per cent); tropical forest (7.88 per cent); *cocales* or palm groves (0.57 per cent); and a small swampy area.

The principal stock-farming centres are Catalão, Jataí, Pedro Afonso, Taquatinga and Rio Verde. The founding of Brasília and the progress achieved by the State capital, Goiânia, are encouraging the development of dairy farms which will undoubtedly constitute one of Brazil's major sources of milk in future. The southern zone, which supplies part of the two capitals' requirements, is already an important producer centre, especially for butter.

The principal breed of cattle in Goiás is the creole strain known as Curraleiro, crosses of which with the zebu, in particular, are becoming daily more common. Purebred zebu are mainly to be found in the vicinity of the Triângulo Mineiro. The predominant activities are cattle breeding and fattening on natural grasslands and on artificial pastures of jaragua, guinea grass and molasses grass. Many of the cattle are sent to fatteners in the State of São Paulo.

(c) *Stock-farming areas in central Brazil*

A discussion of the ecology of the stock-farming areas in the Sul should be preceded by a few remarks on livestock activities in the part of the country described as central Brazil, a geo-economic zone¹⁵ to

which reference will be made several times in the present study, since it is here that Brazil's most progressive stock-farming activities are established.

The stock-farming area of central Brazil proper is made up of the States of Minas Gerais (especially the south and the Triângulo Mineiro), São Paulo (especially the north and north-east), Mato Grosso (especially the Planalto and the Pantanal), and the part of Goiás that lies south of latitude 15° and therefore includes the areas adjacent to Brasília, Anápolis and Goiânia, as well as the south and south-eastern zones and the upper Araguaia valley. Although certain characteristics of stock farming in some of these zones have already been mentioned, attention should be drawn to several aspects of the activity in relation to the area termed central Brazil.

In the first place, this is the stock-farming area with the highest cattle population density—particularly the Triângulo Mineiro and neighbouring zones. The main branches of activity are the breeding, grazing and fattening of beef cattle, and the production of purebred zebu specimens, the principal centre for the latter being the Triângulo Mineiro. Most of the cattle consist of zebu and crosses between these and creole strains such as the Caracu and the Curraleiro, which, in the pure state, are tending to disappear. The Nellore, Gyr and Guzarat are the predominant zebu strains, the Hindu-Brazil becoming less important. The amount of zebu blood in mestizos varies, but those with the highest proportion of Indian blood are found in the north-east of São Paulo and, to a lesser extent, on the stock farms of Mato Grosso and Goiás; in the latter, apart from the Curraleiro strain, now limited almost entirely to the northern part of the State, a cross between this and the zebu is found in abundance.

Most of the stock farming is of the extensive type, and breeding and fattening are usually carried on in different areas. As a rule, the cattle have to travel long distances on the hoof between the breeding, grazing and fattening centres and from there to the slaughterhouses. Transport facilities are gradually improving, however, and intensive and up-to-date farming practices are beginning to make headway, especially as regards fattening. In the north-east of São Paulo, which used to be a fattening centre only, breeding and grazing are undertaken today; more than half the meat consumed in the State of São Paulo comes from stock reared in its own territory. Barretos is no longer the only distribution centre; it has been joined by others like Rio Preto, Araçatuba and Presidente Prudente. Nor are efforts confined to production of the type of steer best suited for slaughter. The State authorities and the more progressive stock farmers are paying special attention to the improvement of fattening conditions, by means of fat stock competitions,¹⁶ the extension of better fattening systems and the introduction of more efficient herd management practices. Central Brazil is witnessing a rapid metamorphosis of stock-farming practices in respect of both its beef and dairy herds as a result of the sweeping changes which its main consumer centres are continually undergoing, particularly the urban areas

¹⁴ J. B. Villares' classification.

¹⁵ Nowadays the geo-economic concept of central Brazil usually includes the States of Minas Gerais, Goiás, Mato Grosso, São Paulo, Espírito Santo, Rio de Janeiro, Guanabara and Paraná, the last-named having been recently added to the list.

¹⁶ Established in 1949, in Barretos, Araçatuba, Presidente Prudente and Rio Preto by the Livestock Production Service of the São Paulo Department of Agriculture.

known as Greater São Paulo (São Paulo, São Caetano, Santo André, São Bernardo, Guarulhos and Osasco) and Greater Rio de Janeiro (Guanabara, Niterói, São Gonçalo, Duque de Caxias, Nova, Iguaçu, Nilópolis and São João do Meriti). The tremendous pace of population growth in central Brazil, the intensive rates of urbanization and industrialization and the need to supply other internal and external markets constantly necessitate the replacement of routine livestock production systems by more up-to-date methods.

5. SUL

Lying below the tropic of Capricorn, this region extends over 825,357 square kilometres, or about 10 per cent of the total area of Brazil. Almost two-thirds of it belong to the States of São Paulo (part of which is included in central Brazil) and Rio Grande do Sul, which are the most important in the region as far as stock farming is concerned. The ecological conditions in which the livestock industry is carried on in São Paulo and Rio Grande do Sul differ so greatly that separate descriptions are called for.

(a) São Paulo

Area	247,898	square kilometres
Population (1960) ...	12.97	million inhabitants
Cattle (1960)	10.39	million head
Pigs (1960)	4.92	million head
Poultry (1960)	36.76	million head

In the breeding zones, the altitude generally ranges from 300 to 600 metres above sea level and the temperature from 22° to 33°C, although exceptions are registered in the shape of higher temperatures during the rainy months and lower temperatures in the dry months, which coincide with winter. The rainy season generally lasts from September to April or May, and the period of drought from June to the end of August or beginning of September. The state of the pastureland and the amount of forage available naturally vary from one season to the other; supplies are plentiful during the hot rainy months, and carrying capacity is as much as 4-6 head per hectare but this falls off considerably during the cold dry months when two hectares are barely enough to keep one head of cattle.

The pastures of São Paulo are mainly composed of guinea, jaragua and molasses grass, which are also common in other stock-farming areas in tropical Brazil. The first abounds on sandy soils and in the hotter zones such as the west of the State; on new land, it may give a carrying capacity of 5 head per hectare, and on soil already used for crop farming, 1 to 2 head. Jaragua is more plentiful on the arable land in the central and northern parts of the State, and molasses grass, which is considered to be partly self-propagating, grows throughout the State, but principally in the south-east, where dairy farms are preponderant. The carrying capacity of jaragua and molasses grass is lower than that of guinea grass. Other less common varieties are Texas grass, Rhodes grass and a wide range of natural grasses. Cutting crops like Guatemala grass, Angola grass, cane for forage, etc., are cultivated on some dairy farms. Legumes are grown very little, either by themselves or in combination with grasses, but cam-

paigns are under way to extend cultivation of the Guandul pea (*Cajanus flavus* D.C.), the perennial soya bean (*Glycine javanica* L.), tropical kudzu (*Pueraria thunbergiana*, Sieb. and Zuss) and others. Pangola grass (*Digitaria decumbens* Stent) has latterly begun to gain ground; it was introduced in recent years by the Livestock Production Service, and highly successful experiments are being carried out at the Araçatuba Experimental Breeding Station.¹⁷

Cattle farming, in all its aspects, constitutes the most important branch of the livestock industry in São Paulo. Cattle are bred practically throughout the State, in some parts for beef and in others for milk. The north-east is the principal grazing area, especially for stock that is being fattened, and to a lesser extent for locally produced breeding cattle. This is Brazil's largest fat-steer centre, for, as a result of the high degree of industrialization in São Paulo, not only are cattle brought in from other States such as Mato Grosso, Minas Gerais and Goiás, but fat-stock production within the State itself is being expanded. São Paulo's beef herds are making notable progress, both quantitatively and as regards genetic improvements, herd and farm management and, very recently, fattening systems. In fact, only very small nuclei of such creole strains as the Caracu and the Mocho Nacional still exist on private farms, and even these are tending to disappear altogether because of their low meat and milk yields, which are far surpassed by those of the zebu, European breeds and high-grade crosses. There have recently been signs of increasing interest in the selection of polled (*mocho*) zebu with some Nellore blood.

In the beef herds the various breeds of zebu are preponderant. São Paulo has the largest number of Nellores, as well as a sizable number of other zebu strains and, generally speaking, crosses with a high proportion of zebu blood (between three-quarters and fifteen-sixteenths). Thanks to the progressive spirit of breeders, and to effective official and private technical guidance, an earlier-maturing kind of cattle is being developed. Charolais-zebu hybrids (Canchim cattle) are rapidly increasing; a more economic and popular type of cattle is thus being obtained, that combines the zebu's hardiness and age-long adaptation to tropical conditions with the higher yield and better quality meat proper to the Charolais.

The principal stock-farming centres for beef cattle are Barretos, Rio Petro, Olimpia, Paulo de Faria, Veadinho, Ituverava, Pitangueiras, Igarapava, Araçatuba, Presidente Prudente, Pereira Barreto, Penapolis, Andradina, Assis, Paraguaçu, Santo Anastácio, Presidente Bernardes and Presidente Wenceslau.

¹⁷ In the course of research on variations in the weight of twin steers, each of 285.5 kilogrammes, pastured on adjacent lots under guinea grass and Pangola grass, respectively, the following differences were registered after continuous grazing during the dry winter months of 1961 (May to September). In the one case a loss of 21.5 kg in weight (7.5 per cent) was registered despite the qualities of guinea grass, whereas the twin steer kept on Pangola grass gained 40.5 kg (14 per cent); this represents a difference of 3,720 cruzeiros (20 per cent of the animal's value) in favour of Pangola as against guinea grass. See São Paulo Department of Agriculture, Livestock Production Service, *Comportamento dos caprins Colômbio e Pangolana produção de carne durante seca de 1961*, Publication No. 16 on forage plants.

Dairy farming is also making rapid progress in the State of São Paulo, as regards both the volume of production and the quality of the milk produced. There was a time when the valley of Paraíba constituted virtually the only big dairy-farming area in São Paulo, since it satisfied over 50 per cent of consumer requirements, but by 1955 its share dropped to approximately 42 per cent, and although it still ranks first in absolute terms at the time of writing, the relative importance of the other dairy-farming zones (the south-east and even the north-west, for example) is increasing daily. Milk production has extended throughout the State, which is the second largest producer after Minas Gerais. The principal dairy-farming centres are Taubaté, Guaratinguetá, Cruzeiro, Cachoeira Paulista, São José dos Campos, Campinas, São João da Boa Vista, Mococa, Cajurú, Araras, Araguara and São Carlos.

Over 90 per cent of the dairy herds consist of European-zebu mestizos (the corresponding proportion some nine years ago was 75 per cent), in which the Indian blood tends to predominate, while the proportion of purebred European cattle may be less than 2 per cent. Outstanding among the best-known European breeds are Holsteins, Brown Swiss and Jerseys, of which there are several first-class herds with purebred specimens either born in Brazil or imported from Europe, the United States, Canada, Argentina and Uruguay. A good deal of cross-breeding work has been done recently on the Red Poll and Guzerat, with satisfactory results.

(b) Rio Grande do Sul

Area	267,528	square kilometres
Population (1960)	5.45	million inhabitants
Cattle (1960)	9.61	million head
Pigs (1960)	5.67	million head
Sheep (1960)	10.09	million head

Roughly speaking, Rio Grande do Sul is bounded by latitudes 27° and 33° and meridians 50° and 57°. It may be divided into the following physiological areas:

- 1. Litoral
- 2. Depressão Central
- 3. Missões
- 4. Campanha
- 5. Serra do Sudeste
- 6. Encosta do Sudeste
- 7. Upper Uruguay
- 8. Campos de Cima da Serra
- 9. Planalto Médio
- 10. Encosta Inferior do Nordeste
- 11. Encosta Superior do Nordeste

Ecological conditions in this State, where the four seasons are clearly differentiated as is characteristic of temperate countries, are unlike those prevailing in the other Brazilian States, with the result that its stock-farming activities have many distinctive aspects and features. The dissimilarities are particularly striking in respect of pastures and breeds of cattle. Mean annual temperatures vary relatively little among the eleven zones; the lowest (16°-16.5°C) are those reg-

istered in the Campos de Cima da Serra and the Serra do Sudeste, while intermediate figures (17°-18°C) are recorded in the southern part of the Litoral, Campanha, the Planalto Médio and the Encosta do Sudeste, and the highest (18.5°-19°C) in Missões, the northern Litoral, the Depressão Central and the upper basin of the river Uruguay.

Heights above sea level range from 5-40 metres in the Litoral, 5-100 metres in the Encosta do Sudeste and 100-400 metres in the Depressão Central, Campanha and Missões, to over 1,000 metres in the Campos de Cima da Serra and the Encosta Superior do Nordeste.

Precipitation varies between 1,150 and 1,500 millimetres on the Litoral and in Campanha and Encosta do Sudeste, for example, and between 1,500 and 2,500 millimetres in the Depressão Central, Missões, the Serra do Sudeste, the upper Uruguay valley, the Campos de Cima da Serra and the Planalto Médio.

The pastures of Rio Grande do Sul are made up primarily of natural forage plants (grasses and legumes) with a high nutritional value. The grasses include those locally known as *grama argentina*, i.e., savannah or carpet grass (*Axonopus compressus* Sw.), *grama forquilha* or Bahía grass (*Paspalum notatum* Flugge), *grama de jardim* or cocksfoot (*Dactylis glomerata* L.), Rhodes grass, *azevém* or Italian ryegrass (*Lolium multiflorem* Lam.) and so forth; legumes are relatively plentiful in the frontier zone, clover and birdsfoot trefoil (*Lotus corniculatus* L.) being those most commonly combined with grasses. Lucerne is grown on some dairy farms.

The quality and condition of the pastureland differs greatly, according to the kind of soil and the rainfall régime. It is poor on the Litoral, especially in the north, and in the Depressão Central, variable in quality in the north-east, and excellent in the areas bordering upon Uruguay and Argentina, for example, Missões, Campanha and the Serra do Sudeste.

As in most of the stock-farming areas of Brazil, pasture shortage is a serious problem during prolonged droughts. For instance, during June, July and August the scarcity of forage becomes acute, causing a high mortality rate, loss of weight and reduction of yields; by the end of the winter, grazing stock are unduly lean. Obviously, this situation is aggravated by the lack of stored forage and inefficient pasture management. However, the formation of artificial winter pastures is being more extensively undertaken.

The carrying capacity of the pastureland, in consequence, varies widely according to the quality of the soil and the season of the year. The lowest averages are registered on the northern Litoral and in the Depressão Central (where 2-4 hectares are needed per head of cattle),¹⁸ while on the southern Litoral, and in Missões, Campanha and the Serra do Sudeste, carrying capacity is much greater, averaging about 1.5-2 hectares of pasture per head of stock.

The cattle population of Rio Grande do Sul is the fourth largest in the country, and is unevenly distributed over an estimated 160,000 square kilometres of pas-

¹⁸ 20-40 head per *quadra de sesmaria*, this measure being equivalent to 87.1 hectares.

tureland; the average livestock population density in the area under grass would therefore seem to be 60 cattle and 63 sheep per square kilometre.

The most important branch of the livestock industry is the breeding and fattening of cattle; these activities are carried on in many parts of the country, but in this State the largest numbers and some of the finest of the beef cattle are to be found along the borders of Uruguay and Argentina where, according to estimates, two-thirds of the cattle population of Rio Grande do Sul is concentrated, and where the average size of the farms is greatest (2,000 hectares), there being many *latifundia*.

Dairy farming is much less wide-spread than farming for meat production, and takes up a relatively limited and clearly demarcated area, situated on the right-hand flank of the Encosta Inferior do Nordeste and in the vicinity of Porto Alegre, and representing the State's principal source of milk supplies. A second dairy-farming area is constituted by the flat plains of Pelotas and Rio Grande, in the neighbourhood of the Lagoa

dos Patos, where the main activity is the breeding of stud bulls for different parts of the country. There are, of course, other parts of the State where dairy herds exist, but they could not properly be called dairy-farming areas.

The main sheep-farming zones are, again, the districts bordering upon Argentina and Uruguay, where beef cattle farming is most highly developed, and, in addition, Santa Victoria do Palmar. Rio Grande do Sul has the largest sheep population in the whole of Brazil (60 per cent of the total); in recent years, however, inventories seem to have dwindled by about a million head, for want of any very strong incentives to producers, despite good wool prices on the world market.

Pigs are bred throughout the State, but the largest concentration of this species of livestock is to be found in the north-east, in the upper basin of the Uruguay, which comprises the biggest pork-processing centre in South America, i.e., the Colonia Nova area, where this industry is the principal economic activity.

III. CHARACTERISTICS OF PRODUCTION

1. LIVESTOCK BREEDS AND THEIR DISTRIBUTION

(a) Cattle

(i) Indian breeds

The zebu or Indian breeds are undoubtedly the principal source of meat output in Brazil. In the cattle population of central Brazil, which represents about two-thirds of that of the whole country, zebu crosses are heavily preponderant,¹⁹ no doubt because of the great adaptability of the Indian breeds to a tropical environment, an advantage which European cattle cannot offer.

The immense potential of the Brazilian market—characterized by a steadily rising demand for meat—and, on the other hand, the adverse conditions prevailing in the tropics, have created the need to build up a cattle population which not only matures relatively early and gives large meat yields, but can also stand high temperatures and is comparatively resistant to pests and diseases. The genetic improvement of the Brazilian zebu is directed towards these objectives, and the progress achieved in this connexion by official development institutions and by stock farmers may be described as substantial. Brazil's zebu inventories are among the most valuable in the world, both for their quantity and quality. With the exception of the stock farms in the States that have a temperate climate, and small nuclei of European and creole cattle in the tropics, the rest of Brazil's cattle population may be regarded as basically composed of the Gyr, Nellore and Guzerat breeds of Indian cattle and the Hindu-Brazil strain. Moreover, the number of purebred and improved zebu cattle is increasing continuously, as can be seen from the fact that between 1939 and 1960 over 79,000 male and female animals were registered

by the breeders' associations.²⁰ In addition, the level of zootechnic improvement achieved in respect of the zebu breeds is paralleled by the progress made in cross-breeding. In Minas Gerais, Goiás, São Paulo and Rio de Janeiro there are many large farms where pure zebu strains and crosses with varying proportions of zebu blood are bred. Cross-breeding is also progressing at a rapid rate in Mato Grosso.

The criteria adopted by Brazilian breeders for improving the zebu have become more practical of late, as they have in other countries; for instance, more weight is now carried by such functional considerations as meat and/or milk yields, while undue concern for secondary external features is a thing of the past. The large ears formerly so greatly sought after by zebu breeders are no longer considered important.

Although the Nellore strain (Indian Ongole) is at present less numerous than the Gyr, it is attracting the attention of breeders more and more every day. This preference for the Nellore, which is strikingly apparent in central Brazil, is consistent with the functional viewpoint of the modern stock breeder and with attributes of this particular breed of beef cattle, which include vitality, early maturity, good weight and high meat yields, greater longevity, high fecundity and a preputial conformation which is less conducive to the development of acrobystitis under extensive systems of breeding. The smallness of the teats facilitates suckling.

²⁰ In the Brazilian Rural Association, the Bahia Livestock Institute and the North-eastern Stock-Breeders' Association, the following number of specimens were registered between 1939, and 1952 and 1960, respectively:

	1939-52	1939-60
Hindu-Brazil	15,046	22,385
Gyr	13,222	33,434
Nellore	5,846	18,420
Guzerat	3,080	5,361
	37,194	79,600

¹⁹ Some Brazilian experts estimate that about 50 million head of cattle are zebu and zebu crosses.

The Nellore is most plentiful in the State of São Paulo, especially in Araçatuba, Rio Preto, Presidente Prudente and Barretos, but it is spreading to other parts of São Paulo and to many areas in Minas Gerais,²¹ Mato Grosso, Goiás, Rio de Janeiro, Bahia, Alagoas, etc.

Official programmes based on the Nellore are being developed in Uberaba, Sertãozinho (in the State of São Paulo), the Campo Grande Experimental Farm (Mato Grosso), Quixeramobim (Ceará), Beaterria (Pará), and Mundo Novo (Bahia).

The Gyr is probably the strain of zebu which is commonest in Brazil, although its popularity as a meat producer appears to have declined, and it is being regarded more as a dual-purpose (beef and dairy) breed; many farmers and some official establishments are selecting it for milk production, in view of its good yields,²² and are using it for cross-breeding with European dairy cattle such as the Dutch, Jersey, Brown Swiss and Guernsey breeds. Although the Gyr is slower to mature and its meat yield is smaller it is held in considerable esteem.

The principal centres for the purebred Gyr are in Uberaba, Cássia and Curvelo (Minas Gerais); in Franca, and the area stretching as far as the Ribeirão Preto, on farms in Barretos and, recently, in Araçatuba and Pereira Barreto (São Paulo); in the municipalities of Vitória da Conquista, Itambié, Itapetinga, Maracani and Encruzilhada (Bahia); and in the States of Rio de Janeiro and Paraná.

In addition to what is being done on private farms, the Government is carrying out genetic improvement programmes in relation to milk production, on the basis of the Gyr, at the Uberaba Experimental Farm (Minas Gerais);²³ the Pedro Leopoldo Hacienda (Minas Gerais); the Umbuzeiro Experimental Station (Paraíba); and the Breeding and Experimental Farms at Sertãozinho (São Paulo), Quixeramobim (Ceará), Mundo Novo (Bahia) and Limoeiro (Pernambuco).

In the zebu grading of Brazilian stock, the Guzerat²⁴ (Indian Kankrej) has exerted a strong influence, since it has been used in mass cross-breeding for many years—in fact, since before the First World War. Numerically, it ranks third in Brazil today. Its improvement through selection is said to have been adversely affected by the extent to which it has been used in the production of the Hindu-Brazil variety.

Apart from its importance as a meat producer in tropical surroundings, the Guzerat is considered a dual-purpose breed; there are Guzerat strains in Brazil which are held to be very satisfactory as milk producers, and it is even claimed that it is as good a dairy breed as the Gyr. Although inferior to the Nellore and Gyr as regards the conformation of its fore and hind-

quarters, it is said to excel them in respect of early maturity and meat yield.

There are large Guzerat breeding farms in Curvelo (Minas Gerais) and Cantagalo (State of Rio de Janeiro), whence this strain has spread to many other parts of the country, particularly Campos, Araçatuba, São Pedro dos Ferros, Montes Claros, Corinto, Teófilo Otoni and Almenara (State of Minas Gerais); it is also common in the south-east of Bahia, in the vicinity of Mundo Novo, Itambé, Itapetinga and Vitória da Conquista. Although the breed is not very widely known in São Paulo, the State authorities possess sizable herds of Guzerat beef cattle on the Sertãozinho and Andradina Experimental Farms (where, furthermore, experiments are being conducted in crossing them with the Devon breed), and of the dairy strain at the Araçatuba Experimental Station. The Guzerat is also being tried out for milk-production purposes at the Uberaba and Campo Grande Experimental Farms referred to above.

By means of the fusion of several imported Indian varieties, chiefly Guzerat and Gyr, the Hindu-Brazil breed²⁵ was built up in Uberaba; hence its original name of "Induberaba". It is generally recognized that the Hindu-Brazil was the outcome of indiscriminate cross-breeding between these imported Indian strains (many of which no longer exist in Brazil), followed by a gradual process of improvement and the securing of some of its external and functional characteristics. One of its attributes is resistance to high temperature, thanks to its great thermo-regulation capacity. Accordingly, it is claimed that the Hindu-Brazil is particularly well adapted to very hot low-lying areas with poor pasturage, like those found in the Brazilian sertão. Its absorption of the low-yielding ordinary stock in continuous crossing is also adduced in its favour.

The best Hindu-Brazil farms are in Uberaba, Conquista, Araxá and Montes Claros (Minas Gerais), and in Mundo Novo (in the south of Bahia). Official experimental work is being carried out in Uberaba, Campo Grande and Sertãozinho, and breeding in Mundo Novo. For some time now this variety has been tending to shift from the Triângulo Mineiro to Bahia.²⁶

To sum up distribution data on the foregoing Indian breeds, they are reared concurrently in several areas, and even within one and the same fazenda or breeding station, as is often the case in Uberaba, Barretos, Araçatuba, Mundo Novo, etc., while in addition breeding stations which specialize in one or other variety are scattered throughout tropical Brazil.

(ii) *European breeds of beef cattle*

These are found chiefly in Rio Grande do Sul, where, except for a few zebu farms, the Hereford, Shorthorn, Aberdeen Angus, Devon, and Charolais breeds predominate. Beef production in the State in question is based essentially on these breeds. The temperate climate and the quality of the pastureland are favourable to the growth cycle as well as to the genetic improvement

²¹ Especially Uberaba, the so-called "zebu Mecca".

²² At the Getúlio Vargas Experimental Farm in Uberaba, in 404 milkings an average output of 1,926.4 (plus or minus 28.1) kilogrammes was registered in 253.6 (plus or minus 2.6) days. Daily output per cow was 7.6 kilogrammes (see Instituto de Zootécnica, *Serie Monografias*, No. 2, 1961).

²³ Between 1950 and 1959 average output per cow rose from 1,454.9 (plus or minus 54.6) kilogrammes to 2,183.7 (plus or minus 64.0) kilogrammes (*ibid.*).

²⁴ Some writers do not admit this to be a separate strain; J. B. Villares regards it as a variant of the Kankrej.

²⁵ There are substantial differences of opinion among zootechnic experts and geneticists as to the classification of the Hindu-Brazil; some hold that it should not be regarded as a separate variety, but simply as a cross, whereas others consider it to be a genuine breed created in Brazil.

²⁶ See A. Alves Santiago, *A Epopeia do Zebu*, p. 500.

of cattle of European origin. In Rio Grande do Sul the creole stock disappeared at least half a century ago, having been steadily absorbed by the European breeds. The continuous crossing responsible for the change is still practised and accounts for the high level

of genetic improvement of the cattle population in this State.

The foregoing assertion is corroborated by the number of registrations on the books of the local association concerned up to the beginning of 1961 (see table 4).

Table 4

Rio Grande do Sul: Genealogical register of European beef cattle, up to 1960

Breed	National		Imported		Total		Grand total
	Males	Females	Males	Females	Males	Females	
Hereford ^a	24,863	26,868	1,964	6,359	26,827	33,227	60,054
Shorthorn ^b	5,158	5,365	695	1,370	5,853	6,735	12,588
Aberdeen Angus ^b	3,770	4,071	212	608	3,982	4,679	8,661
Devon ^c	736	675	72	181	808	856	1,664
Charolais ^d	879	825	65	199	944	1,024	1,968
Others ^e	158	167	19	38	177	205	382
	35,564	37,971	3,027	8,755	38,591	46,726	85,317

Source: Pelotas cattle breeders' associations.

^a Registration of Herefords began in 1907.

^b Registration of the Shorthorn and Aberdeen Angus breeds began in 1906.

^c Registration of Devon cattle was started in 1914.

^d Registration of the Charolais breed began in 1927.

^e Including the following breeds: Sussex and Dun, Limousine, Brown Galloway and Santa Gertrudis. Registration of these began in 1928, 1937, 1951 and 1959 respectively.

It should be noted that the practice of registration has gained ground during the past decade, and that most of the animals entered were born in Brazil. For the first few years after the establishment of the register, the majority of the entries naturally represented imported animals.

Beef cattle breeding techniques are most advanced in the following municipalities in the Campanha area: Alegrete, Bagé, Dom Pedrito, Quaraí, Rosario, Livramento, São Gabriel and Uruguaiana. These provide grazing for about 2.3 million head of cattle. Here the predominant breed is the Hereford (75 per cent or more), the so-called "borderland steers" enjoying a wide reputation; the existence of this hardy, early-maturing and high-yielding strain, and of first-class natural pastures, constitute the distinguishing features of the livestock industry in Campanha. Although the contribution of the other breeds (Shorthorn, Aberdeen Angus and Devon) and crosses with these is smaller in quantitative terms, they are of great importance as being highly specialized and producers of prime beef, while the majority are, through grading, greatly improved or purebred.

Some municipalities in the Serra and Encosta do Sudeste areas and in the vicinity of Lake Mirim also possess fine herds of beef cattle of the breeds listed above, estimated at 1.6 million head. Thus, the best and most valuable beef cattle inventories are to be found in the foregoing areas, which account for 40 per cent of the cattle population of the State.

The biggest nucleus of the Charolais variety which, incidentally, is arousing considerable interest in various countries, is to be found in Julio de Castilhos, on the Planalto of Rio Grande do Sul; this is probably the

largest herd in the world (over 15,000 head) owned by a single breeder.

There are sizable nuclei of Devon cattle in the highlands (Campos de Cima da Serra) and in some parts of the Depressão Central and of the Serra and Encosta do Sudeste.

In a number of places in the Missões area and the centre of the State (Soledad, Sobradinho, Candelaria and Santa Cruz do Sul, Cachoeira do Sul, São Sepe, Rio Pardo, Caçapava do Sul and the north-east of Encruzilhada do Sul), there are zebu herds mainly composed of Nellore and Gyr from Minas Gerais, besides European-zebu crosses.

In the remainder of the country, i.e., in tropical Brazil, stock farming on the basis of European beef cattle is confined to a very few establishments. The principal role of European breeds in this climatic zone is perhaps as a source of industrial crosses, like the Aberdeen Angus x zebu (Brangus),²⁷ which United States and Argentine breeders are establishing; the Charolais x zebu, for the purposes of producing Canchim cattle,²⁸ a cross-breed already established in

²⁷ Experiments are being made in Brazil with these two breeds at the Cinco Cruzes Hacienda, Bagé, Rio Grande do Sul.

²⁸ The most promising type of Canchim cattle, according to the research that is being conducted at the São Paulo Experimental Station, is a Charolais-zebu cross in which the proportion of Charolais blood is five-eighths. Topcrosses, that is, the offspring of the mating of animals which are both $\frac{5}{8}$ Charolais-zebu, show a high degree of heterosis or hybrid vigour with respect to life in the tropics, thanks to their resistance to heat and to ectoparasites, and have the additional attributes of very early maturity and high yields; in feeding tests to measure gains in weight, carried out in São Paulo, five 15 month-old $\frac{5}{8}$ Charolais-zebu heifers beat all the State

the United States under the name of Charbray; and the Shorthorn-zebu, which United States breeders succeeded in establishing at the King Ranch with a ratio of $\frac{3}{8}$ Shorthorn to $\frac{5}{8}$ zebu blood, and which is known today as the Santa Gertrudis, highly recommended for beef production in the tropics. A few nuclei of this breed exist in São Paulo.

(iii) Creole breeds

As in other tropical countries in Latin America, the so-called creole breeds are tending to disappear in Brazil. Despite the innumerable advantages ascribed to them under the heads of hardiness and adaptability the fact remains that creole cattle are to be found, in steadily decreasing numbers, only in the less developed stock-farming areas in the Norte and Nordeste of Brazil, since in central Brazil and Rio Grande do Sul the native stock has been virtually absorbed by the zebu and the European breeds, respectively, with their much greater economic yields. The small nuclei still surviving as classic specimens of the creole breeds belong to the Government and to a few stock breeders, and are kept for selection purposes.

The following are the creole varieties which deserve special mention.

The Mocho Nacional is a hornless strain very similar to the Colombian Romo-Sinuana and to certain types of polled creole cattle existing in other South American countries. Selection was first officially applied to this breed in the State of São Paulo, in 1911, originally with a view to meat production and later to obtain dual-purpose (beef and dairy) cattle. According to zootechnic experts, it originated in crosses between cattle imported in colonial times and the Red Polled and Aberdeen Angus breeds.²⁹

Some experts think that the horned Caracu is best suited for milk production, to which end it has been subjected to selection since 1909, while for others it is a multi-purpose breed (beef, dairy and draught cattle). It was established in the State of Minas Gerais, but the largest herds are to be found in São Paulo.³⁰ The Nova Odessa (São Paulo) Selection Station registers for adult cows and average output of about 1,600 kilogrammes of milk, with a fat content of 4.62 per cent, over a milking period of 300 days.³¹ The variety of Caracu known as the Caldeano is being subjected to selection for milk production purposes at Poços de Caldas (Minas Gerais).

The Mantiqueira breed comes from the south of Minas Gerais, and has resulted from an undefined level of grading of the offspring of creole cattle crossed with the Dutch breed originally imported. Its selection for milk production is of relatively recent date, since the process began in 1952. The Mantiqueira has the virtues

of unusual hardiness and high milk yields. The selection and propagation of these last two creole breeds—and perhaps of other varieties of creole cattle existing in Brazil—on a much larger scale than at present would have important implications from both the zootechnic and the economic standpoints, since it might shed some light on the best way to solve the problem of milk production in the tropical zones of Brazil, a task in which purebred foreign dairy cattle have been of little help.

(iv) Foreign dairy breeds

The State of Rio Grande do Sul possesses the largest number of specialized European dairy cattle, since the mild temperature and the ease with which forage plants of prime nutritional value can be cultivated facilitate farming on the basis of these breeds, either pure or highly graded.

The Dutch breed (Holstein) is fairly wide-spread and is the most popular on farms producing milk for direct consumption. Ninety per cent of the dairy cattle population in the two main sources of milk supplies in Rio Grande do Sul consists of Dutch cattle, the majority purebred through grading, of both the American variety and the Dutch breed proper.

Next in importance come Jersey cattle, which are highly esteemed, and are concentrated mainly in the areas producing milk for industrial processing. The Jersey cattle population is largest in the so-called "Colonial" area, where holdings are small; and the biggest herds are to be found in Pelotas, Canguçu, Santa Rosa, Iguí, Santo Angêlo, Santana do Libramento, Tres de Maio, Rosário do Sul and Bagé.

The State authorities are developing acclimatization programmes with small groups of Ayrshires, so far with satisfactory results, as well as with Brown Swiss and Red Danes.

The distribution of European dairy breeds in areas lying above the tropic of Capricorn is manifestly limited on account of the difficulties of acclimatization in that environment. Purebred and highly graded nuclei of the Dutch, Jersey, Brown Swiss, Guernsey and other breeds, used for commercial farming and for the production of breeding stock, are found both in the vicinity of the large urban centres, where substantial demand and high prices for fresh milk have induced a few enthusiastic farmers to carry the careful feeding and management of these improved breeds far enough to overcome a series of difficulties, and also in certain relatively isolated parts of the interior where conditions are favourable.

Apart from this small quantity of improved European stock, rather more than 50 per cent of the remainder of the dairy cattle population in the Norte, Nordeste and in central Brazil is made up of European-zebu crosses, whose genetic composition ranges from a quarter-strain of the dairy breed upwards, half-breeds representing the largest proportion. In central Brazil the level of grading is higher, and milk production is basically dependent upon such crosses; in São Paulo, for example, almost the whole of the dairy cattle population consists of European-zebu cross-breeds, with an apparent tendency towards $\frac{5}{8}$ European x zebu.

records, reaching an average weight of 486 kilogrammes, with a meat yield of 62.4 per cent (see Ministry of Agriculture, *Estudios Técnicos*, Bulletin No. 17, 1960, pp. 44-46).

²⁹ São Paulo Veterinary Association, *Boletim*, December 1952, p. 12.

³⁰ Municipalities of Ribeirão Preto, Batatais, Franca, São Carlos, Casa Branca, San João da Boa Vista, Tieté, Piracicaba, etc. Other groups are to be found in Lagos (Santa Catarina) and in the Pantanal of Mato Grosso (see O. Domingues, *O Gado nos Tropicos*, p. 269).

³¹ *Ibid.*, p. 14.

The dairy breeds used in crosses for improvement purposes include the Holstein, Brown Swiss, Jersey and Red Polled, while of the zebu strains the Gyr and Guzerat, and then the Nellore, are generally preferred. It would seem that European-Guzerat and European-Gyr crosses are commoner in Minas Gerais, while in São Paulo the European-Guzerat is more plentiful.

Again, Dutch cattle seem to be favoured as the breed used to improve the stock, and the proportion of Dutch-zebu crosses is in fact greater, although this may be partly attributable to the wider distribution of the Dutch breed throughout Brazil, which means that it provides a broader and more readily obtainable basis for improvement. The truth is that no adequately proven technical conclusions have as yet been established on the basis of which economic advantages can be adduced, in general terms in favour of one or the other type of crossing and of an "optimum" level of grading, among other reasons because this depends upon many factors occurring in the most diverse combinations.³² The prevailing view so far seems to be that given the existing environmental conditions and methods of farming, and particularly under the *retiro* system,³³ the important thing is that the cross-breeding should be based on zebu or ordinary stock on the one hand, and on a European breed on the other, with varying percentages of the superior strain. On the Santa Monica Experimental Farm (Juparaná, State of Rio de Janeiro) progress is being made with experiments in Dutch-zebu cross-breeding.

There is likewise, as has already been stated, a tendency on the part of producers and agencies concerned with experimenting and development to subject purebred Gyr and Guzerat to selection for milk production purposes.

In the municipality of Pitangueiras (State of São Paulo), on the Tres Barras da Anglo fazenda, a breed of dairy cattle has been in process of formation for ten years, under the extensive system of farming, on the basis of the Red Polled and Guzerat breeds. The aim is to establish a $\frac{5}{8}$ Red Polled x Guzerat variety, dark red in colour, hornless, the cows with excellent udder conformation and yielding a large output of milk with a high fat content; bulls and cows showing such characteristics already exist. Although the two original breeds are not classified as specialized dairy cattle, it is undoubtedly true that through line breeding high-yielding cows with good conformation for milk production are being obtained.

(v) Buffalo breeding

According to a report by the Regional Inspection Unit of Belém (Pará), the first buffaloes were imported in 1906, from the Island of Trinidad, and were sent to the Island of Marajó. The following imports were subsequently affected: 1907, from Africa and

Java for Alagoas; 1908, unspecified; 1918, from India for Uberaba; 1920, from Italy for São Paulo (information somewhat unreliable); 1921, from India, for Cássia (Minas Gerais); and 1948, from Italy for São Paulo.

The National Dairy Farming Commission of the Ministry of Agriculture³⁴ states that Brazilian buffaloes resemble the Indian breeds known as Meshana, Nagpurí and Jaffarabadi, and crosses with these; the roan and black varieties predominate, the latter being the more docile and better suited for milk production.

Of the total buffalo population, estimated at about 63,000 head, three-fourths are to be found in Amazonia and the remainder in Cássia, Campo Belo, Pedra Negra, Nepomuceno, Uberaba, Neves, Curvelo, Sete Lagoas, Pedro Leopoldo and Aruaguari (Minas Gerais); in the south of the State of São Paulo, in Franca and the Paraíba Valley (São Paulo, and Rio de Janeiro); in Lajes (Santa Catarina); and in Campo Grande and Nhecolândia (Pantanal), in Mato Grosso.

In Amazonia, especially in the Island of Marajó, the buffaloes usually run half-wild, but both here and in other parts of Brazil mentioned above there are signs of a trend towards rational buffalo farming.

The advantages of this species include the fact that it is easy to rear in a humid tropical environment on land liable to flooding, where cattle breeding poses certain difficulties. The buffalo takes good advantage of high-quality pasture, and also thrives in dry-soil areas under natural grassland, provided that it has water in which to wallow.

Although they are slow breeders,³⁵ buffaloes (*Bos bubalus*, Linneo) are valued for their multi-purpose potential as beef and dairy cattle and as draught animals. On good pasture land, buffalo cows not yet selected produce on an average 900 litres of milk yearly (3 litres daily during 300 days of the year), with a high fat content (7 per cent); and this yield could be considerably increased in the case of selected cows kept part of the time in byres. Castrated buffaloes are said to weigh up to 500 kilogrammes or more at 3-4 years of age and give an average meat yield of 48-50 per cent, which means that they produce more carcass meat than ordinary stock and zebu crosses. Although their meat is not very tender, it is suitable for jerked beef. As draught animals, buffaloes are unsurpassable.

In order to turn these attributes of the buffalo species to good account, the Regional Inspection Unit of Belém (a dependency of the National Livestock Production Department established in 1943) undertook experimental work on the São Salvador Model Farm, Island of Marajó, municipality of Soure (Pará), and so did the Institute of Agronomics for the Norte (Pará), a dependency of the National Agricultural Research Service. These are the only experimental stations concerned with buffaloes on the American continent. The first research projects were drawn up in 1944, and

³² Difference in the quality of available resources, market influences, producer preferences, relative effects of hybrid vigour and of the proportion of the superior strain, etc.

³³ Traditional type of non-rationalized dairy farming, based on milking with calf once a day, in the morning, and separation of the calf from the cow in the afternoon. Large herds are generally sub-divided in enclosures with room for 20-40 head and provided with a shed to which the cattle are brought twice a day (for milking in the morning and to separate the cows from the calves in the afternoon).

³⁴ Ministry of Agriculture, National Dairy Farming Commission, *A Criação de Búfalos para Fomento da Produção Leiteira na Amazonia*, Rio de Janeiro, 1958, pp. 20, 29, 41 and 51.

³⁵ First offspring at three and a half to four years of age and gestation period of ten and a half months.

related to the study of breeds, strains, types and varieties of buffaloes in Pará; their phenotype; meat, milk and labour yields; diseases; resistance to environment, etc. It is to be hoped that these studies will enable buffalo farming to be expanded and rationalized in many parts of the Amazon basin in Brazil, particularly in swampy areas that are unsuitable for economic farming of other livestock species.

(b) Pigs

The majority of the Brazil pig population belong to creole breeds of Iberian origin and to crosses of these with foreign strains.

The native breeds include the following: Caruncho, Tatú or Nilo, wide-spread throughout Brazil, and particularly useful as producers of lard and bacon; Nilo-Canastra, for pork and bacon;³⁶ Piau, for pork and bacon, commonest in Minas Gerais, Goiás, São Paulo, Rio de Janeiro and Paraná; Pirapetinga, well known in Minas Gerais, Rio de Janeiro and Espírito Santo; Canastrão; Canastra, for pork, bacon and lard, and Pereira, for pork and bacon.

Broadly speaking, creole pigs are slow-growing and attain little weight, but, on the other hand, they are very hardy and adaptable to environment.

The principal foreign breeds, whose productivity is much higher than that of the creole pigs, include the Duroc-Jersey, Berkshire, Poland-China, Wessex-Saddleback, Landrace, Hampshire, etc. The proportion of purebred pigs has greatly decreased, but the contribution of these breeds as a basis for crossing is continually expanding, the Duroc-Jersey playing a particularly outstanding part in this connexion. Foreign breeds of pigs are most widely used in central Brazil, Paraná, Santa Catarina and Rio Grande do Sul, where half or more than half the pigs sent to the slaughterhouse belong to these breeds and their crosses.

(c) Sheep

Foremost among these are the breeds of foreign origin and crosses with creole strains, descendants, it would seem, of the Churra sheep brought in by settlers in colonial times, and small in size, with long, coarse wool, much in demand for rug-making.

Where conditions are most favourable for the sheep industry—in Rio Grande do Sul, for example—creole sheep have been superseded by higher-yielding varieties with finer wool. Twenty years ago, the sheep population of Rio Grande do Sul was mainly composed of the Romney Marsh and creole breeds, whereas nowadays, as a result of official sheep improvement programmes, Corriedales are paramount, while the Romney Marsh comes next in order of importance. Both are dual-purpose breeds, yielding mutton and medium-staple wool. Cross-bred sheep no longer display outstandingly creole characteristics. Artificial insemination, specially promoted by the Federal Government, has played a major part in the improvement of the sheep population.

Today, the sheep inventories of Rio Grande do Sul can be broken down by breeds as follows: 50 per cent Corriedale, 30 per cent Romney Marsh and the re-

mainder the wool-bearing South American Merino (the same that is found in Argentina and Uruguay), Australian Merino and Ideal or Polwarth, which are becoming increasingly wide-spread. Breeds reared for mutton include Hampshires and Southdowns. In the Nordeste, the sheep have no wool and are kept only for the production of mutton and sheepskins. In Ceará, selection procedures are being applied to Morada Nova sheep.

(d) Goats

The main foreign breeds found in Brazil are the Nubian, Toggenburg, Anglo-Nubian, Indian, Saanen, Murcia, Mambrina, Maltese and Angora. Among the creole breeds, mention may be made of the Moxotó, Curaça or Marota and Canindé, all of which are found in the Nordeste, and the Meridional, in the Centro-Sul. The breeding of goats for the production of meat, skins and milk is of great economic and social importance in the Nordeste and the northern part of the Este.

2. LIVESTOCK PRODUCTION

(a) Value of production

According to the figures in table 5, in 1960 the value of all production (representing meat, milk, lard, bacon, eggs and wool) amounted to the high figure of 208,603 million cruzeiros. If this is added to the other items of primary production (hides, tallow, tongue, offal, etc.) the value amounts to over 230,000 million cruzeiros. The largest contribution to livestock production is from cattle, under the headings of meat and milk, whose share amounts to 67 per cent of the total value. Next in order of importance is pig production (meat, lard and bacon), which constitutes 20 per cent of the total; then come poultry products, representing 11 per cent, and lastly wool, mutton and goat's flesh.

Table 5

Brazil: Composition of livestock production, 1960
(Value in millions of cruzeiros)

	Value	Percentage of total
<i>Meats</i>		
Beef	88,528.6	42.4
Pork	14,866.9	7.2
Mutton and lamb.....	1,189.2	0.6
Goat's flesh	951.9	0.5
Poultry	822.8	0.4
TOTAL	106,359.4	51.1
<i>Other products</i>		
Milk	50,844.0	24.4
Eggs	21,777.6	10.4
Lard and bacon.....	26,604.0	12.7
Wool	3,044.7	1.4
TOTAL VALUE	208,629.7	100.0

Source: Ministry of Agriculture, Production Statistics Service.
^a Fresh, chilled, frozen, salted, jerked, cured, canned, etc., excluding the value of tongue, offal, sausages (all types), pastes and meat extracts.

³⁶ Closely resembling the Colombian creole breed known as Zungo-Costeño.

It should be noted that the revenue generated in the livestock sector represents a considerable part of the national product, and that recently it has exceeded the contribution of a number of basic crop-farming sectors.

The production of beef and pork in 1958 exceeded in value that of coffee berries, and in 1960 the value of the national production of beef exceeded the corresponding figure for coffee.

In the State of São Paulo, for example, which in the past was the principal coffee producer, the value of coffee production has lost ground to livestock production: coffee's share fell from 39.7 per cent in 1955 to 23.2 per cent in 1959, a figure only slightly higher than the 21.7 per cent contributed in 1959 by the production of beef and milk, which during 1948-57 was barely 15 per cent. If pork products are added to cattle products, in 1959 the two together represent for the first time the largest item in the State's agricultural economy.

However, it should be stressed that the increases recorded in the value of livestock production were mainly due to price increases, resulting not only from inflation, but also from the imbalance between supply and demand, for, as shown below, the physical volume of production decreased somewhat in 1959 and 1960.

(b) Meat production

Meat production, not including meat from unregistered slaughtering, amounted in the three-year period 1958-60 to an annual average of 1.95 millions tons, an increase of 31.4 per cent compared with the average for the period 1949-51,³⁷ that represents a cumulative annual growth rate of 3.1 per cent. The increase in the total production of meat was due to the greater number of animals slaughtered. As total production increased at the same rate as demographic growth for the same period, per capita production was much the same in the last few years as in 1949-51, i.e., 28.5 kilogrammes (see table 6).

Table 6

Brazil: Production of red carcass meat and poultry, 1949-51 and 1958-60
(Annual averages)

	1949-51		1958-60	
	Tons	Per-centage of total	Tons	Per-centage of total
Beef	1,101,034	74.0	1,430,507	73.2
Pork	350,906	23.6	479,130	24.5
Mutton	18,813	1.3	22,713	1.2
Goat meat	12,560	0.8	16,841	0.8
Poultry	4,337	0.3	5,746	0.3
TOTAL	1,487,650	100.0	1,954,937	100.0
Per capita (kilogrammes) ...	28.5		28.5	

Source: Statistical annex, table V.

The production of carcass meat is by far the largest in volume, representing 73 per cent of the total; pork represents 24.5 per cent, and mutton and goat's flesh

³⁷ The figures for the years 1949-52 were estimates.

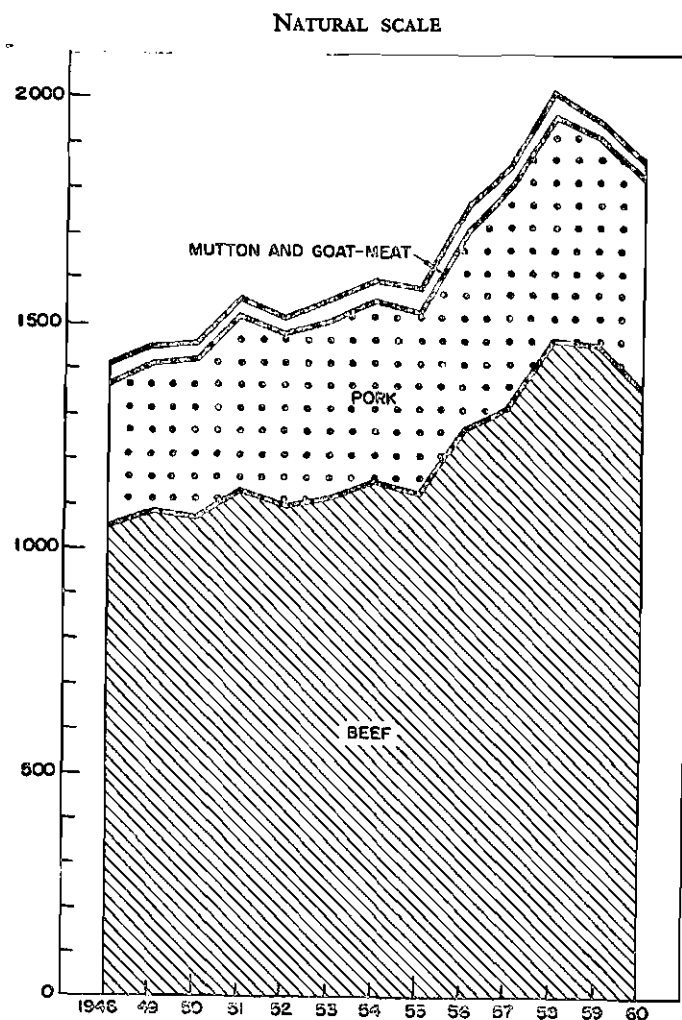
only 2.2 per cent. A comparison of the two periods covered in table 6 shows that the composition of production by types of meat has remained much the same, except that in recent years the share of pork has been slightly larger.

The production of meat other than beef has not shown any relative increase, despite the policy of the National Department of Livestock Production and the action it has taken to increase domestic consumption of such meat and thus make a larger volume of beef available for export.

In 1960 meat production was based on the registered slaughtering of 7.21 million beef cattle, 7.1 million pigs, 1.43 million sheep, 1.52 million goats and 5.43 million head of poultry.

Figure 1

Brazil: Red meat production, 1948-60
(Thousands of tons)



(c) Milk production

	Total production (Millions of litres)	Per capita production (litres)
1949-51	2,403.6	46.1
1958-60	4,670.8	68.0
1960	4,899.8	69.2
1958-60/1949-51 (percentage) ..	194.0	147.5

In round figures, milk production in 1958-60 was 4,670 million litres a year, and compared with the average for the period 1949-51 there was an increase of 94 per cent in total production. During 1958-60 there was a sharp increase in per capita consumption, which rose from 46 to 68 litres. Tables XII and XVI in the Statistical Annex show that there was a continuous increase in milk production, in both total and per capita terms, at least between 1948 and 1960.

Some of the increment in production of milk has been at the expense of beef, as new production zones are being established because of the demand for milk and milk products in the urban centres.

The main milk-producing States in Brazil are Minas Gerais, which produces a third of the national total, and São Paulo, which produces a quarter; thus between them these two States produce nearly three-fifths of the total volume. Rio Grande do Sul produces 8 per cent of the total output.

A list of the milk-producing zones in Minas Gerais and the main zones in São Paulo is given below, with their output in thousands of litres.³⁸

MINAS GERAIS	
1. Sul	447,981
2. Mata	250,050
3. Oeste	199,312
4. Paranaíba—Rio Grande	102,298
5. Metalúrgica	92,607
6. Rio Doce	89,706
7. Triângulo	80,181
8. Campos de Mantiqueira.....	70,341
9. Mucuri	44,160
10. Alto São Francisco.....	26,589
11. Alto Jequitinhonha	25,738
12. Montes Claros	23,720
13. Itacambira	15,321
14. Urucuia	12,600
15. Médio Jequitinhonha	11,195
16. Alto Médio S. Francisco.....	7,539
17. Médio Baixo Jequitinhonha.....	7,300
TOTAL	1,506,638

SAO PAULO	
1. Médio Paraíba	157,164
2. Rio Preto	95,200
3. Barretos	83,860
4. Riberão Preto	71,738
5. Pirassununga	58,016
6. Assis	55,191
7. Marília	51,112
8. São Paulo	49,937
9. Catanduva	47,762
10. Alto Paraíba	46,830
11. Bauru	44,068
12. São José do Rio Pardo.....	39,325
13. São Carlos e Jaú.....	35,090
14. Pereira Barreto	34,845

SAO PAULO (continued)

15. Araraquara	34,270
16. Campos Gerais	31,414
17. Other zones	237,487
TOTAL	1,173,309

The most important dairy-farming area is the one that supplies the city of São Paulo; it includes dairy farms in the Minas Gerais region, as well as in the State of São Paulo. The output of this supply area has increased considerably, partly because of the rise in demand as a result of rapid population growth, and partly because of the advantages and privileges made available to dairy farms in order to improve the exhausted land found in many parts of the State. Between 1950 and 1960 the milk output inspected by the State of São Paulo rose from 212 million to 467 million litres, an increase of approximately 120 per cent. Most of the dairy farms (62 per cent) are small producers with a daily output of up to 50 litres; about 19 per cent produce between 51 and 100 litres, and 13 per cent produce between 101 and 200 litres. Only a small proportion are producers on a larger scale than this.³⁹

Another important production area is that supplying the city of Rio de Janeiro; in 1959-60 it covered about 50,000 square kilometres in 111 municipalities of the following States: Minas Gerais (58 municipalities), Rio de Janeiro (31), São Paulo (9), Espírito Santo (12) and Guanabara (1).⁴⁰ In the last ten years this supply area has extended to a distance of over 500 kilometres.

Of the 7,000 producers that supplied Rio de Janeiro in 1953, about half had dairy farms regarded as of intermediate size (between 51 and 250 hectares);⁴¹ these constitute one-third of the total supply. Large or very large dairy farms account for 28 per cent of the total, and represent the bulk of the output—62 per cent. The smallest proportion—17 per cent—consists of dairy farms of less than 50 hectares, which provide only 4.4 per cent of the supply but which are, on the other hand, more efficient. The largest dairy farms are those with the lowest productivity per hectare; this is due to less intensive farming practices rather than to differences in the quality of the cows.⁴² At present there are about 10,000 suppliers.

In Minas Gerais, apart from the output that goes to supply the cities of São Paulo and Rio de Janeiro, the area that supplies Belo Horizonte and the output for Sete Lagoas and Esmeraldas are also important. Most of this production is on small farms with a daily output of less than 50 litres, situated up to 170 kilometres from Belo Horizonte. The bulk of the producers are members of the Central Co-operative of Rural Producers. In 1959 this association received some 50 million litres of milk from about 6,000 members, through its plants at Belo Horizonte, Sete Lagoas and

³⁹ São Paulo Department of Agriculture, Livestock Production Service, Livestock Industry Bulletin, December 1959, p. 8.

⁴⁰ Includes milk received for the manufacture of milk products.

⁴¹ Result obtained from a sample of 597 farms surveyed in 1952-53. *Bacia Leiteira* do Rio de Janeiro, CNPL publication, 1960, pp. 32, 33 and 35.

⁴² See figures in section V, 4 (b).

³⁸ SEP estimates for 1958.

Esmeraldas. Most of the production is used for immediate consumption in Belo Horizonte, and a smaller share for the processing of dried milk in Sete Lagoas, as well as for butter and cheese.

As the zone that supplies milk to Belo Horizonte and Rio de Janeiro becomes larger, areas that because of their distance from the consumer centres concentrated at one time on the production of butter and cheese, are now tending to become absorbed into the daily supply of fresh milk, as in the case of Barbacena and municipalities in the vicinity of the Serra da Mantiqueira.

In Rio Grande do Sul the most important supply area is around Porto Alegre area, where the per capita consumption of fresh milk is the highest in the country. The four geographical zones partly covered by this area produce about 45 per cent of the State total, estimated for 1959 as 381 million litres. This supply area includes about 18 municipalities and covers 20,000 square kilometres. The main production zones are the Encosta Inferior do Nordeste and the Depressão Central where the State capital is situated. In 1960 the largest volume of production (85 per cent of the supply for Porto Alegre) came from the municipalities of Gravataí, Viamão, Taquara, Triunfo, Porto Alegre, Santo Antonio, Caí and Gramado, which, together with ten other municipalities representing less than 2.61 of the total delivered to the State capital, supply the capital with some 150,000 litres of milk a day.⁴³ About 80 per cent or more is distributed by the State Milk Supply Department (DEAL). In 1960 the milk received directly at the DEAL depot in Porto Alegre and in the two depots in the interior was as follows:

	<i>Thousands of litres</i>
Porto Alegre	35,407
Taquara	6,075
Gramado	3,145
Montenegro	2,393
Osório	1,718
Tapes	689
	<hr/> 49,427

Not all the conditions for milk production in this area are favourable. First, the soil is poor, there are frequent fodder shortages⁴⁴ and management practices are bad. Secondly, small dairy farms predominate, with an average area of less than 15 hectares and a daily output of under 50 litres (an average of 24 litres for 5,000 producers); moreover, about half the farmers operate on rented land. The low productivity of these dairy farms, combined with increased production costs and the lack of sufficient assistance to farmers, began in 1959 to discourage farmers from producing and supplying milk for Porto Alegre, where the supply declined by 20 per cent between 1958 and 1960. Fresh milk requirements may be regarded as 20-30 per cent higher than present consumption. The best production

conditions are found in the medium-sized farms, with an area of 40-60 hectares, where the semi-intensive system of farming may be said to be almost completely applied.

The Pelotas supply area, south-west of Rio Grande do Sul, is perhaps the most important as regards the environmental conditions required for intensive dairy farms with high productivity. This is a low, flat region, with a mild damp climate, which has an enormous potential as a milk-producing area. It was formerly made up of the municipalities of Pelotas and Rio Grande, and now extends to Pedro Osório, Arroio Grande and Jaguarão. As a result of the establishment of a dried milk plant in 1960 there was a considerable increase in output in the zone, largely because the farmers are now embarking on milk production, instead of concerning themselves mainly with producing animals for breeding as before.

In the Nordeste the most important dairy-farming area lies around Recife, which is the third largest city in Brazil. The estimated annual production is about 80 million litres, which represents 90 per cent of Pernambuco's production. The municipalities that together make up this supply area, situated in the geographical zones of the Litoral, Mata, Agreste, and Sertão de Moxotó, cover an area of about 35,000 square kilometres (one-third of the State), with a population of about 3.5 million, about four-fifths of the total population of Pernambuco.

The area in the Agreste (São Bento do Una) is a typical section of the dry Nordeste where milk is produced. Despite its proximity to Recife, milk consumption in that city is based mainly on local production, because of inadequate marketing, and it is only since 1961 that the supply has been increasingly fed from the interior, and, more recently, the agricultural belt. This zone (at Bom Conselho) has the best-organized milk products plant in the Nordeste.

(d) Egg production

	<i>Total production (Thousands of dozen)</i>	<i>Per capita production (Units)</i>
1949-51	269,984	62.2
1958-60	500,216	87.4
1960	520,344	88.2
1958-60/1949-51 (percentage)	185	140

It can be seen that during the last decade total production of eggs increased by 85 per cent, thus permitting per capita production to increase from 62 units a year in 1949-51 to 88 units in 1958-60.

Commercial poultry production, mainly in the vicinity of the large cities, is the most advanced sector of the Brazilian stock-farming industry. Tables XII and XVI in the Statistical Annex show that the production of eggs, like that of milk, has increased year by year, in both total and per capita terms.

(e) Wool production

	<i>Total production (Tons)</i>
1949-51	19,257
1958-60	28,221
1960	22,686
1958-60/1949-51 (percentage)	149

⁴³ Report on dairy cattle at the First Agricultural Fair held in Porto Alegre, November 1960.

⁴⁴ The volume of milk received by DEAL in the months of January, October, November and December 1960 represented a daily average of 147,000 litres compared with 97,000 for April-June (winter months with fodder shortages) in the same year, i.e., a decrease of approximately 34 per cent.

In recent years Brazilian wool production has stood at an annual average of about 28,000 tons, except for 1960, when, because of floods, production was 7,645 tons lower than in 1959, and in fact lower than in 1953. Up to 1958 production increased continuously, although the effect was only a slight increase in per capita output.

The principal production zone is the State of Rio Grande do Sul, which has three-fifths of the sheep population of Brazil and produces 93 per cent of the wool. This State contains the best and perhaps almost the only really suitable areas in Brazil for sheep rearing on the basis of special breeds. There are no factors likely to constitute a permanent limitation on the development of wool production, and if production has not progressed to the full extent permitted by the favourable conditions that prevail, this is because the sheep farms have a number of shortcomings, that could undoubtedly be easily eliminated, with respect to animal hygiene, farm management, artificial pastures, technical assistance and so forth.

3. LIVESTOCK PRODUCTION TRENDS⁴⁵

Throughout the period 1948-58 the quantum of total production (at constant 1960 prices) increased for all items. In 1959 and 1960 there was a decrease in the production of meat and wool compared with that in the previous year, in both total and per capita terms (see Statistical Annex, tables XII and XVI).

The index of aggregate production (1950 = 100) rose from an annual average of 100.9 in 1949-51 to 147.8 in 1958-60, an increase of 46.5 per cent between the two three-year periods; this means that the quantum increased at a cumulative annual rate of 4.3 per cent. Since the annual rate of population growth was 3.1 per cent, the result was that per capita livestock production increased at an annual rate of approximately 1.2 per cent, which may be regarded as low. The largest relative increments were in milk and egg production, whereas the growth trend throughout the period analysed was less marked for meat and wool (see Statistical Annex, table XII). The increase in milk production led to increased processing and consumption of milk products, especially dried milk.

With respect to per capita production, there was a marked and continuous increase for milk and eggs and no significant increase for red meat, as shown by the annual average per capita production figures for each of the three-year periods and years shown in tables 7 and XV. The trend for red meat production was sharply affected by the figures for beef, production of which increased less than the population between 1949 and 1957. Only in 1958 was there any appreciable increase in the production of beef, which raised the per capita production of red meat to 30.2 kg and thus prevented a sharper decline in the average figure for the three-year period 1958-60. In 1959 and 1960 total and per capita production of red meat fell below the level for 1958.

⁴⁵ Meat, lard, bacon, milk, eggs and wool.

Table 7
Brazil: Per capita production of red carcass meat, milk and eggs in selected periods
(Annual averages)

Period	Red meat ^a (Kilogrammes)	Milk (Litres)	Eggs (Units)
Volume			
1949-51	28.5	46.1	62
1952-54	27.3	58.4	74
1955-57	27.5	65.3	85
1958-60	28.4	68.0	87
Growth indices (1950 = 100)			
1949-51	102.1	98.9	98.4
1952-54	97.8	125.3	46.6
1955-57	98.5	140.1	134.5
1958-60	101.7	145.9	138.3

Source: Statistical Annex, tables XIII and XIV.

^a Beef, pork (including bacon and lard), mutton and goat's flesh.

The reasons for the changes in the total production of meat are analysed below in terms of the trends in the number of animals slaughtered and are also dealt with in the section on marketing.

It is of the utmost importance to compare and relate the trends in the number of cattle slaughtered annually in the country with the corresponding figures for beef production, for two main reasons: first, it brings to light the direct ratio between the two variables, and, secondly, since the slaughter of steers and unserviceable cows is the basis for the production of beef, it is easy to assess the relative effects on production of variations in slaughterings. Moreover, if an analysis is made, also for a series of years, of percentage changes in the slaughtering of steers and cows, it will provide sufficient grounds to reach conclusions on such controversial matters as the progress or stagnation of the cattle industry, excessive slaughtering of serviceable dams, the problem of exports, and so forth.

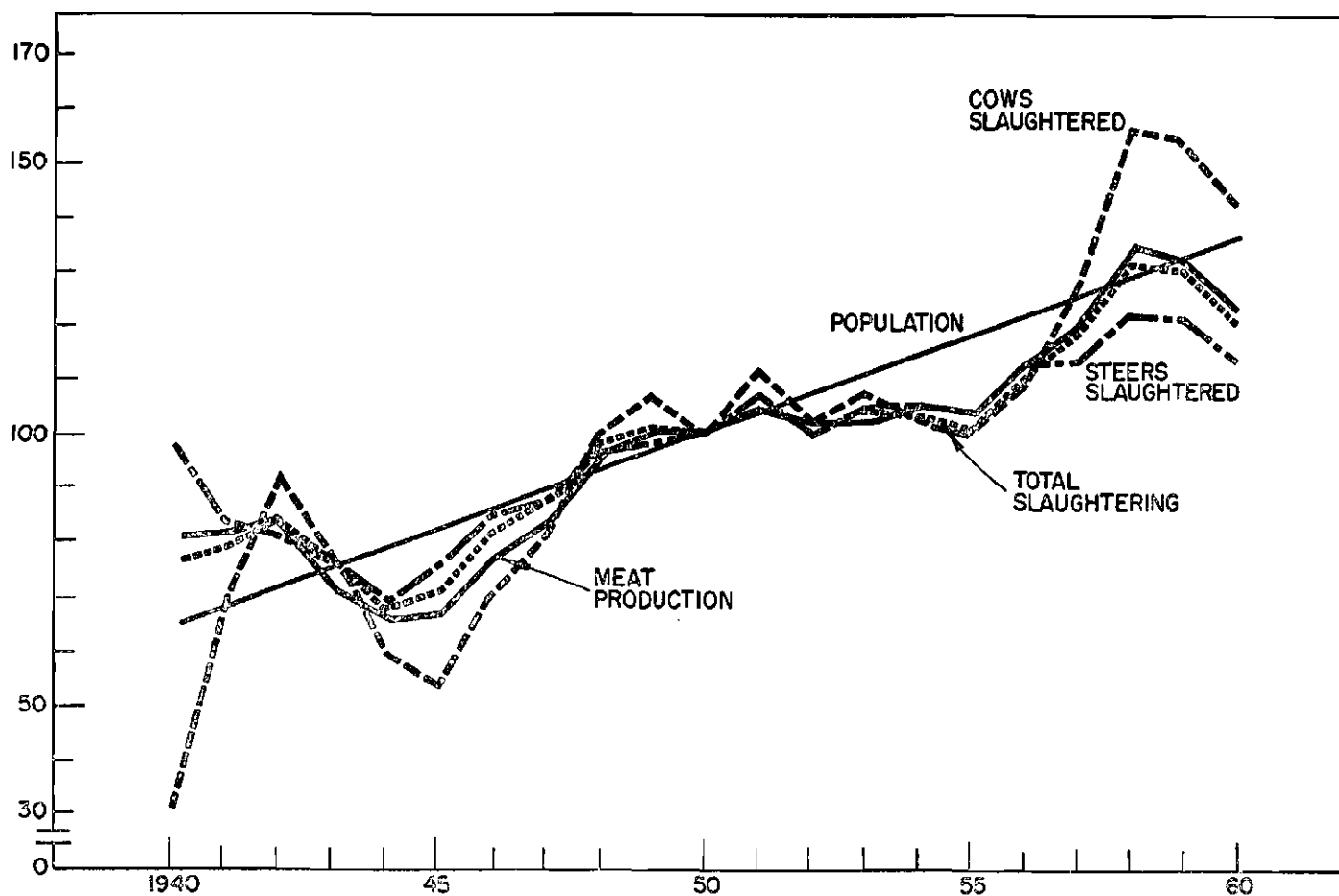
Generally speaking, it may be stated that increases or decreases in meat production are due to corresponding changes in the number of slaughterings, since the influence of the yield per animal is so slight from year to year that it seldom modifies the direct ratio between production and slaughtering. This can be seen from table XVII and figure II, except for 1954 when, despite a decline in the number of cattle slaughtered, there was some increase in meat production, owing to the fact that more steers were slaughtered than cows. In normal stock-breeding and marketing conditions, meat production depends largely on the slaughter of mature steers and unserviceable cows, since it is obvious that the slaughter of serviceable cows and immature steers represents a liquidation of stocks. The excessive slaughter of steers or cows, or both, may be estimated by comparison with the trends for periods regarded as normal.

Figure II

Brazil: Past variations in cattle slaughtering and beef production, 1940-60

(1950 = 100)

NATURAL SCALE



Up to 1957 not only did the trends in meat production and in the slaughtering of steers and cows follow the same direction, but there was very little difference in the corresponding rates of increase and decrease. This seems to indicate a certain balance between the proportion of steers and cows slaughtered, which may be estimated as between 67 and 69 per cent for steers and between 28 and 30 per cent for cows. The slaughtering of calves, mainly bull calves, has increased recently, particularly in the dairy-farming areas, but it is still at such a low level that changes have no radical effect.⁴⁶

In 1958 and 1959 production levels rose appreciably; this was due to a sharp increase in the number of cattle slaughtered, and of cows in particular, since there was no major change in the steer slaughtering trend. This is in line with the figures in table XVIII, which show the highest proportion of cows slaughtered to have been

in 1958, 1959 and 1960 (33.7, 33.4 and 33.2 per cent respectively), involving the slaughtering of about 1 million serviceable dams in the three years. Consequently it seems justified to conclude that in order to meet the increased demand for meat there was undue slaughtering of serviceable cows. Meat exports in those three years undoubtedly had a considerable influence on the rise in total demand for meat; the increase in the number of cows slaughtered was due to the high price of meat and, especially in 1959, the greater demand for cured meats, since the tendency is to slaughter cows for the manufacture of these meats.

At present it is not possible to make a quantitative estimate of the harmful effects that excessive slaughtering of cows may have on the growth of the cattle population in later years, but there is already some evidence that it has reduced the growth rate of the cattle stocks and their productive capacity in recent years. The drop in the price of fat cattle at the beginning of 1961 cannot be taken as an indication of higher production, but rather as the result of an excess of supply over demand; this may be a question of apparent saturation owing to a temporary contraction in consumption and demand because of the high price of meat.

⁴⁶ This analysis is based on national production and slaughtering figures, which include slaughtering at all abattoirs, whether they have refrigeration facilities or not, without a break-down by States. No other method is possible, since the slaughtering of cows predominates in the farming areas and the slaughtering of steers in the consumer centres, and thus any survey of a regional nature would involve great risk of error.

IV. STOCK-FARMING EFFICIENCY AND PRODUCTIVITY

It is not easy to make generalizations about the level of efficiency and productivity in Brazilian stock farming, since there are sharp regional differences in the main factors concerned, such as the quality of the soil and other resources, the degree of technical progress and the systems of administration and management. Nevertheless the national averages serve to supplement the analysis of the wide variations frequently observed in yields and productivity.

One generalization can be made, namely that, with the exception of a few livestock farms with high productivity, the efficiency of Brazilian stock farming is low, and although it is asserted that the livestock population has grown considerably, there has been no change for the better for many years as regards average yield per animal and per unit of pasture area; in fact, in many cases, there has been an appreciable falling-off in productivity due to incorrect use of pastures.

The main indicators of efficient stock farming are the rates of reproduction and slaughtering, the yield per animal and the proportion of cows in milk. The mortality rate is dealt with among the factors that limit production.

It should be noted that the level of efficiency and its variations depend not only on the type of natural resources available, but also to a great extent on farming techniques, livestock management and farm administration. Central Brazil and Rio Grande do Sul have a climate and type of soil suitable for the development of magnificent pastureland and, moreover, it is there, especially in Minas Gerais, São Paulo and Rio Grande do Sul, that the most highly developed breeds are found; nevertheless, livestock efficiency and physical productivity in these areas leave much to be desired.

1. RATE OF REPRODUCTION

Insufficient information is available on the reproduction rate for the cattle population, expressed in terms of the number of calves born or weaned in relation to the number of serviceable dams. The estimated average calving percentage for Brazil as a whole is 45-55. This is, of course, far below that obtained on properly organized stock farms; in the United States, for example, for an average cattle population of 41.5 million cows in 1956-57 a calving rate of 86 per cent was attained. In Brazil the highest figures (60-80 per cent or even more) are recorded on certain farms in São Paulo, the Triângulo Mineiro and Rio Grande do Sul, Rio de Janeiro and Paraná. The lowest birth rate is on the stock farms in the Norte and Nordeste of Brazil, where most cows calve once in 2 years, with the exception of some farms where the level of efficiency is similar to that in the Centro Sul.

If the death rate among calves of under a year old is subtracted from the birth rate, the rate of reproduction is obtained. The variations in the rate of reproduction from one State to another are even greater than for the birth rate, because of the unequal incidence of disease and causes of death among calves. In central Brazil, where the death rate among sucking calves is

rather high (20 per cent or more), the proportion of weaned calves per 100 cows is only 40-60 per cent. A high rate—about 72 per cent—is found on some of the stock farms of Campanha, Rio Grande do Sul, as the result of a high birth rate of 80 per cent and a low death rate of 6-8 per cent; the general situation for stock farming is, of course, much more favourable in this State.

The factors responsible for the low reproduction rate include late impregnation of the cows, widely spaced births, a shortage of sires and a generally low level of reproductive efficiency, in conjunction with inadequate feeding, lack of minerals, inefficient management and the large number of diseases and pests to which breeding cattle are subject. Some of these causes are considered in the section on factors that limit production.

2. SLAUGHTERING RATE

The Brazilian stock-farming industry is also very deficient as regards the slaughtering rate, and is believed to have one of the lowest indices of livestock production for consumption. Table XIX in the Statistical Annex shows an average slaughtering rate of only 10-11 per cent for the twelve years from 1949-60, which is very much lower than the figures of 40 per cent in the United States, 39 per cent in New Zealand, 28 per cent in Australia and 22 per cent in Argentina; even within Latin America Brazil's rate is exceeded by that of most other countries. It should be kept in mind, however, that the maximum slaughtering rates are registered in countries where the slaughtering of calves is high because of the practice of milking without calf.

It is not easy, from the information available, to assess the differences between areas or States as regards the slaughtering rate on the basis of a comparison between the number of slaughterings and the local stocks. The stock-breeding areas send most of their animals to consumer centres in other States; in Mato Grosso and Minas Gerais, for example, the slaughtering rates are only 2 per cent and 5.5 per cent, respectively, since a substantial proportion of the steers reared there are sent to other States for fattening and slaughtering. São Paulo, on the other hand, has the highest slaughtering rate (25 per cent in 1959), because a great proportion of the stock slaughtered comes from other States. Thus the variation in the regional slaughtering rates serves to show which are basically consumer or producer States, rather than to indicate efficiency.

A more accurate index of efficiency would perhaps be a production rate based on the number of livestock slaughtered locally, the number exported to other areas, and the increase in the livestock population, in relation to existing stocks. Thus in 1959 the production rate in Minas Gerais, for example, was 13.7 per cent, made up as follows: 5.5 per cent slaughterings, 5.2 per cent estimated exports and 3 per cent increase in the livestock population. The rate of extraction for consumption would be the sum of the first two figures, or 10.7 per cent (average for central Brazil). However,

these rates cannot be determined very accurately, since in certain States unregistered slaughtering are higher than in others, and the exact number of cattle sent to other centres for consumption is not known, either because of incomplete records of animal movements, or because there are inter-State movements that are not recorded.

It should be stressed that although the beef cattle industry in Rio Grande do Sul undoubtedly holds the first place in Brazil with respect to the quality of the herds, it is by no means outstanding as regards efficiency. The slaughtering rate averaged 11.4 per cent for the three-year period 1957-59, a figure only slightly higher than the average for the country as a whole. In view of the fact that the cattle population has remained stationary in this State for a number of years, and that consignments of cattle on the hoof for consumption in other States, such as Santa Catarina, amount to only 0.8-1.0 per cent of cattle stocks, the production rate would not appear to exceed 12.4 per cent. This rate is relatively lower than that of 13.7 per cent calculated for Minas Gerais, and also lower than the average rate of 14.4 per cent for the country as a whole, obtained by adding the 11 per cent slaughter rate to the 3.4 per cent annual increase in cattle stocks.

The low slaughtering rate is a result of the late age at which the animals are usually sent to the abattoirs, which for steers is generally somewhere between four and five years. In countries where stock farming is really efficient and productivity is high, cattle are slaughtered at an early age, and consequently the slaughtering rates are high. In the United States, for example, steers are prepared for slaughtering at the age of from one and a half to two and a half years.

One of the main factors that determine this lag in the fattening and slaughtering of cattle are the fodder shortages, resulting from natural conditions, and aggravated by poor pasture management and incorrect feeding and handling of the animals, and, to some extent, the structure of the marketing and processing of cattle and meat, the characteristics of demand, and the rate of growth of the cattle. Moreover, there is no doubt that the proportion of the cattle population slaughtered annually is also affected by the proportion of cows slaughtered and by the balance between the cattle birth and death rates.

The production of pigs for slaughter is also at a low level of efficiency, since the annual volume does not amount to a quarter of the stocks, even assuming that there is a 50 per cent volume of unregistered slaughtering. This extremely low slaughtering rate compares very unfavourably with that recorded in other countries,⁴⁷ especially in European countries and in the United States, where the number slaughtered during the year is much higher than the inventory on any given date, since most pigs are slaughtered at the age of six months, and good care is taken of breeding-sows and newborn piglets. In Brazil a sow generally litters only once a year, instead of three times in two

years; half or more of the litter die in the first months of life, and hogs are slaughtered late, at between twelve and eighteen months.

The regional differences in the slaughtering rate for pigs are considerable; for example, the rate is 20-30 per cent in central Brazil and 35-45 per cent in Rio Grande do Sul.

3. MEAT YIELD PER ANIMAL

The meat yield per animal slaughtered does not really give a clear indication of the level of efficiency and productivity in a livestock industry, unless it is related to the age or state of development of the stock slaughtered, or to the unit of pasture area required for its production. This point can be illustrated by comparing the situation in Brazil with that in other countries. New Zealand, thanks to a combination of various highly favourable factors, has one of the most productive beef cattle industries in the world, and yet the yield of meat per animal slaughtered is low; this is because the animals are ready for slaughter early, and consequently the slaughter rate is very high, which is advantageous from the economic standpoint. In Australia and the United States—where cattle are also slaughtered at an early age—the corresponding figures are 158 kilogrammes and 176 kilogrammes respectively.⁴⁸ Countries such as Argentina, Chile, Uruguay, Panama and Colombia have a yield of over 200 kilogrammes of carcass meat per animal, but except in Argentina the steers are usually slaughtered at the age of between four and five years, that is, fully grown. During 1953-60 the carcass weight of cattle in Brazil ranged from a minimum of 179 kilogrammes to a maximum of 194 kilogrammes, and the estimated average dead weight for the same period was about 187 kilogrammes. This figure is rather low for a country that slaughters full-grown animals, and relatively little compared with the average of 200 kilogrammes for the Latin American industry as a whole. The highest yields are in São Paulo and Rio Grande do Sul (with over 200 kilogrammes), and the lowest in the Norte and Nordeste (about 150 kilogrammes).

Some comment is required on the figures for the yield of carcass meat in relation to the live weight of the animal. Firstly, the figure is low in the little developed stock farming regions where ordinary cattle are reared and there are no pastures suitable for fattening; this applies to the Norte and Nordeste regions and to certain zones in central Brazil. The poor breed of cattle and the inadequate conditioning they receive results in a yield of only 45-60 per cent. The highest yields are in central Brazil and Rio Grande do Sul, which have the best fattening pastures, the highest quality beef cattle and the most advanced feeders. The best of the fat steers are slaughtered at the main freezing plants, such as Anglo-Barretos-São Paulo, and Armour-Libramento in Rio Grande do Sul, which consequently have the highest yields, as shown by the following annual averages per animal for 1944-50 and 1952 respectively.

⁴⁷ Percentages for some other countries are: Belgium 174, Sweden 172, Denmark 167, France 165, United States 137, United Kingdom 132, Uruguay 62, Colombia 57.

⁴⁸ These yields are for years chosen at random, solely for the purpose of indicating the great disparities among countries.

	Live weight	Hung meat ^a	Yield (percent-age)	Hides ^b (kilo-grammes)
<i>Anglo-Barretos-São Paulo</i>				
Steers ^c	428.6	245.4	57.2	33.7
Cows ^c	371.7	188.1	50.6	27.2
<i>Armour-Libramento</i>				
Steers ^d	453.2	242.5	53.39	25.95 ^e
Cows ^f	370.6	174.9	47.47	20.39 ^e

^a The weight of this meat is 2.5 per cent less than that of freshly slaughtered meat.
^b Average weight of fresh hides for the period 1951-56.
^c Figures based on a survey of 1.8 million cattle.
^d Export category steers.
^e Average weight of salted hides.
^f Cows for jerked beef.

Mention should be made here of the campaigns promoted by the Livestock Production Service of the State of São Paulo to introduce modern fattening systems for raising the meat yield per animal. They include fat-steer shows, and research on the administration of oestrogenic hormones for the conditioning of beef cattle.⁴⁹ These extension and research campaigns in Brazil are among the most outstanding in Latin America.

In 1949, the São Paulo Livestock Production Service began to hold fat-steer shows at which both the animal's live weight and the meat yield and quality of the meat are taken into consideration. The prior judgement of the various categories according to age, the public nature of the final judgement, the awarding of prizes, the auctioning of the steers, and the control of yields and industrial classification of carcass meat are all matters of increasing interest to the cattle farmer. These shows achieve a number of aims, since as well as providing a means of instruction in the conditioning of the modern beef steer, on the basis of the cross-breed that predominates in central Brazil, they demonstrate the merits of the main breeds, and convince the farmer of the possibilities of getting a better return from his farm through modern fattening practices in relation to weight and age.

The shows are held in Barretos, Araçatuba, Presidente Prudente and Rio Preto, which have the most advanced beef cattle industry in São Paulo. Some of the results of the shows are given below.

	1956	1957	1958
	(Kilogrammes)		
Category A (18-22 months)			
Araçatuba	481.2	408.0	454.0
Presidente Prudente	442.0	464.4	482.6
Barretos	436.0	486.0	397.2
Category B (up to 30 months)			
Araçatuba	461.2	493.2	502.5
Presidente Prudente	488.0	495.4	501.2
Barretos	490.8	433.8	449.2
Category C (up to 36 months)			
Araçatuba	512.8	497.6	522.4
Presidente Prudente	503.0	514.8	498.0
Barretos	539.0	504.8	503.2

⁴⁹ In 1961 the use of this method in the fattening and rearing of cattle was prohibited.

	1956	1957	1958
	(Kilogrammes)		
<i>Category D (over 42 months)</i>			
Araçatuba	518.4	532.4	522.4
Presidente Prudente	503.0	498.2	512.8
Barretos	513.0	549.6	512.8

A comparison of the weight of zebu and part-zebu steers favours the Nellore breed. In the seventh Barretos show in 1956, one lot in Category B had an average weight of 490.8 kilogrammes and an average yield of 66.1 per cent. There are no data available on the Guzerat, but it is known to have achieved the same level as the Nellore as regards feeding tests. High weights were also recorded for the Hindu-Brazil cross-breed, but not for the Gyr, whose reputation as a meat-producer is tending to decline.

4. PRODUCTION PER UNIT OF INVENTORY

For beef cattle this figure can be obtained by dividing the annual output by the number of cattle inventories. This is the most suitable way of measuring the efficiency of meat production, since it covers both the proportion slaughtered in relation to the total inventory and the yield of meat per slaughtered animal. The following figures (in kilogrammes) show that Brazil's production per unit of inventory is 40 per cent lower than the estimated average for Latin America, and far lower than in a number of other countries:⁵⁰ France 75, United States 73, United Kingdom 71, Argentina 48, Australia 47, Latin America 28, Brazil 20.⁵¹

With respect to other livestock species the production of meat per animal slaughtered is relatively low, as shown by the following averages for the three-year period 1958-60 expressed in terms of kilogrammes per full-grown animal: pigs 66.3, sheep 15.6, goats 11.1 and poultry 1.1.

These figures are lower because of the smaller size of the animals, and more particularly because a certain proportion (lard pigs excepted) is slaughtered without being properly conditioned. In the case of sheep and pigs, production per head is much the same as the average for Latin America. Production per unit of inventory is relatively less, partly owing to the effect of the small proportion of herds consumed annually. No data are presented here on production per unit of inventory for these categories; the fact that, on the one hand, a considerable number of slaughterings are not recorded in the official statistics, and that, on the other, the inventory estimates may be too high, might well lead to very low figures that would give a false picture.

5. EFFICIENCY OF MILK PRODUCTION

The low productivity of Brazil's dairy herds is due to the natural limitations on milk production in a tropical climate and the low level of efficiency of the typical Brazilian dairy farm. Technically advanced high-yield dairy farms are found in small numbers where suitable climatic conditions, as in Rio Grande

⁵⁰ Average for the period 1955-57 (except for Argentina), based on figures in the Commonwealth Economic Committee pamphlet *Meat*, London, 1958.
⁵¹ Average for 1953-60.

do Sul, or exceptional measures make it possible to work with specialized herds.

There are wide variations in efficiency and productivity, not only between dairy farms in different States, but even between those in the same zone. This fact, combined with the dearth of fairly recent or representative studies for the country as a whole, precludes the presentation of national averages for milk yields. However, the examples given below will give an idea of the low productivity prevailing in Brazil's dairy industry.

According to a sampling survey by the Ministry of Agriculture Dairy Farming Commission in 1953, the average daily milk yield per cow was only 3.72 litres in what was then the Federal District, and has since become the State of Guanabara, 3.38 litres in São Paulo, 2.65 in Belo Horizonte and 3 in the Niterói supply area. These figures are for the rainy season, which means that the daily average for the whole year is lower, since the yield drops 40 per cent or more during the dry season.⁵²

Federal and State technical agencies that visited various dairy-farming areas in the country found that the average daily yield per cow in milk during their visits was:

		Number of cows in milk	Litres per cow/day
1950	Belém (municipality of Belém)	1,213	5.22
1953	Rio de Janeiro (Guanabara)...	17,409	3.72
1953	São Paulo	11,481	3.38
1953	Niterói	1,988	3.05
1953	Belo Horizonte	4,053	2.65
1956	Maceió	10,808	4.60
1956-59	Recife (the capital and interior)	12,949	4.73
1957	João Pessoa	1,450	4.00
1961	Recife (municipality of the capital)	3,098	5.88
1958	Salvador	1,610	5.53

There are great differences in one and the same State. In Minas Gerais, for example, where there has been very little admixture of European breeds in the herds, and where the *retilo* system is practised, the daily output per cow during a lactation period of 7-8 months is as low as 2-2.5 litres, which adds up to only 500-600 litres annually. Where the same system is practised but there is a high level of grading and more efficient farming methods, as on the best dairy farms, which are in the minority, a daily output of 5-7 litres per cow for a lactation period of 240-300 days is considered to be good, i.e., 1,200-2,000 litres a year. Higher average yields of the order of 7-10 litres daily per cow are found on only a few Brazilian farms with purebred herds or well-cared-for highly graded herds milked twice a day.

If Brazil's dairy industry is compared with those of other countries it appears in a very unfavourable light; the average yield per cow in Brazil is 5-6 times lower than in Belgium, Denmark, the Netherlands and the United Kingdom; 4-5 times lower than in Germany,

Sweden and Switzerland; 3-4 times lower than in Canada and the United States, and 2-3 times lower than in Argentina, Chile and Uruguay.⁵³

The lack of efficiency in milk production is manifested not only in the low yields from cows in milk, but also in the relation of the latter to the total number of cows (dry and in production), the estimated proportion for the Brazilian dairy-farming industry as a whole being only 55 per cent as against 80-90 per cent in countries where dairy farming is advanced. The small proportion of cows in milk, combined with the low yield per cow, results in a minimal milk output per head of the cow population.

6. PRODUCTIVITY LEVELS BY AREA

Now that the level of efficiency in the stock-farming industry and the physical productivity of the livestock have both been considered, there remains the question of productivity per unit of area. This, as shown below, is also extremely low.

In Rio Grande do Sul, despite the good quality of the beef cattle and the favourable environment, the average annual yield per hectare is only 30-40 kilogrammes of live weight, which amounts to 15-20 kilogrammes of carcass meat per unit of area. This is, of course, the average for the State over the total area used for raising beef cattle, since on farms devoted to fattening only the yield per hectare is about 140-150 kilogrammes of cattle on the hoof. This level of yield does not provide any incentive for investment in farm improvement; hence the persistence of routine production methods. At the level of productivity mentioned above the estimated return on investment would be only 4-6 per cent. There is naturally a wide margin for improvement, since on some farms productivity is much higher, as in the frontier zone. Where the slaughtering rate is 20 per cent and steers are slaughtered at the age of three and a half years, the meat yield per hectare is 50-60 per cent higher, giving a return of 7-10 per cent.

On dairy farms the yield per hectare varies widely, according to whether the farms are intensive or semi-extensive. In zones where *minifundia* supply milk to large consumer centres the yield is much higher because the cows are fed mainly on food concentrates and the pasture area is not significant. On semi-extensive dairy farms, where the cow keeps the calf, there is only one milking a day, and concentrates are given very little, or not at all—as is generally the case—the annual yield is only 250-300 litres per hectare in relation to the land used for the dairy herds.⁵⁴ On farms where production is rationalized and intensive, and the daily yield per cow is 7 litres instead of 3.5, where the pasture land is good and has a carrying capacity of 1 head per hectare instead of 0.5 and where 80 per cent of the cows are in production instead of 60 per cent, the yield is four to five times higher. However, it should be stressed that farms of this type are few and far between in Brazil.

⁵² According to CNPL surveys made on 10,000 farms in 1959, production in the Rio de Janeiro (Guanabara) supply area underwent an average seasonal decline of 32 per cent between the months of January (rainy season) and July (dry season). In 1960 it declined more than 40 per cent.

⁵³ Ministry of Agriculture Study No. 28 on the dairy-farming area that supplies the city of Rio de Janeiro with milk, 1960, p. 45.

⁵⁴ In 1953 the average for the zone supplying the city of Rio de Janeiro was 252 litres.

7. COSTS AND PRODUCTIVITY

It should be particularly stressed that livestock production is notable for the high proportion of fixed capital required, mainly in the form of land and cattle, and for the continuance, during the productive process, of certain fairly constant production costs such as interest on fixed capital, pasture maintenance, systematic vaccination of stock, administrative and other fixed costs. This means that where the yield per unit area is low the incidence of these costs is higher in relation to the production of a litre of milk or a kilogramme of meat or wool, and vice versa. Consequently for the same area and carrying capacity, unit costs can be reduced by raising yield.

Various studies carried out in Brazil show the marked effect of productivity levels on dairy-farm production costs. Although some of these studies were made a number of years ago, many of their conclusions remain valid, apart from the fact that the basic information contained therein has been used in making later calculations at current prices. Some results are given below.

Percentage composition of milk production costs in the area that supplies the city of Rio de Janeiro:⁵⁵

<i>Costs</i>	
Cattle feed ⁵⁶	42.2
Labour for weeding and restoring pastures	11.5
Labour for other activities.....	15.8
Interest on capital invested in cattle.....	16.2
Administration	5.1
Disease and pest control.....	2.7
Miscellaneous (depreciation, transport, etc.)....	6.5
	100.0
<i>Income</i>	
Sale of calves, manure, etc.....	8.3
Net operating costs ⁵⁷	91.7

According to these figures, at least half the costs are for feeding the animals (concentrates and grazed and cut fodder), which of course includes the labour costs involved in pasture maintenance. Consequently inefficiency in the management and use of pastures and in the cultivation of fodder for cutting is regarded as one of the main causes of the very close relation

⁵⁵ According to a CNPL survey made in 1953.

⁵⁶ Includes 4 per cent interest on the value of the area under pasture.

⁵⁷ Actual operating costs divided by the total volume of production gives an average cost of 2.52 cruzeiros per litre of milk.

between productivity and production costs. The remedying of these shortcomings should therefore be given first priority by farmers who want to increase production per unit area and thus reduce unit costs.

It was found that in 1958-59, in the State of Guanabara, every increase of one litre in the daily output per cow resulted in a decrease of 0.15 cruzeiros in the cost of producing a litre of milk (at current prices), and that every increase of 100 litres of milk in the annual output per hectare could effect a reduction of 69 cents in the unit cost of production, which for 1959 was 8.80 cruzeiros at current prices as against 2.52 cruzeiros in 1952-53.

It should be added that apart from the effect on unit costs of average output per cow and per hectare, inflation and the continuous rise in the prices of feed, daily labour, etc. also have a very marked effect on them. Moreover, under the fixed-price system, the prices received by producers do not cover all cost items if output is low. The principal reason why such producers continue to operate is the rise in the value of land and cattle and the steady nature of the income.

A survey of milk production costs in the State of São Paulo also showed that the feeding factor (pasture and supplements) was the main cost component.

This study also led to the significant conclusion that on the basis of a producer's price of 4.98 cruzeiros per litre, and an average cost of 6.31 cruzeiros, three-quarters of the farms were operating at a loss, and only those producers whose herds had a high yield (above the average of 757 litres per cow) were able to cover their costs. If the price had been 6.31 cruzeiros, on a level with the average cost, more than half the producers would still have been operating at a loss, because of their low output levels.⁵⁸

Thus it is clear that marginal and sub-marginal farms can be made into profitable enterprises by increasing productivity and reducing costs. The first measure requires cows with an annual yield of 1,000 litres or more, or an output of over 700 litres per hectare. Reduction of feed costs should be sought mainly through the replacement of costly commercial feed by fodder grown on the farm, and, above all, by improving the condition and management of the pastureland. The policy of fixing the prices for the producer undoubtedly has a marked effect on the profitability of the farms, and consequently no such measure should be adopted without first making studies on the cost-price ratio.

⁵⁸ Data obtained from a survey made in 1957 by the São Paulo Department of Agriculture, Livestock Production Service.

V. FACTORS THAT LIMIT PRODUCTION

There are a number of direct and indirect causes of the low yields and low productivity in Brazil's livestock industry. On the one side there are the factors relating to type of soil and environmental conditions, and on the other the quality of the livestock, the technical level on the farms and the type of farm admin-

istration. The present section deals with factors relating to production itself that are subject to control by the farmer unlike the other group of factors which, although they may also have a limiting effect on production, cannot be changed through independent action by the farmer, e.g., credit, marketing, etc.

The main obstacles to the development of the livestock industry in Brazil and the improvement of the farmers' income, are inadequate feeding, animal diseases and pests, problems with respect to breeding techniques, the types of land tenure systems in force and inefficient farm management.

1. INADEQUATE FEEDING

This is dealt with first because it is the main problem in Brazilian livestock farming, for various reasons which are summarized below.

(a) Seasonal forage shortages

There does not seem to have been any assessment of the losses suffered every year by the livestock economy in Brazil as a result of the seasonal forage shortages. However, a rough estimate can be made that will give an idea of the magnitude of the problem, at least with respect to cattle production. The basic assumption is that, during three months of the year, which is regarded as the average period for which pastures are very bare, beef cattle lose some 35 kilogrammes of live weight⁵⁹ and the cows' milk output is reduced by 40 per cent, although in many regions the losses are actually much higher. If the number of cattle slaughterings is estimated as only 7 million, and the price is taken to be 30 cruzeiros per kilogramme of live weight for beef cattle, the total loss of weight during the year would amount to some 700,000 cattle weighing 350 kilogrammes each.

Up to the time of slaughtering for beef cattle, the seasonal pasture shortage amounts to four three-monthly periods of undernourishment for each animal, making a total of twelve months, which means that for six to eight of these months the cattle are living off their own fat. Consequently, it takes four to five years to condition cattle for slaughtering, whereas according to the above calculations this could be done in two to three and a half years provided that they are fed adequately throughout the year. This would not only benefit the farmers financially, but would also eliminate the excessive price rises during the period when pastures are bare.

Regional losses can be illustrated by the case of Rio Grande do Sul, where the recorded deaths from starvation during the winter forage shortage amount to almost a quarter of a million cattle, the equivalent in value of one-ninth of the total budget for that State.⁶⁰ If the annual milk output for dairy cattle is 4,900 million litres, and the difference in output between the rainy season and the dry season is assumed to be 30-40 per cent, the loss of output amounts to 1,000 million litres, which at 1960 prices represents a loss of 10,000 million cruzeiros, the equivalent of one-fifth of the value of total production in the State, at the producers' level.

In brief, the annual weight losses in beef cattle and losses in milk yield can be conservatively estimated

as about 17,000 million cruzeiros, to which should be added the additional costs entailed by the re-fattening and reconditioning of cattle, the higher death rate and the low reproduction rate during forage shortages.

This is not the place to consider the factors of climate and grass ecology that result in rich and abundant pasture during certain months of the year and scanty and poor quality pasture at other times; moreover, the relative effect of this difference varies greatly from one area to another.

In the State of São Paulo, for example, the long summer rains produce plenty of good quality pasture, which means that in autumn the fat stock have the highest weights and the largest number of slaughterings are recorded, about three-quarters of the cattle being slaughtered during the seven months when the pastures are at their best. On the other hand, the scanty rain at the end of autumn and the summer drought in June, July and August lead to a shortage of fresh forage, especially at the beginning of spring; most pastures wither and die and the plants become woody and unpalatable to stock. The lowest weights for fat stock are recorded during this period and there is a considerable reduction in the supply of steers for slaughter; in fact, the five months of the year when pastures are at their barest account for only 25 per cent of the annual cattle slaughterings in São Paulo.

In Rio Grande do Sul, to give another example, the shortage of forage in certain months is due not only to the summer drought but also to the lower temperature in winter, which reduce the carrying capacity of grazing land by at least 50 per cent because of the lack of growth on the natural pastures.⁶¹

The scarcity of forage due to climatic factors, in conjunction with technical and management deficiencies, results in a low carrying capacity for pastureland and low cattle density per unit of pasture. It obviously has a serious effect on extensive stock farming based entirely on direct grazing, which is typical of so much of Brazil's livestock industry, at least as regards cattle raised for meat.

(b) Pasturage problems

(i) Sub-division of pastureland

The lack of sub-division on pastureland is a common problem throughout Latin America, even on dairy farms. It is due to the farmer's preference for grazing his herds in large paddocks, and although this eliminates certain watering problems, the lack of barbed wire for fencing and handling the stock leads to lower pasture yield, and often to the deterioration of the pastureland through continuous and heavy grazing. With few paddocks it is obviously impossible to have pasture rotation; it is equally impossible to separate the stock by groups or categories, to provide a variety of pastures suitable for different seasons, to make intensive use of pastures or to let them lie fallow as required.

⁵⁹ Estimated average loss of live weight: central Brazil, 28 kilogrammes; Norte and Rio Grande do Sul, 50 kilogrammes; Este, 38 kilogrammes.

⁶⁰ *Yearbook of the Association for Pasture Improvement*, 1960, p. 38.

⁶¹ Five-year studies made at the Vacaria Forage Experimental Station to determine the productivity of natural pastures showed that during the four hot months each steer gained 162 kilogrammes in weight, of which 83 kilogrammes (51 per cent) were lost during the severe winter.

(ii) *Grazing systems*

The time-honoured practice, which is undoubtedly harmful in many cases, is to graze the land continuously; this cannot be justified from the standpoint of either pasture growth or output, except for poor pastures which quickly lose their palatability. Continuous grazing permits stock to select the most nourishing and palatable plants for consumption—sometimes to the point of extermination—while the poorer grasses and weeds are left to flourish. The practice is particularly harmful for natural pastures. Hence, if forage is to be used more efficiently, there must be an adequate grazing system, and in addition, forage supplies must be better distributed and the handling of the animals improved.

In the Avaré area in São Paulo, the division of 200 hectares of pasture into five fields and the introduction of short-term pasture rotation (seven days of grazing and twenty-eight days of recovery) led within sixteen months not only to the restoration of the pastures, which had deteriorated to the level of third-class land, but also, and this is the main point, to a fourfold increase in carrying capacity.⁶²

(iii) *Single-crop and mixed pastures*

Stock farmers in the tropics are greatly in favour of single-crop pastures, that is, natural or cultivated pastures containing only one type of plant. This preference may be due either to the influence of tradition, or to ignorance of the immense practical benefits of mixed pastures, especially those combining forage grasses with legumes. Greater efforts should be made to promote mixed pastures, not only to give the cattle a more complete and balanced diet, but also to obtain the benefits ensuing from the use of mixed pastures in the shape of soil fertility.

It is true that certain climatic and soil conditions limit the cultivation of mixed pasture and fodder crops on individual farms, and oblige the farmer to keep to the long-established type of plant or plants. Yet it frequently happens that single-crop pastures, or those with only a small variety of plants, are cultivated on land whose physical and chemical structure would permit the cultivation of more productive species, not only for direct grazing but also for cutting, and storage for use at the appropriate time. The desirability of mixed pastures is, of course, a question of the cultivation of many and better plant species in different fields, and the mixing of forage plants in a single pasture.

The use of a grass-legume mixture or of grass alone is primarily an economic question. When the price of nitrogen is low, higher yields can be obtained by applying it to pure grasslands than by planting grass and legume mixtures.

An experiment carried out with sheep on the Cinco Cruzes Experimental Station at Bagé (Rio Grande do Sul) affords a good example of the advantages of replacing natural by artificial grasses. During the five and a half months of the year when forage is scarcest, and the carrying capacity of natural pastureland is one head per hectare, the carrying capacity of artificial pastures sown with a mixture of birdsfoot trefoil, white

clover and Italian ryegrass was as much as 10 sheep per hectare. Moreover, the weight gain on artificial pastureland was 8 kilogrammes per head more, and the total wool yield was 1.5 kilogrammes per head higher. In all, the total value of yield per hectare was nearly seven times higher. A study made on the Experimental Forage Station of São Gabriel, also in Rio Grande do Sul, demonstrated the economic benefits of grazing on artificial pastures of mixed grasses and legumes; the daily weight increase in cattle, which was 0.936 kilogrammes per head on Italian ryegrass, was 1.108 kilogrammes, or 18 per cent more, on Italian ryegrass combined with red, white or subterranean clover. In 150 days the increase per hectare was 326.4 kilogrammes of live weight on grass and 465 kilogrammes on mixed pasture, which amounts to an increase of 40.5 per cent in the live weight yield per hectare.

(iv) *Weed control*

The usual result of uninterrupted grazing and the failure to weed pastureland is the loss of much of the carrying capacity through the spread of invading plants which the stock cannot eat, and which hamper the growth of the forage plants. Little attention has been given to this problem in the official extension programmes, and consequently they have been largely neglected by the farmers. As a general rule the farmer does not become concerned about weed control until the invading growth threatens to destroy a pasture; moreover at this point he generally resorts to unsuitable burning-off measures which destroy the forage plants and plant cover. Although it is true that burning off is economical and to be recommended in certain cases, its indiscriminate use has involved many harmful practices that need to be corrected. As for chemical weedkillers and biological methods of seed control, little is known of such practices in the ordinary type of extensive stock farming on natural pastures. It should be added that there are a number of poisonous plants that are relatively common and cause deaths among the stock, mainly when forage plants are scarce.

(c) *Cultivated or artificial pastures*

Generally speaking, the Brazilian farmer, apart from a few regional exceptions, does not depart from the extensive type of grazing on natural pastures found in practically all Latin American countries. On the contrary, in 1950 nearly four-fifths of the total pasture area consisted of natural pasture; artificial pastures, especially land used for the cultivation of fodder crops for cutting, constitute a minute proportion of the total area even on the dairy farms. In the main milk-producing areas the following ratios were found to exist between land used to grow hay and fodder plants for cutting and the total grazing area; area supplying São Paulo (grade C milk) 1:33; area supplying the city of Rio de Janeiro 1:45; area supplying Niterói 1:128; and area supplying Belo Horizonte 1:190.

Hence, inadequate feeding is also a basic problem on dairy farms, first because of the type of grazing land, and secondly because of the limited cultivation of plants that could provide supplementary feed. And this state of affairs persists despite the favourable conditions that can be found in most parts of Brazil for

⁶² São Paulo Department of Agriculture, Livestock Production Service, Information Pamphlet No. 17.

the maintenance of abundant forage plants throughout the year, provided of course that appropriate action is taken as regards irrigation, use of fertilizers, proper selection of species, conservation measures, and so forth.

It should be noted that the small proportion of artificial pasture and of land used for cutting crops means that milk production in the vicinity of the main consumer centres is increasingly dependent on the feeding of ordinary concentrated supplements and commercial preparations; these items are becoming more of a financial burden for producers, and greatly affect the consumer in the form of higher prices for milk and milk products. Although the use of these concentrates is essential on farms with few resources in the way of forage, it often leads to the problem of lack of bulk in the cow's diet.

Moreover it should be remembered that if livestock farms are to be made more profitable in keeping with the rapid increase in land values, farmers will have to grow high-yield forage crops and use modern stock-feedings methods. According to CNPL, semi-extensive dairy farms should allocate 5-10 per cent of their total area to the cultivation of crops for cut fodder to ensure a good yield per hectare. Otherwise crop farming will continue to expand to the detriment of production of foods of animal origin, which are in such short supply in all Brazil's consumer centres, and there will also be a continuation of the tendency for dairy farms to move further away from consumer centres, as a result of the urbanization of the land.

(d) *Fodder conservation*

Although this practice constitutes an important source of animal feed in other countries, it has not received nearly enough attention from stock farmers⁶³ and agencies concerned with the promotion of stock farming. Unhappily little has been done in this field, and no national campaign has been launched to solve the problem. This is hard to understand, in view of the many successful experiments made by Brazilian technical experts, who want nothing better than to see their achievements repeated on as many stock farms as possible. The serious consequences of the forage shortage in times of drought could be substantially mitigated by processing the surplus forage produced during the rainy periods, which is largely unused, and by preserving fodder in the form of silage. Brazil's foremost agrostologists agree that the dire consequences of the seasonal forage shortage could be forestalled if the practice of growing fodder crops for cutting were generally adopted, together with simple methods of processing the fodder, and if there were a wider use of silos and protein concentrates. But so far these ideas, which are of such great potential significance for Brazil's livestock economy, have not met with the reception they deserve.

(e) *Feed complements*

Other aspects that are greatly neglected are the provision of properly selected mineral salts that are

lacking in the forage, and the provision of drinking water. The insufficiency of certain minerals in both forage plants and soil is responsible for slow growth, low fertility and a number of metabolic disturbances and diseases that are discussed hereafter.

The direct application of minerals and the use of fertilizers would remedy many of the mineral deficiencies, in addition to encouraging the growth and yield of forage plants and providing a more balanced soil, but neither practice is adopted, whether the land concerned is for grazing or for the cultivation of fodder crops for cutting. The poverty of much of the pastureland and the very low proportion of legumes are attributable to a lack of phosphorus and calcium, which can to some extent be supplied.

The shortage or lack of shade on the grazing grounds, and failure to provide shelter to protect the stock from unfavourable weather conditions, such as heat and intense sunlight, are other wide-spread problems that affect the extensive type of farming.

2. LIVESTOCK DISEASES

If it had been possible, it would have been illuminating to include in this study an account of the economic losses to Brazil's livestock industry caused by the more common infectious and parasitic diseases; this would have underlined the magnitude of the problem and the need to increase veterinary prophylactic campaigns and control of the infectious and parasitic diseases that cause the highest mortality. The vast extent of Brazil's territory, the distribution of livestock throughout most of the country, the large number of herds, the variety of climates and the low technical level of stock farming all facilitate the spread of a large number of parasitic and pathogenic agents. Contrary to general belief, the stock farmer knows little about the nature of what are generally referred to as animal "pests", or how to control them. And, what is even more serious, he is usually reluctant to take the systematic measures that are needed to prevent diseases or reduce their incidence. There is no doubt, in fact, that most farmers resort to the veterinary or the official technical assistance services in this field only when their animals are being decimated by an epizootic disease or pest.

On the basis of the 1950 census figures, and on the assumption that rates were the same as in 1950⁶⁴ (although there has admittedly been some improvement in health conditions), probable stock losses in 1960 were as follows:

	Inventories (thousands of head)	Deaths (percentage)	Number of deaths (thousands of head)
Cattle	73,962	4.2	3,106
Pigs	47,944	21.6	10,356
Sheep	18,162	7.4	1,344
Goats	11,195	8.5	952

On the basis of an average price per head, weighted for the proportion of young and full-grown animals in each species and for the various mortality rates

⁶³ In 1953 the proportion of silos used was extremely small: there was one for every 30 dairy farms in Guanabara, 23 in São Paulo and 40 in Belo Horizonte.

⁶⁴ Based on the mortality figures recorded in 1949, applied to the 1950 census.

assumed, the losses in 1960 probably cost the Brazilian economy the vast sum of 55,000 million cruzeiros, of which 23,000 million represented cattle deaths and about 30,000 million deaths among pigs.

It would not be appropriate here to enter into the regional incidence of animal diseases and pests, or to review the different morbidity and mortality rates, about which there is not yet sufficient information available. For the time being all that will be done is to give an account of outbreaks and foci of infection in Brazil in recent years (see the Statistical Annex, table XX) and to make the following brief summary of the animal diseases and parasites that do most damage in Brazil.

(a) *Infectious and contagious diseases*

(i) *Foot-and-mouth disease*

Although this does not in itself have a high mortality rate, it is rightly regarded as the acute disease that causes the greatest economic losses to the livestock industry in Brazil, as in many other Latin American countries. The losses are mainly due to the marked decline in the milk yield of affected cows, the consequent loss of weight in sucking calves, mortality among pigs, loss of weight in fat stock, after-effects (such as chills), and the serious implications of control of stock movements, quarantine measures, restrictions in export markets, and so forth.

The Pan American Foot-and-Mouth Disease Centre in Rio de Janeiro, and the various official and private laboratories engaged in preparing the vaccine, are making a substantial contribution to the control of this disease. But the campaign is limited by a number of factors that include the scarcity of the vaccine, inadequate vaccine control, the shortness of the immunity conferred, the problems arising from the existence of three types of virus, A, O and C, which do not give cross-immunity, the high cost of control campaigns and the half-hearted co-operation given by so many stock farmers. All these factors, in conjunction with the wide prevalence of the disease, are a serious obstacle to the launching of a broader control campaign, but the agencies concerned with the development and protection of stock farming are undoubtedly bent on achieving this aim.⁶⁵

(ii) *Brucellosis, or Bang's disease, and other diseases of the reproductive system*

Bang's disease seriously affects Brazilian cattle, especially dairy strains, although it is enzootic in nature and much less spectacular than foot-and-mouth disease. Losses are high, and are mainly due to the premature birth and death of calves, temporary or permanent sterility in cows, reduced milk yield, etc. The undesirable effects of this zoonosis on human health must also be taken into account.

Some idea of the economic loss sustained by Brazil's livestock industry as a result of the infectious abortions

caused by Bang's disease can be obtained by pointing out that this disease usually reduces the birth rate by either 18 or 50 per cent, depending on whether it is due to chronic reactors or to recent acute outbreaks; that for every five cows which abort, one becomes sterile and the remaining four do not give birth again for up to two years; and that milk production is reduced by about a quarter. It is estimated that in the State of Rio Grande do Sul alone the losses suffered in 1959-60 amounted to some 800 million cruzeiros, solely as a result of the reduction in the number of live births. The high incidence of the disease is explained by the fact that vaccination is not compulsory, and that animals with a positive reaction are sold to other farms.

Other diseases that affect reproduction in cattle herds include bovine trichomoniasis (caused by *Trichomonas foetus*), found on 11 out of 44 farms inspected, with an incidence of 25 per cent; of 197 bulls examined, 18.2 were found to be infected.⁶⁶ The existence of the disease has been confirmed in the Paraíba valley, in the State of Rio de Janeiro, in Ceará, Paraíba, Pernambuco, Bahia and Rio Grande do Sul. Leptospirosis (caused by *Leptospira pomona*) was found on 18 of 44 farms examined. It has been recorded in the States of Rio de Janeiro, Paraná and São Paulo, and in São Paulo it is regarded as comparable in importance to brucellosis. Vibriosis (caused by *Vibrio foetus*) was found, with an incidence of 40 per cent, on farms inspected in the Paraíba valley and the State of Rio de Janeiro. It has also been found in São Paulo and Rio Grande do Sul. It has been proved in São Paulo that granular vaginitis is a cause of partial sterility.

(iii) *Infectious diseases in calves*

Certain diseases such as colibacillosis, salmonellosis, pneumonia, omphalophlebitis, pyobacillosis and diphtheria have a high death rate among calves a few months old; on a number of farms the rate is as much as 50 per cent for very young calves. Notable among these diseases is paratyphoid or salmonellosis, with its clinical picture of pneumoenteritis, which mainly attacks calves aged one to three months. The high incidence of this disease is due to the fact that at least three-quarters of the breeders do not go in for systematic immunization. Failure to use the vaccine is also sometimes found in cases of black-legs.

In these diseases of young cattle, the accompanying symptoms and simultaneous attack by various parasites often complicate the diagnosis, prophylaxis and treatment. Greater attention should be paid by farmers and official bodies to improved methods of preventing and controlling these concurrent diseases, since they constitute the main cause of the high death rate indicated above.

(iv) *Other infectious diseases*

Other diseases that cause heavy losses are rabies in cattle, swine fever, salmonellosis in pigs, strangles (*adenitis streptococcalis*) and encephalomyelitis in horses, and Newcastle disease in poultry.

⁶⁵ In 1961 the Government established the basic principles for a more effective campaign, which included an improvement in the supply and quality of the vaccine, through statutory regulations, the financing of laboratories by means of official credit organizations, and the compulsory vaccination of cattle whose meat is intended for export.

⁶⁶ The percentage incidence of trichomoniasis, leptospirosis and vibriosis refers to the State of Rio de Janeiro.

(b) Parasitic infestations

Among the endoparasitic diseases there are, firstly, roundworm infestations of the respiratory and gastrointestinal tracts caused, respectively, by the lungworm *Dictyocaulus viviparus* and by species of the genera *Haemonchus*, *Trychostrongylus* and *Oesophagostomum*, which ravage herds of young cattle kept on low-lying humid pastures where the drinking water is contaminated. The high incidence is also due to the farmer's failure to adopt the practice of regular vermifuge administration. Other intestinal infestations are coccidiosis (eimeriasis) in calves, and endoparasitic diseases of sheep, which are responsible for many deaths.

Secondly, cattle suffer great annual losses from piroplasmosis (caused by *Babesia*) and anaplasmosis (caused by *Anaplasma*). These haematozoa infestations are found virtually throughout Brazil, except in the Nordeste, where there are no ticks.

The economic losses resulting from ticks and the parasites they transmit are believed to be enormous. Together with the tropical warblefly (*Dermatobia hominis*), these infestations are regarded by technical experts and stock farmers as the main causes of the decline in livestock production in Brazil. A good illustration is provided by the losses reported at the First Agricultural Fair in Rio Grande do Sul (November 1960), as a result of attacks by ticks and haematozoa in that State:

(i) Through weight loss, amounting to 50 kilogrammes of live weight per head, at a price of 30 cruzeiros per kilogramme, in 1.1 million cattle slaughtered, i.e., a loss of 1,650 million cruzeiros;

(ii) Through damage to the hides of slaughtered cattle: 726 million cruzeiros;

(iii) Through expenditure on insecticides and other medicines: 400 million cruzeiros.

Consequently, annual losses, not including mortality and the cost of building dipping vats and spraying pens, must be in the neighborhood of 2,800 million cruzeiros. These heavy losses, and the high breeding and production value of the Rio Grande do Sul herds, more than justify a tick-eradication campaign.

(c) Mineral deficiency problems

In Brazil a number of minerals may be present in too small a quantity or lacking altogether, including basic minerals such as phosphorus and calcium and trace elements such as copper and cobalt. This may be the cause of premature mortality and a falling-off in economic performance. Although not much is known about these conditions, with respect either to their true aetiology or their various effects, some observations and studies indicate that they are responsible for a lower birth rate, retarded growth, declining production and a number of diseases, including *peste de secar* ("wasting sickness"), *mal de colete* ("wry neck") and *mal de areia* ("gravel disease"), and others with regional names, considered by technical experts to be probably due to lack of cobalt.⁶⁷

⁶⁷ The symptoms are similar to those of "bush sickness" in New Zealand, "salt sickness" in the United States and "pinning" in England. These ailments affect ruminants only and the

It is known that mineral deficiencies can be remedied by providing properly prepared mineral salts, but this is often neglected. Another related problem is that the formula of certain commercial preparations is not appropriate for the deficiencies found in particular regions; as a general rule these preparations contain more calcium than phosphorus, for reasons of cost, whereas phosphorus deficiencies are likely to be more serious and wide-spread.

3. FACTORS LIMITING BREED IMPROVEMENT

It should be made clear at the outset that the main difficulty with respect to breed improvement is that research and campaigns must be carried out on a long-term basis before results can be evaluated and turned to account whereas the benefits of action in respect of feeding, health control and administration can be obtained over the short or medium term. Because of the long-term nature of improvements in breeding—which amount to several years of patient work in the building and selection of cattle breeds—proper guidance should be given from the very beginning in order to increase the chances of success. Otherwise, indiscriminate research and projects relating to breed improvement carried out in different places may lead—indeed have led in Brazil and many other countries—to the unnecessary duplication of resources and functions, and just as frequently, to costly experiments and observations that have little or no value or give conflicting results. It should be recalled, moreover, that just as the improvement of a herd is a slow process, particularly at the regional level, the correction of mistakes made by stock farmers for lack of timely guidance is both expensive and difficult.

Breed improvement is still governed essentially by the desires, actions and whims of stock farmers. Hence, the standardization and co-ordination of research campaigns and technical assistance, and the separation of breeds by area, are factors which ought to be planned on a nation-wide scale with due regard, of course, to the local conditions obtaining in each area. Important if limited action to achieve such standardization and co-ordination has so far been taken only by the Institute of Zootechny of the National Department of Livestock Production, the National Dairy Farming Commission, the National Poultry Commission, and by some agencies in a few States.

Another major stock-breeding problem in Brazil is the lack of a strain of dairy cattle adapted to the tropical conditions prevailing in most dairy-farming areas. Notwithstanding the efforts made to solve this problem, no definite conclusions have been reached as to the particular merits of one breed or cross-breed over another. Research to provide the answers to these questions and to give guidance to stock farmers is, of course, urgently needed. Although intensive farming on the basis of purebred European dairy strains is possible with efficient feeding and management, relatively few producers engage in it. Most of them prefer to use cross-bred cattle (European-zebu or European-ordinary), which are more adaptable to the

symptoms are lethargy, loss of appetite or depraved appetite, anaemia and cachexia, even on good pasture; the post mortem shows muscular dystrophy, oedema, etc.

environment and to the prevailing farming conditions. There is no doubt, however, that greater dividends can be obtained from the propagation of highly adaptable European stock, which can be brought about through the extension of efficient feeding and management practices.

The stock farmer often has to decide which of the European strains would be best for improving his cross-bred, zebu, or ordinary cattle, and what degree of cross-breeding produces the most satisfactory results. There are no final answers to these questions. It has already been stated in another section that, as far as cross-breeding between European and zebu dairy cattle is concerned, no marked differences have been noted in output that could be attributed to the improvement in the strain and that, moreover, it is not known what is the most desirable degree of cross-breeding. Everything depends upon the characteristics of the environment (climate, quality of the soil, topography), the most common cattle diseases and parasites, feeding techniques, and knowledge and care in the management of cattle, according to the type of farming undertaken—intensive, extensive, or aimed at the production of a particular type of milk or the breeding of stud bulls. Only the experienced expert in breeding techniques, who is familiar with local conditions, can select the best alternative. In some areas, such as Minas Gerais, a cross between the European-zebu dairy strain in the proportions of $\frac{1}{2}$ to $\frac{3}{4}$ might be the most desirable breed, whereas in better organized dairy-farming areas, such as São Paulo, the most economic ratio might be as high as $\frac{7}{8}$ or $\frac{15}{16}$.

To determine the point at which increases of European blood reduce output under certain farming conditions is indeed a complicated problem. Faced with this difficulty, farmers whose cattle are already relatively highly cross-bred should seek to increase output per cow through better feeding, better disease control and careful management. It should be pointed out that there are stock farmers in central Brazil who, with proper guidance, have managed in this way to increase average output from the same cows by 75 per cent in only three years. This rapid progress contrasts with the length of time required for a mass improvement in breeding techniques intended to raise output per animal. It is estimated that, in São Paulo, which has the highest rate of cattle development, ten years were needed to raise the proportion of cross-bred dairy cattle by 20 per cent. In other words, it took ten years to improve 20 per cent of the dairy cattle population by cross-breeding and grading.

One of the obstacles to a more rapid development of improved breeding techniques for dairy cattle in a tropical environment, apart from the adverse conditions of the environment itself, is the great shortage of pure or graded sires, particularly those that have been proved. Emphasis seems to have been placed on the production of pure dairy cattle sires, a lengthier and most costly process, when the same results might be achieved in less favoured areas by using proved bulls with a varying proportion of mixed blood. It is obvious that to improve the distribution and use of proved sires, good milk yield records must be kept, and much remains to be done in this respect. The shortage of

good sires has not been satisfactorily remedied through recourse to artificial insemination, since transport difficulties, lack of trained personnel and the reluctance of stock farmers to use semen from purebred sires, have all prevented this practice from becoming more wide-spread. Inadequate management is also responsible for the shortage of sires.

With respect to the tendency of some producers to breed pure zebu dairy strains, the outlook is promising, although the lack of a wide selection of good cows is a problem. The few herds of pure high-yield zebu dairy cattle have taken twenty or more years to build up. This work should be expanded, publicized and intensified and at the same time the mass improvement of dairy cattle through the cross-breeding of European strains with zebu and creole cattle, a method which has given good results throughout the country, should be promoted on an even broader scale.

If a sufficiently large herd of pure zebu dairy cattle is built up, the bulls could be used for upgrading to ensure more rapid progress.

As regards the solution of breeding problems, Brazil has many achievements to its credit in the case of beef cattle which, in a relatively short time, have placed its improved breeds at a high level. This is particularly true of the State of Rio Grande do Sul and several areas in central Brazil. But the output and efficiency of beef cattle production are still low in those areas, simply because no cattle, however good they may be from a genetic standpoint, can produce high yields unless they are properly fed and sensibly cared for and handled.

With the help of official action, the valuable contribution of cattle geneticists and the growing interest of progressive producers, Brazil has succeeded in building up a beef herd based on zebu cattle, highly improved and increasingly adapted in its development to the interests of the producers and the requirements of the market. The best pure zebu steers arrive at the slaughterhouse weighing between 450 and 500 kilogrammes (exceptionally high figures), as against 375 to 400 kilogrammes for graded and 250 to 300 kilogrammes for creole steers. This explains the trend towards the absorption of creole strains and ordinary cattle and their replacement by pure bred zebu cattle or hybrids with a high proportion of zebu blood. It used to be argued that zebu meat was not suitable for export markets but, although it is admittedly inferior in texture and muscle fibre, the best Brazilian zebu can undoubtedly compete on foreign markets. Another factor in its favour is the world trend towards the consumption of lean meat, such as that of the zebu.

In contrast to the situation as regards dairy cattle, there are no factors limiting production from the standpoint of beef cattle breeding techniques. Breed improvement is progressing and the prospects of improving the quality of the meat on the basis of existing inventories, with the addition of some European strains, are most promising.

Other zootechnic fields, in which breed constitutes the factor limiting yield and output, are the minor livestock species, precisely because of the preponderance of native strains with low productivity. Several problems remain to be solved, such as those relating

to the selection of certain comparatively favourable creole breeds, the study of the behaviour and adaptation of new breeds which might be introduced into the country and the better use of those already brought in, both for farming in the purebred state and for crossing with native breeds.

4. OTHER LIMITING FACTORS

(a) Management defects

Breeders of cattle, pigs, sheep and goats, etc., who run their own farms at a high level of administrative efficiency, are still few in number, the general rule being routine management with inadequate farming methods. There are several reasons for this state of backwardness, the more salient being the difficulty of investing in improvements, the lack of incentives, particularly under the tenant farming system, absenteeism on the part of owners of large properties and their failure to introduce modern practices into stock-farm administration, ignorance of such practices on the part of many small producers and certain limitations in the national agency responsible for extension services and vocational training in this field. Incidentally, one of the main gaps concerns the co-ordination that should exist between the results of research and modern technology and their application by producers, and this can only be achieved through an administration operating on sound lines. The first thing to do would be to deal with the management defects which can be remedied at the lowest cost, such as those relating to the cultivation of fodder crops for cutting, the conservation of fodder, the proper use of grasslands, their rotation and weeding, the organization of standard health control practices, the establishment of production registers, the supervision of reproduction and births, information on markets, simplified accounting procedures, co-operatives, etc.

(b) Land tenure problems

It is being increasingly argued that livestock production and its level of productivity have little connexion with the structure of ownership and the land tenure system on stock farms. This may be true of countries where stock farming is well developed, and both small and large farms, whether owner-operated or rented to tenant farmers, function at an adequate level of efficiency. It is not true of Brazil (or of most Latin American countries), where it has been found that certain systems of land tenure and the size of the stock farms usually do have an effect—very often of a negative kind—on farm organization, improvement and productivity, as will be seen from the following paragraphs.

Out of a total of 596 dairy farms surveyed in the Rio de Janeiro dairy area, the National Dairy Farming Commission found that production per hectare of pasture, according to the size of the farm, was as follows:

Size	Average output per hectare of pasture (Litres per year)
Up to 25 hectares	368
26-50	361
51-100	252
101-250	208

Size	Average output per hectare of pasture (Litres per year)
251-500	185
501-1,000	176
1,001-2,000	143
Over 2,000 hectares	170

Thus, for farms essentially engaged in milk production, the output of milk per hectare was at least 50 per cent lower on the large and very large properties of over 250 hectares, owing to less efficient use of the land rather than to any marked differences in the quality of the cattle.

In a study sponsored by the São Paulo Department of Agriculture on the structure of agriculture in that State in 1959, it was noted that pastureland was used in inverse proportion to the size of the farm. In fact, the ratio of cattle per *alqueire*⁶⁸ was found to be only 1.79 head or 0.74 animals per hectare on farms of more than 3,000 hectares, as against a ratio of 1.39 head per hectare on farms of 3 to 9 hectares. The State average was 0.86 head per hectare.⁶⁹

It should be borne in mind that greater physical productivity per hectare is not always correlated with higher revenue. Thus, for example, revenue is low on intensively developed farms, that are in the vicinity of major urban centres, and therefore forced to pay high prices for inputs of labour and concentrated feed and, in particular, for land. The prospect of a rise in land values as a result of urban development and the influence exerted by the proximity of a large consumer centre have produced in Brazil, more than in other countries, a rapid and unwarranted increase in the value of land and land rents which militates against the use of the land for economic purposes and creates problems with respect to the supply of fresh milk in many cities. As a result, dairy farms are moving further away from the urban centres because of the speculation in land that is held on to in the hope that its value will go up.

Another land tenure problem that affects production is the unsatisfactory situation of milk producers working on small *minifundia* they own or rent, who are often—perhaps nearly always—subjected to the competitive influence and pressure of larger neighbouring properties and who have not the slightest hope of expanding. Examples of this are afforded by the municipalities of Viamão, Gravataí, Porto Alegre, Santo Antonio and Canoas, in the State of Rio Grande do Sul, where the average farm is about fifteen hectares, and producers are compelled to grow additional feed on land owned by neighbours that is leased to them at rates amounting to 30-50 per cent of the value of production. This characteristic of the dairy *minifundio* is anti-economical because the land cannot be used for both crop and stock farming, at least with respect to pasture cultivation, and the result is a lower milk yield from milch cows because their diet contains too much feed concentrate and too little bulk fodder, as is the case on small dairy farms near the large Nordeste towns.

⁶⁸ *Alqueire* in São Paulo is equal to 2.4 hectares.

⁶⁹ São Paulo Department of Agriculture, *Agricultura em São Paulo*, Bulletin No. 5, 1960, p. 7.

The stock-farming *latifundia*, at the other end of the producer scale, generally suffer because of absenteeism on the part of the owners and are characterized by low levels of efficiency and productivity per unit of area, though they still manage to provide their owners with a large and easy income, thus creating serious economic and social problems. Typical examples of this kind of large stock-farming property, with the attendant characteristics of more or less permanent absenteeism on the part of the landlord and an extremely low level of physical production, are to be found in several Brazilian States, particularly when the farms are for beef cattle.

Thus, there is, on the one hand, a growing number of small producers who work more efficiently and with a greater sense of dedication, but for whom there is no possibility of expansion or of integration into units of a more economical size, and, on the other, a much smaller number of owners of large stock farms whose main concern is to hold on to their land for purposes of speculation, thereby making the supply of land very inelastic. It should be pointed out that notwithstanding the low level of productivity on such farms, the total revenue is enough to provide a wide margin of profit. This is partly due to the existence of relatively favourable price conditions as a result of the large proportion

of total supplies provided by the *latifundia*, and partly to the fact that lower productivity tends to condition prices.

It should be recalled, moreover, that the limited supply of land is also a problem for the medium-scale stock farmer who works on leased land, and has no chance of securing a bigger yield from labour and capital because of the higher prices he has to pay for the land he uses. He seldom receives any recognition for the permanent improvements he makes to it, and therefore seeks to obtain the highest profit at the lowest cost by refraining from such activities as pasture improvement and soil conservation.

These anomalies or shortcomings in the land tenure system as it affects stock farming are mentioned here as being factors that militate against the promotion and technical improvement of stock farming. The disposal of these shortcomings is not a matter for the stock farmers themselves, but comes rather within the scope of agrarian reform. The need for such reform has already been recognized and is being pressed by the different social and political forces in the country. Legislation to this effect is already in force in the State of São Paulo, and the Federal Government is seeking to promulgate similar laws.

VI. THE MARKETING OF LIVESTOCK PRODUCTS

The problems of marketing livestock products should be dealt with at some length, not only because marketing is often a factor contributing to a bottleneck in the livestock economy but also because it has serious repercussions on supply and demand and, *ipso facto*, on the interests of producers and consumers. However, only the more critical aspects of the market for meat and dairy products are analysed in this study.

Before describing the many shortcomings in collection, transport, grading, processing, transfer and distribution as well as in other phases of the marketing of meat and milk, it should be pointed out that a considerable improvement in the commercial and technical structure of markets is taking place in the more densely populated areas of Brazil. In this connexion, mention might be made of the progress achieved in central Brazil and Rio Grande do Sul with the establishment of a large industrial processing centre for livestock and meat and of modern slaughterhouses and plants for the processing of milk under hygienic conditions and the preparation of milk products.

It should be recalled that many market problems are merely a reflection of the anomalies and shortcomings at the primary production level; in fact the low productivity, seasonal variations and high costs at that level and the highly perishable nature of meat and milk have a powerful impact on the size of the market, on the processing of primary products and on prices. There have been cases where producers have been paid prices equal to or below cost and this has, over the long term, produced a reduction or stagnation of supply, thus creating supply problems, reducing commercial activity and raising retail prices.

Moreover, the pattern of final demand for products is what affects marketing. The extremely limited purchasing power of vast sections of the population, the relatively high price of animal products and certain eating habits have caused lower-income consumers, who are in the great majority, to adapt themselves to the conditions of a scarce and inefficient market with respect to services and the quality of the products. Prosperity in some States such as São Paulo has clearly brought about a general improvement in markets, and the higher personal income level has produced a greater demand for better quality products and improved packing and distribution services.

The following are some of the defects common to the marketing of all animal products: (a) problems created by the lack of means of communication and transport and, to some extent, the inadequate organization of these services; (b) obviously backward methods for the slaughtering and processing of meat and milk; (c) the monopolistic action of the major processing enterprises, which is fortunately undergoing a change in some respects; (d) the existence of numerous abattoirs operating at low levels of use and productivity and without any health control whatsoever, as is the case in municipal slaughterhouses; (e) losses and wastage from the time the product leaves the producer until it reaches the consumer; (f) the unduly large proportion of retail distributors with a small turnover who sometimes have to pay high prices for better service or, conversely, operate under deplorable conditions as far as hygiene and organization are concerned; (g) high marketing costs bearing no relation to services and the quality of the products, sometimes

attributable to unnecessary middlemen; (h) lack of regular, systematized information on the conditions and trends of supply, demand, prices and other market factors; (i) absence of a suitable national policy to improve and guide marketing for the benefit of producers and consumers and to reconcile the occasionally conflicting interests of the different States.

1. THE MARKETING OF MEAT

(a) *Beef cattle*

Marketing begins when the animals are sold by the breeder to the first grazer or, if already fat, to the slaughterer, merchant or refrigerating plant. In some areas of central Brazil there are only two graziers, the second of whom sells the lean steers to the fatterer, usually when they are three years old, and the latter in turn sells them for consumption at the age of four or more. This peculiar feature of the trade is due to the fact that breeders have no fattening facilities and to the long distances between production and consumer centres which make it essential to provide for staggered grazing and to condition steers in areas somewhat closer to slaughtering and consumption centres. The State of São Paulo, which is the major consumer in Brazil, formerly considered itself a fattening area because the bulk of the cattle came from the State of Minas Gerais and the southern zones of Mato Grosso and Goiás where few fattening pastures are available. It had previously been argued that the establishment of additional packing plants in the State of São Paulo, as part of the national plan, was not advisable since it was not considered a breeding area because of inadequate grazing, transport and other conditions. Things have changed since then, and the State of São Paulo now breeds nearly three-fifths of the cattle it slaughters.

The marketing of beef cattle is quite different and of a highly individual nature in Rio Grande do Sul, where the stock farmer is at once breeder, grazer and fatterer. Moreover, as there are no middlemen, the producer usually sells his fat steers through production co-operatives. The location of slaughtering plants is no longer a major problem and this, together with the fact that the entire supply of fat stock comes from herds in the State itself, makes for easier and more regular marketing conditions.

Brazil has no central or terminal public markets for fat stock, except for the cattle fairs in the Nordeste, since the animals are sold directly to slaughterhouses and packing plants, slaughterers, co-operatives, agents and brokers. The latter usually take advantage of market irregularities to impose their price for fat steers on the producer.

The absence of classification and grading of fat stock according to degree of fattening, age, weight, quality, etc., is a serious defect. Virtually the same price is paid, per kilogramme on the hoof, for meat from an old animal, for baby beef or for chilled beef. The same price is asked on the consumer market for a specific cut of meat, regardless of origin. This explains the lack of economic incentives for improving the growth rate and quality of cattle, which are usually provided by grading standards. The stock farmer is

normally interested only in producing the fattest animals he can.

(b) *Transport*

Although conditions for the transport of cattle in the Centro Sul and other areas are improving, they are still very unsatisfactory, particularly in the Norte, Nordeste and Oeste. There is a shortage of railways and roads and a considerable proportion of the cattle has to be moved on the hoof to fattening areas or slaughterhouses. Railway services are inadequate and transport by lorry is fairly expensive.

In the State of São Paulo 90 per cent of the cattle transported to fattening areas are moved by road and the remaining 10 per cent by rail. Some 80 per cent of the cattle transported from fattening areas to slaughtering plants are moved by rail, 10 per cent by lorry and 10 per cent on the hoof. Transport by lorry is increasing.

Severe losses are sustained during transport for lack of proper arrangements. The animals lose much weight, particularly when moved on the hoof over long distances; hides are damaged; and animals die or suffer bruises and contusions which often cause the meat to be confiscated or to lower its quality. A survey undertaken by the Livestock Production Service of the São Paulo Department of Agriculture⁷⁰ shows that even when transported by rail cattle lose from 31 to 52.5 kilogrammes of weight over distances of 500-815 kilometres. In spite of the fact that most of the loss is due to the emptying of the digestive and urinary tracts, there is a loss of between 2 to 9 kilogrammes in carcass weight. Out of approximately 1 million head of cattle transported by rail, 432 carcasses were condemned, 2,154 were rejected for sale as fresh meat, and 4,121 animals died, although part of the meat was used for the manufacture of by-products. In themselves, these figures do not appear to be particularly unsatisfactory. However, they represent an appreciable cumulative loss if conditions remain unchanged, and point to the existence of a much more serious problem in areas lacking transport facilities. The transport of live cattle obviously involves the movement of some dead weight of little if any use. If carcass meat were transported in suitably conditioned trucks instead of live animals, transport capacity would be substantially increased and the above-mentioned losses would not be sustained.

It is therefore clear that as long as there are no facilities for fattening cattle in the breeding centres or areas themselves, and no proper roads and transport media for meat, the establishment of meat-packing plants in the breeding areas is not advisable. Unless these conditions change, the cost of marketing cattle will remain high from the grazing stage to the slaughterhouse in view of the heavy cost of transporting cattle from remote areas of the country, the mortality rate estimated at between 1 and 2 per cent, loss of weight in fat stock, costs incurred because of the greater incidence of cattle diseases during transport, etc. It should be borne in mind that the policy of sending

⁷⁰ Report by J. B. Villares and co-workers on the location of new meat-packing plants in the State of São Paulo, June 1958.

to processing plants the surplus cows commonly found at breeding centres should, in any case, be encouraged.

(c) *Slaughtering and processing*

(i) *Municipal slaughterhouses*

According to the data in table 8, nearly half the cattle, 30 per cent of the pigs and half the sheep and goats are killed in municipal slaughterhouses scattered all over the country. These establishments are normally constructed and maintained with municipal funds and in many cases are administered on unsound lines by the slaughterers or distributors. Except for those established in large cities, most of them have a low volume of operation, usually lack equipment for the slaughtering of animals and the handling and storage of meat and very often have no health control or veterinary inspection service; this is also true of estates and farms which, as will be seen in table 8, slaughter as many pigs, sheep and goats as the municipal abattoirs. In general the latter do not have facilities for the utilization and processing of the by-products of slaughtered animals, or cold-storage plants for meat conservation.

They operate at a loss of at least 50 per cent to the municipal treasuries because of the low fees or rates charged for slaughter, which in many cases are the same as in colonial days. A case in point is the municipal slaughterhouse at Carapicuíba, in São Paulo,⁷¹ which in 1954 registered a loss of 23.5 million cruzeiros by charging a slaughter fee of only 33 cruzeiros.

Apart from the fact that the municipal slaughterhouses do not have to undergo Federal inspection—which incidentally they could never pass—and thus are not involved in the cost of such inspection although partly responsible for the harmful consequences for the consumer, they act as a sort of subsidy, incentive and protection for the intermediate slaughterer who delivers the meat to the consumer market (distributor), as a result of obsolete provisions in municipal codes. The continued existence and protection of this antiquated and outdated system of slaughter not only prevents the establishment of adequate channels for the meat trade but also places the properly organized regional slaughterhouses at a competitive disadvantage.

⁷¹ There are 500 municipal slaughterhouses in the State of São Paulo alone.

Table 8
Brazil: Breakdown of slaughtering by establishments, 1960

	Cattle		Pigs		Sheep		Goats		Poultry	
	Number	Per-cent-age	Number	Per-cent-age	Number	Per-cent-age	Number	Per-cent-age	Number	Per-cent-age
Municipal slaughterhouses	3,548,000	49.2	2,110,000	29.7	647,000	45.3	785,000	51.7	—	—
Refrigerating plants	1,376,000	19.1	301,000	4.2	10,000	0.7	—	—	399,000	7.3
Other slaughterhouses	979,000	13.6	121,000	1.7	14,000	1.0	—	—	19,000	0.4
Jerked beef plants	592,000	8.2	3,000	0	2,000	0.1	—	—	—	—
Pork processing plants	105,000	1.5	2,644,000	37.3	5,000	0.4	6,000	0.4	174,000	3.2
Farms, holdings, etc.	587,000	8.1	1,889,000	26.6	745,000	52.2	684,000	45.1	—	—
Occasional processors	20,000	0.3	1,000	0	—	—	1,000	0.1	—	—
Poultry killing plants	—	—	23,000	0.3	4,000	0.3	42,000	2.8	4,841,000	89.1
TOTAL	7,207,000	100.0	7,092,000	100.0	1,427,000	100.0	1,518,000	100.0	5,433,000	100.0

Source: Ministry of Agriculture, Production Statistics Service (SEP).

(ii) *The manufacture of jerked beef*

About half a million head of cattle are slaughtered in establishments engaged in the preparation of jerked, dried and salted beef. While some of them are properly organized, most of the jerked beef is produced in inadequate establishments under the worst possible health conditions.

Many of the jerking plants are in Rio Grande do Sul, which in 1960 accounted for about 17 per cent of Brazilian production. A large number are also to be found in central Brazil (particularly Minas Gerais, Mato Grosso and Goiás), where 80 per cent of the total is produced. It should be pointed out that jerked beef is also produced in slaughterhouses and refrigerating plants.

The jerked beef industry is losing ground because of its low productivity and the reduced demand for this type of low-quality meat. Its market is becoming

more limited every year and this applies also to the Norte and Nordeste where the main consumer centres are situated and which today import fresh beef from other areas. The decline in the jerked beef industry has reduced the number of less efficient establishments, which are usually small. Admittedly the preparation of jerked beef involves considerable wastage, both in the quantity and quality of the beef. The loss of quality is an important factor, particularly in Rio Grande do Sul, where prime quality meat from European steers is converted into a dried product of poor quality.

This industry does, of course, provide a partial solution to the supply problem in areas where no fresh meat is available and for the low-income groups. It is also a means of converting surplus meat which cannot be exported, sent to other consumer centres or preserved for lack of cold-storage facilities. However, other solutions will be found as the marketing of meat improves and the demand for better-quality meat increases.

(iii) *Meat-packing plants*

By the end of 1961 the number of Federally-inspected establishments in Brazil was as follows:⁷² Bahia, 2; Ceará, 1; Espírito Santo, 1; Minas Gerais, 3; Paraná, 2; Pernambuco, 1; Rio Grande do Sul, 16; Rio de Janeiro, 1; Santa Catarina, 4; São Paulo, 8; making a total of 39. This list, taken from table XXI, includes only the meat-packing plants engaged in the slaughtering and cold storage of beef and, on a lesser scale, of other types of meat, since similar establishments exist for pork and others for the slaughter of poultry, as well as cold-storage plants which only offer storage facilities.

The daily capacity of the largest meat-packing plants is as much as 2,000 steers, in addition to pigs. Rio Grande do Sul and São Paulo have the largest industrial processing centres in the country. In the former, five meat-packing plants can slaughter about 1 million head of cattle during the normal fattening season, but actually operate at very low capacity because of the shortage of animals and the trend towards establishing plants in the interior.⁷³

The five main meat-packing plants in the State of São Paulo (two in the capital and the three others in Utinga, Barretos and Araçatuba) have a daily slaughtering capacity of 6,000 steers but in fact handle only 60 per cent of that total. Table 8 shows that only 1.4 million head of cattle were slaughtered in 1960 in all establishments of this type in the country.

In central Brazil the serious problem of under-utilization has led to keen competition in the purchase of animals and has resulted in the vertical integration of the large concerns which breed, graze and fatten their own cattle.⁷⁴ This, in addition to other factors, allows them to operate under oligopolistic conditions created by a few companies which dominate the cold-storage industry, as is the case, for example, in São Paulo.

It should be pointed out that while capacity is not fully used in some areas, either because of poor location or shortage of animals, additional plants have had to be set up in others (e. g., north of latitude 16°).

The meat-packing industry has, of course, done much to improve slaughtering conditions, the economic use of by-products, the distribution of properly inspected and higher quality products, the conservation of surpluses and many other operations designed to place meat processing and marketing on a sounder basis. It has also had a direct and favourable effect on the improvement of beef cattle breeds and the increase in the supply of fat stock.

⁷² Under the provisions of Act No. 1,283 of 1950 and its regulations, establishments engaged in inter-State or international trade in meat products must be inspected by the Livestock Products Inspection Division of the National Livestock Production Department, Ministry of Agriculture.

⁷³ In 1960 the Swift Company had to suspend operations at its packing plant in the port of Rio Grande, in Rio Grande do Sul, which has a daily slaughtering capacity of 1,500 head of cattle, 1,000 pigs and 5,000 sheep.

⁷⁴ Legislative Decree No. 9,883 of 1948 limits the grazing and fattening activities of meat-packing plants, and forbids the processing of animals during the fattening seasons.

Steps should therefore be taken forthwith to correct existing mistakes, to avoid them in future, and to preserve what has been achieved by means of an over-all plan to regulate meat processing on the basis of the following measures and objectives:

(a) Co-ordination and integration of the present industry in order to make better use of its capacity and to ensure a regular supply to markets, whether municipal, State or foreign;

(b) Determination of priorities in the location of new establishments, not only with regard to the availability of animals but also in terms of market conditions and their possible expansion, bearing in mind that it is not always valid to assume that meat-packing plants should be set up in production areas only;

(c) Modernization, rationalization and control of meat-packing activities, on the one hand, to ensure that full use is made of the animal and that the processing of by-products is diversified in strategically located plants, and, on the other, to avoid the disadvantages of a monopolistic market;

(d) Co-ordination of municipal, State and national interests as well as the activities and interests of breeders, fatteners, processing plants, slaughterers and retail distributors through adequate supply standards, supervision of slaughter,⁷⁵ investment policies, etc.

In the interior of the country, application of a policy aimed at integrating the interests of municipal slaughterhouses, breeders, slaughterers and distributors in the same area through the establishment of enterprises, particularly co-operatives, which would ensure the use of the by-products of animals slaughtered there. This might provide a basis for the establishment of regional slaughterhouses.

(d) *The meat trade*

Probably no other factor has aroused such keen and lasting controversy as the meat trade and this can be attributed to its complex and peculiar structure and to its highly disorganized state. It is a serious problem in every under-developed country, affecting producers, dealers and consumers alike. Fundamentally, the obstacles to an improvement in the meat trade are closely related to the seasonal and inelastic character of cattle supply, the highly perishable nature of the product, lack of cold storage facilities, absence of proper grading, the lack of co-ordinated national supply plans, the presence of conflicting interests, the uncontrolled actions of certain middlemen, high marketing costs, high meat prices and meat price control difficulties. The magnitude of the problem is particularly apparent in Brazil and commands the daily attention of public opinion, experts, stock farmers, the processing industry and dealers, official quarters, etc. The radio and press are constantly publishing and commenting upon various topics, and a simple enumeration of these topics and comments in chronological order will suffice to demonstrate the

⁷⁵ In 1957 the Ministry of Agriculture lifted the supply controls which had been in force since 1946 to prevent the slaughter of cows under seven years of age and to replenish the stock. Slaughtering in general was released from controls, but restrictions were maintained on the slaughtering of dams under five years of age.

nature of market problems.⁷⁶ The main shortcomings and resulting adverse effects of marketing, particularly in the major markets of central Brazil (São Paulo and Rio de Janeiro) are dealt with in the following paragraphs.

The relative abundance of fat stock when pasture conditions are good during the rainy season, and the shortage in the period between fattening seasons, together with the very limited facilities for preserving and storing meat, produce severe fluctuations and disequilibria in the cattle supply which naturally have an effect on the supply and prices of meat. During the grazing season the supply of cattle and meat exceeds demand and prices are relatively low, the catchwords then tend to be over-production and surpluses for export, cold-storage facilities for surplus meat are lacking and it often has to be converted into jerked beef, and stock farmers are opposed to the sale of frozen meat when the supply of fresh meat is plentiful. As pasture becomes scarce and the supply of fat stock begins to dwindle to a critical point, prices for cattle and meat tend to rise, sometimes considerably, slaughterhouses and packing plants compete for the few animals available in an attempt to maintain operations, and distributors are faced with a shortage of fresh meat.

Confronted with these market irregularities and the effects of partial price-fixing at earlier levels which, among other things, produced a black market in meat, the packing plants clamoured for freedom from controls, a desire sometimes shared by butchers as a means of reconciling their interests with those of the consumer. As prices continued to rise, public opinion demanded strict price controls, and seasonal supply difficulties once again brought into the open the problems of the slaughter of dams and the disadvantage of exports. It was even suggested that meat should be imported. It was then that the compulsory conservation of meat in cold-storage plants was mentioned, but nothing was said about the opposition of consumers to meat frozen by methods which would be considered obsolete today.

These meat market irregularities are repeated year after year, to one degree or another, for lack of a clear and final solution to major problems such as the following:

⁷⁶ "Failure to establish national meat-packing plants in São Paulo unjustifiable" (May 1955); "Warning to the stock-farming trust of meat packers"; "Federal Act governing stock-farming activities of meat packers not being implemented"; "COAP reduces the profit margin of butchers"; "Butchers taking steps not to obtain meat from Tendal"; "After nine years the liberal Act on grazing and fattening by meat packers is being made the subject of regulations"; "Maximum weekly quotas set for cattle slaughter"; "The CRB feels that the problem of surpluses should be solved through exports" (December 1956); "COFAP decisions may lead to a collapse of the meat market" (November 1957); "Lock-out of butchers" (December 1958); "Slaughtering of cows under five years of age banned"; "Threatened collapse of meat supplies" (August 1959); "Meat shortage due to arbitrary price policy and not to export or slaughter of cows"; "COFAP controller threatens military occupation of packing plants" (October 1959); "88 per cent of the retailers are selling meat at black market prices"; "The price of meat rises 207 per cent in one year" (October 1960); "MAF advises housewives to reduce consumption"; etc.

(i) *Unsatisfactory price policy*

When prices are fixed only on the basis of certain grades of cattle and/or meat without an expert study beforehand of production and processing costs, fair marketing margins and any other factors ought to be taken into consideration. In view of the lack of bases and data conducive to the adoption of a policy of fair prices, it would be better to leave the market to the free play of supply and demand, in other words, to abolish all meat controls.⁷⁷ In doing so, measures would have to be taken to deal with factors limiting competition to the disadvantage of some and encouraging monopolistic practices to the benefit of others.

(ii) *Absence of a network of refrigeration plants and modern storage facilities*

Wholesale meat markets in the major consumer centres are also lacking. Present storage capacity for the fresh meat surpluses built up during the grazing season is completely inadequate. Even in the State of São Paulo, which has the largest concentration of big refrigeration plants, storage capacity in its chief consumer centre—the capital—is only 16,000 tons of frozen or chilled meat, barely enough to supply the city's meat requirements for a few weeks. Moreover, packing plants in the interior do not always have storage space in the capital. In view of the trend towards the establishment of packing plants in production areas, it is even more essential that the large cities should be provided with cold-storage and modern warehousing facilities in which meat could be properly received, frozen, stored, thawed and sold. The present limited storage capacity—less than 100,000 tons for the whole country—is mainly in the hands of a small number of large firms,⁷⁸ which did not install it in order to ensure regular supplies between grazing seasons but to facilitate the exportation and handling of the meat. However, the warehousing monopoly, although limited in scale, offers advantages to those who possess it, because refrigeration facilities are a factor conducive to the control of marketing in view of the irregularity of supply and the highly perishable nature of meat.

Organization of an ample and efficient network of warehouses and cold-storage plants is clearly the responsibility of official agencies, which should encourage cold storage not only at the industrial but also at the commercial and household levels through the use of existing facilities in Brazil for the manufacture of refrigerating equipment.⁷⁹ Only thus can a solution be found to the serious supply problem which every year, particularly in August, September, October and November, affects consumers in the major cities of central Brazil, whose meat requirements should not be left at the mercy of seasonal fluctuations in production. Moreover, it would eliminate the losses resulting from the conversion of much of the surplus fresh meat into

⁷⁷ In São Paulo the authorities freed meat prices in October 1962, but price controls were maintained in the other States.

⁷⁸ In the State of São Paulo, 75 per cent of the cold-storage capacity is in the hands of the Anglo, Armour, Wilson and Swift meat-packing plants (M. J. Vilaca).

⁷⁹ After a series of unsuccessful attempts to provide the country with a network of cold-storage plants, particularly for distribution, Congress has passed a law for that purpose.

jerked beef, and the financial losses of producers who are unable to maintain the weight of their cattle during fodder shortages.

The establishment of a cold-storage industry on an adequate scale is a long-term proposition, since it requires substantial investment, tradition and experience, the backing of producers and industrial processing concerns and a change in the habits of consumers who, in Brazil, as in most tropical countries, refuse to accept frozen meat. The national and State governments are aware of the problem, and in some cases, have assigned priority to its solution. Nevertheless, the preparation of a national supply and marketing plan, carefully worked out and on a scale consistent with the country's interests, seems essential.

In view of the lengthy and costly process involved in the organization of a modern and adequate network of cold-storage facilities and warehouses with cold-rooms, it should be supplemented by a campaign to encourage the production of fat steers between grazing seasons.

(iii) *Shortcomings in grading standards*

Since meat is not graded by types of cattle, a distinction is made between first-, second- and third-class meat obtained from the same carcass—which is arbitrary, unrealistic and unsuitable. It is arbitrary and purely nominal because the term does not necessarily imply the concept of quality. Meat classified as second-class which comes from the fore or hindquarters of a young steer or European baby beef is certainly of better quality than meat classified as first class but coming from the hindquarters of an old ox or a tired, bruised animal, etc. It is unsuitable because the system is often used to deceive the consumer and as an excuse for charging prices which bear no relation to the quality of the meat offered. Moreover, the usual cuts of meat, while normally related to different cooking uses, are generally governed by the habits of the butchers and the whims of the consumers instead of being part of a sound grading system.

It should be pointed out that the greater trend towards the direct consumption of meat from hindquarters, except for the *ponta de agulha*, and the reduced demand for forequarters, which are a characteristic of the market in São Paulo and Rio de Janeiro,⁸⁰ are also obstacles to the normal distribution and better use of meat. It can therefore be said that in these circumstances only about 70 per cent of the meat from a steer is used for immediate consumption, the remainder, consisting of forequarters and the *ponta de agulha*, being converted, particularly into jerked beef.

(iv) *Monopoly and speculation*

The effects of an oligopolistic structure or organization, while perhaps not very pronounced, are felt in the processing, transport and distribution of meat. This

is largely due to the fact that the supply of meat to the larger cities is in the hands of a few foreign or domestic meat-packing concerns, and also to the fact that the partial vertical integration of some of these concerns allows them to breed, graze, fatten and slaughter their cattle in their own plants, which are equipped for the full use of by-products and have cold-storage facilities. In addition, some have set up a network of retail distributors. Organized on this basis, they are obviously in a position to indulge in certain practices or to enter into agreements to fix prices for fat stock and meat, thus causing the consumer, and sometimes the producer, to suffer from the compulsory price-fixing for fat steers and its effect on final consumption. Fortunately, this meat trust is gradually becoming weaker as the network of processing plants expands and is centralized, and more effective control is exercised over the oligopolistic activities and agreements of some concerns.

It may be assumed that high prices and the upward trends for fat stock and meat are a reflection of the low productivity level in the production centres, the inflationary process, the incomplete use of the animal in the slaughterhouses, the high cost of inputs and, lastly, an inelastic and inadequate supply, but it is also true that some responsibility for the rise in prices should be attributed to speculation in the interval between fattening seasons. Even retail butchers have been implicated in black market and speculative activities in spite of official supervision and control and the relentless criticism and vigilance of public opinion.

(v) *Shortcomings in retail distribution*

On the one hand there is the retail trade in small villages, country towns and populated areas, characterized by the sale of meat on completely inadequate premises and under deplorable sanitary conditions, as in the case of meat and meat products sold in public markets and by hawkers, with no care or control exercised and very often without previous inspection of the meat.

On the other hand there is the network of retail distributors in the large cities and chief consumer centres, whose services are quite efficient but are provided at a very high cost, not only because of the requirements they have to meet with respect to equipment and sanitary conditions, but also because of their limited turnover.⁸¹ The sales of these distributors, who specialize in a single product, are being threatened daily by competition from super-markets and general stores, whose distribution costs are lower because they handle several products on a more regular basis and with a greater margin of security.

(vi) *High marketing margins*

No systematic studies have been made of producer and consumer prices or the distribution and extent of the costs of processing and marketing which, added to the profit made by each middleman, constitute the margin or difference between the price of the steer or

⁸⁰ The normal distribution ratio in the São Paulo and Rio de Janeiro markets is five hindquarters to two forequarters during the grazing season and five to three between grazing seasons. The separation is effected at the height of the fifth rib, thus providing forequarters with eight ribs. In the Porto Alegre and Belo Horizonte markets, the cut is made at the third rib.

⁸¹ On the basis of a daily distribution of 500 tons of meat each in São Paulo and Rio de Janeiro through 3,000 and 2,200 butchers' shops respectively, the average volume of sales per distributor is 150 to 250 kilogrammes per day.

animal on the hoof and its sale as meat or meat by-products. The margin varies considerably according to whether the agency concerned is a single middleman acting between the municipal slaughterhouse and the butcher, a dealer who is at the same time a slaughterer and distributor or a meat-packing plant, etc. The margin usually expands as market organization improves and as the services of meat-cutting, presentation, handling and distribution become more efficient. The broader margin does not necessarily reflect greater profits for the middleman but rather increased costs owing to expansion and improvement of services, or to waste and loss. The profit margin of a butcher who has modern distribution facilities but whose unit cost is higher may be less than that of a provincial butcher who sells his meat in a sub-standard shop with rudimentary equipment and without cold-storage facilities, employees or telephone, in other words, with very low overheads.

It should be recalled that the final price is the product of a cumulative process of computing costs and profits. The meat-packing plant, the slaughterer and the distributor determine the final price on the basis of the sums paid to the fatteners and retailer in terms of the price on the wholesale market, plus the fixed and operational cost of slaughter, processing, transport, distribution and sale of meat, interest on capital, excess profits, etc.

The comment is often made that marketing margins should be reduced as a means of combating high meat prices. This would in many cases be feasible through:

- (i) Reduction or elimination of the losses and waste resulting from the various marketing processes and channels;
- (ii) Reduction of fixed unit costs in distribution and sales to the public by means of an increase in the volume of distributor operations and/or improved and more economical sales practices;
- (iii) Control of activities by middlemen to prevent price increases as a result of excessive profits.

Research by the Livestock Production Service of the São Paulo Department of Agriculture showed that, in 1953, the breakdown of the final price of fresh meat was as follows: 56.6 per cent to the producer, 9.7 per cent for transport and taxes, 9.2 per cent to the slaughterer and 25.6 per cent to the retailer. The last two margins could be reduced and the savings transferred to the consumer and producer.⁸²

Data are provided below on the beef market in São Paulo-Rio de Janeiro in April 1961, for the purpose of indicating the elements and factors that determine the price rather than to illustrate the structure of meat distribution and sales costs.

Steer carcass weighing 16 *arrobas* (15 kilogrammes each):

⁸² Meat marketing margins are much broader in the United States because of consumer requirements with respect to quality, presentation, packaging, etc. The margin at the retailer level is nevertheless being reduced through better organization. In 1932 it accounted for 33 per cent of the final price, but shrank to 25.7 per cent in 1939 and 16.1 per cent in 1947.

	Cruzeiros
1. <i>Cost of processing and distribution</i>	
Initial cost (1,280 cruzeiros per <i>arroba</i>)....	20,480
Sales and delivery tax (4.8 per cent).....	983
Freight from Presidente Prudente to São Paulo	753.70
<i>Ad valorem</i> duty (1.02 per cent).....	208.90
Total cost	22,425.60
Cost price of 1 kilogramme of carcass meat ⁸³	93.40
Cost of slaughter, preparation and shipment..	1.50
Freight and insurance from São Paulo to Rio	2.35
Coastal shipping, transit, loading and unloading	0.71
Cost in Rio.....	97.96
Less value of by-products.....	12
Base cost price for the industry.....	85.96
Administrative costs	3.20 ⁸⁴
Sales and delivery tax (4.8 per cent).....	4.80 ⁸⁴
Sales cost (3 per cent).....	3 84
Profit margin (3 per cent).....	3 84
Final price	99.96

In this case there is a difference of 14 cruzeiros per kilogramme between the base cost for the industry and the retailer's cost (allowance made for the value of the by-products).

2. <i>Consumer price</i>			
Two hindquarters, weighing 114.5 kilogrammes (49.21 per cent of the carcass weight): ⁸⁵			
	Percentage	Price per kilogramme	Amount
Boned cuts:			
Filet mignon	3.7	250	1,059.12
Sirloin	13.75	198	3,117.27
Rump	9.12	170	1,775.21
<i>Coxão mole</i>	14.50	160	2,656.40
<i>Coxão duro</i>	15.64	160	2,865.25
<i>Patinho</i>	9.12	160	1,670.78
<i>Lagarto</i>	4.10	160	751.12
<i>Aba de filé</i>	3.42	110	430.75
<i>Capa de filé</i>	1.82	110	229.23
Trimming	2.10	110	264.50
Bones	17.44	12	239.62
Fat	4.78	34	186.01
Loss	0.51
	100.00		15,245.26

Purchasing price per kilogramme, 110.00 cruzeiros; sales price, 133.14 cruzeiros; margin, 17.38 per cent. Two fore-

	Kilogrammes
⁸³	
Fresh killed weight (16).....	240
Fat deposition resulting from castration....	2.20
Kidney fat deposits.....	2.60
Kidneys	0.74
Loss from chilling.....	1.80
	232.66

⁸⁴ Calculated on the sales price (discount included).
⁸⁵ Excluding the *ponta de agulha* which is not normally bought by the retailer.

quarters, weighing 88.16 kilogrammes (37.89 per cent of the carcass weight):

	Percentage	Price per kilogramme	Amount
<i>Pá con músculo</i>	28.75	120	3,041.52
Brisket	16.27	110	1,578.13
<i>Acém</i>	29.49	110	2,859.82
Trimming	1.26	110	122.19
Bones	19.92	12	210.74
Fat	3.79	34	113.60
Loss	0.52
	100.00		7,926.00

Purchasing price per kilogramme, 68 cruzeiros; sales price, 89.90 cruzeiros; margin, 24.36 per cent.

It will thus be appreciated that there is a relatively substantial difference between the price paid by the retailer and by the consumer. The broad gap is due to the incidence of various costs which must be incurred by meat distribution outlets, many of which are idle several days in the week for lack of supplies, and to the demand for boneless meat which entails additional costs in the form of losses from boning.

2. THE MARKETING OF MILK PRODUCTS

(a) Distribution of output

The figures in table 9 provide only an approximate idea of the way in which output is distributed by use; practically all the uninspected milk, amounting to over half the total output, is used for the manufacture of by-products, and only a quarter of the total volume is consumed as whole milk, the remaining three-quarters being converted into milk products. Experts in São Paulo believe that the proportion of fluid milk consumed is much higher.

These averages are clearly unable to provide more than an abstract frame of reference, since the uses for which the milk is intended vary greatly. In densely populated and urbanized States a high proportion is consumed direct; in production areas remote from populated centres, on the other hand, most of the milk is converted into butter, cheese, etc. In Rio Grande do Sul, for example, 45 per cent of the milk is converted into butter, 13 per cent into cheese, 23 per cent is consumed as fresh milk and the remainder is used for other purposes. In the State of São Paulo, on the other hand, most of the output (68 per cent) is consumed directly and only one third is available for processing. In Minas Gerais most of the milk is processed, and milk products account for a very considerable portion (60 per cent) of Brazil's total milk output. This major dairy State sends cooled milk to be pasteurized in São Paulo and Rio de Janeiro, milk powder to other States, particularly Rio Grande do Sul, butter to the Nordeste, etc. In the Nordeste most of the raw milk is converted into butter, cheese and curd in sub-standard conditions for lack of organized marketing and modern plants for pasteurization and the preparation of by-products. Recife, a major consumer centre, absorbs barely one-sixth or one-seventh of the milk produced by its dairy area.

Table 9

Brazil: Destination of milk output, 1957^a

Destination	Millions of litres	Percentage
<i>For consumption as fluid milk</i>		
Federal District (Guanabara) ..	155	3.6
State capitals	382	9.0
Towns in the interior	242	5.7
Rural areas	300	7.0
	1,079	25.3
<i>For processing</i>		
Butter	646	15.1
Cheese and curds	384	9.0
Milk powder	230	5.4
Condensed and other milk	65	1.5
Dried milk	18	0.4
	1,343	31.4
<i>Uninspected^b</i>	1,842	43.3
TOTAL	4,274	100.0

Source: National Dairy Farming Commission.

^a The National Dairy Farming Commission is carrying out studies to determine with greater accuracy the destination of output in 1960.

^b Butter, cheese, curds and other dairy products manufactured in small urban and rural plants.

(b) The marketing of fluid milk

The marketing of milk suffers from relatively few shortcomings and irregularities, in comparison with that of meat. It is organized on fairly efficient lines in São Paulo, Rio de Janeiro, Belo Horizonte, Porto Alegre and a few other capitals, but leaves much to be desired in the Norte and Nordeste capitals.

The marketing of milk for the main consumer centres usually follows the pattern given below:

Primary producer

Collection plant (cooling centre)

Regional factory (retailer in towns in the interior)
(consumer in towns in the interior)

Depot-factory in the capital (retailer in the capital)
(consumer in the capital)

These are the usual channels in towns located in the major dairy areas. Conditions are different in the lesser dairy areas which normally have only one centre or factory, in common with a few of the larger areas.

The various functions and services are carried out through private concerns,⁸⁶ co-operatives⁸⁷ and State agencies.⁸⁸ They include collection, cooling, pre-pasteurization, transport to the milk depot or pasteurizing plant by the regional centre and, lastly, pasteurization, cooling, packing and distribution to the

⁸⁶ São Paulo: Vigor Food Products (with over 50 per cent of the total milk distribution), Union Milk Company and Dominio and Co.; Rio: Mineira and Fluminense Milk Co.

⁸⁷ Central Co-operative of Milk Producers (CCPL) which provides nearly three-fifths of the milk supply to Guanabara; Central Co-operative of Rural Producers of Belo Horizonte (CCPR).

⁸⁸ State Department of Milk Supplies in Porto Alegre (DEAL), Milk Processing Co. of Florianópolis (UHL), State Milk Trading and Processing Co. of Niterói (CECIL) and the Milk Processing Co. of Pernambuco in Recife (CILPE), etc.

retailer. At least six concerns have achieved vertical integration and handle butter, cheese, milk powder, casein and milk concentrates.

Special kinds of milk and some raw milk are sold by the producer directly to the consumer. Milk may also be supplied by the original producer to the pasteurizing plant or milk shed without going through the regional centre. In the State of Guanabara the milk depot sells direct to the consumer and retailer.

In the less developed markets milk is distributed, without benefit of processing, directly to the consumer (household, hotel, hospital, etc.), to the milk distributor or to a collector who then transports it from the farm or dairy, generally in unsatisfactory conditions. Apart from the serious shortcomings in the transport of milk and its distribution to the public, and the frequent losses through deterioration, there are the problems posed by milking in poor conditions and milk adulteration. These conditions obtain throughout the Norte, Nordeste and Centro Oeste, with the exception of Recife, Salvador, Aracajú, Cuabá, Goiânia and Brasília, as well as in most of the cities and towns in the interior of the Centro Sul region, where properly organized processing and marketing facilities are scarce, except for those supplying milk to the capitals.

Vitória and Florianópolis also have centres of average marketing efficiency. Their main problems are the existence of small independent units with a low volume of activity, material and equipment difficulties, defective sanitary inspection and limited supplies of raw material at the plant level.

(c) Milk marketing margins

Prices received by producers vary considerably, even within the same dairy-farming area, as a result of such factors as distance from the dairy farm, type of milk produced, marketing channels, different levels of productivity and unit costs, and levels at which prices are officially fixed.

Data on this subject are also lacking, although some examples can be given for purposes of illustration. Producers located near major consumer centres receive the highest prices in absolute and relative terms, i.e., 20 cruzeiros for a litre of Grade C milk, which is 80 per cent of the consumer price in Recife at the beginning of 1961. The further they are from consumer centres the lower the price they receive (e.g., 10 cruzeiros per litre for milk sold to the industry).

The marketing margin for milk processed and distributed through producer co-operatives is generally lower, not only because the milk is not handled by middlemen but also because marketing costs are reduced as a result of vertical integration. Pressure applied by producers seeking better prices and the high cost of labour, animal feed and land near urban centres are some of the factors continually pushing up the price received by the producer. Pressure on the part of processing plants eager to obtain higher prices at the plant level and the demands made by the general public for better service also tend to raise prices and to widen the marketing margin. During the ten years under review the increases have been relatively large at the processing plant level, as will be seen from table 10.

Table 10
São Paulo: Breakdown of the final milk price, 1951-59
(Percentage)

Year	Percentage			Index		
	Producer	Processing plant	Dealer	Producer	Processing plant	Dealer
1951	61.4	28.6	10.0	100.0	100.0	100.0
1953	56.4	34.6	9.0	91.8	120.0	90.0
1955	56.7	35.8	7.5	92.3	125.2	75.0
1957	56.8	36.4	6.8	92.5	127.3	68.0
1959	56.2	37.2	6.6	91.5	130.1	66.0

Source: São Paulo Department of Agriculture, Livestock Production Service.

This shows that the share of producers and dealers dwindled considerably from 1951 to 1953, while the margin at the processing level expanded by 20 per cent. The producer's share remained stable between 1953 and 1959 while the processing plant's margin continued to increase, this time at the expense of a greater reduction in the dealer's margin. The producer's share has dropped even further in the last few years. This is due to the fact that only one-third of the milk distributed in the State of São Paulo goes through producer co-operatives, whereas in Guanabara and Belo Horizonte, which have a more extensive co-operative system, 60 per cent and nearly 100 per cent respectively is distributed through co-operatives.

Co-operative plants pay higher prices to the producer, even compared with independent concerns.⁸⁹

This seems to point to the need for greater integration in the production, processing and distribution of milk through co-operatives, in view of the advantages they offer to producers and consumers.

It should be stressed at this juncture that a mere absolute or relative change in the marketing margin does not necessarily mean a difference in the absolute

⁸⁹ In September 1960 a producer in the Paraíba valley received 13.50 cruzeiros per litre instead of the fixed price of 13 cruzeiros, while plants in Promissão were paying the individual producer a price far below the level fixed by COFAP.

price received by the producer but only frequent fluctuations or differences in the final price. In view of the elasticity of demand and inelasticity of supply, it might be expected that the price increases produced by the former would be reflected in more income for the producers. But there is no reason to believe that this would occur in a marketing structure subject to price-fixing. On the contrary, under such conditions, increases in productivity and reductions in cost at the production and marketing levels are not usually reflected in lower consumer prices.

Without going into the advantages and drawbacks of price-fixing policy, the prices authorized by COFAP in August 1960 are given below in order to demonstrate how differences in the final price are produced, even on the basis of equal prices for producers in different areas and an identical margin for different plants—which clearly operate at different levels of productivity and cost, and how such differences, in turn, modify the percentage breakdown of the final price between producers, processing plants and dealers.

The highest figures in table 11 correspond to towns where most of the milk is sold in bottles with sealed

caps, i.e., Rio de Janeiro, São Paulo, Belo Horizonte and Niterói, and where sales and delivery taxes are imposed on every commercial transaction.

The average margin for all milk sold commercially in Rio de Janeiro and São Paulo in 1956 was 43.7 per cent of the final price, broken down as follows (ex-dairy farm):⁹⁰

Transport	10.0
Personnel	7.2
Depreciation	4.8
Interest	1.7
Taxes	4.0
Metal caps	1.2
Administration, cleaning, etc.	1.8
Industrial profit and retailer's margin	13.0
	<hr/> 43.7
Producer	56.3
	<hr/> 100.0

⁹⁰ Data from the Supply Co-ordination Board.

Table 11

Brazil: Price structure for grade C milk on the basis of prices fixed by COFAP

Town		Producer	Regional plant	Milk depot	Retailer	Tax	Final price
Rio	Cruzeiros	12.90	2.20	4.00	0.90	0.80	20.80
	Percentage	62.0	10.6	19.2	4.3	3.9	100.0
São Paulo	Cruzeiros	12.90	2.20	7.50		2.40	25.00 ^a
	Percentage	51.6	8.8	30.0		9.6	100.0
Belo Horizonte ...	Cruzeiros	12.90	2.20	3.40	1.00		19.50
	Percentage	66.1	11.3	17.4	5.2		100.0
Niterói	Cruzeiros	12.90	2.20	7.40			22.50 ^b
	Percentage	57.3	9.8	32.9			100.0
Vitória	Cruzeiros	12.90	2.20	4.40			19.50
	Percentage	66.1	11.3	22.6			100.0

^a Takes account of a subsequent change, since the final price fixed by Government directive was 20 cruzeiros. Milk was later freed from restrictions in São Paulo.

^b Bottled milk sent from Guanabara, not subject to price controls.

(d) Processed milk products

In recent times—at least during the last ten years of the period under review—the supply of milk both for direct consumption and in the form of by-products has been increasing in Brazil. The progress achieved in processing has, of course, made an appreciable contribution to the improvement of quality and this, together with advances in distribution, has favoured the growth of demand. As far as the milk product industry is concerned, it is estimated that its output has been growing since 1950 at an annual rate of 4.5 per cent, a rate higher than that of the natural increase in demand resulting from population growth. The main expansion was registered in the State of

São Paulo, where the processed milk index rose by 168 per cent between 1951 and 1958.⁹¹

The main items of the milk products industry are butter and cheese, the output of which, both inspected and uninspected, was estimated at 70,000 and 80,000 tons respectively in 1959, thus absorbing over 40 per cent of the milk output. The canned milk industry (particularly milk powder), which increased its output from 7,818 tons to 39,876 tons between 1950 and 1960, is also clearly of economic importance. Brazil stands out in this field, and its position is still improving, since the industry has a production capacity of some 60,000 tons.

The following figures are given to indicate the size of the processing plant network. They refer to establishments under the control of the Livestock Products Inspection Division (DIPOA) of the Ministry of Agriculture in 1960:

⁹¹ São Paulo Department of Agriculture, Livestock Industry Bulletin, December 1959, table V, p. 12.

	<i>Centres</i>	<i>Plants</i>	<i>Milk depots</i>
Minas Gerais	667	55	11
São Paulo	56	3	23
Rio de Janeiro.....	29	44	1
Goiás	56		
Santa Catarina	24		
Guanabara	3	3	
Espírito Santo	3	2	
Rio Grande do Sul.....	4		
Bahía	4		
Rio Grande do Norte.....	4		
Alagoas	2		
Mato Grosso	2		
Pernambuco	1		
Paraíba	1		
Paraná	1		
TOTAL	857	107	35

Milk powder manufacturing plants are distributed as follows, by States:

São Paulo	8
Minas Gerais	6
Rio de Janeiro.....	3
Rio Grande do Sul.....	2
Guanabara	1
	20

Except for milk powder plants, the number of establishments is, of course, much larger since, as indicated earlier, a little over two-fifths of the milk is converted into by-products in plants not subject to Federal inspection. In the State of São Paulo, for instance, the number of milk depots and plants under State inspection is much greater.

It should be pointed out that the expansion of the milk industry engaged in manufacturing by-products can largely be attributed to excess supplies, particularly of the seasonal type, and to the transfer of a number of dairy farms to areas remote from consumer centres. Mention has already been made of the shift which has been taking place as a result of population concentration and subsequent urbanization; this has led to the liquidation of many dairies near large cities and the establishment of new dairy farms on less expensive land such as exhausted soil useless for high-yield farming or land adjacent to the dairy-farming areas. As the delivery of milk to consumer centres becomes more difficult because of greater distances and transport problems, the producer prefers, or is compelled, to sell or use milk as raw material, and therefore has little, if any, interest in producing good quality milk.

Moreover, when the supply of milk exceeds consumption, suppliers of fresh milk for immediate consumption are compelled to sell part of their output at the lower prices prevailing for the processing of by-products or are subject to the processing quota which means less income for them.

(e) *Grading and quality standards*

Grading and control of milk and milk products in Brazil are governed by the Regulations on Industrial and Sanitary Inspection of Livestock Products, adopted under Executive Decrees Nos. 30,691 of March 1952

and 39,093 of April 1956.⁹² Authority for all functions and decisions relating to products for inter-State or international trade is vested exclusively in the Ministry of Agriculture which acts through DIPOA. Production for intra-State and municipal consumption has its own regulations.

This legislation provides for grading and various requirements which must be met by production plants, collection media, transport, processing and distribution as well as by the different products themselves. While it is unnecessary to go into details, it should be pointed out that many processing and distribution operations and services evade the control and inspection required by law, and this is also true of many other products. Moreover, there is not enough staff to undertake the immense task which health inspection represents. Violations of existing laws are committed daily and many are a permanent feature in various phases of marketing.

The Brazilian market offers the consumer three grades of pasteurized milk—A, B and C—which will be described below.

Grade A: Refrigerated, pasteurized and bottled on dairy farms,⁹³ with its original fat content, i.e., whole milk; produced by cows submitted to periodic individual examination and permanent veterinary control, and containing only 10,000 germs per millilitre; containing not more than 500 germs per millilitre and no coliform organisms per millilitre after pasteurization; not previously subjected to homogenization, pre-boiling or freezing; and maintained and transported at a temperature of 10°C, etc.

Grade B: Obtained in sheds and from controlled cows, with its original fat content; pasteurized and bottled on the farm itself or in a plant, in the latter case between 9 and 11 hours after milking, depending upon whether or not it has been cooled at less than 15°C; no prior homogenization, pre-boiling or freezing; maintained at less than 5°C in the cooling plant or in the milk storage plant⁹⁴ before pasteurization; processed and distributed within 48 hours of receipt; with not more than 500,000 and 50,000 germs per millilitre before and after pasteurization, respectively, and with a half-millilitre tolerance of coliform organisms, etc.

Grade C: From farms subject to periodic health inspection, homogenized at not less than 3 per cent of its fat content; with 8.7 per cent of fatless dry extract between, 1,031 and 1,034, at 15°C and with a two-tenths of a millilitre tolerance of coliform organisms; pasteurized and bottled at the place of consumption or elsewhere after the relevant requirements have been met; distribution within twenty-four hours following receipt in the processing plant, etc.⁹⁵

⁹² And also Executive Decree No. 1,255 of 25 July 1962.
⁹³ Milked in sheds, provided with a processing plant, stainless steel utensils, and space for the isolation and treatment of sick animals, etc.
⁹⁴ Establishment located in a consumer centre, provided with modern equipment for receiving milk and cream, and with the space required for processing and distribution to the retail trade.
⁹⁵ New legislation was recently introduced which establishes even stricter bacteriological standards for the various grades of milk sold for direct consumption (Decree No. 1,255).

Also included in fresh milk is skim milk, containing less than 3 per cent fat in addition to the statutory 2 per cent minimum. Creamed or skimmed milk is usually used in the manufacture of sweets, sherbets, etc. Attempts to encourage direct consumption have failed, as in Belo Horizonte.

Raw milk is deemed to be milk whether or not subjected to filtering, cooling, freezing or pre-boiling. Its sale is permitted in areas which have no pasteurization plants.

Reconstituted milk—milk powder dissolved in water—may be distributed if homogenized and pasteurized and if milk fat has been added.

Dehydrated milk includes milk powder, evaporated and condensed milk.

The following three types of table butter may be sold:

“Extra quality”, with 92 points and maximum acidity of 3 millilitres;

“First quality”, with 80-91 points and maximum acidity of 5 millilitres;

“Ordinary quality”, with 70-81 points and maximum acidity of not more than 8 millilitres;

Cooking butter should not have less than 60 points or more than 12 millilitres of acidity.

Some of the commercial grades or categories of cheese are as follows:

(a) According to consistency:

Soft: Minas, Ricota, Gorgonzola, Roquefort, etc.;

Semi-hard: Minas, Pratos, Mussarela, Emmentaler, etc.;

Hard: Minas, Parmesan, Cheddar, Provolone, Ricota, etc.

(b) According to milk fat content:

High fat content;

Medium fat content;

Low fat content;

Creamed.

(c) According to quality:

Extra;

First quality;

Second quality.

The quality of milk products varies widely from one region to another and within the same market. As a rule, milk and milk products of lower quality are sent to less-developed markets for use by the lowest income groups.

The State of São Paulo, apart from being the major consumer of milk products, is far ahead with respect to quality and marketing. It is the only producer of Grade A milk in Brazil, which is equal to certified pasteurized milk in the United States, although subject to stricter bacteriological control since it must be absolutely free of coliform organisms per millilitre. Grade B milk in São Paulo is better, from the bacteriological standpoint, than milk of a similar grade in the United States, being closer to Grade A milk there. This means that, apart from Brazilian Grade A milk, Grade B milk in São Paulo is of the highest quality. Grade C may be compared to Grade B in the United States and, because of its bacteriological characteristics, is among the best milk of this grade in the world.⁹⁶ These remarks on the high quality of milk produced in São Paulo also apply to Grade C milk distributed in Rio de Janeiro, Belo Horizonte and Porto Alegre.

With respect to pasteurized milk, Grade C has the highest rate of consumption in Brazil. In São Paulo, for instance, the State registers show that in 1960 consumption of Grade C amounted to 96 per cent, followed by 3 per cent for Grade B and only 0.5 per cent for Grade A, the remainder consisting of raw milk. Grade A milk requires very special production, processing, conservation and distribution conditions, which are steadily increasing its cost and raising the sales price to the point where it discourages demand. The high quality of Grade B and Grade C in São Paulo may also be contributing to the elimination of Grade A.

In concluding this section on the marketing and processing of milk and milk products, it should be pointed out that many of the shortcomings and irregularities in this field are due to the lack of standard inspection measures and services.

⁹⁶ In accordance with the new standards adopted in 1957, Grade C milk should not contain more than 100,000 germs per millilitre, instead of the previous limit of 300,000. In 1955-57 nearly 99.82 per cent of the milk met this standard and over three-quarters of the Grade C milk supply contained not more than 30,000 germs per millilitre (São Paulo, Livestock Industry Bulletin, December 1959, p. 75).

VII. DEMAND AND CONSUMPTION

Until there is a substantial improvement in the purchasing power of the under-privileged sectors of the population, or the prices of foodstuffs of animal origin are significantly reduced and supply conditions altered, average per capita consumption will remain low.

It is impossible, for want of sufficient data, to define the relative influence of each of the factors determining and affecting demand and/or the level and trends of consumption. Attention should be drawn, however, to the following points: (a) the high rate of demographic growth in Brazil, which creates additional consumer requirements that are intensified by the progressive

concentration of the population in the large urban centres, with the consequent steady expansion of total demand; (b) real per capita income, which, although it shows some improvement in the areas where the influence of industrial development and increasing urbanization makes itself felt, is insignificant in the case of rural wage-earners and other groups of workers, who have virtually no purchasing power as far as expensive foods like meat, milk and eggs are concerned. In these major sectors of the population the degree of under-consumption is such that their disposable personal income would have to be substantially increased before

it could operate as a factor in effective demand for the foods in question; (c) the prevalence of high or rising relative prices, which deprives the lower-income and subsistence-level groups of any possibility of substituting better quality and higher-priced products, such as those listed above, for the low-cost foods they habitually consume. On the contrary, cases might be adduced in which per capita consumption of foods of animal origin has actually declined, on account of supply difficulties and the resultant price increases; (d) the possibility of regularizing consumption or real demand to some extent through changes in dietary habits. Meat consumption, for example, would be more evenly distributed over the different seasons of the year if consumers could be induced to eat frozen meat.

The level of consumption is also adversely affected, in a measure which should not be under-estimated, by the conjunction of certain adverse circumstances, such as low productivity in the stock-farming sector, inelasticity and inadequacy of supply, and distribution deficiencies.

A comparison of absolute figures will give a clearer idea of the serious problem presented by the low consumption of animal proteins in Brazil. The over-all daily average barely amounted to some 21 grammes in 1957-59, far below consumption levels in Argentina, Canada, United States, Uruguay and other countries (see table 12). Argentina and Uruguay consume four times as much meat protein as Brazil, and in respect of milk and egg proteins the difference is equally large or even greater.

Under-consumption of foods of animal origin is at its worst among the rural population, where families in the lowest income groups consume no milk and meat at all. To illustrate the gravity of this problem of the diet of the rural population, it may be recalled that, according to surveys carried out in 1955 by the National Agrarian Policy Commission,⁹⁷ 93 per cent of the rural wage-earners, 70 per cent of the tenants and share-croppers and 63 per cent of the smallholders and settlers were suffering from malnutrition. The diet of the owners of large estates and farms, on the other hand, almost without exception, was satisfactory or excellent.

There is a very considerable difference between levels of consumption in the urban and the rural populations, and the gap is continually widened by the increasing disequilibrium in purchasing power. Milk and meat afford enlightening cases in point: per capita consumption of fluid milk amounts to only 13 litres per annum (a mere 35 grammes a day) among the rural population, while the average per capita consumption in urban areas is three to six times higher. The country-dweller consumes only 10 kilogrammes of meat yearly, as against a corresponding figure of 50 kilogrammes for the urban population, which, as an average, closely approaches the standard recommended by dietitians.

⁹⁷ Survey of the rural population of 1,836 municipalities in 1955, when the total number of municipalities in Brazil was 1,894.

Table 12
Per capita consumption of animal protein in selected countries, 1953-59

Country		Red meat and poultry	Milk	Eggs	Total	Average daily consump- tion
		(Annual average in kilogrammes)				(grammes)
Argentina	1948-50	21.97	7.84	0.85	30.66	84.00
	1957-59	20.67	7.63	0.98	29.28	80.22
Brazil	1953-54	4.96	2.12	0.05	7.13	19.53
	1957-59	5.13	2.35	0.05	7.53	20.63
Canada	1948-50	11.88	17.42	1.81	31.11	85.23
	1957-59	13.05	16.19	2.09	31.33	85.84
Chile	1948-50	6.86	2.48	0.32	9.66	26.47
	1957-59	5.11	3.07	0.35	8.53	23.27
United Kingdom	1948-50	7.27	6.68	0.97	14.92	40.88
	1957-59	10.28	7.53	1.57	19.38	53.10
United States	1948-50	13.95	11.67	2.80	28.42	77.86
	1957-59					
Uruguay	1948-50	19.66	5.71	0.05	25.42	69.64
	1957-59	19.11	8.50	0.08	27.69	75.86

Source: The basic consumption data given in table 14 and the relevant conversion factors.

1. CONSUMPTION LEVELS AND TRENDS

(a) Meat

Before present levels of meat consumption are analysed, together with its fluctuations and trends, attention must be drawn to the existence of certain margins of error in the computation of consumption data. An unspecified proportion of the animals butch-

ered, especially in the case of small livestock slaughtered in rural areas, is not declared, as was shown by the 1950 census, and is therefore not taken into account in supply statistics. Again, in many slaughter-houses no register is kept of the yield of carcass meat, which means that averages have to be applied to the total number of animals slaughtered in order to obtain estimated output data. Furthermore, part of the fresh

meat is made into jerked beef or otherwise processed, or is frozen, etc., so that weight is reduced, and different conversion factors have therefore to be applied in order to express consumption in terms of carcass meat. Thus real per capita consumption data are presented as approximate figures. Moreover, the fact that they are expressed as general or over-all per capita averages deprives them of all but an abstract value, in view of the vast differences from one area to another and between the various social strata. Even so, these reservations do not invalidate the analysis of changes and trends in consumption, or the considerations set forth in the paragraphs that follow.

Total consumption of red meat (beef and veal, pork, mutton, lamb and goat's flesh) and poultry, which, as

shown in table 13, averaged 1.5 million tons yearly in 1949-51, rose to an annual average of 1.9 million tons in the three-year period 1958-60; this represents a cumulative annual rate of increase of 2.9 per cent. A study of yearly variations in consumption (see Statistical annex table XXIII) will show that from 1948 onwards an almost uninterrupted upward trend was followed until 1958, consecutive downturns being registered in 1959 and 1960, primarily in consequence of contractions in output, since, broadly speaking, the volume of exports was too small to have much effect on consumption.⁹⁸

⁹⁸ The peak export figure for the period 1948-60 was registered in 1959, and was equivalent to only 0.5 per cent of consumption.

Table 13

Brazil: Apparent consumption of meat, total and per capita, 1949-51 to 1958-60
(Annual average in terms of carcass meat)

	Beef	Pork ^a	Mutton	Goat's flesh	Red meat	Poultry	Red meat and poultry
<i>Total consumption (thousands of tons)</i>							
1949-51	1,069.9	350.9	18.8	12.6	1,452.2	4.3	1,456.5
1952-54	1,123.9	394.1	24.9	13.3	1,556.2	4.8	1,561.0
1955-57	1,223.4	442.6	22.8	15.0	1,703.8	5.1	1,708.9
1958-60	1,367.7	478.1	22.4	16.8	1,885.0	5.7	1,890.7
1960	1,333.0	473.6	22.1	17.0	1,845.7	5.8	1,851.5
<i>Per capita consumption (kilogrammes)</i>							
1949-51	20.50	6.72	0.36	0.24	27.85	0.08	27.93
1952-54	19.70	6.91	0.43	0.23	27.27	0.08	27.35
1955-57	19.53	7.06	0.36	0.24	27.19	0.08	27.27
1958-60	19.94	6.97	0.33	0.25	27.49	0.08	27.57
1960	18.83	6.69	0.31	0.24	26.07	0.08	26.15

Source: Statistical annex, tables XXIII and XXIV.

^a Includes bacon and lard.

Consumption data for the various kinds of meat reveal a preference for beef, which accounts for about 74 per cent of total consumption of red meat. Increments in total consumption have been achieved mainly in respect of beef, since consumption of pork, like total consumption of mutton and goat's flesh, has increased very little.

Per capita meat consumption did not progress at all during the last 10-12 years of the period under consideration, since it averaged about 28 kilogrammes both in 1949-51 and in 1958-60. Attention has already been drawn to the expansion of cattle-slaughtering in 1958, and the accompanying increase in production and consumption; it was in this year that aggregate consumption reached its peak—29.3 kilogrammes—subsequently falling to 27 and 26 kilogrammes in 1959 and 1960, respectively. The decrease was apparent only in the case of beef.

Thus, per capita meat consumption is manifestly low, not only in relation to recommended standards of diet, but in comparison with the levels prevailing in other countries; it is equivalent to only one-fourth of the volumes registered in Argentina and Uruguay and to one-third of the United States figure, and also

falls short, although in lesser measure, of consumption in several other Latin American countries (see table 14).

It should be recalled that average consumption data are given only for reference purposes, as averages in themselves bear but little relation to the real state of affairs, with its innumerable examples of minimal consumption, or none at all, among the under-privileged classes and in rural areas, and of better or satisfactory levels in the large urban centres. In Rio de Janeiro, São Paulo, Curitiba, Porto Alegre and other places per capita consumption of fresh and chilled or frozen meat exceeds 50 kilogrammes. In the under-developed area (the Norte and Nordeste) consumption is deficient in both quantity and quality.

It is estimated that, given the animal protein supply possibilities and the dietary habits existent in Brazil, meat consumption would have to be at least doubled before nutritional targets or recommended standards could be attained.⁹⁹ Apart from beef, a substantial

⁹⁹ Recommended nutritional standard for consumption of meat in general: 50.44 kilogrammes per annum, within a diet comprising the equivalent of 3,000 calories daily.

increase might be achieved in consumption of pork, poultry and fish, which in many other countries are also a very important source of proteins of high biological value.

Table 14

Per capita consumption of livestock products in selected countries, 1948-50 and 1957-59
(Annual average)

Country		Red meat and poultry (kilogrammes)	Total milk (litres)	Eggs (units)
Argentina	1948-50	118.60	257.56	147
	1957-59	111.40	217.68	154
Brazil	1948-50	27.36	46.30 ^a	61
	1957-59	28.23	68.00	87
Canada	1948-50	66.59	497.05	277
	1957-59	72.40	461.72	320
Chile	1948-50	47.20	77.00	46
	1957-59	33.90	97.40	55
United Kingdom ...	1948-50	39.98	190.70	144
	1957-59	57.56	214.93	233
United States	1948-50	78.07	333.05	413
	1957-59	86.38	315.20	371
Uruguay	1948-50	106.40	163.00	118
	1957-59	103.30	243.00	126

Source: Basic data on meat consumption in Argentina, Canada, United Kingdom and United States: Commonwealth Economic Committee, *Meat*, 1953 and 1961. For Brazil: Statistical Yearbook of Brazil. For Chile: CORFO, *Programa Nacional de Desarrollo Ganadero*. For Uruguay: (basic data on milk and egg consumption): FAO, *Production Yearbook*, 1960.

^a 1949-50.

(b) Milk and milk products

The levels and fluctuations of consumption of milk products, expressed in terms of fluid milk equivalent, are shown in table 15.

In aggregate terms, total consumption doubled between 1949-50 and 1958-60, rising from 2,379 to 4,935 million litres. This significant increase in consumption was basically due to an expansion of production, since Brazil is not an importer of milk products, except for a relatively small quantity of powdered milk. Milk products represent three-fourths of consumption, and fluid milk (pasteurized and raw) only one-fourth. Although consumption of fluid milk may quite feasibly account for a larger proportion, since a part of it does not appear in any statistical records, it will undoubtedly tend to increase as marketing conditions improve and the pasteurization service is expanded.

Broadly speaking, both total and per capita consumption show definitely rising trends, the rate of increase being rapid in the case of powdered milk, available supplies of which doubled in the period mentioned above. There are also signs of a preference for pasteurized milk which has pushed up consumption of this product. In relative terms, consumption of raw, condensed and evaporated milk, as well as of cheese and butter, decreased in the last ten years of the period under review, for various reasons connected with the educational level of consumers, changes in dietary habits, price fluctuations and the availability of substitutes, as in the case of butter, with which margarine vigorously competed. The National Dairy Farming Commission observed, for example, a fall in consumption amounting to about 80 tons a month in the city of Rio de Janeiro, where it dropped from 680 tons monthly in the second half of 1959—a period when raw material was in short supply—to 599 tons per month in the first half of 1960, when the supply of milk was plentiful. Brief though this interval was, the price of butter soared from 133 cruzeiros to 181 cruzeiros per kilogramme, which was equivalent to a 36-per-cent increase, whereas the cost-of-food index rose by only 12.5 per cent.

Table 15

Brazil: Apparent consumption of milk products in terms of fluid milk, 1949-50, 1958-60 and 1960^a

	1949-50 ^b		1958-60 ^b		1960	
	Thousands of litres	Per-cent-age	Thousands of litres	Per-cent-age	Thousands of litres	Per-cent-age
Pasteurized milk	155,730	6.5	326,908	6.9	353,012	7.1
Raw milk	434,942	18.3	840,781	17.9	871,942	17.7
Dried milk	75,774	3.2	326,430	6.9	335,174	6.8
Condensed and evaporated milk	48,041	2.0	50,222	1.1	50,522	1.0
Cheese	227,145	9.6	396,076	8.4	394,550	8.0
Uninspected products	1,023,042	43.0	2,017,538	42.8	2,106,921	42.7
Other items	414,266	17.4	754,844	16.0	822,841	16.7
TOTAL	2,378,940	100.0	4,712,800	100.0	4,934,962	100.0
Litres per capita.....	46.3		68.6		69.7	

Source: Basic data taken from statistical yearbooks and given in the Statistical Annex, table XXV.

^a Production plus imports, excluding butter in order to avoid duplication, since it is regarded as a by-product of milk processing.

^b Annual averages for the period.

In the country as a whole, the average level of per capita consumption of milk products, expressed in terms of fluid milk equivalent, also improved, rising from 46.3 litres per annum in 1949-50 to an annual average of 68.6 litres in 1958-60 and about 70 litres in 1960. It was no doubt the rapid rate of growth of the population and its low purchasing power that prevented per capita consumption from increasing to a greater extent.

An indication has already been given, in table 14 above, of consumption of milk products (in terms of fluid milk) in several countries. While it should not be forgotten that Brazil is one of the few countries which have managed to raise per capita consumption to a substantial extent of late, it is still faced with serious under-consumption problems in several sectors of the population, and the average level registered is surpassed by a wide margin in various countries. It is equivalent to only 15 and 22 per cent of the levels attained in Canada and the United States, respectively, and barely amounts to one-third of those reached in Argentina, the United Kingdom and Uruguay.

A glance at the consumption targets recommended by the Brazilian Institute of Nutrition shows how much ground still remains to be covered in this direction. Thus, for Brazil as a whole, daily consumption of fluid milk averages only 50 cubic centimetres, falling far short of the following recommended nutritional standards:

Adults	200 cc
Expectant and nursing mothers.....	400 cc
Children up to 10 years of age.....	500-1,000 cc

If, then, the average recommended nutritional standard is estimated at about 400 cc per capita, consumption should rise to eight times its present volume. Consumption of butter, cream and cheese also fails to satisfy nutritional requirements (butter, 15 grammes; dairy cream, 30 grammes; and cheese, 20 grammes).

The highest per capita consumption figures are, of course, registered in the large urban centres in which the personal income of the population is higher, which are supplied by dairy-farming areas fairly close at hand and which possess a more or less organized market. The statistics presented in table 16 show that in 1960 per capita consumption of fluid milk in the State capitals was about 128 grammes, or 156 per cent higher than the average for the country as a whole. The peak figures corresponded, in the order given, to Porto Alegre, Niterói, São Paulo, Belo Horizonte and Rio de Janeiro, which are the cities with the highest per capita income levels.¹⁰⁰ It may be noted, however, that in urban centres like São Paulo and Rio de Janeiro, where incomes are highest, per capita consumption was lower than in Porto Alegre and Niterói, where per capita income is much smaller. This is because in the first two cities rising milk prices had a definitely discouraging effect on consumption. On the other hand, towns like Recife, Manaus and Belém, with intermediate income levels, register a fairly low consumption figure for fluid milk, because of the obstacles to pro-

duction in the Norte and Nordeste; in this part of the country more powdered milk is consumed, although its price is higher than that of fluid milk.

An important point to note is the reduction in per capita consumption of fluid milk registered in the State capitals in the aggregate; it dropped from 138 grammes daily in 1950 to 130 grammes in 1960. This means that the increments in the average consumption figures for the country as a whole were achieved on the basis of other milk products (powdered milk, for example), and in the group designated "Other items" in table 15. In a recent study by the Livestock Production Service of the São Paulo Department of Agriculture,¹⁰¹ reference is made to a 27-per-cent rise in real income between 1948 and 1958 and, in the same period, an increase of 35 per cent in annual per capita consumption of milk (from 51.3 to 69.3 kilogrammes). Towards the close of the decade it became imperatively necessary to encourage consumption in order to absorb production surpluses. In 1959 and 1960, although per capita consumption continued to expand in São Paulo, the rate of increase was slower. During the first four months of 1960, consumption in the State capital rose by 14.6 per cent, price levels being the same as in 1959. Conversely, in the last eight months of the year consumption contracted by about 12 per cent, as the result of a sharp upswing (66 per cent) in prices; and not because of any shortage of milk, since a larger volume was retained in the urban centres in the interior. These facts throw into relief the high income and price-elasticity of demand for fresh milk. They clearly demonstrate the favourable effect on consumption produced by an improvement in income when prices remain stable, as well as the contraction of real demand when prices are following an upward trend.

It should also be borne in mind that a rate of population growth as high as that recently registered in central Brazil, particularly in the cities of São Paulo and Rio de Janeiro, may have been accompanied by certain difficulties on the supply side deriving from the considerable expansion of potential demand.

(c) Eggs

There has also been a steady increase in total and per capita consumption of eggs. The latter rose from an annual average of 61 units in 1948-50 to 87 units in 1957-59, which would represent a 42-per-cent increment. Of course, as in the case of meat and milk products, the minimum and maximum levels of consumption of eggs are a very long way from the average for the country; the biggest figure corresponds to the State of São Paulo (120 units per capita per annum). However, the rate of expansion of production in recent years, although high in absolute terms, has barely sufficed to maintain average per capita consumption in a rapidly-growing population. Sharp price increases were partly responsible for the stagnation of per capita consumption in the State of São Paulo. Between 1956 and 1960, the average price of eggs per dozen rose by 156 per cent on the São Paulo market.

Brazil is still far from attaining the standard of egg consumption recommended by some dietitians (one

¹⁰⁰ Between 17,000 and 52,000 cruzeiros per person per annum, according to IBGE, *Yearbook of Statistics*, 1960.

¹⁰¹ São Paulo Department of Agriculture, Livestock Production Service, *Zootécnia*, Bulletin No. 1, 1961, pp. 20 and 45.

Table 16
Brazil: Consumption of fluid milk in the Federal District and the capitals of the States and territories, 1960

City	Population (1960)	(Thousands of litres annually)	Milk consumption		
			Average daily consumption		
			Total (litres)	Per capita (millilitres)	Per capita (grammes)
Northern region	749,517	4,392	12,000	16.0	16.5
Porto Velho	51,049	73	200	3.9	4.0
Rio Branco	47,882	531	1,450	30.3	31.2
Boa Vista	26,168	293	800	18.1	18.6
Macapá	46,905	201	550	11.7	12.0
Manaus	175,343	1,464	4,000	22.8	23.5
Belém	402,170	1,830	5,000	12.4	12.8
Northeastern region	2,104,277	31,293	85,500	40.6	41.8
São Luís	159,628	915	2,500	15.7	16.2
Teresina	144,799	2,562	7,000	48.3	49.7
Fortaleza	514,828	6,954	19,000	36.9	38.0
Natal	162,537	3,660	10,000	61.5	63.3
João Pessoa	155,117	2,562	7,000	45.1	46.5
Recife	797,234	10,980	30,000	37.6	38.7
Maceió	170,134	3,660	10,000	58.8	60.6
Eastern region	5,102,648	230,262	629,131	123.3	127.0
Aracaju	115,713	1,035	2,827	24.1	25.1
Salvador	655,735	4,729	21,922	19.7	20.3
Belo Horizonte	693,328	38,300	104,645	150.9	155.4
Vitória	85,242	3,343	9,135	107.2	110.4
Rio de Janeiro	3,307,163	168,090	459,262	138.9	143.1
Niterói	245,467	14,765	40,340	198.7	204.7
Southern region	4,926,353	331,246	905,044	183.7	189.2
São Paulo	3,825,351	268,482	733,558	191.8	197.6
Curitiba	361,309	11,732	32,055	88.7	91.4
Florianópolis	98,520	1,484	4,055	41.2	42.4
Porto Alegre	641,173	49,548 ^a	135,376	211.1	217.4
West Central region	353,107	7,488	20,459	57.9	59.6
Goiânia	153,505	4,780	13,059	85.1	87.7
Cuiabá	57,860	878	2,400	41.5	42.7
Brasília	141,742	1,830	5,000	35.3	36.4
TOTALS FOR BRAZIL...	13,235,902	604,681	1,652,133	124.8	128.5

Source: National Dairy Farming Commission (data subject to revision).
^a Not including consumption of raw milk, estimated at 20,000-30,000 litres.

egg daily), and in this respect is at a disadvantage in relation to other countries.

2. SEASONAL FLUCTUATIONS IN CONSUMPTION

(a) Meat

In the section on factors limiting production, attention was drawn to the seriousness of the adverse effects of seasonal forage shortages on livestock production, especially in respect of meat and milk. The critical scarcity of cattle feed during the dry and winter seasons is in sharp contrast with the position in the rainy periods, when there is plenty of pasturage for livestock and their productivity shows a marked improvement.

Table 17 presents the seasonal fluctuations in slaughterings of cattle and pigs registered between 1950 and 1960 in the State of São Paulo, which afford a good example of the variations in the meat supply during the course of the year and of the changes affecting consumption and price levels. Broadly speaking,

a great many more cattle are slaughtered during the first half of the year, especially from March to June; in July, although the rate of extraction is still high as compared with the monthly average, it begins to decline. In the five months of the grazing season 52 per cent of the cattle population is slaughtered. During this period a production surplus is registered, most of which has to be consumed, since very little cold storage capacity is available. Despite this surplus, the lack of storage facilities and the limitations of purchasing power preclude utilization of all the livestock that is ready for slaughter in the grazing season, with the resultant partial waste of beef cattle production capacity, since the animals have to spend a longer time at pasture, and thus lose weight during the months when forage is scarce. In the second half of the year, the volume of slaughter rapidly decreases, reaching the minimum dry-season levels which characterize the months of August, September, October and November (see figure III). During these four months only 24 per

cent of the cattle are slaughtered, and this reduction leads to supply problems, a slump in meat processing and marketing, price increases and lower levels of consumption. The consequences would be worse still but for the fact that at this time of year the supply and consumption of pork usually show their highest seasonal levels; in fact, the number of pigs slaughtered between August and November constitutes 41 per cent of the annual total.

Table 17

Brazil: Seasonal distribution of slaughterings of cattle and pigs at five meat-packing plants in São Paulo, 1950-60^a

	Cattle		Pigs ^b	
	Total slaughterings	Percentage	Total slaughterings	Percentage
January	136,686	8.5	210,727	6.6
February	705,155	8.2	171,224	5.4
March	777,787	9.0	181,275	5.7
April	851,359	9.9	208,233	6.6
May	981,620	11.4	242,551	7.6
June	976,616	11.3	252,864	8.0
July	872,636	10.1	301,102	9.5
August	615,772	7.1	335,295	10.5
September	491,694	5.7	319,619	10.1
October	450,765	5.2	337,225	10.6
November	511,652	5.9	324,966	10.2
December	668,342	7.7	292,567	9.2
	8,640,084	100.0	3,177,648	100.0

Source: Bulletins of the Rural Economy Division of the São Paulo Department of Agriculture, and data supplied by the Division.

^a The percentage distribution of the slaughterings in these plants is representative of the seasonal fluctuations in slaughterings in the State as a whole.

^b Slaughterings in establishments subject to Federal inspection.

Seasonal supply fluctuations in 1950-60 were not reflected in any very marked variations in meat prices, owing to the price-fixing policy adopted. Nevertheless, the deflated price curve shown in figure III closely follows the seasonal fluctuations in slaughterings; the lowest prices correspond to the months in which the largest proportion of animals is slaughtered, and the highest to the last five months of the year, which is precisely the period when the volume of slaughter decreases.

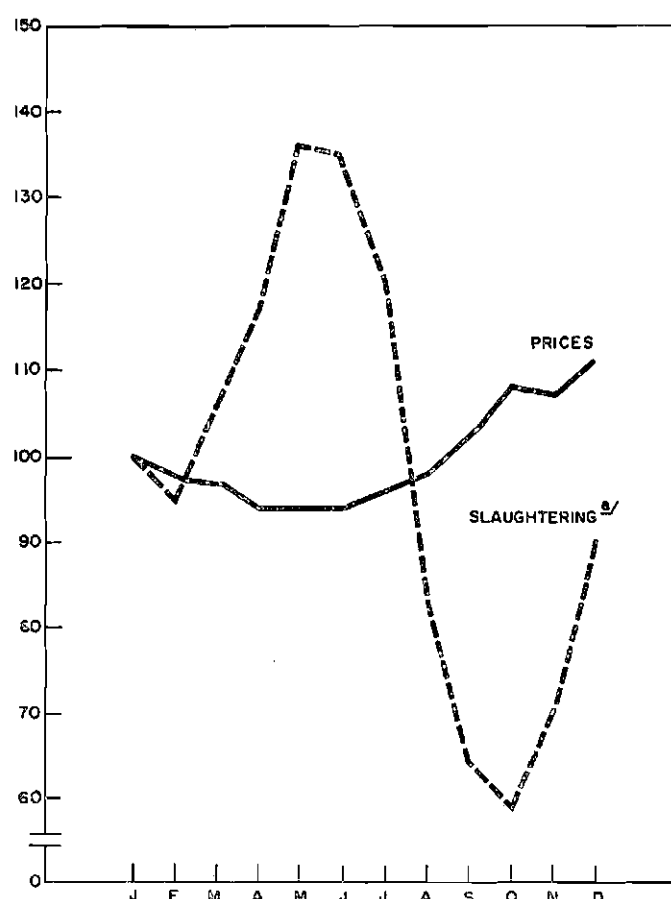
It is needless to stress the enormous economic and social losses caused every year by the seasonal contraction of meat production and supplies, both to producers on the one hand and to industrialists, dealers and consumers on the other. All that remains to be said is that the persistent and regular recurrence of the problem is no reason why it should be shelved. On the contrary, the need to solve it is urgent, since consumers cannot remain indefinitely at the mercy of market vicissitudes. It is essential that regular supplies be ensured, but this is not feasible unless firm decisions are first adopted on the planning of campaigns designed to mitigate, even if only in part, the seasonal production crises, to expand cold storage capacity and to encourage consumption of chilled or frozen meat. The conservation of fodder against periods of drought,

the expansion of the freezing industry in respect of slaughterhouses with refrigeration facilities, depots, distribution media and sales premises, and the increased use of quick freezing and slow defreezing systems, are basic aspects of the problem which call for sound organization, properly planned and integrated with due regard to long-term implications.

Figure III

Brazil: Seasonal variations in cattle slaughtering and in deflated prices for beef cattle (steers) in São Paulo, 1950-60
(Ten-year average)

NATURAL SCALE



^a In five meat-packing plants.

(b) Milk and milk products

Milk production is also affected by rain distribution, but seasonal variations in supply and consumption are less marked than is the case with meat. When forage is abundant there is an increase in total milk production, which makes a larger supply available both for per capita consumption of fluid milk and for processed milk products, and what is left after direct consumption has been met is made into cheese, butter, dried milk, casein, etc., that can be preserved for subsequent consumption. When forage is scarce, the situation is reversed; output falls, and during this seasonal shortage of the raw material a smaller proportion of milk is used for the manufacture of milk products. In fact, part of the milk normally used for this purpose is diverted to meet the demand for fluid milk. It should be noted that the relatively less unfavourable milk

supply conditions tend to improve further as the various processing and market channels become more efficiently integrated, especially as regards supplies for direct consumption and processing plants; this will be the only way of eliminating the imbalances in the allocation and distribution of milk within a single supply area.

The National Dairy Farming Commission is conducting regional studies to determine the seasonal characteristics of the supply and consumption of milk and milk products. Thus far the observations reported cover only a few years, but in future years they will make it possible to reach final conclusions and will be a very useful instrument in establishing guidelines for the programmes and improvements required in respect of the supply and distribution of milk and milk products.

Although these studies have only recently been undertaken, they show that there are no great seasonal variations in the price, and consequently in the consumption, of fluid milk destined for the large towns; this is attributable both to the effect of fixed prices and to the practices followed by the plants in distributing the amounts of milk intended for direct consumption. The decrease in milk production in the dry season and the consequent increase in relative costs naturally obliges the producers to insist on a higher price level in order to re-establish the previous parity. There is also evidence that butter and cheese, on the other hand, do show some seasonal variation in price, clearly apparent during the rainy months; in the State of Guanabara, for example, wholesale butter prices decline during the rainy period in October and November, while at the same time there is an increase in consumption and a tendency to accumulate larger stocks, as a result of the more plentiful supply of raw material. In April and May, when the dry season begins, the milk supply diminishes, butter prices go up, and at the same time there is a reduction in the consumption of butter and in butter stocks.

3. THE INFLUENCE OF PRICES

Given the situation of the Brazilian market for livestock products, which is strongly affected by the price-control policy, there is not, in the accepted sense, any clear correlation between consumption and price levels. Changes and trends in these two variables are often affected by other factors such as the volume and inelasticity of supply, the perishable nature of the products, marketing anomalies, rapid demographic growth and the boom in urbanization and industrialization, which in central Brazil has led to serious imbalances between supply and demand.

However, subject to certain limitations and provisos, it can be said that the largest increases in consumption are found in respect of the products whose relative prices have remained at a level favourable to the consumer. As stated earlier, improvements were achieved in levels of total and per capita consumption of milk, milk products and eggs during the period 1950-60. It is considered that these improvements were due not only to an appreciable increase in the supply and better organization in the marketing of these products, but perhaps even more to the favourable level of parity

prices at the consumer level. In fact, figure IV shows that in relation to a group of basic foods milk and egg prices remained at lower levels between 1951 and 1959. The most rapid increase was in milk consumption, and it was precisely for milk that the relative price level was lowest.

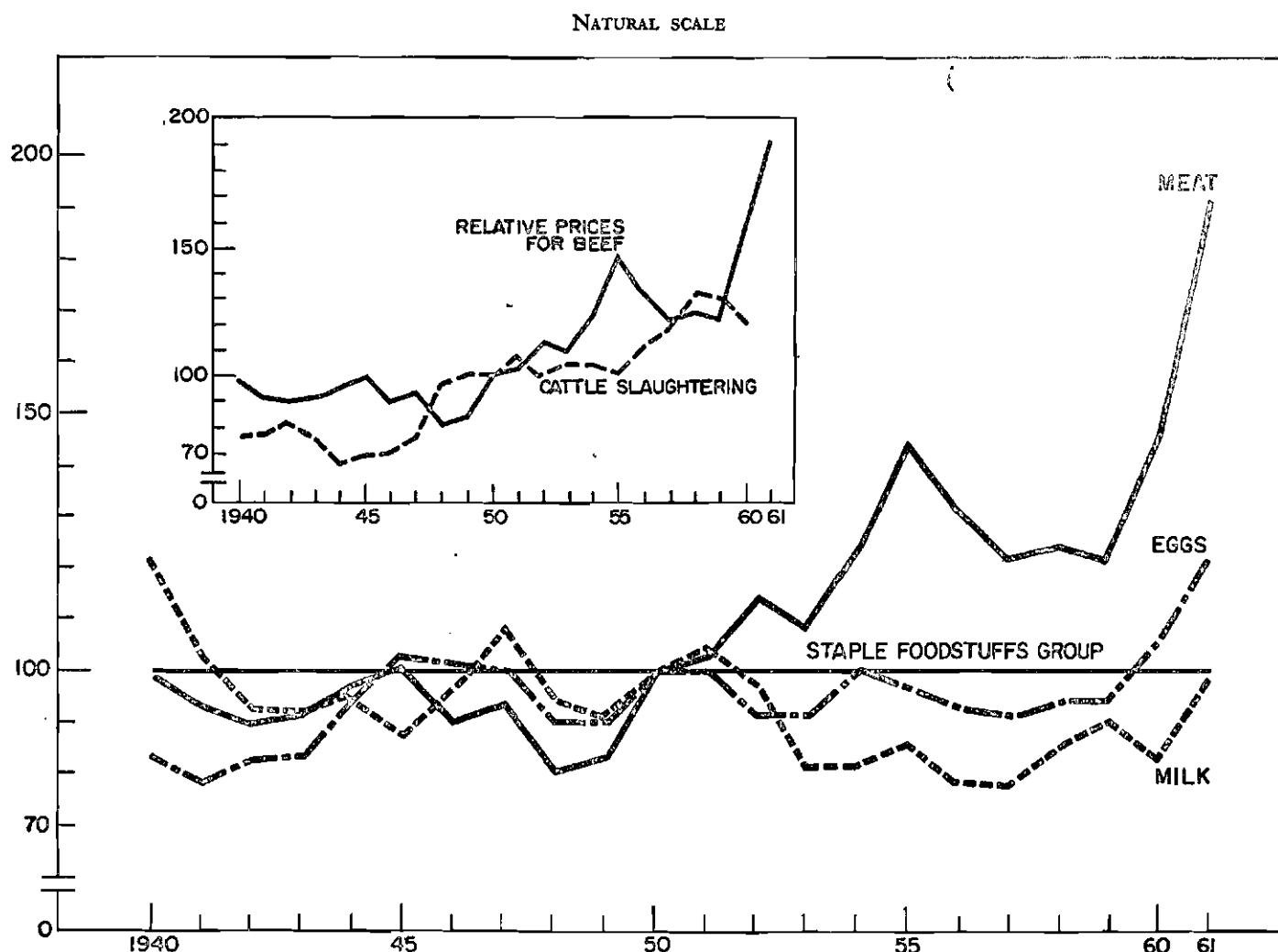
With respect to meat, high prices resulted in some reduction in slaughterings, and consequently in consumption, particularly in 1960 and 1961. A contraction in real demand at a high price level usually means, of course, apparently large animal inventories, since supply cannot make short-term adjustments to changes in demand, because once the stocks have been conditioned for consumption, they cannot be kept at pasture for long. Analysis of the variations in the curves for meat prices and livestock slaughterings shows that when meat prices follow an upward trend the number of slaughterings decreases, as happened, for example, in 1954 and 1955. In the three following years the relative prices of meat declined appreciably in relation to the maximum level attained in 1955, which led to so great an increase in real consumer demand that a point was reached where serviceable dams were being slaughtered.

An important point is that distortions and imbalances between producer and consumer prices create bottlenecks in the production and distribution of goods through the powerful influence they exert on supply and demand. The argument is often advanced that the producer's price should be raised to offset increases in the cost of inputs and the effects of inflation on rural activities, and thus stimulate the growth of supply. Unhappily, a mere increase in the producer's price, unaccompanied by any favourable change in the structure of the functions of production, naturally results in a rise in consumer prices and, usually, in reduced consumption. This is what has happened fairly recently in certain Brazilian markets for meat, milk and milk products and other commodities.¹⁰² But the most serious bottleneck is caused by price programmes and policies that attempt simultaneously to push up producers' prices and to control prices at the consumer level. The two aims cannot be achieved in conjunction unless subsidies or methods of direct compensation are established. An improvement in the producer's income, as an incentive to production, should be effected by increasing productivity, and through technical assistance campaigns, credit expansion, etc.

With respect to price-fixing policy, the prevailing view is that its orientation and execution have been handicapped by serious deficiencies, and that it has defeated its own ends. No attempt will be made here at a thorough analysis of the advantages and disadvantages of the policy adopted by the Federal Commission on Supplies and Prices (COFAP) with respect to the Brazilian meat and milk market, but it seems appropriate to make some reference to the situation brought about by the fixing of prices.

¹⁰² In Bulletin No. 1 (1961) of the São Paulo Department of Agriculture's Livestock Production Service, there is a reference to a 17.1-per-cent decrease in the State capital's consumption of beef in 1960, in relation to 1959. This was due to an excessive price increase, amounting to 63 per cent for the producer, 59 per cent for the processor and 115 per cent for the distribution sector, within the short period between the first and last quarters of 1960.

Figure IV
Brazil: Relative prices for beef, milk and eggs, 1940-61
(1950 = 100)



^a In relation to the weighted price index for a group of commodities: sugar, rice, potatoes, manioc and wheat flour, beans, maize and bread, in the capitals of the Federal States.

First, the attempt to stabilize prices was clearly fruitless, since they continued to rise in response to the general upward trend of the prices paid for the use of factors of production and distribution media; the relatively greater increase in the case of meat has already been referred to.

Resolutions adopted by COFAP and similar State bodies encouraged the development of a black market in meat, with disastrous consequences for the consumer.¹⁰³ Although its existence was ephemeral, its harmful effects are still making themselves felt in some sectors of the market.

One of the most notable deficiencies of the measures applied was that meat prices were controlled only at the last stage of marketing, without any analysis of production, processing and distribution costs, without due regard to the interests of the different groups con-

cerned, and without recourse to appropriate technical standards.

With respect to milk, on the contrary, the results of the price policy followed cannot be dismissed as negative, since the application of this policy was accompanied not only by a steady expansion of production, but also by an increase in per capita consumption of fluid milk. However, the lack of any firm basis for establishing reasonable prices at the various stages of production and marketing led to continual disputes and anomalies that made the system less and less workable.

Since meat price controls were removed by COFAP in 1960, and reimposed in August 1962, the question arises whether the exceptionally steep—almost vertical—upward trend in meat prices in 1960 and 1961 (see again figure IV) was a consequence of the lifting of price controls or merely a symptom of the general inflation prevailing in the country. Undoubtedly both factors were concerned: the first must have played a part, since the rise was sharper in the case of the

¹⁰³ In November 1959, the official price per *arroba* was 530 cruzeiros, but the black market price ranged between 850 and 880 cruzeiros. In September and October COFAP bought cattle at prices higher than those it had itself established.

decontrolled product (meat); and the second likewise, since the increase was also relatively marked for eggs, the price of which was not controlled.

A little thought will show that the conditions prevailing in the Brazilian meat and milk markets—characterized as they are by an immense and growing demand but a low level of supply, and by certain elements of oligopoly and oligopsony at the processing and marketing levels—are not such that the supply and prices of commodities so essential to the daily diet can be left at the mercy of these conflicting forces. As long as the imbalance between production and consumption and the marketing anomalies already analysed persist, the only way of reconciling the interests of the different sectors is to control and regulate the market, with respect both to supply and to prices, through an essentially technical body with all the appropriate powers and resources. In default of such an organization, the least undesirable alternative in the present circumstances would be to leave the market free.

4. OUTLOOK FOR DEMAND

No attempt will be made here to predict the demand for meat that may exist in 1965 and 1970, for example, since sufficient basic data are not available; moreover, it would be too hazardous to estimate the changes that may occur in all the various factors determining this

demand. The figures presented as projections in tables 18 and 20 are, at bottom, only estimates of possible future alternatives in respect of milk and meat demand and consumption. Many hypotheses could be advanced, but it appears the most practical and reasonable course to postulate, as one possibility, that demand will remain what it has been in the past, although this hypothesis is, of course, pessimistic, since it assumes that the supply difficulties and low purchasing power of past and present times will persist in 1965 and 1970. Another useful step is to assess, however roughly and approximately, the magnitude of the great potential demand in Brazil deriving from the rapid population growth and the high rates of urbanization and industrialization typical of central Brazil, for example.

With respect to demand for meat, extrapolation of the historical trend would seem to indicate an undoubtedly very unfavourable downward movement in per capita consumption. More specifically, if the trend in real demand recorded for the period 1948-60 continues, the aggregate per capita supply of meat will decline from an average of 27.6 kilogrammes in 1958-60 to 25 kilogrammes in 1970, a reduction of almost 3 kilogrammes. This serious situation may arise if no steps are taken to control the steep upswing in prices resulting from the standstill in supply and the steady growth of potential demand. If this imbalance

Table 18
Brazil: Projections of demand for red meat and poultry by 1965 and 1970^a

	Population (thousands) ^b	Extrapolation of past trend ^c	Natural increase in demand ^d	Potential demand ^e	Consumption targets ^f
Total consumption (thousands of tons)					
1965	82,631	2,161	2,281	2,570	2,789
1970	96,439	2,402	2,662	3,308	3,954
Per capita consumption (kilogrammes)					
1965		26.1	27.6	31.1	33.8
1970		25.0	27.6	34.3	41.0

^a In terms of carcass meat.
^b Estimated on the basis of an annual growth rate of 3.1 per cent, as recorded for the period 1950-60, and assuming the following population distribution: 1965 — urban, 52 per cent, rural, 48 per cent; 1970 — urban, 60 per cent, rural, 40 per cent.
^c Projection of the trend registered for 1948-60.
^d Based only on the expected demographic growth rate, that is, without any change in the per capita consumption level.
^e In terms of the cumulative growth rates of the population (3.1) and of real per capita income (2.5), with an average coefficient of income-elasticity of demand of 0.8 per cent and a basic per capita consumption of 27 kilogrammes.
^f Assuming that per capita consumption levels improve by 1965 and 1970 as follows: urban consumption by 52 and 55 kilogrammes respectively, and rural consumption by 14 and 20 kilogrammes respectively.

continues and increases, only consumers in the highest income groups, most of whom live in the towns, will be able to eat adequate amounts of meat; the rural population and the under-privileged urban groups will suffer further reductions in their already low levels of consumption, and greater social unrest is likely to result from the impossibility of obtaining essential foods.

The projections of the natural growth of demand estimated on the basis of the assumed demographic growth rate do not differ greatly from the figures obtained by extrapolating the historical trend, which means that in the past the increments in total meat consumption were due entirely to the increase in the population, and that income played no part in stimulating per capita consumption. Even if the same real

per capita supplies—27.6 kilogrammes of red meat and poultry—were to be available in 1970, there would have to be an increase of about 43 per cent in the total supply in relation to 1960, in other words, a production increment greater than that registered in 1950-60, which was about 30 per cent.

The last two demand projections are optimistic, since the increase in per capita consumption assumed is relatively substantial, although still a good deal lower than the average of 50 kilogrammes recommended by Brazilian nutrition experts. It is obvious that if consumption levels corresponding to these two projections of demand are to be attained, vigorous action is required, first to effect a considerable expansion of supply on the basis of domestic production, and secondly to raise the purchasing power of the groups with the lowest consumption levels by means of better income distribution. The essential aim should be to keep supply in line with potential demand, so as to ensure a level of relative prices that will encourage consumption. Feeling in Brazil is generally favourable to the channelling of meat production with a view to securing Brazilian exports a substantial share in the world market, but it will be readily understood that official action should first be directed to solving the problem of under-consumption, before embarking on a rapid expansion of exports.

To give an idea of the extent to which the stock-farming industry will have to be developed in order to attain by 1970 the meat consumption indicated in the last column of table 18, suffice it to say that, assuming Brazil could by then export about 100,000 tons of beef, the following increases in animal inventories would have to be achieved:

	Millions	Millions	Percentage
Cattle	73.96	121.21	163
Pigs	47.94	57.83	112
Sheep and goats.....	29.36	40.34	137
Poultry	184.13	365.00	198

If it were assumed in addition that during the next ten years consumption habits and the relative price structure will remain as they are now, and that the composition of consumption will therefore also be the same, an increase of 63 per cent in cattle inventories would be required, amounting to an annual growth rate of 5 per cent, greatly exceeding that of population growth. Requirements respecting pig inventories would be relatively less, since a higher slaughtering rate has been assumed. A moderate increase in sheep and goat inventories would be needed, since these meats are less popular with consumers. The number of poultry would have to be doubled in view of the rapidly rising trend in the production and consumption of poultry products (see table 19).

An increase of this order in cattle and poultry inventories could only be achieved by an integrated stock-farming development plan which would, in brief, aim at the extension and improvement of pastures, the control of the factors that limit production—especially diseases—and the rational management and more efficient utilization of livestock at the national level. Until such a plan is put into effect, the increase in livestock production will continue to be slow, and there will be

little hope of the country's improving its domestic supply of meat and at the same time substantially increasing its exports.

Table 19

Brazil: Targets for livestock and meat production for 1970^a

Species	Inventories required (thousands of head)	Slaughtering rate (percentage)	Volume of slaughterings required (thousands of head)	Meat production (thousands of tons) ^c
Cattle	121,215	13	15,758	2,994 ^d
Pigs	57,832	25	14,458	969
Sheep and goats	40,342	14	5,648	79
Poultry	365,000			12
TOTAL				4,054

^a Requisite targets to meet the consumption indicated in the last column of table 18.

^b Rates corresponding to the slaughterings reported or statistically recorded, which do not usually include *in situ* slaughterings of the smaller livestock.

^c In terms of carcass meat, assuming the same yield per animal as that recorded in 1960.

^d Includes 100,000 tons of possible beef exports.

The expansion of demand for milk and milk products seems likely to continue, encouraged by a steady increase in supply at a reasonable price level. Potential demand for milk is also great, not only because of the same factors that determine demand for any food of animal origin, but also because the quality of this product is recognized by consumers, and is steadily improving still further. Moreover, marketing is better organized for milk than for meat, which undoubtedly encourages real demand.

In view of the lack of background data for projecting Brazil's demand for milk for direct consumption, a minimum long-term aim would be to raise consumption in the State capitals in line with the targets indicated in table 20. This table shows that greater priority has been assigned to increasing consumption levels in the Norte and Nordeste, where the per capita supply at present available is very inadequate. Relatively smaller increases in per capita consumption would be needed in the capitals in the east and south of Brazil, as these are the centres where the supply is best and the amount available per capita is greatest.

Table 20

Brazil: Daily milk consumption targets for the State capitals by 1970

	Total consumption (thousands of litres)		Per capita consumption (grammes)	
	1960	1970	1960	1970
Norte	12	77	17	67
Nordeste	85	400	42	125
Centro Oeste ...	21	130	60	129
Este	629	1,360	127	186
Sul	925	1,915	189	235
	1,672	3,882	128	186

Source: Basic data supplied by the National Dairy Farming Commission of the Ministry of Agriculture.

Since milk is such an essential food, its production and consumption should not be envisaged merely in terms of the population growth and increased income that can be foreseen, but, basically, as a social problem that differs in nature and scope from one area to another. Consequently the execution of programmes aimed at the progressive attainment of milk production and consumption targets, as indicated in table 20, calls for the establishment of priorities, regional plans and various incentives.

5. DEMAND AND FOREIGN TRADE

It is of interest to analyse the situation and trends in Brazil's foreign trade in livestock products, in order, *inter alia*, to assess its effect on both production and consumption.

Broadly speaking, Brazil's foreign trade in food of animal origin is restricted to the importing of certain milk products and the exporting of meat. At present, moreover, this trade is on a relatively modest scale.

Under the heading of milk products the main imports are powdered milk and butter. The largest imports are those effected under Title 1 of Public Law 480 on United States agricultural surpluses, and next come those from Denmark. Brazilian imports from Latin American countries are insignificant, but may increase within the Free-Trade Area. It should be noted that high tariff duties and surcharges are applied to imports of milk products in Brazil, and this, in conjunction with certain exchange restrictions, has hampered the growth of the import trade, and consequently stimulated domestic production.

Meat exports, as shown in table 21 and figure V, began in 1914 and increased sharply during the First World War, by the end of which they amounted to some 80,000 tons, two-thirds of this amount representing chilled and frozen meat, and the remainder preserved meats. In succeeding years exports continued without interruption, although at a lower level, still with chilled and frozen meats as the major item; in 1930 they reached the high figure of about 119,000 tons, of which only a very small proportion represented preserved meats. Exports declined in the following decade, but recovered during the first years of the Second World War (150,000 tons in 1940), at the end of which they fell by more than 50 per cent. The decline continued subsequently, except for fairly large consignments during 1946-48, when the main item was preserved meats, production of which had been thriving since the Second World War. During 1951-56 exports were at their lowest ebb (1,568 tons in 1954), and serious domestic supply problems arose that made it necessary even to introduce rationing and to resort to imports in 1952, 1953 and 1954. This supply crisis and the complete reversal of the direction of foreign trade in meat were the natural result of excessive slaughtering of breeding cattle during 1939-43. In 1958 and 1959 exports improved, but again this coincided with some liquidation of cattle stocks that subsequently led, not long ago, to a further slowing-down in the growth of the herds and consequently in the rate of development of production for consumption.

Table 21
Brazil: Meat exports in selected years
(Thousands of tons)

Year	Chilled and frozen	Preserved	Total
1914	—	200	200
1919	54,100	25,400	79,500
1924	75,300	1,400	76,700
1930	112,200	6,600	118,800
1935	54,200	14,200	68,400
1940	101,942	48,217	150,159
1945	1,522	22,724	24,243
1950	12,020	8,789	20,809
1954	1,050	518	1,568
1957	29,296	820	30,116
1958	33,248	11,341	51,033
1959	23,359	36,634	65,852
1960	5,894	8,141	14,035

Source: Economic and Financial Statistics Service of the Ministry of Finance.

The foregoing account would not in itself be significant, but for the glimpse it gives of an anomalous situation in foreign trade in meat products. First, it shows that an increase in meat shipments is usually associated not with a real expansion of stocks, but with a larger number of slaughterings at the expense of the breeding herds, that is, an artificial surplus. Secondly, it reveals that although the volume of exports amounts to only a small percentage of domestic consumption, a boom in sales abroad can lead to serious difficulties when it is not based on a normal expansion of production, especially if there is a marked upswing in domestic demand such as that recorded in Brazil in recent times. In view of the invariably high level of demand for meat on the world market, sharp fluctuations in the volume of exports must be regarded not as the result of any external situation, but as reflecting the fact that trade has not yet been properly organized.

Brazil has, of course, immense natural resources which could enable it to become a leading exporter of meat; this item might, in fact, easily provide a very significant source of foreign exchange, like coffee. But such an aim could only be attained by the formulation of an export policy that would reconcile national and private interests, and benefit the producer without harming the consumer.

Brazil undoubtedly needs a programme or plan for meat exports, that would enable it to direct a portion of its great resources into foreign markets. An integrated programme would, of course, require, as a first step, action to develop meat production, preferably through the introduction of improved stock-farming techniques in order to increase productivity; this in turn would presuppose the establishment of priorities, at the regional level, for the execution of specific projects, investment decisions, the expansion of credit facilities, and so forth. It would be equally essential to improve meat processing and marketing conditions, especially as regards establishing more meat-packing plants, and a network of cold-storage depots at ship-

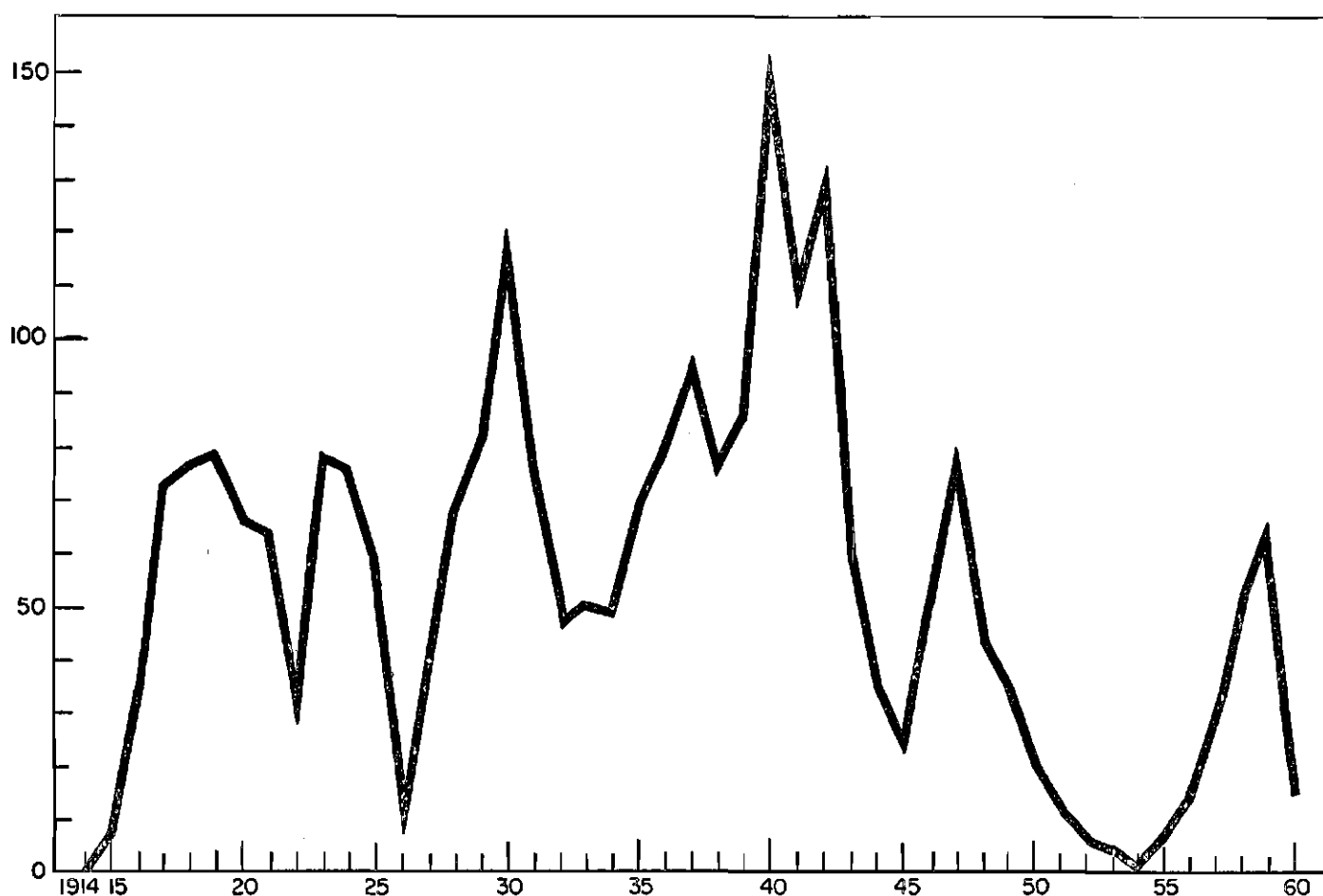
ping points. In addition, systematic and continuing studies would be required on production costs, parity prices and world market conditions and trends; lastly,

exchange measures to encourage exports, protection of the existing foreign trade, and a search for additional markets would be indispensable.

Figure V

Brazil: Exports of frozen and canned meat, 1914-60
(Thousands of tons)

NATURAL SCALE



VIII. LIVESTOCK DEVELOPMENT: PROMOTION AND PROSPECTS

1. DEVELOPMENT OF LIVESTOCK ACTIVITIES

(a) *Livestock experts*

At the national level, the body chiefly responsible for the promotion and protection of livestock production is the Ministry of Agriculture, acting through the National Livestock Production Department. The latter works through a General Secretariat, through four main Divisions (Livestock Production Development, Health Protection, Inspection of Livestock Products, Hunting and Fishing), and through its institutes of animal biology and breed improvement. State authorities usually have similar units in the Livestock Production Services of their respective Departments of Agriculture. This work is supported and supplemented by numerous organs and agencies directly or indirectly related to the livestock sector, such as breeders' associations, rural associations, producer co-operatives,

credit institutions, marketing and processing concerns, laboratories manufacturing veterinary products, and many others.

There is no need to discuss the organization of research, extension and technical assistance in the field of the livestock industry, or the important official agencies connected with it. Throughout the present study reference has already been made to several of these agencies, and all that need be done is to add the following remarks.

In view of the size of the livestock industry in Brazil and the innumerable health, breed improvement, agrostological, economic and other problems, the present body of top- and medium-level professionals (the former including veterinarians and agronomists) connected with the promotion and protection of livestock and related activities is clearly inadequate, despite the fact that Brazil has a larger number of such profes-

sionals than any other Latin American country. There is a great need for specialists in zootechny and in animal physiology, genetics and nutrition. According to the Brazilian Rural Credit and Aid Association (ADCAR), at the end of 1959 there were in Brazil totals of 6,373 agronomists and 2,388 veterinarians, most of whom (80 per cent and 95 per cent respectively) were attached to Federal and State agencies or were teaching in the schools. To give an idea of the shortage of experts in livestock development, it need only be pointed out that of the 1,063 agronomists and 367 veterinarians working for the Ministry of Agriculture in December 1960, a mere 10 per cent were attached to the Livestock Production Development Division. In 1961 there were not as many as ten veterinarians attached to agricultural stations, whereas at least 200 are needed. Besides these shortages, there is a complete lack of economists specializing in the livestock industry.

Brazil has numerous centres and stations for experimental work. Apart from the units attached to the Institute of Zootechny, the State authorities have important experimental stations engaged in breed improvement and agrostological research; many of them have already been mentioned. Brazil has also made significant advances in research on animal pathology. However, more efficient organization and integration of experimental work is required, and for this a larger team of specialists is needed.

Progress has been slow in respect of extension, this being at least partly due to the low technical level prevalent on most livestock farms. It should be recalled in this connexion that, precisely for lack of top-level and, more particularly, medium-level extension experts, producers have not profited by many of the recommendations and solutions that the research service has propounded.

If the country is to embark upon a broad and effective livestock development programme, it will obviously have to begin by promoting the training of technical staff, not only through the expansion of professional and vocational training institutions, but also through the creation of incentives which will lead to a rapid increase in the number of candidates for enrolment in these ranks. Among other inducements, provision should first be made for a substantial increase in allowances and stipends for professional and technical experts in agriculture, since it is obvious that at present salary levels and under present conditions of remuneration in general it will be more than difficult to arouse much interest in careers such as veterinary medicine, agronomy and other professions related to agricultural development.

Moreover, the basic conditions and environment in which experts work will have to be improved, and this will entail reorganization of some of the government agencies for the purpose of making them more dynamic, insulating them from the political interference which so often adversely affects professional interests and activities, and inducing them to think on economic lines. A modernization of livestock farms designed to increase productivity cannot be achieved unless the agencies responsible for promoting it are modernized first.

(b) *Livestock development plans*

In Brazil, as in many other Latin American countries, there are a vast number of livestock projects, studies and programmes awaiting execution. To refer to the many livestock plans which, for one reason or another, have not been carried out would be a tedious undertaking. The most recent programme was drawn up by the National Livestock Production Department as part of the Ministry of Agriculture's five-year plan. For the period 1962-66 it provides for specific programmes in the fields of breed improvement research, pathology, animal biology and technical assistance aimed at increasing production, health control and the inspection and technology of livestock products. These objectives are justified from the standpoint of the economy and of social welfare, to which latter, in the case of a vast sector of the population, narrow limits are set by the numerous problems deriving from the low consumption of animal proteins. The funds needed to finance the plan were estimated at 22,000 million cruzeiros, a little over half of which was to be obtained through international co-operation.

However, even if the plan were carried out it would have to be made part of an over-all plan which, while dealing with production, would at the same time provide for an improvement in transport media, the processing and marketing of products and the organization of a liberal and expeditious credit scheme for the livestock industry. For Brazil a co-ordinated plan of this kind is essential in order to prevent the perpetuation of certain bottlenecks which hamper the rapid development of production.

Federal and State programmes will have to be co-ordinated and made reciprocally complementary, the chief objectives being to avoid duplication of effort, to standardize measures and targets, to reconcile conflicting interests, to assign priorities and to encourage the execution and broaden the scope of projects whose importance has already been established.

With respect to the livestock plans of the various States, it should be pointed out that steady improvement is aimed at in central Brazil and Rio Grande do Sul. Many States are carrying out very effective development programmes, and it would really be advisable to extend these to all areas of known livestock potential. There is, for example, the pilot farm campaign of the Livestock Production Service of the Department of Agriculture of São Paulo, designed to improve dairy-farming techniques on low-yield farms. Specific development and extension projects have been drawn up in an attempt to improve livestock feeding, disease control, breed improvement in respect of dairy cattle, establishment of production controls and better training of personnel connected with milk production. To this end, aid is provided not only through technical assistance but also in the form of funds and the loan of stud bulls. Of the 1,000 pilot farms provided for in the plan, some 25 per cent are already in operation, with very satisfactory results. It should be pointed out that much of the success is due to the credit resources made available as an integral part of the programme.

(c) *Development through credit*

It should be pointed out that Brazil lacks a sufficiently well-organized and extensive livestock credit service. The volume of credit granted is far below the livestock industry's already considerable requirements, and is still more inadequate if account is taken of the country's huge potential for the development of the livestock industry. Countless livestock producers have had no access to credit facilities. Until recently barely one-fifth of the 2,763 municipalities in Brazil—with a little over 2 million rural properties—had agricultural credit agencies, which means that credit is extended to only a minority of stock farmers. In 1959, for example, 70 per cent of the credit made available to the livestock industry was granted to medium-scale and large-scale producers, and only 4.3 per cent of the total was accorded to small stock farmers. Credit should therefore be extended on a more democratic basis so as to benefit the greatest possible number of recipients. This would require a simplification of the formalities—that is, of the system—and the abolition of certain requirements regarding security and guarantees which cannot be met by the small stock farmer. This can be done by providing personal credit based on the applicant's ability and character.

It is important to recognize that the necessity for a considerable increase in credit facilities is borne out by the urgent need not only to serve a greater number of stock farmers, but also to counteract the effects of inflation,¹⁰⁴ and to cover other branches of activity allied to or collateral with the livestock industry. Moreover, it is patent that a more comprehensive and systematic credit service should be organized to make it possible to expand meat processing and storage plants.

In spite of the more pressing need to promote the production of foodstuffs of animal origin, crop farming has been in a less unsatisfactory position. For example, in fairly recent years (1957-59), the livestock sector received only about 14 per cent of the resources available in the rural and industrial credit portfolio of the Bank of Brazil, its position having deteriorated since 1940, when it obtained 38 per cent. On the other hand, the share of crop farming increased, rising from 50 per cent to 60.4 per cent during the same period.

Although there are agricultural departments in the Bank of Brazil, the Co-operative Credit Bank, the Nordeste Bank and the Bank of the State of São Paulo, and despite credit facilities made available by other agencies, the Agricultural and Industrial Credit Department (CREAI) of the Bank of Brazil can be described as virtually the only source of credit for the beef cattle industry. Credit requirements are also very substantial in the dairy cattle industry.

Apart from these shortcomings in the volume and organization of credit, other defects are the lack of co-ordination among the credit departments of the different agencies and the drawbacks of granting credit without prior planning.

Lastly, it must be recognized that credit activities cannot be satisfactorily channelled, much less can

agencies specializing in agricultural credit be organized, and supervised credit services established on a generous scale, unless more properly trained personnel are made available.

2. LIVESTOCK DEVELOPMENT PROSPECTS

The prospects for the livestock sector cannot be considered unless reference is previously made to the country's potential in respect of the production and consumption of livestock commodities. For, in the last analysis, the level of development of livestock production is determined by potential supply and demand and their variations in relation to the break-even point.

As far as supply is concerned, Brazil's potential capacity is very great. In the first place, substantial increases in production could easily be achieved on the basis of the present livestock population by improving techniques and productivity. As pointed out elsewhere, inventories have increased appreciably, but yields are still low, although they could very well be improved. Moreover, the country's natural resources are such that it could expand its grazing area considerably and maintain a livestock population several times larger than at present.

The areas occupied by the various branches of the Brazilian livestock industry could be greatly expanded in several parts of the country, some of which are indicated here in broad outline. There are vast tracts of land suitable for beef cattle in Mato Grosso, with a carrying capacity of at least 30 million head of cattle; in Pará, Maranhão, Piauí, the southern part of Bahia, Paraná¹⁰⁵ and Santa Catarina. Areas suitable for dairy farming are to be found all over the country, and will be increasingly turned to account as the consumer markets expand. The dairy-farming area may be extended by incorporating crop land where the soil has been depleted and yields reduced by injudicious farming practices, grazing land formerly used for beef cattle and, in other cases, virgin land. Milk production has considerable room for expansion in Amazonas (Isha do Careiro), in Pará (Bragantina), and in the several valleys of the Maranhão, Piauí, Ceará and Rio Grande do Norte; in Paraíba (Agreste, Caatinga and Cariris Velhos), in the Agreste area of Pernambuco, and in various parts of Alagoas, Sergipe and Bahia; in the valleys of the rivers Paraopeba, Velhas and Doce in Minas Gerais, in the central and southern regions of Espírito Santo, in the States of Rio de Janeiro and Guanabara, and so forth.

Given the combination of particularly favourable factors found in central Brazil and Rio Grande do Sul, existing dairy farms could be expanded on a vast scale.

It should be recalled, moreover, that livestock production capacity as a whole could be increased considerably through the sheep, pig, goat and smaller livestock industries. The possibilities of expanding poultry and pig breeding are enormous.

The supply of livestock products could also be increased through complementarity and integration meas-

¹⁰⁴ Between 1948 and 1959, credit transactions for the livestock industry increased twentyfold, whereas the deflated value was only trebled.

¹⁰⁵ In the northern part of Paraná large tracts of artificial pastures and fertile soil, adjacent to natural pastures, have been used for cattle breeding and fattening. The new pastures carry eight head of cattle per *alqueire*, as compared with two head for every three *alqueires* of natural pastures.

ures in respect of crop and stock farming. These sectors have acted independently, which has resulted in waste of resources, misuse of the soil and maladjustments in agricultural employment. The modernization of crop and stock farming should, as far as possible, be based on mixed farming.

Potential demand is as great as or even greater than supply. Reference has already been made to the rapid rate of population growth and the higher income levels in central Brazil resulting from industrial development and the progress of urbanization. Apart from a potentially large domestic market, there is also the external demand for meat and other livestock commodities of which many countries cannot produce enough to meet their needs.

It may therefore be concluded that prospects for the livestock sector in Brazil are closely tied to official and private action aimed at developing supply. Over the short term, livestock production and marketing will continue to face the serious problems with which they are confronted at present, because, *inter alia*, their solution implies radical changes which cannot be quickly made. Over the medium and long term, the outlook is bright, and there is every reason to believe that the execution of an integrated livestock plan will place Brazil in a position not only to supply the domestic market with high-quality livestock products at a satisfactory level of per capita consumption, but also to become a major meat exporter.

IX. STATISTICAL ANNEX

Table I

Brazil: Livestock and poultry inventories, 1948-60
(Thousands of head)

Year	Cattle	Horses	Asses	Mules	Pigs	Sheep	Goats	Poultry
1948	50,089	6,918	1,529	3,094	22,979	13,390	7,888	...
1949	51,937	6,902	1,536	2,095	24,152	13,549	8,249	...
1950	52,655	6,937	1,572	3,101	26,059	14,251	8,526	...
1951	53,513	6,994	1,593	3,181	27,801	15,891	8,840	...
1952	55,854	7,111	1,611	3,215	30,916	16,264	8,822	123,106
1953	57,626	7,059	1,612	3,133	32,721	16,800	8,915	134,255
1954	60,700	7,316	1,675	3,245	35,296	17,459	9,414	143,996
1955	63,608	7,564	1,774	3,390	38,606	18,484	9,879	154,209
1956	66,695	7,935	1,876	3,576	41,416	18,867	10,339	160,352
1957	69,548	8,128	1,967	3,760	44,190	20,164	10,640	165,958
1958	71,420	8,185	1,946	3,917	45,262	19,921	10,194	169,102
1959	72,829	8,333	2,031	4,047	46,823	18,995	10,644	175,401
1960	73,962	8,273	2,175	4,086	47,944	18,162	11,195	184,133

Source: Ministry of Agriculture, Production Statistics Service (SEP).

Table II

Brazil: Estimated distribution of cattle population by States and geo-economic regions, 1960
(Thousands of head)

State and region	Head of stock	Percentage	State and region	Head of stock	Percentage
Norte	1,403	1.90	Sergipe	617	
Rondonia	9		Bahia	5,949	
Acre	39		Stock-farming area of central Brazil	47,242	63.89
Amazonas	179		Minas Gerais	16,213	
Rio Branco	168		Espírito Santo	859	
Pará	956		Rio de Janeiro	1,389	
Amapá	52		Guanabara	11	
Nordeste and eastern part of the			São Paulo	10,394	
Norte	14,042	18.99	Paraná	1,955	
Maranhão	1,498		Mato Grosso	10,061	
Piauí	1,410		Goiás	6,360	
Ceará	1,446		Far south	11,275	15.25
Rio Grande do Norte	529		Santa Catarina	1,664	
Paraíba	799		Rio Grande do Sul	9,611	
Pernambuco	1,143		TOTAL	73,962	
Alagoas	651				

Source: As for table I.

Table III
Brazil: Stock-farming area, according to the 1950 census
(Hectares)

<i>State and zone</i>	<i>Natural pastures</i>	<i>Percentage</i>	<i>Artificial pastures</i>	<i>Percentage</i>	<i>Total</i>
<i>Norte</i>	2,344,566	96.4	87,846	3.6	2,432,412
Rondonia	2,533	63.9	432	36.1	3,965
Acre	98,818	95.7	4,391	4.3	103,209
Amazonas	56,168	60.0	37,411	40.0	93,579
Rio Branco	506,698	99.7	1,476	0.3	508,174
Pará	1,555,600	97.4	41,346	2.6	1,596,946
Amapá	124,749	97.8	2,790	2.2	127,539
<i>Nordeste</i>	11,586,175	96.8	380,346	3.2	11,966,521
Maranhão	3,454,444	98.8	40,820	1.2	3,495,264
Piauí	2,045,263	97.3	55,711	2.7	2,100,974
Ceará	2,317,805	96.9	74,251	3.1	2,392,056
Rio Grande do Norte	1,291,923	98.3	22,816	1.7	1,314,739
Paraíba	1,307,408	97.4	35,271	2.6	1,342,679
Pernambuco	934,652	91.4	88,338	8.6	1,022,990
Alagoas	234,680	78.8	63,139	21.2	297,819
<i>Este</i> ^a	22,595,908	75.5	7,336,403	24.5	29,932,311
Sergipe	236,947	58.5	167,841	41.5	404,788
Bahía	2,260,945	49.1	2,343,590	50.9	4,604,535
Minas Gerais	18,714,580	81.6	4,212,563	18.4	22,927,143
Espírito Santo	265,428	83.4	318,357	16.6	583,785
Rio de Janeiro	1,088,102	81.0	254,946	19.0	1,343,048
Distrito Federal ^b	5,491	93.2	399	6.8	5,890
<i>Sul</i>	22,959,001	84.0	4,381,265	16.0	27,340,266
São Paulo	4,952,565	57.3	3,695,370	42.7	8,647,935
Paraná	1,967,767	87.5	280,815	12.5	2,248,582
Santa Catarina	1,686,120	92.3	141,452	7.7	1,827,572
Rio Grande do Sul	14,352,549	98.2	263,628	1.8	14,616,177
<i>Centro Oeste</i>	33,174,333	92.2	2,787,200	7.8	35,961,533
Mato Grosso	19,656,276	96.5	722,536	3.5	20,378,812
Goiás ^c	13,518,057	86.8	2,064,664	13.2	15,582,721
TOTAL^a	92,659,983	86.1	14,973,060	13.9	107,633,043

^a Including 63,122 hectares of the Serra dos Aimerés, an area which is claimed by both the States of Minas Gerais and Espírito Santo.

^b Now the State of Guanabara.

^c Including the present Distrito Federal.

Table IV
Brazil: Indices of cattle population and meat production, by geo-economic areas, 1960

	Norte	Nordeste and eastern part of the Norte	Stock-farming area of central Brazil	Far south	Total
Area (square kilometres)	3,579,991	1,555,130	3,001,445	377,278	8,513,844
Area as a percentage of the total	42.0	18.3	35.3	4.4	100.0
Head of cattle	1,403,000	14,042,000	47,242,000	11,275,000	73,962,000
Head of cattle as a percentage of the total	1.9	18.9	63.9	15.3	100.0
Density (square kilometres)	0.39	9.02	15.73	29.88	8.68
Number of inhabitants	2,601,519	22,428,803	37,789,001	7,595,732	70,799,352
Ratio of cattle to population	0.53	0.62	1.25	1.48	1.04
Slaughtering:					
Steers	88,000	919,000	2,869,000	701,000	4,577,000
Cows	22,000	325,000	1,690,000	359,000	2,396,000
Calves	6,000	19,000	199,000	10,000	234,000
Total	116,000	1,263,000	4,758,000	1,070,000	7,207,000
Percentage of cows	18.9	25.7	35.5	33.5	33.2
Slaughtering rate (Percentage)	8.26	8.99	10.07	9.49	9.74
Yield of carcass meat (kilogrammes)	17,001,000	195,324,000	932,572,000	214,320,000	1,359,217,000
Average weight of carcass meat (kilogrammes)	146.5	154.6	196.0	200.3	188.5
Average weight of steer carcass (kilogrammes)	158.2	163.4	217.8	219.6	206.0
Production per head of cattle population (kilogrammes)	12.1	13.9	19.7	19.0	18.3

Table V
Brazil: Production of carcass meat, total and per head of stock, 1948-60
(Thousands of tons)

Year	Beef		Pork ^a		Mutton		Goat's flesh		Poultry ^b		Total weight
	Thou- sands of tons	Average yield per animal slaugh- tered (kilo- grammes)	Thou- sands of tons	Average yield per animal slaugh- tered (kilo- grammes)	Thou- sands of tons	Average yield per animal slaugh- tered (kilo- grammes)	Thou- sands of tons	Average yield per animal slaugh- tered (kilo- grammes)	Thou- sands of tons	Average yield per animal slaugh- tered (kilo- grammes)	
1948	1,050.6	180.2	324.6	63.7	19.3	14.9	12.6	10.0	3.9	1.0	1,411.0
1949	1,093.3	181.6	322.4	63.6	17.9	15.0	12.8	9.9	4.4	1.1	1,450.8
1950	1,074.4	180.1	344.6	63.7	20.3	15.8	12.0	9.9	4.1	1.1	1,455.4
1951	1,135.5	176.0	385.6	64.4	18.3	14.9	12.9	9.9	4.5	1.1	1,556.7
1952	1,098.7	183.0	380.2	61.9	25.1	15.9	12.9	9.9	3.8	1.2	1,520.6
1953	1,118.5	179.1	393.8	63.4	26.3	15.8	13.6	9.8	4.1	1.1	1,556.3
1954	1,151.9	186.7	408.4	64.5	23.2	15.3	13.6	9.9	6.5	1.3	1,603.5
1955	1,131.8	187.7	405.4	62.6	24.3	15.6	14.4	9.8	4.8	1.1	1,580.6
1956	1,277.2	194.3	437.1	64.0	22.0	14.8	15.0	9.9	5.3	1.1	1,756.7
1957	1,318.6	187.5	485.4	67.7	22.1	15.6	15.6	10.5	5.3	1.1	1,846.9
1958	1,473.4	187.5	496.9	66.4	23.3	15.6	17.2	11.1	5.8	1.0	2,016.6
1959	1,458.9	187.4	466.5	65.6	22.7	15.7	16.3	11.1	5.6	1.2	1,970.1
1960	1,359.2	188.6	474.0	66.8	22.1	15.5	17.0	11.2	5.8	1.1	1,878.2

Source: SEP data for 1953-60, and estimates for previous years obtained through the use of conversion factors for the different types of meat.

^a Including butter and bacon.

^b Meat and processed products.

Table VI

Brazil: Meat production, 1948-60^a
(Tons)

Year	Beef	Pork	Mutton	Goat's flesh	Red meat	Poultry	Total
1948	910,292	116,622	17,782	12,554	1,057,250	3,927	1,061,177
1949	954,664	119,902	17,203	12,801	1,104,570	4,445	1,109,015
1950	955,956	125,315	18,836	12,012	1,112,119	4,092	1,116,211
1951	1,002,765	139,710	17,574	12,869	1,172,918	4,473	1,177,391
1949-51	971,128	128,309	17,871	12,561	1,129,869	4,337	1,134,206
1952	974,620	132,959	22,301	12,897	1,142,777	3,829	1,146,606
1953	984,813	137,469	23,784	13,524	1,159,590	4,135	1,163,725
1954	1,003,411	145,410	21,839	13,554	1,184,214	6,460	1,190,674
1952-54	987,615	138,613	22,641	13,325	1,162,194	4,808	1,167,002
1955	992,432	150,964	22,314	14,637	1,180,347	4,790	1,185,137
1956	1,076,825	160,415	20,748	15,012	1,273,000	5,316	1,278,316
1957	1,156,545	175,469	21,770	16,566	1,370,350	5,262	1,375,612
1955-57	1,075,267	162,283	21,611	15,405	1,274,566	5,123	1,279,689
1958	1,285,159	181,227	22,501	17,216	1,506,103	5,831	1,511,934
1959	1,261,076	170,235	21,891	16,347	1,469,549	5,585	1,475,134
1960	1,196,842	170,266	22,005	16,981	1,406,094	5,822	1,411,916
1958-60	1,247,692	173,909	22,132	16,848	1,460,581	5,746	1,466,327

Source: As for table I.

Note: The difference in tonnage from the figures in table 4 is due to reductions in weight.

^a Fresh meat ("green"), chilled, frozen, salted, canned, jerked, cured, etc. Excluding tongue, offal, sausage products, whether canned or not, pastes and meat extracts.

Table VII

Brazil: Value of meat production, 1948-60^a
(Thousands of cruzeiros at current prices)

Year	Beef	Pork	Mutton	Goat's flesh	Poultry	Total
1948	5,277,784	1,066,701	87,981	62,305	74,186	6,568,957
1949	6,016,407	1,146,383	86,866	68,745	86,617	7,405,018
1950	6,686,672	1,262,964	101,022	69,088	82,396	8,202,142
1951	8,604,335	1,646,728	112,101	92,335	106,844	10,562,343
1949-51	7,102,471	1,352,025	99,996	76,723	91,952	8,723,167
1952	10,772,220	1,876,170	171,170	110,773	99,236	13,029,569
1953	13,112,574	2,322,809	205,565	135,581	131,585	15,908,114
1954	17,013,089	3,099,242	255,127	171,060	261,284	20,799,802
1952-54	13,632,628	2,432,740	210,621	139,138	164,035	16,579,162
1955	23,357,518	4,076,698	346,771	248,431	212,023	28,241,441
1956	28,509,844	5,031,118	386,111	296,286	320,215	34,543,574
1957	31,854,388	5,878,031	450,103	371,260	316,501	38,870,283
1955-57	27,907,250	4,995,282	394,328	305,326	282,913	33,885,099
1958	40,056,227	7,007,660	536,351	448,621	422,800	48,471,659
1959	55,641,253	9,729,083	728,450	578,541	540,637	67,217,964
1960	88,528,558	14,866,911	1,189,153	951,894	822,825	106,359,345
1958-60	61,408,679	10,534,551	817,985	659,685	595,421	74,016,321

Source: As for table I.

^a Value of the meat included in table 4, with the same exceptions.

Table VIII
Brazil: Volume and value of milk, egg and wool production, 1948-60
(Value in thousands of cruzeiros at current prices)

Year	Milk		Hen eggs		Wool	
	Volume (thousands of litres)	Value	Volume (thousands of dozen)	Value	Volume (tons)	Value
1948	2,117,171	...	238,663	1,222,746	18,100	265,648
1949	2,305,600	3,367,186	258,840	1,437,155	17,580	322,973
1950	2,419,766	3,949,437	273,674	1,634,896	19,659	720,957
1951	2,485,232	4,683,309	277,437	1,858,040	20,533	934,809
1949-51	2,403,563	3,999,977	267,984	1,643,364	19,257	659,580
1952	2,982,611	6,387,216	311,016	2,461,828	21,233	884,029
1953	3,384,561	8,154,091	352,822	3,379,860	24,199	1,347,431
1954	3,621,828	10,074,276	386,564	4,326,041	25,360	1,428,440
1952-54	3,329,667	8,205,194	350,134	3,389,243	23,597	1,219,967
1955	3,866,407	13,326,846	418,943	5,383,792	27,520	1,576,580
1956	4,114,750	17,624,541	441,198	7,106,527	28,102	1,744,632
1957	4,274,482	20,738,715	470,547	8,955,632	28,289	2,261,589
1955-57	4,085,213	17,230,034	443,563	7,148,650	27,970	1,860,934
1958	4,464,372	25,893,895	483,288	11,225,276	31,627	3,010,577
1959	4,648,086	33,101,479	497,015	15,643,345	30,351	3,205,162
1960	4,899,816	50,843,570	520,344	21,777,647	22,686	3,044,730
1958-60	4,670,758	36,612,981	500,216	16,215,423	28,221	3,086,823

Source: As for table I.

Table IX
Brazil: Livestock slaughtered, by species, 1948-60
(Thousands of head)

Year	Cattle				Pigs	Sheep	Goats	Poultry
	Total	Steers	Cows	Calves				
1948	5,829	3,881	1,689	259	5,094	1,293	1,258	3,753
1949	6,023	3,953	1,813	257	5,072	1,192	1,294	4,145
1950	5,965	4,035	1,689	241	5,408	1,284	1,216	3,814
1951	6,452	4,337	1,886	229	5,986	1,229	1,299	4,016
1949-51	6,147	4,108	1,796	243	5,489	1,235	1,270	3,992
1952	6,003	4,074	1,725	204	6,140	1,581	1,309	3,426
1953	6,245	4,233	1,820	192	6,207	1,665	1,375	3,830
1954	6,171	4,262	1,725	184	6,328	1,516	1,378	4,951
1952-54	6,140	4,190	1,757	193	6,225	1,587	1,354	4,069
1955	6,031	4,170	1,686	175	6,474	1,562	1,464	4,268
1956	6,574	4,522	1,838	214	6,831	1,488	1,513	4,703
1957	7,033	4,574	2,146	313	7,167	1,421	1,487	4,961
1955-57	6,546	4,422	1,890	234	6,824	1,490	1,488	4,644
1958	7,857	4,907	2,647	303	7,480	1,491	1,553	5,774
1959	7,783	4,886	2,603	294	7,109	1,453	1,473	4,794
1960	7,207	4,577	2,396	234	7,092	1,427	1,518	5,433
1958-60	7,616	4,790	2,549	277	7,227	1,457	1,515	5,334

Source: As for table I.

Table X
Brazil: Index of livestock slaughtered, by species, 1948-60
(1950 = 100)

Year	Cattle				Pigs	Sheep	Goats	Poultry
	Total	Steers	Cows	Calves				
1948	97.7	96.2	100.0	107.5	94.2	100.7	103.5	98.4
1949	101.0	98.0	107.3	106.6	93.8	92.8	106.4	108.7
1950	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1951	100.2	107.5	111.7	95.0	110.7	95.7	106.8	105.3
1952	100.6	101.0	102.1	84.6	113.5	123.1	107.6	89.8
1953	104.7	104.9	107.8	79.7	114.8	129.7	113.1	100.4
1954	103.5	105.6	102.1	76.3	117.0	118.1	113.3	129.8
1955	101.1	103.3	99.8	72.6	119.7	121.7	120.4	111.9
1956	110.2	112.1	108.8	88.8	126.3	115.9	124.4	123.3
1957	117.9	113.4	127.1	129.9	132.5	110.7	122.3	130.1
1958	131.7	121.6	156.7	125.7	138.3	116.1	127.7	151.4
1959	130.5	121.1	154.1	122.0	131.5	113.2	121.1	125.7
1960	120.8	113.4	141.9	97.1	131.1	111.1	124.8	142.4

Source: Table IX.

Table XI
Brazil: Partial quantum of livestock production, 1948-60
(Value in millions of cruzeiros at 1960 prices)

Year	Meat ^a	Butter and bacon	Milk	Eggs	Wool	Total
1948	79,938	17,899	21,969	9,989	2,429	132,224
1949	83,542	17,370	23,924	10,833	2,359	138,028
1950	84,084	18,846	25,109	11,454	2,638	142,131
1951	88,693	21,197	25,788	11,611	2,756	150,045
1949-51	85,440	19,138	24,940	11,299	2,584	143,401
1952	86,374	21,092	30,949	13,017	2,850	154,282
1953	87,663	20,963	35,120	14,766	3,248	161,760
1954	89,693	22,600	37,582	16,179	3,404	169,458
1952-54	87,910	21,552	34,550	14,654	3,167	161,833
1955	89,276	22,038	40,120	17,534	3,694	172,662
1956	96,295	23,472	42,697	18,465	3,772	184,701
1957	103,625	26,747	44,355	19,694	3,797	198,218
1955-57	96,399	24,085	42,391	18,564	3,754	185,193
1958	113,894	27,350	46,325	20,227	4,245	212,041
1959	111,122	25,483	48,231	20,801	4,073	209,710
1960	106,359	26,604	50,844	21,778	3,045	208,630
1958-60	110,458	26,479	48,467	20,935	3,788	210,127

Source: As for table I.
^a Excluding tongue, edible offal, sausage products, pastes and meat extracts.

Table XII
Brazil: Index of increase in the volume of livestock production, 1948-60
(1950 = 100)

Year	Meat	Butter and bacon	Milk	Eggs	Wool	Total
1948	95.1	95.0	87.5	87.2	92.1	92.0
1949	99.4	92.2	95.3	94.6	89.4	97.1
1950	100.0	100.0	100.0	100.0	100.0	100.0
1951	105.5	112.5	102.7	101.4	104.5	105.6
1949-51	101.6	101.5	99.3	98.7	98.0	100.9
1952	102.7	111.9	123.3	113.6	108.0	108.5
1953	104.3	111.2	139.9	128.9	123.1	113.8
1954	106.7	119.9	149.7	141.3	129.0	119.2
1952-54	104.6	114.4	137.6	127.9	120.0	113.9
1955	106.2	116.9	159.8	153.1	140.0	121.5
1956	114.5	124.5	170.0	161.2	143.0	130.0
1957	123.2	141.9	176.6	171.9	143.9	139.5
1955-57	114.6	127.8	168.8	162.1	142.3	130.3
1958	135.5	145.1	184.5	176.6	160.9	149.2
1959	132.2	135.2	192.1	181.6	154.4	147.5
1960	126.5	141.2	202.5	191.1	115.4	146.8
1958-60	131.4	140.5	193.0	183.1	143.6	147.8

Source: Table XI.

Table XIII
Brazil: Quantum of meat production, 1948-60
(Value in millions of cruzeiros at 1960 prices)

Year	Beef	Pork	Mutton	Goat's flesh	Poultry	Total
1948	67,333	10,183	961	704	555	79,736
1949	70,615	10,469	930	718	628	83,360
1950	70,711	10,942	1,018	673	578	83,922
1951	74,173	12,199	950	721	632	88,675
1949-51	71,833	11,203	966	704	613	85,319
1952	72,091	11,609	1,205	723	541	86,169
1953	72,845	12,003	1,285	758	584	87,475
1954	74,221	12,697	1,180	760	913	89,771
1952-54	73,052	12,103	1,223	747	679	87,805
1955	73,409	13,182	1,206	820	677	89,294
1956	79,651	14,007	1,121	842	751	96,372
1957	85,548	15,321	1,176	929	744	103,718
1955-57	79,636	14,170	1,168	864	724	96,461
1958	95,061	15,824	1,216	965	724	113,890
1959	93,280	14,864	1,183	916	824	111,032
1960	88,529	14,867	1,189	952	823	106,360
1958-60	92,290	15,185	1,196	944	812	110,427

Source: Table VI.

Table XIV

Brazil: Index of the volume of meat production, 1948-60
(1950 = 100)

Year	Beef	Pork	Mutton	Goat's flesh	Poultry	Total
1948	96.2	93.1	94.4	104.6	96.0	95.0
1949	99.9	95.7	91.4	106.7	108.7	99.3
1950	100.0	100.0	100.0	100.0	100.0	100.0
1951	104.9	111.5	93.3	107.1	109.3	105.7
1949-51	101.6	102.4	94.9	104.6	106.0	101.7
1952	102.0	106.1	118.4	107.4	93.6	102.7
1953	103.0	109.7	126.2	112.6	101.0	104.2
1954	105.0	116.0	115.9	112.9	158.0	107.0
1952-54	103.3	110.6	120.2	111.0	117.5	104.6
1955	103.8	120.5	118.5	121.8	117.1	106.4
1956	112.6	128.1	110.1	125.1	129.9	114.8
1957	121.0	140.0	115.5	138.0	128.7	123.6
1955-57	112.5	129.5	114.7	128.3	125.2	114.9
1958	134.4	144.6	119.5	143.4	142.6	135.7
1959	131.9	135.8	116.2	136.1	136.5	132.3
1960	125.2	135.9	116.8	141.5	142.4	126.7
1958-60	130.5	138.8	117.5	140.3	140.5	131.6

Source: Table XI.

Table XV

Brazil: per capita production of red carcass meat, milk and eggs, 1949-60

Year	Meat ^a (kilogrammes)	Milk (litres)	Eggs (units)	Year	Meat ^a (kilogrammes)	Milk (litres)	Eggs (units)
1949	28.5	45.4	61.2	1955	26.0	63.7	82.9
1950	27.9	46.6	63.2	1956	28.0	65.8	84.6
1951	29.0	46.4	62.1	1957	28.6	66.2	87.6
1949-51	28.5	46.1	62.2	1955-57	27.5	65.3	85.0
1952	27.4	53.9	67.5	1958	30.2	67.1	87.1
1953	27.2	59.3	74.2	1959	28.6	67.7	86.9
1954	27.2	61.5	78.9	1960	26.4	69.2	88.2
1952-54	27.3	58.4	73.7	1958-60	28.4	68.0	87.4

Source: As for table I.

^a The figures for 1949 and 1952 were calculated on the basis

of total estimated production of carcass meat in those years. In the case of pork carcasses, lard and bacon were included.

Table XVI

Brazil: Indices of per capita production of red meat, milk and eggs, 1949-60
(1950 = 100)

Year	Red meat	Milk	Eggs	Year	Red meat	Milk	Eggs
1949	102.2	97.4	96.8	1955	93.2	136.7	131.2
1950	100.0	100.0	100.0	1956	100.4	141.2	133.9
1951	103.9	99.6	98.3	1957	102.5	142.1	138.6
1949-51	102.1	98.9	98.4	1955-57	98.7	140.1	134.5
1952	98.2	115.7	106.8	1958	108.2	144.0	137.8
1953	97.5	127.3	117.4	1959	102.5	145.3	137.5
1954	97.5	132.0	124.8	1960	94.6	148.5	139.6
1952-54	97.7	125.3	116.6	1958-60	101.8	145.9	138.3

Source: As for table I.

Table XVII
Brazil: Indices of meat production and cattle slaughtering, 1944-60
(1950 = 100)

Year	Beef production	Cattle slaughtered	Steers	Cows	Calves
1944	65.5	67.7	69.9	59.2	90.0
1945	66.6	70.5	75.8	53.9	97.5
1946	77.0	81.7	84.8	70.6	109.1
1947	83.7	87.2	87.8	81.1	120.7
1948	95.2	97.7	96.2	100.0	107.5
1949	99.9	101.0	98.0	107.3	106.6
1950	100.0	100.0	100.0	100.0	100.0
1951	104.9	108.2	107.5	111.7	95.0
1952	102.0	100.6	101.0	102.1	84.6
1953	103.0	104.7	104.9	107.8	79.7
1954	105.0	103.5	105.6	102.1	76.3
1955	103.8	101.1	103.3	99.8	72.6
1956	112.6	110.2	112.1	108.8	88.8
1957	121.0	117.9	113.4	127.1	129.9
1958	134.4	131.7	121.6	156.7	125.7
1959	131.9	130.5	121.1	154.1	122.0
1960	122.1	120.8	113.4	141.9	97.1

Source: Basic data on cattle slaughtering from SEP.

Table XVIII
Brazil: Distribution of cattle slaughtering, 1940-60
(Percentage)

Year	Steers	Cows	Calves	Year	Steers	Cows	Calves
1940	86.53	11.12	2.35	1951	67.22	29.23	3.55
1941	71.11	24.79	4.10	1952	67.87	28.73	3.40
1942	65.21	30.97	3.82	1953	67.78	29.14	3.08
1943	66.81	28.44	4.75	1954	69.06	27.95	2.99
1944	69.85	24.78	5.37	1955	69.14	27.95	2.91
1945	72.73	21.67	5.60	1956	68.79	27.96	3.25
1946	70.15	24.45	5.40	1957	65.04	30.51	4.45
1947	68.10	26.31	5.59	1958	62.45	33.69	3.86
1948	66.58	28.98	4.44	1959	62.78	33.44	3.78
1949	65.63	30.10	4.27	1960	63.51	33.24	3.25
1950	67.64	28.31	4.05				

Source: As for table XVII.

Table XIX
Brazil: Cattle slaughtering rate and meat yield, 1949-60

Year	Slaughtering rate	Carcass meat per animal slaughtered (kilogrammes)	Carcass meat per head of stock ^a (kilogrammes)	Year	Slaughtering rate	Carcass meat per animal slaughtered (kilogrammes)	Carcass meat per head of stock ^a (kilogrammes)
1949	12.3	181.6 ^b	20.2 ^b	1955	9.5	187.7	17.8
1950	11.3	180.1	20.4	1956	9.9	194.3	19.2
1951	12.1	176.0	21.2	1957	10.1	187.5	19.0
1952	10.8	183.0	19.7	1958	11.0	187.5	20.6
1953	10.8	179.1	20.6	1959	10.4	187.4	20.0
1954	10.2	186.7	19.0	1960	9.7 ^c	188.6	18.3 ^c

Source: Basic data on inventories, cattle slaughtered and meat yield from SEP.
^a Meat yield from cattle carcasses, divided by annual inventories.

^b The figures for 1949-52 are estimates, since no statistics on carcass meat yield were published before 1953.
^c The low figures may be partly due to overestimation of inventories.

Table XX

Brazil: Animal diseases recorded by the federal service, 1960^a

Diseases	Norte	Nordeste	Eastern part of Norte	Stock- farming area in central Brazil	Sul	Total
Strangles	6	46	—	65	61	178
Bovine anaplasmosis	—	66	—	1	—	7
Actinobacillosis	—	—	—	2	—	2
Actinomycosis	—	—	—	2	—	2
Bovine brucellosis	—	23	3	68	9	103
Brucellosis (pigs)	—	—	—	12	—	12
Verminous bronchopneumonia ...	—	1	—	8	—	9
Cysticercosis (pigs)	—	—	—	63	1	64
Anthrax	1	17	3	12	69	103
Clostridium chauvoei	8	72	5	86	53	224
Fowl cholera	13	127	—	55	32	227
Malignant catarrhal fever.....	4	—	—	4	—	8
Infectious coryza	2	15	—	9	—	26
Dermatobia and tick paralysis....	—	4	—	1	—	5
Verminous bronchitis	—	—	—	—	1	1
Hydatidosis	—	—	—	52	—	52
Contagious pustular dermatitis...	—	—	—	—	2	2
Bovine coccidiosis	—	—	—	1	—	1
Avian coccidiosis	—	1	—	1	1	3
Avian spirochaetosis	1	10	—	—	—	11
Strongylosis	—	—	—	1	—	1
Equine encephalomyelitis	2	71	1	3	—	77
Contagious epithelioma	6	38	—	29	17	90
Kidney worm infestation.....	—	—	—	61	—	61
Foot-and-mouth disease	29	365	53	150	90	687
Parasitic gastroenteritis	—	—	—	16	—	16
Botfly infestations	—	—	—	—	—	1
Swine influenza	—	—	—	3	—	3
Helminthiasis	—	—	—	—	2	2
Habronemiasis	1	—	—	—	1	2
Mastitis	1	10	—	15	3	28
Glanders	—	—	—	2	—	2
Verminous bronchitis (pigs).....	—	—	—	1	—	1
Avian neuroleucosis complex.....	—	—	—	1	—	1
Newcastle disease	11	97	3	19	23	153
Necrobacillosis	—	—	1	2	—	3
Oestriasis (sheep)	—	—	—	—	1	1
Pneumoenteritis (pigs)	—	—	3	19	8	30
Pneumoenteritis (calves)	1	37	—	—	17	63
Hog cholera	3	230	1	178	105	517
Enzootic pneumonia (pigs).....	—	—	—	45	38	83
Bovine paratyphosis	—	—	—	5	—	5
Paratyphosis (pigs)	—	—	—	4	19	23
Bovine pasteurellosis	—	—	—	5	—	5
Bovine piroplasmosis	—	16	—	18	27	61
Bovine paratuberculosis	—	—	—	1	—	1
Pullorum disease	—	18	—	1	—	19
Pseudorabies	—	—	—	5	—	5
Bovine pneumonia	—	—	—	12	—	12
Rabies of herbivorous animals....	12	144	70	90	78	394
Infectious rhinitis	—	—	—	4	—	4
Bovine salmonellosis	1	—	3	13	—	17
Bovine trypanosomiasis	—	1	—	2	—	3

Table XX (continued)

<i>Diseases</i>	<i>Norte</i>	<i>Nordeste</i>	<i>Eastern part of Norte</i>	<i>Stock- farming area in central Brazil</i>	<i>Sul</i>	<i>Total</i>
Equine trypanosomiasis	4	—	—	9	—	13
Bovine tuberculosis	—	7	—	24	—	31
Tuberculosis (pigs)	—	—	—	12	—	12
Fowl typhoid	—	4	—	17	15	36
Trichinosis (pigs)	—	—	—	3	—	3
Equine tetanus	—	1	—	—	—	1
Cow pox	—	—	—	7	—	7
Bovine verminosis	9	1	—	64	35	109
Verminosis (pigs)	3	1	—	53	37	94
Verminosis (sheep)	—	—	—	1	3	4

^a The findings recorded in this table were made by the Ministry of Agriculture, Department of Livestock Production, Animal Health Service, between 1 December 1959 and 30 November 1960. For this reason they do not include the cases of illness registered by the State Health Services, the Institutes of Animal Biology, the Laboratory for the Physiopathology of Reproduction, private veterinary services, etc.

Table XXI

Brazil: Private meat and meat-product establishments federally controlled by DIPOA, 1961

<i>State</i>	<i>Slaughter- houses</i>	<i>Meat- packing plants</i>	<i>Slaughter- houses for poultry</i>	<i>Jerking plants</i>	<i>Packing plants for pork products</i>	<i>Canning plants</i>	<i>Fish canneries</i>	<i>Fish depots</i>	<i>Depots for meat and meat products</i>	<i>Plants for fat products</i>	<i>Plants for egg pre- serving</i>	<i>Plants for non-edible products</i>
Amazonas	—	—	—	—	—	—	—	—	—	—	—	1
Pará	—	—	—	—	—	—	—	—	1	—	—	—
Ceará	—	1	—	—	1	—	1	3	1	1	—	—
Maranhão	1	—	—	—	—	—	1	—	—	—	—	—
Rio Grande do Norte	—	—	—	—	—	—	—	—	7	—	—	—
Pernambuco	1	1	—	—	—	—	2	5	3	3	—	—
Sergipe	—	—	—	—	—	—	—	—	4	—	—	—
Alagoas	—	—	—	—	—	—	—	—	1	—	—	—
Bahía	—	2	—	—	—	—	—	—	5	1	—	—
Minas Gerais	9	3	2	11	12	6	—	—	—	—	—	—
Espírito Santo	1	—	—	—	—	—	—	—	—	—	—	—
Rio de Janeiro	5	1	5	—	3	6	40	3	—	—	—	1
Guanabara	—	—	—	—	—	2	—	1	4	1	—	—
Mato Grosso	—	—	—	8	—	—	—	—	—	—	—	—
Goiás	3	—	—	7	3	—	—	—	—	—	—	—
São Paulo	10	8	2	—	7	7	—	—	8	7	1	8
Paraná	—	2	1	—	2	3	—	—	2	—	—	1
Santa Catarina	—	4	—	—	18	—	10	10	1	—	—	—
Rio Grande do Sul ...	3	11	1	10	47	2	32	—	1	1	1	—
TOTAL	33	33	11	36	93	26	86	22	38	14	2	11

Table XXII

Brazil: Private meat and meat-packing establishments, 1961

<i>Type</i>	<i>Number</i>
Meat-packing plants	154
Jerking plants	25
Plants available for jerking.....	34
Packing plants for pork products.....	625
Slaughterhouses	224
Slaughterhouses for poultry.....	22

Sources: As for table I (1956) and DIPOA (1961).

Table XXIII

Brazil: Total apparent meat consumption in terms of carcasses, 1948-60

(Thousands of tons)

Year	Beef	Pork	Mutton	Goat's flesh	Total red meat	Poultry	Total red meat and poultry
1948	979.5	324.6	19.3	12.6	1,336.0	3.9	1,339.9
1949	1,046.9	322.4	17.9	12.8	1,400.0	4.4	1,404.4
1950	1,044.2	344.6	20.3	12.0	1,421.1	4.1	1,425.2
1951	1,118.7	385.7	18.3	12.9	1,535.6	4.5	1,540.1
1949-51	1,069.9	350.9	18.8	12.6	1,452.2	4.3	1,456.5
1952	1,099.2	380.2	25.1	12.9	1,517.4	3.8	1,521.2
1953	1,116.6	393.8	26.3	13.5	1,550.2	4.1	1,554.3
1954	1,155.8	408.4	23.2	13.6	1,601.0	6.5	1,607.5
1952-54	1,123.9	394.1	24.9	13.3	1,556.2	4.8	1,561.0
1955	1,122.3	405.4	24.3	14.4	1,566.4	4.8	1,571.2
1956	1,262.2	437.1	22.0	15.0	1,736.3	5.3	1,741.6
1957	1,285.8	485.4	22.1	15.6	1,808.9	5.3	1,814.2
1955-57	1,223.4	442.6	22.8	15.0	1,703.8	5.1	1,708.9
1958	1,415.1	495.3	23.3	17.2	1,950.9	5.8	1,956.7
1959	1,354.9	465.5	21.9	16.3	1,858.6	5.6	1,864.2
1960	1,333.0	473.6	22.1	17.0	1,845.7	5.8	1,851.5
1958-60	1,367.7	478.1	22.4	16.8	1,885.0	5.7	1,890.7

Sources: Data for 1953-60 supplied by DIPOA, and estimates for 1948-52 based on production figures published by SEP, on the conversion factors for the different kinds of meat and on the balance of foreign trade in meat.

Table XXIV

Brazil: Per capita meat consumption in terms of carcasses, 1948-60

(Kilogrammes)

Year	Beef	Pork	Mutton	Goat's flesh	Total red meat	Poultry	Total red meat and poultry
1948	19.75	6.55	0.39	0.25	26.94	0.08	27.02
1949	20.62	6.35	0.35	0.25	27.57	0.09	27.66
1950	20.09	6.63	0.39	0.23	27.34	0.08	27.42
1951	20.87	7.19	0.34	0.24	28.64	0.08	28.72
1949-51	20.53	6.72	0.36	0.24	27.85	0.08	27.93
1952	19.88	6.88	0.45	0.23	27.44	0.07	27.51
1953	19.58	6.91	0.46	0.24	27.19	0.07	27.26
1954	19.65	6.94	0.39	0.23	27.21	0.11	27.32
1952-54	19.70	6.91	0.43	0.23	27.27	0.08	27.35
1955	18.50	6.68	0.40	0.24	25.82	0.08	25.90
1956	20.17	6.99	0.35	0.24	27.75	0.08	27.83
1957	19.93	7.52	0.24	0.24	28.03	0.08	28.11
1955-57	19.53	7.06	0.36	0.24	27.19	0.08	27.27
1958	21.26	7.44	0.35	0.26	29.31	0.09	29.40
1959	19.74	6.78	0.32	0.24	27.08	0.08	27.16
1960	18.83	6.69	0.31	0.24	26.07	0.08	26.15
1958-60	19.94	6.97	0.33	0.25	27.49	0.08	27.57

Source: Table XXIII.

Table XXV

Brazil: Apparent consumption of milk products in terms of fluid milk, 1949-60
(Thousands of litres)

	1949	1950	1949-50	1957	1958	1959	1960	1958-60
Pasteurized milk	149,999	161,460	155,730	273,867	303,577	324,136	353,012	326,908
Raw milk	426,401	443,482	434,942	794,754	812,516	837,885	871,942	840,781
Powdered milk ^a	68,636	82,912	75,774	338,342	315,795	328,321	335,174	326,430
Condensed and evaporated milk...	48,089	49,993	48,041	43,316	51,524	48,619	50,522	50,222
Cheese	213,560	240,730	227,145	341,940	407,670	386,010	394,550	396,076
Uninspected products ^b	998,325	1,047,759	1,023,042	1,850,851	1,933,073	2,012,621	2,106,921	2,017,538
Other consumption	421,769	406,762	414,266	738,167	700,217	741,475	822,841	754,844
TOTAL	2,324,779	2,433,098	2,378,940	4,381,237	4,524,372	4,679,067	4,934,962	4,712,800
Per capita consumption (litres)....	45.8	46.8	46.3	67.9	68.0	68.2	69.7	68.6

Source: *Anuario Estatístico do Brasil*.

Note: Butter has been excluded to avoid duplication since it is considered to be a processed product.

^a Including imports of powdered milk in terms of fluid milk.

^b Including cheese, curds and other products of uninspected small urban and rural plants. It is calculated that these industries absorbed 43.3 per cent of total milk production in 1957, and in the absence of additional information the same proportion was adopted for the whole period.

Table XXVI

Brazil: Average retail prices for meat, milk and eggs in the capitals of the Federal States, 1940-61

Year	Beef ^a (cruzeiros per kilogramme)	Milk (cruzeiros per litre)	Eggs (cruzeiros per dozen)	Year	Beef ^a (cruzeiros per kilogramme)	Milk (cruzeiros per litre)	Eggs (cruzeiros per dozen)
1940	2.14	1.10	2.50	1951	10.26	4.26	13.57
1941	2.38	1.09	2.73	1952	13.90	4.87	15.07
1942	2.78	1.18	3.45	1953	16.30	5.05	18.69
1943	3.30	1.37	4.06	1954	20.46	5.65	22.42
1944	4.31	1.73	5.66	1955	28.09	6.83	25.65
1945	5.30	1.90	7.40	1956	33.64	8.31	32.74
1946	5.90	2.60	9.00	1957	39.71	10.42	40.31
1947	6.80	3.20	9.90	1958	44.45	12.51	46.15
1948	6.90	3.30	10.50	1959	55.11	16.83	57.86
1949	7.85	3.54	11.59	1960 ^b	84.76	18.83	77.80
1950	9.06	3.72	12.27	1961	129.12	27.35	113.13

Source: *Boletim Estatístico do Brasil*.

^a Fresh meat with bones.

^b The prices for 1960 and 1961 are the average for April.

Table XXVII

Brazil: Average retail prices for selected foodstuffs in the capitals
of the Federal States, 1940-61
(Cruzeiros per kilogramme)

Year	Sugar	Rice	Potatoes	Manioc flour	Wheat flour	Beans	Maize	Bread
1940	1.40	1.22	1.54	0.62	1.62	1.22	0.43	1.87
1941	1.48	1.63	1.65	0.72	1.71	1.34	0.49	1.94
1942	1.71	2.06	1.78	0.96	1.89	1.33	0.63	2.13
1943	2.16	2.11	2.44	1.16	2.32	1.44	0.80	2.44
1944	2.53	2.43	3.35	1.49	2.81	1.95	0.99	2.83
1945	2.94	2.83	5.40	1.71	3.24	2.36	1.12	3.33
1946	3.30	3.30	6.20	2.00	5.20	3.00	1.40	5.30
1947	3.50	3.50	6.30	2.10	6.30	3.70	1.60	6.50
1948	3.86	4.28	5.89	2.45	8.18	4.55	1.85	8.00
1949	4.34	5.28	6.04	3.10	7.75	4.48	1.94	7.89
1950	4.88	4.98	6.57	2.90	7.09	4.05	1.86	7.22

Table XXVII (continued)

Year	Sugar	Rice	Potatoes	Manioc flour	Wheat flour	Beans	Maize	Bread
1951	5.07	5.18	7.83	3.25	7.34	4.78	2.20	7.38
1952	5.66	5.92	7.87	4.51	8.40	6.49	2.75	8.45
1953	5.93	9.36	9.75	4.98	9.14	8.25	3.27	8.93
1954	7.21	11.91	11.67	5.08	8.68	7.32	3.26	9.84
1955	9.29	11.51	13.14	5.34	11.68	13.82	4.26	11.90
1956	13.03	14.10	16.71	7.37	15.21	19.84	5.64	15.79
1957	15.26	19.84	19.10	10.88	18.90	20.14	6.60	19.38
1958	15.62	21.12	23.59	12.85	20.27	20.36	7.67	21.50
1959	20.70	26.30	31.56	13.19	30.14	30.57	9.43	31.38
1960 ^a	22.92	31.60	40.16	14.60	31.54	56.41	9.76	33.16
1961	32.40	35.92	48.20	20.64	52.91	38.95	14.71	57.08

Source: As for table XXVI.

^a The prices for 1960 and 1961 are the average for April.

Table XXVIII

Brazil: Market price index for staple foodstuffs in the capitals of the Federal States, 1940-61
(1950 = 100)

Year	Weighted price index for staple foodstuffs ^a	Price index for beef	Price index for milk	Price index for eggs	Year	Weighted price index for staple foodstuffs ^a	Price index for beef	Price index for milk	Price index for eggs
1940	24.3	23.6	29.6	20.4	1951	109.9	113.2	114.5	110.
1941	28.2	26.3	29.3	22.2	1952	133.5	153.4	130.9	122.8
1942	34.1	30.7	31.7	28.1	1953	165.1	179.9	135.8	152.
1943	39.9	36.4	36.8	33.1	1954	182.3	225.8	151.9	182.
1944	49.0	47.6	46.5	46.1	1955	213.5	310.1	183.6	209.0
1945	58.3	58.5	51.1	60.3	1956	282.5	371.3	223.4	266.8
1946	72.1	65.1	69.9	73.3	1957	357.5	438.3	280.1	328.
1947	79.8	75.1	86.0	80.7	1958	395.6	490.6	336.3	376.1
1948	94.1	76.2	88.7	85.6	1959	498.3	608.3	452.4	471.
1949	104.0	86.6	95.2	94.5	1960 ^b	601.3	935.5	506.2	634.
1950	100.0	100.0	100.0	100.0	1961	750.2	1,425.2	735.2	921.8

Source: Tables XXVI and XXVII.

^a Weighted by 1950 production.^b The indices for 1960 and 1961 are the average prices April.

Table XXIX

Brazil: Relative price index for meat, milk and eggs in the State capitals, 1940-61
(1950 = 100)

Year	Meat	Milk	Eggs	Year	Meat	Milk	Egg
1940	99.7	121.8	84.0	1951	103.0	104.2	100.
1941	93.3	103.9	78.7	1952	114.9	98.1	92.
1942	90.0	93.0	82.4	1953	109.0	82.3	92.
1943	91.2	92.2	83.0	1954	123.9	83.3	100.
1944	97.1	94.9	94.1	1955	145.2	86.0	97.
1945	100.3	87.8	103.4	1956	131.4	79.1	94.
1946	90.3	96.9	101.7	1957	122.6	78.3	91.
1947	94.1	107.8	101.1	1958	124.0	85.0	93.
1948	81.0	94.3	91.0	1959	122.1	90.8	94.
1949	83.3	91.5	90.9	1960 ^a	155.6	84.2	105
1950	100.0	100.0	100.0	1961	190.0	98.0	122

Source: Table XXVIII.

^a The indices for 1960 and 1961 are the average prices for April.

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