1969

Urban-rural developmental interrelationships in Minas Gerais, Brazil, 1940-1960

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URBAN-RURAL DEVELOPMENTAL INTERRELATIONSHIPS IN MINAS GERAIS, BRAZIL, 1940-1960

by

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A Dissertation Submitted to the
Graduate Faculty in Partial Fulfillment of
The Requirements for the Degree of
DOCTOR OF PHILOSOPHY

Major Subject: Agricultural Economics

Approved:

Signature was redacted for privacy.

In Charge of Major Work

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Signature was redacted for privacy.

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Iowa State University
Of Science and Technology
Ames, Iowa

1969

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I. INTRODUCTION

Economic development is a very uneven process. This applies not only to the sectoral expansion within the economy, but also to the geographic dispersion of economic activity.

These comments apply directly to the development process in Brazil. As will be shown below in Chapter II, Brazil has had one of the most rapid rates of development of any country in the world in the post-war period. However, the difference in growth rate among sectors is very great, and there are important regional disparities in the growth rate.

In response to intensive development efforts, implemented largely through an import-substitution-industrialization development policy, industrial output has expanded rapidly. Agricultural output has expanded at about the same rate as expansions in demand, and the service sector has been somewhat of a residual category.

The benefits of this development have not been widely distributed, however. The industrial sector has not absorbed an increasing fraction of the labor force, despite its rapid increase in GNP. Labor has left the agricultural sector in relatively large flows, and per capita incomes have risen in that sector. But it appears that this labor is being channeled into the service sector, where a decline in per capita incomes is taking place.

Perhaps more importantly, Brazil is characterized by very-wide regional disparities in growth. At one extreme is the very rapid development of Sao Paulo--blessed in many respects with a modern economy typical of much more advanced countries. At the other extreme is the poverty-

stricken Northeast, where economic activity is relatively stagnant and per capita incomes are extremely low. In between are all degrees of variation.

What has been said in a general way about the economy applies with equal force to the agricultural sector. In some regions, notably Sao Paulo, the agricultural sector is relatively productive, uses modern inputs, and is growing at a rapid rate. In other regions, the agriculture remains stagnant and tradition bound. Production practices are still the same as those used a century ago, and per capita incomes are unchanging. To summarize, the modernization and development process is not being dispersed throughout the economy.

The general objective of this thesis is to increase our understanding of the way in which the development process is spread through the economy. This will be done by examining the inter-sectoral relations between the farm and non-farm sectors, and by testing hypothesis about the relations between industrial development and agricultural development.

A. The Study Area

Minas Gerais[1] is an important state in Brazil, economically as well as politically. It is larger than France, and larger than all the countries of Latin America except for Mexico and Argentina. Its population is approximately 11 million.

In many respects it is a strategic state in the Federation. Its relative size and strategic location give it a major role in the econ-

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[1]The state is also known by the name of Minas simply. In this thesis, both designations were used for the sake of variety.

omy, and in political affairs. Most of the important banks in Brazil have their headquarters in Minas Gerais.

In terms of stage of development, it is somewhere between the relatively-highly developed state of Sao Paulo, and the poverty-stricken Northeast. It is well-endowed with natural resources, and has some of the richest iron ore deposits in the world.[2]

With the construction of Brasilia, Minas Gerais has been the focus of a substantial development process. A large fraction of the state lies within the Industrial Triangle formed by Belo Horizonte, Rio de Janeiro and Sao Paulo. Its capital city, Belo Horizonte, is one of the most-rapidly growing in the world (already approximately 1 million), and has a rapidly-growing industrial sector based on the nearby iron ore mines.

However, the rate of development within the state is very uneven. Population is distributed heavily to the regions near the seacoast (Minas Gerais is itself an interior state), and large parts of the interior are only sparsely settled. The state has been a major exporter of population for a long period of time.

The agriculture of Minas Gerais is also very unevenly developed. Parts of the northern half of the state are included in the drought polygon of the Northeast. The Zona da Mata, in the southeast, is one of the oldest, most traditionally-bound zones in the country. On the other hand, southern Minas Gerais has a reasonably well-developed dairy industry which is integrated into the market economies of Sao Paulo and

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[2]Minas Gerais was the home of valuable jewel and gold mines--which were important in the settlement of Brazil. Hence its name: "General Mines."

Rio de Janeiro. To the west, especially in the Minas Triangle (Triangulo Mineiro) is one of the most fertile agricultural areas in Brazil.

Because of this very-wide geographical disparity in the level of general economic development, and in agricultural development, Minas Gerais provides an opportunity to test hypotheses about interrelations between farm and non-farm development, and to examine the relations between the various sectors of the economy. It has the added advantage of in many respects being "typical" of Brazil. Many of the aggregate indices of the Minas Gerais economy are quite similar to those for Brazil taken as a whole. In this respect it has the potential for being a micro-cosm of the nation at large.

B. Objectives and Procedures

The specific objectives of the research reported in this thesis are:

1. To study the structural characteristics of the urban and agricultural sectors in Minas Gerais, with comparisons to other regions and the national economy.

2. To test hypotheses about the interrelations within the urban sector.

3. To test hypotheses about the extent to which urban-industrial development is correlated with agricultural development in Minas Gerais.

4. To compare the results of the analysis with those of a similar study made for the state of Sao Paulo.

The analysis is based on data drawn from the 1940, 1950, and 1960

Censuses. Aggregate indices are synthesized for geo-economic zones within the state. The basic units of measurement are county (municipio) averages, but these are grouped into geographic zones.

Non-parametric methods are used in testing hypotheses about the inter-sectoral relations. More specifically, Spearman rank correlation coefficients are estimated among the various data series in order to determine the degree of relation between the indicators of urban-industrial and agricultural development. These correlations are the basis for the analysis.

C. Some Related Studies

The analytical framework on which the present research is based owes its intellectual heritage to T. W. Schultz (45). Schultz was concerned with the spatial difference in labor incomes within the agricultural sector. His immediate concern was the fact that the poverty problems of U. S. agriculture had significant regional dimensions. For example, Schultz observed that in 1945 one county in Kentucky had an index of 5 on the Hagood farm-operator family living index, while another county in Iowa had an index of 196 (45, p. 153 ftn). A difference such as this is comparable to the difference existing in 1947 between China and the U. S. in terms of Colin Clark's data on levels of real national product per manhour.

To explain these regional disparities in income within agriculture, Schultz developed a spatial-development hypothesis, or what has come to be known as the industrial-urban hypothesis. Briefly summarized, this hypothesis is as follows: (a) economic growth occurs at different loca-

tions and at different times in a country, (b) the centers of growth are primarily industrial-urban in composition, (c) the existing economic organization works better at or near the center of a particular matrix of economic development, and it also works best in those parts of agriculture situated favorably in relation to such a matrix.

Thus, the income level of agriculture in a community which experiences industrial-urban growth can be expected to increase relative to that in a community which does not experience such growth. Moreover, because of a spatial adjustment lag, the closer a community is to a center, the higher would be the income level of agriculture in the community.

Schultz goes on to argue that there are three factors accompanying industrial growth which create regional income disparities:

a. An increase in the proportion of the population engaged in productive work.

b. An increase in the productivity of the labor force from such factors as increased investments in education.

c. A reduction in the impediments to factor-price equalization, or a reduction in the imperfections in the factor and product markets faced by agriculture.

This hypothesis has been tested in the U. S. economy by Ruttan (38), Nicholls (35), Tang (50 and 51), Sisler (48 and 49), Bachmura (2), Sinclair (47), and Bryant (19). The results of these tests have not been uniformly favorable to the hypothesis, and as a result the theory has been refined and extended to a more general framework.

In brief form the results from testing the hypothesis with U. S. data are as follows:

1. Ruttan, Nicholls, and Tang--each of them working with data from the Southeastern United States--found the data to be consistent with the hypothesis.

2. Bachmura obtained similar results for the lower Mississippi Valley, as did Sinclair for the South as a whole.

3. Sisler and Bryant, by extending the analysis to include the total United States, found the hypothesis to be lacking.

a. Sisler found that the hypothesis was borne out by the data from east of the Mississippi River, but not so by the data from west of the Mississippi.

b. Bryant used a larger analytical frame of reference, and a different set of data, but obtained results similar to those of Sisler. He found that east of the Mississippi River, the closer a county is to an industrial complex and the larger the complex, the higher are the earnings of farmers. However, the reverse is true in the divisions west of the Mississippi. Hence, the hypothesis not only failed for the western part of the United States, but a relationship was found which operated in the opposite direction to that postulated.

Nicholls tested the hypothesis with data from the state of Sao Paulo in Brazil (36 and 37). He used data from the 1940 and 1950 censuses, and took per capita value added by manufacturing as a proxy for urban-industrial development. He correlated the 1950 rankings in per capita value added by manufacturing of the 23 physiographic zones of Sao Paulo with the

rankings of indices measuring the performance of the urban and rural sector, including some social-educational characteristics. In general he found the data to be supportive of the hypothesis.

Schuh (41), in commenting on Nicholls' paper (37), raised basically two issues. The first was the question of causality. In the case of Sao Paulo, Schuh argued that the causality probably went the other direction. That is, a prosperous agriculture was probably what gave rise to a strong local industrial sector. Secondly, he questioned whether the industrial-urban "effect" was as dependent on the reduction in imperfections in the factor and product markets as Nicholls implied.

Two other studies are peripherally related to this research. Youmans and Schuh (53), in seeking to test hypotheses about the existence of underemployed labor in Minas Gerais agriculture, found a very mixed picture. Two of the five regions they studied were found to have excess labor, but two others were found to have actual labor shortages. Only one of the five regions was reasonably close to equilibrium. They concluded from this that the labor market appeared to be performing very imperfectly, but that this involved much more than a failure to transfer labor out of agriculture rapidly.

Schuh and Whitaker (44) examined the labor market in a larger context, and again found important imperfections. Their data indicate that sectoral disparities in per capita incomes are increasing over time, with the industrial sector increasing very rapidly, the agricultural sector increasing somewhat, and the service sector declining. Labor leaving the agricultural sector is forced into the service sector, with

the rapidly-growing industrial sector being essentially walled off from the rest of the economy.

D. Organization of the Remainder of the Thesis

Background data on the Brazilian economy and in particular on Minas Gerais are presented in the next chapter. In Chapter III, the analytical and statistical models are presented, together with a listing of the hypotheses to be tested. The empirical results are presented in Chapter IV, and in Chapter V conclusions are presented and suggestions for further research are given.

II. BACKGROUND

The objective of this chapter is to provide background material which will help in interpreting the analysis which is to follow. The chapter is divided into two parts. The first part provides material on the general economy of Brazil in the post-World War II period. The second part provides some basic data on the state of Minas Gerais, with a comparative analysis in relation to some other pivotal states and regions.

A. The Postwar Development of Brazil[1]

Brazil is larger than the continental United States, and spans approximately half of the continent of South America. It has climatic and ecological conditions ranging from the temperate in the south to the tropical in the north.

The state of general development, as well as agricultural development, varies widely from region to region. The South, particularly, the state of Sao Paulo, has a well-developed industrial sector, and an agriculture that is almost as productive and modern. The poverty-stricken Northeast, on the other hand, has little industrialization, a very traditional, poor agriculture, and in general quite low per capita incomes. Minas Gerais lies somewhere between these two extremes on the development spectrum.

In 1965 the population of Brazil was estimated to be 81 million, with roughly half of this classified as urban. Since 1950 this population has

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[1] A good general reference on the economic development of Brazil in the post-war period can be found in Baer, Werner (3).

been increasing at a rate of about 3.0% per year. It is distributed very unevenly over the land mass, with the major portion concentrated along the seacoast. Detail on regional distribution can be found in Table 1.[2]

Table 1. Brazilian regional population, 1960[a]

Region	Population (1,000)	Density (Number of People per Square Kilometer)
North	2,602	.73
Northeast	15,678	16.35
East	24,832	19.90
South	24,848	30.47
Central West	3,007	1.60
Brazil	70,967	8.38

[a]Source: Schuh and Alves (42, pg. 40).

Estimated gross national product was estimated to be $11.3 billion in 1963. Average per capita income was estimated to be about $360, with very wide differences among regions. Average per capita income in the Northeast, for example, was estimated to be around $100.

In the post-war period the government had pursued an explicit import-substitution industrialization policy. The result has been one of the most rapid, sustained increases in industrial output of any country in the world. Agriculture tended to be neglected, but despite this, per-

[2]The regional classification used throughout this thesis is that used by IBGE (6 and 7).

formed reasonably well. Data below will show that agricultural output expanded about in accord with the increase in demand, with the result that there was no significant shift in the terms of trade in the aggregate. However, it would appear that agriculture did not make the contribution to total development that it might have made had some attempt been made at modernizing this important sector.

Table 2 provides indices of the total and sectoral domestic product (1953 = 100), and the annual percentual variation of each for the period 1947-1965. During the 1947-1962 period, the total domestic product grew at an average rate of 6% per year. The rates of growth of domestic product for the agricultural, industrial and services sectors were respectively: 4.7%, 9.5%, and 5.1% (43, page 33). Since 1963, the rates of growth of the total net product have been much smaller. Indeed, in 1963 this rate was even negative, due to a large decline in the secondary sector. In 1964 the tertiary sector had a negative rate and in the following year the industrial sector again had a negative rate, although much smaller than that of 1963.

The participation of these sectors in the total net domestic product is presented in Table 3. This table shows that, in view of the differential rates of growth, the participation of the agricultural sector fell from 32.4% in 1947 to 26.6% in 1962, and that of the services sector from 47.1% in 1947 to 40.2% in 1962. On the other hand, the participation of the industrial sector in the total net domestic product rose from 20.5% in 1947 to 33.2% in 1962.

Table 2. Variations in total and sectoral net domestic product, 1947-1962[a]

Year	Total Domestic Product		Primary Sector (Agriculture)		Secondary Sector (Industry)		Tertiary Sector (Services)	
	Index (1953=100)	Percentage Variations	Index (1953=100)	Percentage Variations	Index (1953=100)	Percentage Variations	Index (1953=100)	Percentage Variations
1947	71.9	--	80.1	--	66.2	--	73.0	--
1948	78.7	9.4	85.7	6.9	67.0	11.2	80.6	10.4
1949	83.1	5.6	89.5	4.4	74.0	10.4	83.9	4.0
1950	87.3	5.1	90.0	1.6	82.4	11.3	87.6	4.4
1951	91.8	5.1	91.5	0.6	87.6	6.3	94.3	7.6
1952	96.9	5.5	99.8	9.0	92.0	5.0	97.7	3.6
1953	100.0	3.0	100.0	0.2	100.0	8.6	100.0	2.3
1954	107.7	7.7	107.9	7.9	108.5	8.5	107.1	7.1
1955	115.0	6.7	116.2	7.7	120.0	10.5	111.5	4.1
1956	117.2	1.9	113.4	2.5	128.3	6.9	113.8	2.0
1957	125.2	6.9	124.0	9.3	135.5	5.3	120.8	6.1
1958	133.6	6.6	126.5	2.0	157.7	16.4	125.4	3.8
1959	143.4	7.3	133.2	5.3	178.0	12.9	131.5	4.8
1960	153.0	6.7	139.7	4.9	195.9	10.1	138.6	5.3
1961	164.1	7.3	150.3	7.6	217.0	10.8	144.9	6.3
1962	172.9	5.4	158.5	5.5	233.7	7.7	149.9	5.0
1963	169.9	-1.7	160.5	1.3	192.7	-17.2	163.9	-9.3
1964	172.6	1.6	174.3	8.6	199.4	3.5	157.6	-3.8
1965	176.3	2.1	180.3	3.4	194.9	-2.3	164.1	4.1

[a]Schuh and Alves (43, page 33) and Schuh (40).

Table 3. Variations in the percentage participation of the sectors in the total domestic product, 1947-1962[a]

Year	Agriculture	Industry	Services
1947	32.4	20.5	47.1
1948	31.6	20.9	47.5
1949	31.3	21.8	46.9
1950	30.3	23.1	46.4
1951	29.0	23.4	47.6
1952	29.9	23.3	46.8
1953	29.1	24.5	46.4
1954	29.1	24.7	46.2
1955	29.4	25.6	45.0
1956	28.1	26.9	45.0
1957	28.7	26.5	44.8
1958	27.5	29.0	43.5
1959	27.0	30.4	42.6
1960	26.5	31.4	42.1
1961	26.6	32.4	41.0
1962	26.6	33.2	40.2
1963	27.3	27.5	45.2
1964	29.2	28.1	42.7
1965	29.6	26.8	43.6

[a]Source: Schuh and Alves (43, page 34) and Schuh (40).

As the table indicates, the industrial sector became larger than the agricultural sector in 1958. In consequence, however, of the changes in the rates of the growth of the sectors after 1963, there was a reversal of the trends in the sectors' participation in the total domestic product. Thus, the agricultural and the services sectors regained part of their losses, while the industrial sector lost part of its gains.

Table 4, which uses somewhat different data, shows the indices of real product for a more recent period. Great variation can be seen in the index for the agricultural sector: a large decline in 1963, due to poor weather conditions, and a sharp increase in 1965. The industrial sector in this period (1960-65) showed a smaller rate of growth than in the period 1947-62. The stagnation of the industrial sector, which started in about 1962, has continued up to the present. The reasons for this appear to be the exhaustion of import-substitution possibilities, and the rather rigorous containment policy which the government has followed to reduce the chronic inflation which spurted to a rate of 120 percent in early 1964.

Table 5 compares the long-run rates of growth of the agricultural and industrial sectors, both on an absolute and on a per capita basis. The rate of growth of agriculture was the same as that of industry in the period prior to 1940. However, one has to take into account the fact that the enormous rate of growth of the agricultural sector in the 1930's (more than double that of the 1920's) was due to the rise in the production of extractive plant products in this period. During the 1940's agriculture grew slowly, but in the 1950's its rate of growth increased.

Table 4. Variations in total and sector indices of the real product, 1960-1965; 1960 = 100[a]

Year	Agriculture	Industry	Services	Total
1960	100.0	100.0	100.0	100.0
1961	107.6	110.8	105.4	107.3
1962	113.5	119.3	109.8	113.0
1963	114.6	120.1	113.9	114.8
1964	116.1	126.2	117.5	118.4
1965	135.1	120.2	120.7	123.9

[a]Source: Schuh and Alves (43, page 35).

Table 5. Variations in total and sectoral rates of growth, 1920-1962[a]

Period	Agriculture		Industry		Total	
	Absolute	Per Capita	Absolute	Per Capita	Absolute	Per Capita
1920/22 to 1930/32	2.9	1.4	2.7	1.2	3.1	1.6
1930/32 to 1940/42	6.3	4.8	6.0	4.5	5.2	4.7
1940/42 to 1950/52	1.4	-0.9	7.7	5.3	4.8	2.4
1950/52 to 1960/62	4.7	1.7	8.9	5.9	6.0	3.0

[a]Source: Schuh and Alves (43, pages 35 and 36).

On a per capita basis, agriculture grew after 1940 at a slower rate than that of total production. In the 1930's, its per capita rate of growth was approximately the same as that of total production, but as already explained, this was due to an increase in the production of extractive plant products, more specifically firewood and "plant" charcoal to replace liquid combustibles.[3]

The industrial sector has been growing at high rates, both in an absolute sense and on a per capita basis. Its growth in the 1940's partially offset the decline of the agricultural sector in that period, so that the total production per capita of the economy grew at a rate (2.4%) fifty percent higher than the rate which prevailed in the 1920's (1.6%).

Data on the composition of the labor force are presented in Table 6. The absolute and the percentage distribution among agriculture, industry, services and inactives is given, as well as the rates of growth of the population in each sector. The fraction of the population engaged in agriculture decreased from 32.6% in 1940 to 27.0% in 1950 and to 24% in 1960. The decrease in the participation of agriculture was compensated in the 1940-50 period by an increase in the participation of the inactives from 49.1% to 53.2% and by the industrial sector--the participation of which rose from 6.2% to 7.3%. The three percentage-points fall of the agricultural sector in the 1950-1960 period was compensated by a rise in the participation of the service sector from 12.5% to 15.4%. In

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[3]Reflected in the data of the early 1940's. See Schuh (40).

this period, the participation of the industrial sector fell slightly (0.2%) and that of inactives rose slightly (0.3%).

Table 6. Variations in total and sectoral population 10 years of age or older, 1940-1960[a]

Period	Agriculture	Industry	Services	Inactives	Total
		Absolute (1,000 people)			
1940	9,454	1,791	3,514	14,279	29,038
1950	9,887	2,676	4,554	19,441	36,558
1960	11,698	3,428	7,525	26,110	48,761
		Percentage of the Total			
1940	32.6	6.2	12.1	49.1	100.0
1950	27.0	7.3	12.5	53.2	100.0
1960	24.0	7.1	15.4	53.5	100.0
		Rate of Growth (% per decade)			
1940/50	0.5	4.1	2.6	3.1	100.0
1950/60	1.7	2.5	5.2	3.0	100.0

[a]Source: Schuh and Alves (43, page 29).

Employment grew in agriculture during the 1950's at almost 3.5 times the rate of the 1940's (1.7%)as against (0.5%). Between these two decades (1940/50 and 1950/60), the rate of growth in the services sector doubled (from 2.6% to 5.2%), while the inactives remained practically the same (3.1% and 3.0%). The rate of growth of employment in the industrial sector fell from 4.1% to 2.5%.

Descriptive data on the industrial sector from the most recent census are presented in Table 7. Food products, textiles, and ferrous metals, the three largest contributors to industrial output as measured by value added, produced 39.7% of the industrial output in 1959--a decline from 48.5% in 1949. In 1959, these three groups of industries provided 44.8% of the industrial employment. Auto manufacturing held first place in percentage change of value added and in employment. Electrical and communication materials held second place among the industries with respect to these two characteristics. Construction of heavy equipment held third place with respect to the percentage change in employment, and fourth place with respect to the percentage change in value added.

The industrial sector as a whole provided 28.1% more employment during the period 1949/59, but the three sectors which were providing employment at the fastest rates; i.e., auto-manufacturing (318.2%), electrical and communication equipment (240.3%), and heavy equipment (122.5%) represented respectively 4.2%, 2.9% and 3.2%, adding up to only 10.3% of the total industrial employment. If the percentage of total employment provided by ferrous metals (10.1%), which had a 68.3% increase in employment, is included, the total of these four rapidly-growing industries is 20.4% of the total industrial employment.

Given that the total population of Brazil increased 34% between 1950 and 1960 and the industrial employment rose 28.1% from 1949 to 1959, it can be seen that the rate of growth in industrial employment is short of that of the population. The situation is still worse when one considers that the urban population increased 73% in the 1950/60 period.

Table 7. Major Brazilian industries, 1959[a]

Industry	Percentage of Total Industrial Output (Value Added)	Percent Change in Value Added	Percentage of Total Industrial Employment	Percent Change of Employment
	1959	1949/59	1959	1949/59
Food Products	16.2	811.7	14.4	2.7
Textiles	11.8	590.1	20.3	-2.5
Ferrous Metals	11.7	1,331.5	10.1	68.3
Chemical	8.5	1,744.5	4.0	45.4
Auto-manufacturing	7.4	3,716.7	4.2	318.2
Non-ferrous Metals	6.5	948.0	9.5	29.4
Electrical and Communication Materials	3.8	2,647.6	2.9	250.3
Clothing and Shoes	3.5	845.2	5.6	13.3
Heavy Equipment	3.4	1,727.1	3.2	122.5
Wood Products	3.2	769.7	5.0	33.3
Paper and Cardboard	3.0	1,431.6	2.3	58.9
Printing	2.9	751.9	3.0	30.1
Beverages	2.8	630.7	2.1	-4.9
Pharmaceutics	2.4	908.2	0.9	8.4
Extractive Minerals	2.2	1,315.3	2.3	8.3
Rubber	2.2	1,247.9	1.0	61.3
TOTAL	100.0	1,027.9		28.1

[a]Source: Schuh and Alves, (43, page 8).

Another factor to be considered is that the industrial groups growing the fastest are exactly those which require rather skilled labor. The unskilled labor has to be absorbed by other types of employment such as the construction industry. Unfortunately, there are no data available on this industry.

The transportation system in Brazil is very inadequate. Data on the railroad system for the period 1950-1964 are given in Table 8. It can be seen that the extension of the railroad system decreased in this period, although the number of passenger-km and of ton-km increased.

Table 8. Transportation by railroads, 1950-1964[a]

Year	Extension of the Railroad Network (km)	Number of Passengers (No. of People)	Merchandises (tons)	Passengers (km)	Merchandises (ton-km)
1950	36,681	342,709	38,040	10,466,976	8,066,303
1955	37,092	364,322	41,369	12,685,942	9,069,073
1960	38,287	420,583	43,727	15,394,764	12,078,817
1961	37,548	456,563	43,885	16,852,951	12,866,123
1962	36,572	477,703	47,353	17,926,127	14,921,007
1963	35,349	459,175	53,446	17,314,660	17,914,311
1964	34,636	440,409	52,041	17,003,719	16,387,271

[a]Source: IBGE (7, page 96).

Since the railroad system has not grown, the increased amount of transportation associated with the growth of the economy has come from a growth of the highway system. Table 9 shows the increase in the several types of roads for the period 1956 to 1965. The increase in the last year for which data are available was substantial, leading to a substantial increase in relation to population.

The Brazilian government has spent a substantial fraction of its budget to subsidize the transport sector. In 1963 this fraction was as high as 19% of the government budget. Lately, as one of the austerity measures to control inflation, the government is attempting to reduce these subsidies in real terms.

Table 9. Development of the highway system in Brazil, 1956-1965[a]

Year	Total Extension (km)	Per 1,000km2	Per 10,000 People
1956	409,488	48.1	68.4
1957	445,109	52.3	72.6
1960	466,926	54.9	65.8
1961	498,771	58.6	68.2
1962	524,395	61.6	69.7
1963	539,343	63.4	69.6
1964	548,510	64.4	68.7
1965	803,068	94.3	97.7

[a]Source: IBGE (6, Vol. 27, page 239; 7, page 99).

A final point that deserves attention is that there is lack of adequate farm-to-market roads, which becomes a hindrance for fuller integration of the economy. Furthermore, there are still large areas lacking adequate penetration roads. The inadequacy of the transportation system constitutes one of the factors inhibiting agricultural progress.

The educational system in Brazil is also very deficient, although the system has been growing in an absolute sense. Table 10 shows the growth of the several levels of education in the decade 1950-60. The table distinguishes between nominal and real growth. The latter results from the adjustment of the figures to the 36% growth of the population during the period. It is to be noted that the elementary level of education is the one which has grown at a slower pace, 20% during the decade, as compared to 60% for the secondary level and 38% for the college level.

Table 10. School enrollment, 1950 and 1960[a]

Level	Enrollment (1,000) (Rounded Figures)		Percentage Variation	
	1950	1960	Nominal	Real
Elementary	4,352	7,141	+ 64	+20
Secondary	540	1,177	+118	+60
College	50	93	+ 86	+38

[a]Source: Presidencia da Republica (10, page 89).

Table 11 shows the proportions of the 13,806,000 children in elementary school age (7 to 14 years of age), and the 10,821,000 in secondary school age (12 to 18 years of age), which have had access to school, graduated, and pursued further education in the year 1959. For a better understanding of this table, it is necessary to add that the elementary school involves for most parts of the country only four grades. The secondary school is divided into two cycles, the first of four years and the second of three years.

Table 11. Proportions of students from the population at the respective age brackets enrolling, graduating, and pursuing further education, 1959 (per thousand)[a]

	Northwest	Northeast	South	Brazil
Population Between 7 and 14 Years of Age (13,806,000)				
Enrolling in Elementary School	46.0	110.0	361.0	517.0
Graduating in Elementary School	2.0	3.0	35.0	40.0
Enrolling in Secondary School	1.5	3.5	17.0	22.0
Population Between 12 and 18 Years of Age (10,821,000)				
Graduating in 1st Cycle	0.5	2.0	9.0	11.5
Graduating in 2nd Cycle	0.3	0.8	4.4	5.5
Enrolling at University	0.1	0.4	1.8	2.3

[a]Source: Presidencia da Republica (10, page 90).

The percentage of children entering grade school is rather small (52%), but this already represents a big improvement over the two previous decades. The percentage was 26.9% in 1940 and remained at the same level in 1950.

More detailed comparisons among regions and between the urban and rural sectors is provided in Table 12. It is interesting to notice that the percentage entering grade school for the entire nation rose from 51.7% to 66.2%. In the rural areas the percentage in 1964 attained the 1960 level for the whole country; viz., 52.5%.

Table 12. Percentages of children of selected age groups enrolled in school, by regions, 1964[a]

	Total	Urban	Rural
	Students 7-11 Years of Age		
Brazil	66.2	81.3	51.5
North	69.7	87.6	54.1
Northeast	52.6	78.5	37.3
East	65.6	79.5	48.1
South	73.8	83.4	64.6
Central West	71.5	78.2	51.1
	Students 12-14 Years of Age		
Brazil	66.5	81.0	51.4
North	74.1	90.6	58.4
Northeast	57.7	81.7	42.3
East	67.8	80.6	50.8
South	69.3	79.9	58.1
Central West	77.7	83.6	56.4

[a]Source: Schuh and Alves (43, page 139).

For the country as a whole, the rural areas are at a disadvantage as far as the percentage of children attending grade school. Furthermore, the quality of education provided in the rural areas is much lower than that in the urban areas. The situation is much worse when regional dif-

ferences are taken into account. Within regions the differences among states, if data were available, would be shown to be greater.

Table 13 shows the allocation among the primary, secondary and higher education of the funds the government spent for education in the 1959-1963 period. The expenditures were corrected for variations in the price level and, thus, are expressed in real terms. It is to be noted that from 1959 to 1961 there was a 20% increase in the funds allocated for education. From 1961 to 1962 the increase was small, and in 1963 there was a decline in the expenditures on education.

Table 14 tells a similar story. National expenditures on education as a percentage of the internal national product rose from 2.38% in 1959 to 2.85% in 1961, but declined to 2.43% in 1963. Thus, this percentage falls short of the 4% which has been suggested for the developing countries of Africa, Asia and Latin America at various international meetings (43, page 141).

B. The State of Minas Gerais[4]

The objective of this section is to provide the necessary background for a fuller understanding of the intersectoral relations in the state of Minas Gerais.[5] The description is made against the background of Brazil, its regions, and two selected states, Sao Paulo and Ceara.

[4]This thesis is concerned with the correlation between Minas' agriculture in 1950 and in 1960 and its urban development in those years and in 1940 as well. The description here, however, will for the sake of better perspective, give also some attention to data from periods both preceding and following the time period covered in the analytical sections below.

[5]It is expected that the information contained here should provide further support for the statement made in Chapter I on the importance of Minas in the development of the Brazilian economy.

Table 13. National expenditures for primary, secondary and higher education, 1959-1963, in 1960 cruzeiros[a,b]

Year	Billions of Cruzeiros				% of Total			
	Primary	Secondary	Higher	Total	Primary	Secondary	Higher	Total
1959	20.01	17.63	10.98	48.53	41.2	36.4	22.4	100.0
1960	22.98	17.06	9.99	50.03	45.9	34.1	20.0	100.0
1961	30.83	16.06	11.36	53.25	52.9	27.6	19.5	100.0
1962	30.66	17.57	11.06	59.29	51.7	29.6	18.7	100.0
1963	26.23	16.56	11.86	54.65	48.0	30.3	21.7	100.0

[a]Source: Schuh and Alves (43, page 141).

[b]Cruzeiro is the Brazilian monetary unit.

Table 14. Percentage of domestic national product expended for education, 1959-1963[a]

Years	(Billions of Cruzeiros) Internal National Product	National Expenditure for Education	Percentage
1959	1761.60	41.85	2.38
1960	2363.60	63.90	2.70
1961	3522.00	100.50	2.85
1962	5586.80	147.90	2.83
1963	9847.00	239.05	2.43

[a]Source: Schuh and Alves (43, page 141).

Sao Paulo is the most advanced Brazilian state, situated in the Southern region and bordering on Minas Gerais. Its capital, also called Sao Paulo, is the most important corner of the Brazilian industrial triangle. The other corners are Rio de Janeiro[6] and Belo Horizonte, capitals of the states of Guanabara and Minas Gerais, respectively.

Sao Paulo, due to its economic dynamism, has been likened to the engine that pulls the remaining cars of a railroad train. The other states are the cars that are pulled. The zones of Minas that are situated in the neighborhood of this "engine" are very much under its influence. For these reasons, it is enlightening to compare data from Minas with those from Sao Paulo.

[6]The city of Rio de Janeiro, ex-capital of Brazil, should not be confused with its neighboring state with the same name. The old Federal District, consisting of the city of Rio de Janeiro and its suburbs, became a state with the name of Guanabara after the transfer of the nation's capital to Brasilia.

Ceara, the other state chosen for comparison with Minas, is the most dynamic state in the poverty-stricken Northeast. Almost all of its area is located in the so-called Drought Polygon, formed mostly by sections from the Northeastern states. Ceara contributes 15% of the Polygon's area. The almost 10% of Minas' area, which is included in the Polygon, constitutes about 6% of the Polygon's total area.

Minas Gerais and Ceara are the two Brazilian states with the largest net out-migration to other states. These characteristics in common justify the choice of Ceara as a basis of comparison.

1. An overall view of Minas' economy

Minas Gerais occupies an area of approximately 58.3 million hectares of the 846 million hectares covered by the whole country. Thus, the state has 6.85% of the country's area, while Sao Paulo has 2.91% and Ceara, 1.74%. The regional participation in the country's area is the following: North, 42.07%; Northeast, 11.35%; East, 14.80%; South, 9.7%: and Central West, 22.08%.

The long-run trends of the shares of the three states in the country's total population are shown in Table 15. The shares of the physiographic zones are also shown in the table.

In the period of concern for this thesis; viz., 1940-60, Minas showed a continuation of the long-run trend as to its share in the country's total population. To some extent, this is true also for Ceara. Sao Paulo's increasing trend continued, but at a less-accelerated pace.

Table 15. Percentage distribution of the population among regions[a] of Brazil and among selected states: 1872, 1890, 1900, 1920, 1950 and 1960[a]

Regions[b] and States[b]	1872	1890	1900	1920	1940	1950	1960
North (N)	3.35	3.32	3.99	4.70	3.55	3.55	3.67
Northeast (NE)	31.04	26.31	24.52	24.27	24.19	24.05	22.09
Ceara (CE)	(7.26)	(5.62)	(4.87)	(4.31)	(5.07)	(5.19)	(4.70)
East (E)	47.69	48.49	45.96	42.01	37.89	36.38	34.99
Minas Gerais (MG)	(20.05)	(22.21)	(20.61)	(19.22)	(16.34)	(14.86)	(13.81)
South (S)	15.70	19.64	23.39	26.54	31.32	32.68	35.01
Sao Paulo (SP)	(8.43)	(9.66)	(13.08)	(15.00)	(17.41)	(17.59)	(18.28)
Central West (CW)	2.22	2.24	2.14	2.48	3.05	3.34	4.24
Brazil (BR)	100.00	100.00	100.00	100.00	100.00	100.00	100.00

[a]Source: IBGE (6).

[b]In subsequent tables, use will be made of the abbreviations given here in parentheses. Since the percentages for the states are included in the percentages for the respective regions, the former are provided in parentheses.

Table 16 gives the shares of the regions in the national income. Likewise, Table 17 shows the selected states' percentage participation in their respective regions. In terms of participation in domestic income, Minas Gerais' share of the income of the Eastern region fell from over 30% in 1947-50 to over 28% in 1958-60. The participation of the East in the nation's domestic income fell from 36.78 in 1947-50 to 35.56 in 1956-60 period. Sao Paulo's participation in the income of the South fell also, but in compensation the share of the South in the nation's domestic income rose. Ceara maintained approximately the same share (about 19%) of the Northeast's income, which fell from over 11% of the nation's domestic income in 1947-50 to somewhat over 10% in the late 1950's.

It is interesting to compare the composition of the domestic income for the basic sectors in Minas and in the whole country (Table 18). Differences in the relative importance of agriculture and industry in the domestic income for Minas and for Brazil are very great. In the latter, agriculture and industry had approximately the same share (29% and 28%). In Minas, agriculture's share (48%) was three times as large as that of industry (16%). Thus, agriculture's share in Minas was almost double that for the nation as a whole. On the other hand, industry's share in Minas Gerais was little more than 50% of that for the whole nation. The shares of services and government were somewhat lower in Minas than in Brazil. These shares were 25% and 11% in Minas, and 29% and 14% in Brazil.

Table 16. Percentage distribution of national income among regions, 1947-1962[a]

Year	N	NE	E	S	CW[b]
1947	2.61	11.26	36.75	46.61	1.77
1948	2.48	11.23	36.91	47.39	1.98
1949	2.35	11.00	37.07	47.60	1.98
1950	2.25	11.26	36.39	48.15	1.95
1951	2.24	10.70	36.22	48.72	2.12
1952	2.19	10.35	35.33	49.96	2.16
1953	2.04	9.52	35.50	50.28	2.65
1954	1.94	9.33	35.80	50.30	2.63
1955	2.00	9.15	35.20	51.09	2.64
1956	2.31	9.74	36.50	50.37	2.56
1957	2.41	10.12	36.13	50.61	2.39
1958	2.21	9.36	35.83	50.00	2.59
1959	2.12	10.32	35.34	49.77	2.44
1960	2.21	10.63	34.00	50.67	2.49

[a]Source: IBGE (6, Vol. 9-23).

[b]See footnote b in Table 15.

Table 17. Variations in share of selected states in their respective regional income, 1947-1962[a]

Year	CE	MG	SP[b]
1947	19.43	31.16	66.02
1948	19.62	31.82	66.76
1949	19.97	30.10	67.31
1950	21.08	29.60	67.06
1951	18.33	29.57	68.73
1952	20.02	29.73	67.60
1953	19.09	31.49	65.65
1954	18.44	31.53	67.36
1955	18.95	31.43	64.36
1956	19.67	30.72	68.38
1957	19.56	31.34	62.28
1958	15.30	28.80	64.95
1959	18.98	28.82	64.27
1960	19.72	28.56	63.60

[a]Source: IBGE (6, Vol. 9-23).

[b]See footnote b in Table 15.

In that same year, 1964, Minas's total domestic income represented about 10% of that of the nation. The contribution of Minas for the country's domestic income from agriculture was 16%. In industry, services and government, Minas' contributions were of about 6%, 8.5% and 8%, respectively.

Table 18. 1964 domestic income for Brazil and Minas Gerais in the various economic sectors[a]

	Total	Agriculture	Industry	Services	Government
			Absolute Values (Million Cruzeiros[b])		
Brazil	15,107,205.9	4,414,901.8	4,237,504.0	4,424,998.2	2,029,807.9
Minas	1,485,370.0	706,024.1	242,577.7	373,165.7	163,602.5
			Percentage Compositions of the Domestic Income		
Brazil	100.0	29.2	28.1	29.3	13.4
Minas	100.0	47.5	16.3	25.1	11.0
			Participation of Minas in the Nation's Income		
	9.8	16.0	5.7	8.4	8.1

[a]Source: ACAR (1, p. 21).

[b]See footnote b in Table 13.

The distribution of the labor force among the various sectors provides a useful way of comparing the economic structure of Minas Gerais with those of the selected states. Table 19 provides the necessary data from the 1920, 1940 and 1950 censuses. Inter-year comparisons are hindered because of changes in definitions from one census to another. Intra-year comparisons, however, can meaningfully be made.

One sees that the margin by which industry's (agriculture's) share of the labor force is greater (smaller) in Sao Paulo than in the other states, has been increasing over time. Minas Gerais and Ceara had their relative positions with respect to agriculture's and industry's shares of the labor force reversed since 1920. In that year Minas' position was extreme when compared to the two other states. In the other years, Minas occupied intermediate positions with respect to them.

Indices of real product for Minas Gerais for the 1947-64 period are shown in Table 20. One notices that after a period of slow growth, the total index rose in 1955 somewhat sharply, and continued its slow rate of growth until 1958. In 1959, another sharp rise occurred, and the increase continued at a somewhat slower pace, until 1962. In 1963, a decline occurred, but by 1964 the 1962 level had been regained.

The index for services followed somewhat the same pattern, except that the fluctuations were stronger. For instance, the 1951 index was very high, and the 1957 and 1958 indices were very low compared to the indices of the years immediately proceeding or following.

The index for industry maintained a continually rising trend. The index for agriculture showed smaller fluctuations than the index for the total real product.

Table 19. Percentage distribution of the working age population among the various economic activities in selected Brazilian states, 1920, 1940 and 1950[a]

	Ceara	Minas Gerais	Sao Paulo
	1920		
Soil and Subsoil	77.43	80.02	63.85
Industry	11.13	9.39	16.59
Transportation	0.94	1.54	3.73
Commerce	3.83	3.60	6.34
National Defense	0.43	0.43	0.84
Management	1.23	0.70	1.75
Liberal Professions	1.22	1.37	2.77
Property Income	0.17	0.29	0.84
Domestic Services	3.62	2.66	3.29
Total	100.00	100.00	100.00
	1940		
Agriculture	36.20	35.49	29.48
Extractive Industries	0.51	1.01	0.44
Transformation Industries	3.38	2.96	8.26
Merchandise Trade	1.99	1.69	3.66
Financial Market	0.06	0.12	0.35
Transportations and Communications	0.63	1.18	2.50
Government and Education	0.66	0.79	1.37
National Defense	0.14	0.36	0.47
Liberal Professions	0.21	0.34	0.62
Services	3.05	2.23	3.43
Housewife and Student	39.36	42.32	41.23
Unemployed	13.81	11.51	8.19
Total	100.00	100.00	100.00
	1950		
Agriculture	66.29	59.46	37.95
Extractive Industries	0.96	1.75	1.28
Transformation Industries	3.57	7.21	18.52
Merchandise Trade	4.03	3.46	6.59
Financial Market	0.15	0.44	1.11
Transportation and Communications	1.76	2.76	5.56
Government	0.72	0.87	1.41
National Defense	0.61	0.63	1.01
Liberal Professions	0.13	0.30	0.65
Services	2.54	3.14	6.21
Housewife and Student	6.54	8.47	9.26
Sundry	0.16	0.10	0.13
Unemployed	12.07	10.65	8.68
Total	100.00	100.00	100.00

[a]Source: IBGE (6, Vols. 5, 6 and 14).

Table 20. Variations in the indices of the real product for Minas Gerais, 1947-1964; 1949 = 100[a]

Year	Agriculture	Industry	Services	Total
1947	89.90	88.68	75.17	84.01
1948	92.35	92.14	90.38	91.55
1949	100.00	100.00	100.00	100.00
1950	104.55	107.57	108.91	106.57
1951	106.62	115.70	130.96	116.49
1952	100.54	117.31	113.99	107.67
1953	111.13	130.63	124.15	118.65
1954	107.52	134.66	123.97	117.09
1955	118.67	144.85	143.79	131.43
1956	106.93	166.92	142.26	130.05
1957	124.11	179.04	129.42	134.05
1958	127.47	204.10	122.01	136.24
1959	125.75	228.90	142.62	149.73
1960	138.64	247.71	146.47	159.96
1961	140.05	262.84	152.59	165.95
1962	139.70	289.15	158.04	172.32
1963	134.61	301.32	91.24	148.33
1964	141.17	357.18	123.17	172.52

[a]Source: ACAR (1, p. 20).

The transportation system is an important factor in economic development. A simple index can be constructed by dividing a state's share of the country's total number of kilometers of highways by its share in the country's area. In 1953, Minas had an index of only 1.5, while Sao Paulo's index was 8.5, and the states of Rio de Janeiro and Guanabara taken as a whole had an index of 8.5 (4, p. 8).

On the question of roads, Minas Gerais has taken many steps forward, thus somewhat closing the gap between itself and the other more advanced states. In number of kilometers of highways per 1,000 km2, Minas changed from 74.0 in 1956 to 126.9 in 1964, while during the same period, the indices changed from 342.7 to 393.8 for the state of Rio de Janeiro, from 733.0 to 790.0 for Guanabara, from 310.7 to 417.0 for Sao Paulo, and from 48.1 to 64.4 for the whole country (7).

In number of km per 10,000 inhabitants, the changes between 1956 and 1964 were as follows: from 51.7 to 69.6 for Minas Gerais; from 56.1 to 42.7 for Rio de Janeiro; from 3.5 to 2.7 for Guanabara; from 72.8 to 69.7 for Sao Paulo, and from 68.4 to 68.7 for the country as a whole. It should be noticed that Guanabara is a case apart, since it is almost completely urbanized. The important point is that Minas changed from an index inferior to that of the whole nation (51.7 for Minas and 68.4 for Brazil in 1956) to one slightly superior (69.6 for Minas and 68.7 for Brazil in 1964).

Indices for roads which take into account both population and area[7] changed in the following way between 1956 and 1964: from 1.2 to 1.5 for Minas Gerais, from 4.0 to 3.4 for Rio de Janeiro, and from 7.6 to 6.1 for Guanabara. The index for Sao Paulo remained 3.8 (7).

Being a hinterland state, the participation of Minas Gerais in coastal trade is null, and in foreign trade extremely small. Tables

[7]This combined index is obtained by dividing both the indices of roads per area and per 10,000 people by the corresponding indices for the whole country. An arithmetic average is taken of the corresponding ratios to constitute the combined index.

21 and 22 give the regions' and the selected states' participation in local and in internal trade.[8]

The South and the Central-West were the only zones to have increases in their shares in local trade. The decline of Ceara's share paralleled somewhat that of the Northeast. Minas' shares did not show great fluctuations, while the East had a decline. Sao Paulo's share increased from about 40% to almost 50%. The South had an increase, but of a smaller magnitude.

Since Minas Gerais has an extensive border with its neighboring states, control of its "internal" trade is very deficient. This is seen in Table 22, particularly in the exports. There was a continuous decline in the participation of Minas in the internal exports. As to imports, the fluctuations were of smaller magnitude.

In Ceara, the increase in participation was greater for imports than for exports. In Sao Paulo, a decline in exports occurred in the second half of the 1940's, but by the end of the 1950's, there was recuperation to the participation prevailing in the early 1940's. In imports, Sao Paulo's participation increased in the late 1940's, but by 1950 and 1960 it had fallen below the level of the early 1940's.

Table 23 shows the terms of internal trade. Ceara's terms of internal trade had a declining trend in the 1940's, but they recuperated partially by the end of the following decade. Minas Gerais had terms of trade that were much lower than those for Ceara. Sao Paulo, on the other hand, always had very high terms of trade, never below 2.

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[8]Local trade is the intra-state trade. Internal trade is the interstate trade other than the coastal trade.

Table 21. Variations in the percentage participation of the regions and of selected states in the country's total "local" trade[a]

Year	N	NE	CE	E	S	SP	CW[b]
1940	1.24	9.45	1.68	33.79	8.07	55.91	40.44
1941	1.29	9.68	1.95	33.84	7.75	54.02	40.46
1942	1.40	8.95	1.51	34.10	7.94	53.99	39.41
1943	1.38	9.10	1.34	32.33	6.82	55.97	42.23
1944	1.40	8.89	1.07	32.28	6.73	56.11	41.64
1945	1.48	9.68	1.31	27.37	7.26	60.25	44.62
1948	1.05	9.16	1.54	29.43	7.66	59.18	43.29
1952	0.96	8.26	1.36	28.90	7.83	60.50	44.08
1953	1.11	6.80	1.02	31.92	8.26	58.75	42.45
1954	0.91	6.86	0.96	31.48	7.89	59.48	43.30
1955	0.93	7.46	1.10	27.56	8.91	62.74	45.28
1956	1.04	7.46	1.09	29.39	8.03	60.79	44.26
1957	1.14	7.20	0.91	28.43	7.19	61.57	45.80
1958	0.91	6.36	0.91	28.31	6.12	63.04	46.79
1959	0.76	6.26	0.90	28.84	7.53	62.70	45.85
1960	1.14	6.47	1.09	27.93	7.22	62.88	47.30
1961	1.41	6.56	1.18	26.69	7.10	63.44	47.47
1962	0.98	6.31	1.15	27.35	7.14	63.27	50.44

[a]Source: IBGE (6, Vol. 5-25).

[b]See footnote b in Table 15.

Table 22. Variations in the percentage participation of the regions and selected states in the internal trade 1939-60[a]

		1939	1942	1943	1945	1946	1947	1948	1949	1950	1959	1960
N[b]	X[c]	.41	.62	.75	.51	.34	.33	.06	.09	.04	.17	.21
	M	.20	.75	.83	.70	.62	.58	.37	.30	.29	.58	.63
NE	X	9.90	5.29	7.07	6.75	7.27	7.72	6.78	7.77	8.33	8.38	8.12
	M	7.07	5.83	7.84	7.39	7.83	8.30	9.78	8.80	9.33	9.28	9.41
CE	X	.61	.45	.83	.81	.97	.96	1.55	.89	.77	.84	.65
	M	.61	.44	.90	1.02	1.18	1.20	1.41	1.31	1.41	1.74	1.81
E	X	39.46	53.85	54.12	52.87	52.21	54.77	56.65	59.67	59.34	41.92	42.40
	M	57.68	58.37	61.08	59.66	58.97	58.39	55.86	56.25	55.68	40.13	38.01
MG	X	37.42	25.66	21.61	17.33	14.61	14.30	13.25	11.81	10.22	10.76	12.38
	M	11.51	12.55	12.12	13.32	12.91	13.79	13.81	13.70	13.72	11.01	10.23
S	X	46.22	37.20	35.74	37.61	38.08	35.13	32.05	29.87	29.87	47.49	47.30
	M	30.29	31.40	27.26	28.77	29.88	30.20	31.66	32.41	32.72	36.45	36.23
SP	X	38.26	30.05	28.78	28.46	28.48	24.34	19.34	17.23	14.91	33.11	31.37
	M	20.47	22.93	19.96	20.27	20.99	21.97	24.01	24.15	24.64	18.56	18.24
CW	X	4.00	3.05	2.31	2.23	2.08	2.03	2.48	2.60	2.41	2.04	1.97
	M	4.42	3.57	3.01	3.37	2.56	2.51	2.34	2.22	1.96	2.92	2.84

[a]Source: IBGE (6, Vols. 4-23).

[b]See footnote b in Table 15.

[c]X = exports and M = imports.

Table 23. Variation in the terms of internal trade[a]

	N	NE	CE	E	MG	S	SP	CW[b]
1939	.27	1.11	1.02	.94	1.02	1.29	2.22	.38
1942	.99	.90	.75	.95	.47	1.20	2.16	.41
1943	.88	.92	.51	.91	.57	1.38	2.30	.36
1945	1.03	.93	.34	.85	.42	1.49	3.06	.40
1946	1.15	.93	.37	.84	.31	1.48	3.15	.38
1947	1.11	.93	.46	.90	.31	1.35	2.67	.37
1948	3.29	.89	.56	.97	.26	1.19	2.43	.42
1949	3.02	.89	.39	.99	.26	1.10	2.19	.60
1950	8.02	.92	.35	1.12	.28	.85	2.06	.66
1959	1.39	.82	.63	.62	.12	...[c]	...	.15
1960	2.08	.75	.66	.69	.13	...	...	.24

[a]Source: IBGE (6, Vols. 4-23).

[b]See footnote b in Table 15.

[c]Three dots denote nonavailable data.

Table 24 shows long-run trends in the percentage distribution of the value of the industrial production. Indices of the value of per capita industrial production expressed in terms of the national average[9] are shown in Table 25.

The South is the only region in which there was an increase in the percentage participation. This increase was due mainly to Sao Paulo's industrial development.

[9]Indices of this nature will be used in the remainder of this chapter. A state's index is computed by dividing its percentage participation in the nation's value of the industrial production by its percentage participation in the country's population.

Table 24. Percentage participation of the regions and selected states in the value of Brazil's industrial production (1907-60)[a]

	N	NE	CE	E	MG	S	SP	CW[b]	BR[b]
1907	4.81	7.12	.40	48.75	4.80	38.50	16.50	.82	100.00
1920	1.32	12.01	.80	38.60	5.50	47.69	31.50	.38	100.00
1940	1.12	8.21	.60	32.93	6.74	57.18	43.49	.55	100.00
1950	.67	7.52	.77	29.52	7.23	61.65	47.54	.63	100.00
1960	.86	5.68	.78	24.58	6.00	68.16	54.83	.73	100.00

[a]Source: Jobim (28, page 96); IBGE (6, Vols. 5, 6, 16 and 26).

[b]See footnote b in Table 15.

Table 25. Variations in the per capita industrial production in terms of the national average, 1907-1960[a]

	N	NE	CE	E	MG	S	SP	CW	BR[b]
1907	118	27	8	106	23	164	126	33	100
1920	26	46	19	91	29	179	210	12	100
1940	32	34	11	87	41	183	250	18	100
1950	19	31	15	81	49	189	270	19	100
1960	23	26	17	70	43	195	300	17	100

[a]Sources: Jobim (28, page 26); IBGE (6, Vols. 5, 6, 16 and 26).

[b]See footnote b in Table 15.

Although the participation of the East underwent a decrease of about 50%, that of Minas increased up to 1949, but suffered some setback in 1959. In per capita terms, the rate of increase in the South and of the decrease in the remaining regions declined in magnitude, but not enough to reverse their relative positions.

Some other industrial and urban characteristics of the state of Minas will be contrasted with the corresponding ones of the state of Sao Paulo in Appendix B.

2. The agricultural sector

Table 26 provides indices of the real product in the agricultural sector for the 1947-64 period. The overall index fluctuated around an increasing trend. The fluctuations were due to variations in crops and extractive agriculture. The indices for animal products showed a continuous increase, achieving in 1964 a level 80% above the 1949 level.

In the 1953-57 period, the index for extractive agriculture remained below the 1949 base level. Since 1957, the increase has been continuous. In 1963-64, the index was more than 50% above the 1949 level.

The crops index, although below the base level only in 1952,[10] started a rising trend in 1957 which led it in 1960-61 to a level about 40% above the base. After the latter year, a declining trend began and in 1963, the 122 level was hit. The index for cattle slaughtering did not fluctuate very much. Only in 1952 did the index fall below the 1949 level. The index for animal products maintained a continuous rising trend during the whole period, almost doubling its basic level by 1964.

[10] In the following discussion, references to indices falling below the base, 1949, level are always for the years after 1949.

Table 26. Variations in the indices of the real product of the sub-sectors of Minas' agriculture, 1947-1964; 1949 = 100[a]

Year	Agriculture	Crops	Extraction of Vegetal Products (Firewood and Vegetal Coal)	Total	Animal Production		Fishery
					Animal Slaughtered	Animal Products	
1947	89.90	89.00	100.54	86.78	91.50	84.51	100.78
1948	92.35	92.21	99.98	88.88	100.16	83.27	133.45
1949	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1950	104.55	106.26	102.05	101.00	101.50	100.57	127.70
1951	106.62	107.19	102.46	108.18	112.63	104.79	182.75
1952	100.54	96.75	101.27	112.54	99.85	116.67	174.79
1953	111.13	109.45	99.91	122.86	105.52	129.19	170.61
1954	107.52	103.49	98.20	126.88	107.23	134.45	166.49
1955	118.67	117.65	99.22	131.64	105.36	142.33	180.26
1956	106.93	102.80	95.90	137.59	111.83	148.04	178.69
1957	124.11	126.97	96.64	142.49	121.43	150.00	209.51
1958	127.47	128.39	104.51	149.57	130.73	155.80	194.89
1959	125.75	122.02	114.27	153.28	134.41	159.43	200.46
1960	138.64	141.41	119.75	157.38	135.25	165.38	197.59
1961	140.05	142.58	120.60	159.58	131.27	171.20	204.39
1962	139.70	134.18	133.82	168.99	133.38	184.74	228.69
1963	134.61	122.26	152.37	172.01	138.84	185.86	278.99
1964	141.17	129.39	153.42	179.33	145.77	193.00	322.46

[a]Source: ACAR (1, page 22).

In 1966, the value of animal production slightly exceeded that of crop production (9, p. 24).

Rice and corn in that year each represented a little more than 20% of the value of crop production. Beans and coffee each contributed about 12% of the value of crop production. The contribution of other crops was: sugar cane, 8.5%; manioc and potato, about 5% each; cotton and banana, about 3.5% each; oranges, less than 2%; tobacco, little more than 1%; sweet potato, 1% (9, p. 25-26).

Milk and beef constituted almost 45% and 28%, respectively, of the value of animal production. Pork and hog products constituted 18%, and eggs, almost 9% of that value (1, p. 31).

The relative position of Minas Gerais with respect to some individual agricultural products is also of importance. In 1939, Minas and Sao Paulo produced respectively 24% and 23% of the corn, 19% and 22.5% of the rice, and 18% and 60% of the coffee, in relation to the whole country, (9, page 93). The two states have since had a decline in their share of the total production of these three products. In the 1960-63 period their percentage participation had fallen respectively to 19.59% and 18.14% for corn, 16.44% and 16.80% for rice, and 12.14% and 25.83% for coffee (9, page 85).

In the 1963-65 period, Minas held second place in the production of beans, in poultry production, and in hogs slaughtered. Minas produced 12.8% of the bean crop and Parana, the leading state in beans, produced a percentage almost twice that, 24.2%. Rio Grande do Sul and Sao Paulo, which held respectively the third and fourth places, had shares of 9.2% and 8.4% of the national production of beans (9, page 156ff).

In 1964 and 1965 there were 1,071,000 and 1,175,000 hogs slaughtered in Minas Gerais, while the leading state, Rio Grande do Sul, slaughtered 2,497,000 and 2,402,000 hogs. Sao Paulo, the state which was in third place, slaughtered 1,011,000 and 937,000 hogs (9, p. 175).

In poultry production, Sao Paulo is the leading state. Minas has a flock almost as large as that of Sao Paulo, 23,008 as against 24,667 birds, but the productivity of the hens in Sao Paulo, as measured by the average number of eggs per hen per year, is almost double that of Minas; 95.2 in Sao Paulo compared to 51.7 in Minas. The egg production in Sao Paulo and Minas Gerais was 1,000 dozen eggs, respectively 196,213 and 99,202. The highest productivity of eggs in Brazil is found in the state of Guanabara, where the average number of eggs per hen per year is 142.6. While Minas Gerais holds second place in flock size and in the amount of eggs produced, it occupies, among the nine leading states, seventh place in productivity (9, p. 284).

With 18.4% of the country's production of corn, Minas held second place in the 1962-64 period. First place was held by Rio Grande do Sul with a 19% share of the country's production. By 1963, Minas was losing the position of second largest producer to Parana, a state which in 1962-64 produced 16.7% of the nation's corn (9, p. 167ff).

In the 1962-64 period, Minas was the fourth largest producer of potatoes, after Sao Paulo, Rio Grande do Sul and Parana. The shares of these states were, in decreasing order, 36.3%, 23.6%, 20.8%, and 13.6% (9, p. 51).

In cotton production, Minas, with a share of 4.1%, held seventh place. The leading six states with their shares are: Sao Paulo (36.5%); Parana (15.4%); Ceara (12.4%); Paraiba (7%); Rio Grande do Norte (6%) and Pernambuco (5%) (9, p. 106ff).

Minas does not produce a significant share of the nation's output of either soybeans, peanuts, or wheat. In soybeans, Minas holds seventh place, but with less than 1% of the national production. As to peanuts, Sao Paulo alone produces 94.1% of the country's output. Wheat in Brazil is produced mostly in the South. Even Sao Paulo has a much smaller share than the other southern states. Outside of the South, Mato Grosso, Espirito Santo, Goias and Bahia produce more wheat than Minas Gerais.

Having seen the main agricultural products of Minas and their relative position in the nation's total production, a look will be given to the use of land, capital and labor. Questions of land use, land tenure, size of farms, etc. are utmost in agricultural development.

Table 27 gives the geographical area and agricultural land for Brazil, its regions and for the states of Ceara, Minas Gerais and Sao Paulo, in million hectares. These states have respectively somewhat less than 2, 7 and 3 percent of the nation's total land. From 1920 until 1960, Ceara more than doubled its agricultural area, while Minas, Sao Paulo and the country as a whole had an increase of about 50%.

In 1960, while Brazil had only 31% of its land in agriculture, these three states had put 68% or more of their land into such use. The distribution of the country's agricultural land among the regions

Table 27. Total land area and agricultural land in Brazil in regions and selected states of Brazil[a]

	N	NE	CE	E	MG	S	SP	CW	BR[b]
	Geographical Area (Million of Hectares) and Percentage of the Nation's Land								
Total Area	355	96	15	126	58	81	25	188	846[c]
Percent of the country	42	11	2	15	7	10	3	22	100[c]
	Agricultural Land (Million of Hectares) at Different Periods and Percentage of the Region's or of State's Total Land Area								
1920									
Absolute	22	27	6	41	27	41	14	44	175[c]
Percent	6	28	38	33	47	51	56	24	21[c]
1940									
Absolute	26	29	9	53	34	50	19	40	198[c]
Percent	7	30	58	42	57	62	75	21	23[c]
1950									
Absolute	23	42	10	60	37	54	19	54	232[c]
Percent	7	43	69	47	63	67	77	29	27[c]
1960									
Absolute	32	46	11	65	39	60	20	61	264[c]
Percent	9	48	77	51	68	74	81	33	31[c]

[a]Source: IBGE (6); CIDA (27).

[b]See footnote b in Table 15.

[c]Differences between the sum of the regions and the figure for the whole country is due to rounding.

and these three states is given in Table 28. Ceara's share of agricultural land increased from 1920 to 1950, and then decreased slightly. Sao Paulo and Minas had their shares increased in the 1920-40 period, and decreased since then. The percentage shares of the three states of the country's agricultural land were, in 1960, larger than their shares

Table 28. Percentage distribution of agricultural land among the regions and selected states of Brazil, 1920, 1940, 1950 and 1960[a]

	N	NE	CE	E	MG	S	SP	CW	BR[b]
1920	12.27	15.35	3.23	23.40	15.64	23.61	7.93	25.37	100.00
1940	12.90	14.47	4.35	26.89	16.93	25.36	9.40	20.39	100.00
1950	9.96	17.89	4.39	25.69	15.78	23.45	8.19	23.10	100.00
1960	12.18	17.33	4.29	24.71	14.83	22.63	7.56	23.09	100.00

[a]Source: IBGE (6).

[b]See footnote b in Table 15.

of the country's territory. Table 29 refers to the geographical distribution of cultivated land among regions and selected states.

The distribution of the number of farms over the regions and the three states is given in Table 30. Ceara and the Northeast as a whole about doubled their share of the number of farms in the 1920-40 period. From then on Ceara's share began to decline, while that of the Northeast continued its rise, though at a much slower rate. In the 1920-60 period, Minas underwent a decline in its share of the number of farms that was much greater than the decline experienced by the whole East. Sao Paulo's share increased a little in the 1920-40 period, and from then on declined from 13.26% in 1940 to 9.52% in 1960. The South as a whole had a decline from 1920 to 1960, with a small rise in the 1940-50 period.

Table 31 gives the area per farm in terms of the national average. This is obtained by dividing the percentage share of the agricultural land by the percentage of the number of farms and multiplying the re-

Table 29. Percentage distribution of cultivated land among the regions and selected states of Brazil, 1920, 1940, 1950 and 1960[a]

	N	NE	CE	E	MG	S	SP	CW	BR[b]
1920	1.84	12.28	2.76	38.49	23.46	46.40	29.89	2.02	100.00
1940	4.89	22.39	6.97	30.27	15.06	38.52	22.93	3.86	100.00
1950	2.06	21.20	5.27	28.53	14.95	43.97	21.18	3.98	100.00
1960	1.57	24.03	4.75	24.19	13.10	44.56	14.76	5.64	100.00

[a]Source: IBGE (6, Vols. 6, 16, 24).

[b]See footnote b in Table 15.

Table 30. Percentage distribution of the farms among Brazilian regions and selected states, 1920, 1940, 1950 and 1960[a]

	N	NE	CE	E	MG	S	SP	CW	BR[b]
1920	5.09	13.68	2.50	36.37	17.84	41.75	12.48	3.10	100.00
1940	4.26	25.03	4.90	33.85	14.95	33.40	13.26	3.46	100.00
1950	3.77	26.31	4.20	32.04	12.89	34.02	10.73	3.86	100.00
1960	4.13	28.82	3.66	28.21	11.10	33.77	9.52	4.77	100.00

[a]Source: IBGE (6).

[b]See footnote b in Table 15.

sult by 100. Ceara's area per farm has fluctuated around the national average, while the Northeast from 1940 to 1960 has had an area per farm 32% to 42% below the national average. Minas Gerais in 1920 was below the national average in area per farm, but has been above it since then. During the 1920-60 period, the East has seen its area per farm rise, but in 1960 it still was 13% short of the national average. From 1920 to

1940, the area per farm in terms of the national average rose--in Sao Paulo from 64 to 71% and, in the South from 57 to 76%. Since then, Sao Paulo's area per farm continued to rise while that of the South began to fall.

Table 31. Area per farm in terms of the national average in the regions and selected states of Brazil, 1920, 1940, 1950 and 1960; national average = 100[a]

	N	NE	CE	E	MG	S	SP	CW	BR[b]
1920	241	112	129	64	88	57	64	818	100
1940	303	58	89	79	113	76	71	589	100
1950	263	68	105	80	123	69	76	598	100
1960	295	60	117	87	134	67	79	485	100

[a]Source: IBGE (6).

[b]See footnote b in Table 15.

Table 32 gives the percentage distribution of the farms of the three states and of Brazil according to size. One can see that, for the whole country, the percentages of farms smaller than 100 hectares increased from 71.5% in 1920 to 85.7% in 1940, remained at about this level in 1950 and rose to 89.6% in 1960. The share of farms between 1,000 and 10,000 hectares decreased from 3.8% in 1920 to 1.4% in 1940, remained at approximately the same level in 1950, and fell below 1% in 1960.

In Sao Paulo, the changes in the distribution of the farms according to size followed approximately those of the whole country. Compared with the whole country, Minas Gerais in the 1920-60 period had a smaller percentage of farms less than 100 hectares. Within this group of farms,

Table 32. Changes in the percentage distribution of farms by size classes in Brazil and in selected states of Brazil, 1920, 1940, 1950, 1960[a]

	CE	MG	SP	BR[b]
	1920			
Less than 100 hectares	46.9	60.5	73.6	71.5
101 to 1,000 hectares	46.4	36.0	23.9	24.4
1,001 to 10,000 hectares	6.6	3.4	2.4	3.8
Over 10,000 hectares	0.1	0.1	0.1	0.3
Total	100.0	100.0	100.0	100.0
	1940			
Less than 100 hectares	80.4	78.2	88.0	85.7
101 to 1,000 hectares	18.5	20.2	11.0	12.8
1,001 to 10,000 hectares	1.0	1.5	0.9	1.4
Over 10,000 hectares	0.1	0.1	0.1	0.1
Total	100.0	100.0	100.0	100.0
	1950			
Less than 100 hectares	76.6	75.5	85.6	85.4
101 to 1,000 hectares	21.7	22.5	13.2	13.0
1,001 to 10,000 hectares	1.6	1.9	1.1	1.5
Over 10,000 hectares	0.1	0.1	0.1	0.1
Total	100.0	100.0	100.0	100.0
	1960			
Less than 100 hectares	82.1	80.8	89.7	89.6
101 to 1,000 hectares	16.9	17.9	9.5	9.4
1,001 to 10,000 hectares	1.0	1.3	0.8	0.9
Over 10,000 hectares	0.0	0.0	0.0	0.1
Total	100.0	100.0	100.0	100.0

[a]Source: IBGE (6, Vols. 5, 6, 16 and 24).

[b]See footnote b in Table 15.

Minas Gerais had a smaller percentage of farms below 10 hectares, and a larger percentage of farms between 10 and 100 hectares than the whole country. Ceara was an intermediate case between those of Sao Paulo and Minas. In 1920, Ceara had 46.9% of its farms in the below 10 hectares group, while the country as a whole had 71.5% in that group. In 1960, the gap between these two percentages decreased greatly. The group of farms with an area between 100 and 1,000 hectares was 46.4% for Ceara, and 24.4% for the country. The corresponding percentages in 1960 were 16.9% and 9.41%, respectively.

Table 33 gives the average number of hectares per farm in the various regions and in the selected states.

Table 33. Average number of hectares per farm, 1965[a]

N	NE	CE	E	MG	S	SP	CW	BR[b]
429	81	79	69	81	50	80	523	92

[a]Source: IBRA (8, p. 93).

[b]See footnote b in Table 15.

The percentage distribution of agricultural land according to use in 1950 is given in the upper half of Table 34. In Sao Paulo and in the South, the percentages of areas in crops were respectively three and two times that of the whole country. Minas, Ceara and their respective regions had a somewhat higher percentage of land in such use than the nation. On the other hand, the North and the Central West have about 1% of land in crops, as against 8.2% for the whole country.

Table 34. Variations in land use in Brazil, in its regions and in selected states[a]

	N	NE	CE	E	MG	S	SP	CW	BR[b]
					1950				
Crops:									
Temporary	0.8	8.5	8.0	6.5	7.0	12.1	15.0	1.0	6.3
Permanent	0.2	0.6	1.0	3.1	2.0	4.0	9.0	0.1	1.9
All Crops	1.0	9.1	9.0	9.6	9.0	16.1	24.0	1.1	8.2
Cultivated Pasture	0.4	0.9	1.0	12.3	12.0	8.0	20.0	5.2	6.4
Total Cultivated Land	1.4	10.0	10.0	21.9	21.0	24.2	44.0	6.3	14.6
Natural:									
Pasture	10.1	27.9	25.0	37.9	56.0	42.2	27.0	61.9	39.9
Woods	76.8	24.2	32.0	17.1	10.0	15.7	16.0	17.7	24.1
Idle Land	8.8	27.9	33.0	15.1	13.0	13.5	13.0	8.0	14.7
Unproductive Land	2.7	9.9		8.1		4.4		6.1	6.5
Total Land	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
					1960				
Crops:									
Temporary	0.4	3.1	6.2	4.0	2.3	6.2	8.7	.3	3.1
Permanent	1.4	11.5	9.1	7.9	7.3	16.0	16.0	2.0	8.4
All Crops	1.8	14.6	15.3	11.9	9.6	22.2	24.7	2.3	11.5
Cultivated Pasture	0.8	1.7	1.1	12.6	10.8	10.5	24.7	8.1	8.0
Total Cultivated Land	2.6	16.3	16.4	24.5	20.4	32.7	49.4	10.4	19.5
Natural:									
Pasture	8.7	31.7	29.7	42.6	57.0	37.6	26.4	61.6	40.9
Woods	72.7	23.1	28.8	14.9	8.6	15.4	12.1	16.9	22.4
Reforested Land	0.3	0.9	1.3	0.7	0.7	1.7	2.3	0.3	0.8
Idle Land	12.8	20.4	20.2	11.1	7.5	9.0	5.9	6.5	11.3
Unproductive Land	2.9	7.6	3.6	6.2	5.8	3.6	3.9	4.3	5.1
Total Land	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[a]Source: IBGE (6, Vols. 16 and 24).

[b]See footnote b in Table 15.

The ratio of temporary crops to permanent crops for the whole country was slightly greater than 3:1. This ratio for the regions varies from 14:1 in the Northeast to 2:1 in the East. Sao Paulo has a ratio of 1.64:1, smaller than that of the East. On the other hand, Minas Gerais had a ratio of 3.5:1, larger than that prevailing in the South. Ceara has a ratio of 8:1, smaller than that of the Central West (10:1) and much smaller than that of the Northeast (14:1).

Brazil had, in 1950, 6.4% of its agricultural area in cultivated pastures. Sao Paulo had a percentage three times higher (20%). Minas had 12%; i.e., less than two times the national percentage. Ceara had only 1% in cultivated pastures.

When the percentages in artificial pastures are added to those in natural pastures, the situation in 1950 was somewhat different. The South and the East had 50.2%, slightly above the national average. Sao Paulo had about the same percentage as the country as a whole. Minas had 68%, which was much above the country's percentage, and almost equal the percentage of the Central West. The Northeast and Ceara had percentages much below the nation's average, but almost three times that of the North.

In terms of the percentage of forest reserves, the only region with a percentage above the national average was the North, with 77%, while the nation had 24%. Ceara had 32%, thus above the Northeast percentage, which was the same as the national average. Minas Gerais had 10%, while the East had 17%. Sao Paulo's percentage was approximately the same as that of the South and two-thirds of the national average.

The situation with respect to the percentage of land unused, whether usable or not, is also of interest. Brazil had about one-fifth of its agricultural land not in use. The South had a percentage somewhat lower, 17.9%, and the East a percentage somewhat higher, 23.2%. The Central West, Sao Paulo, and Minas Gerais had approximately two-thirds, and the North about one-half, of the country's average percentage. The Northeast had a percentage almost double that of the nation. Ceara had about 1.5 times the country's percentage.

Brazil had 14.6% of its land under cultivation, Ceara, 10%; Minas, 21%; and Sao Paulo, 44%. It is to be noted that Ceara and Minas had approximately the same percentages as their respective regions. Sao Paulo, on the other hand, had almost double the percentage of the South.

The Northeast, East and South had respectively 28%, 38% and 42% of their land in natural pastures, while the whole country had 40% in such usage. Minas had 56%, which was a higher percentage than the East. Ceara had 25% and Sao Paulo, 27%, which were both below their respective regions.

The lower half of Table 34 shows land use in percentage for 1960. Comparing it with the 1950 data, one notes that the country as a whole had a larger percentage of land in crops. The increase was proportionally larger for Ceara, while for Minas and Sao Paulo the percentages remained practically the same.

The country's ratio of the percentage in temporary crops to the percentage in permanent crops changed from 3.3:1 in 1950 to 2.7:1 in 1960. Large changes occurred in the Northeast and in Ceara, where the ratios

changed from 14:1 to 3.7:1 and from 8:1 to 1.7:1, respectively.

The percentage of cultivated pastures rose from 6.4% to 8.0%. The increases in Sao Paulo and in the South were proportionally the same, and greater respectively than the change for the country. In Minas there was a decline, while in the East there was practically no change. The Central West had an increase proportionally greater than that of Brazil as a whole. The largest increases were noticed in the North and in the Northeast. In Ceara, however, the percentage remained practically the same.

In general, during the 1950-60 period, there was an increase in the percentage of the total farmland which was under cultivation. The regions North, Northeast and Central had increases proportionately greater than the increase observed for the entire country. The increase in the South paralleled that of the whole country, while the increase in the East, and in Sao Paulo as well, were less than proportionate to the national increase. In Minas, however, a slight decline was observed.

Table 35 shows the land tenure trends for Brazil and the three states during the 1920-60 period. From 1920 to 1940 there was a sharp decline in the percentage of farms operated by their owners. This decline was greater for Sao Paulo, and smaller for Minas Gerais and Ceara. Between 1940 and 1950 the percentage of owners remained the same for Sao Paulo, while it increased somewhat for Brazil and the other two states. From 1950 to 1960 there were sharp declines in Sao Paulo, and a less sharp decline for the country as a whole, while the declines for Ceara and Minas were much smaller.

Table 35. Percentage distribution of the farms according to the type of tenure in Brazil and selected Brazilian states, 1920, 1940, 1950 and 1960[a]

	CE	MG	SP	BR[b]
1920				
Owners	84.41	92.57	89.37	89.05
Renters	2.84	1.81	2.91	3.61
Administrators	12.75	5.62	7.72	7.34
Total	100.00	100.00	100.00	100.00
1940				
Owners	75.37	81.90	64.12	72.28
Renters	8.31	5.25	26.49	11.63
Occupants	0.36	3.13	0.56	5.72
Administrators	15.73	9.50	8.48	9.37
Total	100.00	100.00	100.00	100.00
1950				
Owners	80.58	88.43	64.57	75.24
Renters	4.90	3.35	23.97	9.05
Occupants	3.28	2.47	3.47	10.11
Administrators	11.24	5.75	7.94	5.59
Without Declaration	--	0.00	0.05	0.01
Total	100.00	100.00	100.00	100.00
1960				
Owners	76.50	85.05	52.88	66.97
Tenants	4.45	3.47	16.51	9.80
Sharecroppers	5.56	2.53	20.91	7.57
Occupants	2.35	2.88	2.75	10.68
Administrators	11.14	6.07	6.95	4.98
Total	100.00	100.00	100.00	100.00

[a]Source: IBGE (6, Vols. 5, 6, 16 and 24).

[b]See footnote b in Table 15.

The percentage of occupant-operated farms increased from 1940 to 1950 for the country as a whole, and remained in 1960 practically at the same level. For Ceara and Sao Paulo there was an increase from 1940 to 1950, and then a decline between 1950 and 1960. For Minas Gerais there was a decline from 1940 to 1950 and then a rise in 1960.

In the 1940-50 period, there was a sharp decline in the percentage of farms operated by administrators for the whole country, for Ceara and Minas Gerais. From 1950 to 1960 there was a slight rise in this percentage for Minas Gerais, and a slight decline for Ceara. In Sao Paulo, during the 1940-60 period, there was a steady, but slow decline in this percentage.

The 1960 Census distinguished between tenants and sharecroppers. In Minas Gerais, as in Brazil, the percentage of tenants was larger than that of sharecroppers. The reverse held true for Ceara and Sao Paulo.

Table 36 contains the percentage distributions of agricultural capital for the nation, the regions and the three selected states during the years 1940, 1950, and 1965. Table 37 shows the shares of the regions and the states in the various classes of agricultural capital. Table 38 expresses the relative position of the regions and states in the several classes of agricultural capital in terms of the national average.

Unfortunately, the classifications adopted by the sources were not the same for the various years. Intra-year comparisons among the regions and states are useful in providing basic information on their differences.

In 1940, Minas had a percentage of farm capital in real estate about the same as that of the East, and smaller than that of the whole country, of the Northeast, and of the South. This percentage was approximately the same as that of Ceara, and much below that of Sao Paulo.

Considering the capital per farm in the various classes, Minas was much above the national average, except for buildings, where it was equal

Table 36. Composition of farm capital in Brazil, in regions and selected states of Brazil, 1940, 1950 and 1965[a]

	N	NE	CE	E	MG	S	SP	CW	BR[b]
				1940					
Land	46.3	55.3	61.9	57.1	58.0	59.3	61.0	42.9	57.1
Buildings	20.7	18.3	12.7	13.9	11.1	15.6	18.0	11.9	15.2
Sub-total	67.0	73.6	74.6	71.0	69.1	74.9	79.0	54.8	72.3
Animals	28.1	22.7	21.6	25.1	26.5	19.7	14.5	42.7	23.2
Machines	3.2	2.5	2.4	2.4	2.5	2.8	3.7	1.2	2.5
Vehicles	1.7	1.2	1.4	1.5	1.9	2.6	2.8	1.3	2.0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
				1950					
Land	67.2	73.4	72.0	79.2	80.6	78.2	79.4	77.3	77.9
Buildings	22.2	18.7	20.9	13.3	11.1	14.1	13.4	13.8	14.4
Sub-total	89.4	92.1	92.9	92.5	91.7	92.3	92.8	91.1	92.3
Vehicles and Work Animals	6.2	5.6	4.9	5.8	6.5	5.4	4.8	7.7	5.7
Machines and Equipment	2.2	0.9	0.4	0.7	0.7	1.5	1.6	0.5	1.1
Other Machines	2.2	1.4	1.8	1.0	1.1	0.8	0.8	0.7	0.9
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
				1965					
Land	48.8	39.9	35.6	43.3	47.5	44.5	39.8	57.0	44.9
Permanent crops	8.6	8.2	9.5	7.2	4.0	10.0	10.7	2.2	8.4
Sum	57.4	48.1	45.1	50.5	51.5	54.5	50.5	59.2	53.3
Buildings	2.6	2.4	2.0	3.3	3.5	8.3	7.8	2.6	5.9
Sub-total	60.0	50.5	47.1	53.8	55.0	62.8	58.3	61.8	59.2
Animals	17.3	16.6	15.5	21.3	23.0	14.2	13.5	21.4	16.8
Equipment	10.0	25.9	30.5	19.1	16.3	15.6	19.1	13.3	17.3
Other	12.7	7.0	6.9	5.8	5.7	7.4	9.1	3.5	6.7
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[a]Source: IBGE (6, Vols. 6 and 16); IBRA (8).

[b]See footnote b in Table 15.

Table 37. Percentage distribution of farm capital by regions and selected states, 1940, 1950 and 1965[a]

	N	NE	CE	E	MG	S	SP	CW	BR[b]
					1940				
Land	1.17	12.51	2.97	32.22	20.64	50.00	19.92	4.16	100.00[c]
Buildings	2.00	15.50	2.25	29.29	14.85	49.02	21.94	4.25	100.00
Animals	1.73	12.60	2.68	34.86	23.18	40.77	11.62	10.04	100.00
Machines	1.79	12.98	2.70	30.32	19.70	52.22	27.62	2.68	100.00
Vehicles	1.00	7.48	1.94	24.68	19.62	63.34	26.67	3.50	100.00
TOTAL	1.43	12.90	2.99	32.19	20.30	48.03	18.63	3.13	100.00
					1950				
Land	0.84	9.36	1.97	30.98	16.62	54.32	24.56	4.50	100.00
Buildings	1.50	12.89	3.10	28.24	12.36	53.04	22.45	4.33	100.00
Vehicles and Work Animals	1.06	10.01	1.83	31.14	18.21	51.69	20.75	6.11	100.00
Machines and equipment	1.86	7.54	0.75	19.44	10.35	69.06	33.78	2.10	100.00
Other machines	2.26	14.60	4.25	33.19	19.85	44.57	19.96	3.37	100.00
Total Value	0.97	9.93	2.13	30.49	16.06	54.08	24.10	4.53	100.00
					1965				
Land	1.94	10.44	2.22	21.84	14.32	53.74	18.24	12.04	100.00
Permanent Crops	1.83	11.59	3.17	19.58	6.43	64.47	26.25	2.53	100.00
Buildings	0.79	4.80	0.95	12.67	8.15	77.59	27.58	4.16	100.00
Animals	1.84	11.60	2.59	28.68	18.53	45.76	16.54	12.13	100.00
Equipment	1.04	17.59	4.95	25.05	12.69	49.05	22.72	7.27	100.00
Other	3.37	12.28	2.88	19.54	11.55	59.83	27.72	4.97	100.00
TOTAL	1.79	11.77	2.80	22.66	13.54	54.29	20.58	9.50	100.00

[a]Source: IBGE (6, Vols. 6 and 16); IBRA (8).

[b]See footnote b in Table 15.

[c]Since the percentages for the selected states are already included in the percentages of the respective regions, the former should not be added to the latter to avoid double counting.

Table 38. Capital per farm in the regions and selected states of Brazil, expressed in terms of the national average, 1940, 1950 and 1965; national average = 100[a]

	N	NE	CE	E	MG	S	SP	CW	BR[b]
				1940					
Land	27	50	61	95	138	150	150	118	100
Buildings	46	62	46	87	99	147	165	123	100
Animals	41	50	55	103	155	122	88	290	100
Machines	42	52	55	90	132	156	208	77	100
Vehicles	33	30	40	73	131	190	201	101	100
Total Value	34	52	61	95	136	144	140	90	100
				1950					
Land	22	36	47	97	129	160	229	117	100
Buildings	40	49	74	88	96	156	209	112	100
Vehicles and Work Animals	28	38	44	97	141	152	193	158	100
Machines and Equipment	49	29	18	61	80	203	314	54	100
Other Machines	60	55	101	104	154	131	186	54	100
Total Value	26	38	51	95	125	159	225	117	100
				1965					
Land	111	49	48	72	90	129	234	249	100
Permanent Crops	105	54	69	64	40	155	337	52	100
Buildings	45	23	21	42	51	186	354	86	100
Animals	105	55	57	94	116	110	212	251	100
Equipment	59	83	108	82	79	118	291	151	100
Other	193	53	63	64	72	144	355	103	100
Total	102	55	61	74	85	130	264	197	100

[a]Sources: IBGE (6, Vols. 6 and 14); IBRA (8).

[b]See footnote b in Table 15.

to the national average. It had proportionally much more capital per farm invested in animals than in the other items, but this index was still almost half of that for the central West. On the other hand, the Minas index for animals was almost double that of Sao Paulo, where the index for animals was the smallest among the indices for the various classes of capital. But the index for total capital per farm was approximately the same for Sao Paulo and for Minas in 1940.

However, in 1950, the index for total capital per farm fell for Minas Gerais, and increased greatly for Sao Paulo. Ceara also underwent a decline with respect to this index, although not of the same magnitude as that of the Northeast as a whole. The Minas index for capital per farm in agricultural machines and equipment fell below the national average, becoming one-fourth that of Sao Paulo. The relative position of Minas with respect to the national average worsened still more in 1965. The index for total capital per farm fell below this average, while in the two previous periods it had been substantially above it. This index, which in 1940 was comparable to that of Sao Paulo, now became less than one-third. Even with respect to Ceara, Minas lost much of its previous advantages. The indices for these two states fell between 1940 and 1950, but in 1965 Ceara's index regained the 1940 level, while that of Minas had an approximate one-third decline.

Table 39 provides the 1965 average total values per farm and per hectare for Brazil, its regions and selected states. Table 40 gives the average land values for them.

Table 39. Value of all assets per farm and per hectare of farmland, 1965[a]

	N	NE	CE	E	MG	S	SP	CW	BR[b]
	(Thousand Cruzeiros)								
Per Farm	7,647	4,136	4,585	5,553	6,328	9,758	19,731	14,712	7,480
Per Hectare of Farmland	18	52	59	80	79	197	252	28	82

[a]Source: IBRA (8, p. 93).

[b]See Footnote b in Table 15.

Table 40. Average land values per farm and per hectare of farmland, 1965[a]

	N	NE	CE	E	MG	S	SP	CW	BR[b]
	(Thousand Cruzeiros)								
Per Farm	3,731	1,650	1,632	2,404	3,009	4,341	7,858	8,381	3,362
Per Hectare of Farmland	9	21	21	35	37	88	100	16	37

[a]Source: IBRA (8, p. 93).

[b]See footnote b in Table 15.

Tables 41, 42 and 43 refer to farm expenditures in 1940 and 1950.[11] The first of these provides the composition of the farm expenditures in Brazil and in the Brazilian regions and selected states. Table 42 gives the geographical percentage distribution for each of the items of expenditures. Table 43 shows indices of the several types of expenditures for the various geographical units in terms of the national average.

In Minas Gerais, for the year 1940, the three most important items were wages, taxes and purchase of animals. Wages for that state made up a smaller percentage than for the other regions and states, with the exception of the Central West. Taxes constituted, on the other hand, a much higher percentage of the total expenditures in Minas Gerais than in any of the regions. Sao Paulo and Ceara were much below the national percentage with respect to this item. Purchase of animals in Minas resulted in a high percentage expenditure, second only to the central west. Sao Paulo had a lower percentage than the national average. Ceara's percentage was still lower.

In 1950, wages, taxes and rent constituted for Minas the three most important items. For the first two items, the percentages were similar to those of the whole country. As to taxes, however, the percentage was double that of the country.

Minas' share of national farm expenditures was 17% and 14% in 1940 and 1950, respectively. Minas, in 1940 and in 1950, had a share in tax expenses double that of overall expenditures. The share of wages was in both years approximately the same as the share in overall expenditures.

[11] More recent data not available.

Table 41. Percentage composition of farm expenditures in Brazil, in regions and selected states of Brazil, 1940 and 1950[a]

	N	NE	CE	E	MG	S	SP	CW	BR[b]
				1940					
Wages	69.1	75.9	80.2	64.3	60.3	63.0	70.3	51.6	64.8
Fertilizer and Seed	2.1	3.2	3.6	2.9	2.5	8.1	7.9	1.3	5.7
Transportation	9.9	6.4	4.0	5.7	4.5	5.7	5.9	3.1	5.7
Taxes	8.0	5.6	5.3	12.3	16.5	8.3	4.7	9.9	9.2
Purchase of Equipment and Tools	6.0	3.8	3.5	3.3	3.0	4.4	3.5	3.6	4.0
Purchase of Animals	4.9	5.1	3.4	11.5	13.2	10.5	7.7	30.5	10.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
				1950					
Wages	67.8	61.8	58.6	53.8	50.2	46.0	55.4	37.3	50.0
Fertilizers	0.2	3.6	1.5	1.9	1.9	5.2	6.9	0.1	3.9
Seeds	0.5	2.7	1.6	1.8	1.6	4.0	3.2	0.6	3.1
Insecticides	0.2	0.4	0.4	1.3	1.3	2.5	3.0	0.3	1.8
Rent	3.1	3.2	2.2	3.0	4.2	5.1	4.5	4.1	4.3
Taxes	1.4	3.2	3.9	7.4	9.8	4.1	2.9	5.0	4.8
Other	26.8	25.1	31.8	30.8	31.0	33.1	24.1	52.6	32.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[a]Source: IBGE (6, Vols. 6 and 16).

[b]See footnote b in Table 15.

Table 42. Percentage distribution of types of farm expenditures among regions and selected states of Brazil, 1940 and 1950[a]

	N	NE	CE	E	MG	S	SP	CW	BR[b]
				1940					
Wages	1.72	15.30	2.21	30.59	15.56	51.78	42.40	2.57	100.00
Fertilizer and Seed	0.59	7.32	1.12	14.69	7.25	76.65	54.27	0.74	100.00
Transportation	2.80	14.60	1.24	28.37	13.04	52.52	40.09	1.72	100.00
Taxes	1.41	8.05	1.03	38.74	30.15	48.30	20.28	3.50	100.00
Purchase of Equipment and Tools	2.41	12.40	1.56	23.87	12.52	58.44	33.71	2.87	100.00
Purchase of Animas	0.75	6.23	0.56	31.17	20.78	52.60	28.52	9.24	100.00
Total	1.62	13.06	1.78	28.83	16.71	53.27	39.09	3.22	100.00
				1950					
Wages	3.01	14.42	1.80	27.86	14.32	52.33	38.83	2.38	100.00
Fertilizers	0.13	10.79	0.62	12.64	6.96	76.37	62.44	0.07	100.00
Seeds	0.33	10.30	0.80	14.61	7.39	74.19	35.70	0.57	100.00
Insecticides	0.21	2.46	0.35	18.64	9.96	78.16	58.07	0.55	100.00
Rent	1.59	8.64	0.79	18.48	13.96	68.26	37.14	3.03	100.00
Taxes	0.65	7.85	1.25	39.80	29.26	48.41	21.44	3.34	100.00
Others	1.86	9.16	1.53	24.92	13.81	58.86	26.37	5.23	100.00
Total	2.22	11.69	1.59	25.92	14.28	56.98	35.08	3.19	100.00

[a]Source: IBGE (6, Vols. 6 and 16).

[b]See footnote b in Table 15.

Table 43. Expenditures per farm in the regions and selected states of Brazil, expressed in terms of the national average, 1940 and 1950; national average = 100[a]

	N	NE	CE	E	MG	S	SP	CW	BR[b]
					1940				
Wages	40	61	45	90	104	155	320	74	100
Fertilizer and Seed	14	29	23	43	48	229	409	21	100
Transportation	66	58	25	84	87	157	302	50	100
Taxes	33	32	21	114	202	145	153	101	100
Purchase of Equipment and Tools	57	50	32	71	84	175	254	83	100
Purchase of Animals	18	25	11	92	139	157	215	267	100
TOTAL	38	52	36	85	112	159	295	93	100
					1950				
Wages	80	55	43	87	111	154	362	62	100
Fertilizer	3	41	15	39	54	224	582	2	100
Seed	9	39	19	46	57	218	333	15	100
Insecticide	6	9	8	58	77	230	541	14	100
Rent	42	33	19	58	108	201	346	78	100
Taxes	17	30	30	124	227	142	200	87	100
Others	49	35	36	78	107	173	246	135	100
TOTAL	59	44	38	81	111	167	327	83	100

[a]Source: IBGE (6, Vols. 6 and 16).

[b]See footnote b in Table 15.

Minas' per farm expenditures on taxes were double that of the national average, while the expenses per farm with seeds and fertilizers were half that of the national average, both in 1940 and 1950. In per farm overall expenditures, the state was only about 10% above the national average.

Tables 44 and 45 give the geographical distribution of the agricultural labor force and of the tractors and plows among the regions and selected states. In its percentage participation in the country's agricultural labor force, and in number of tractors and plows, Minas had a small rise between 1940 and 1950, and a decline in the 1940-60 period. From 1940 to 1960, the state had a steady decline in the percentage of number of farms, farm area, and cultivated area. This decline was more accentuated for the first of these three items. These variations had such relative magnitudes as to produce the following results.

The indices for labor rose in the 1940-50 period, and fell in the subsequent period. In per farm terms, this rise and fall was from 9% above to 30% above, and back to 8% above the national average. In per total area terms, the rise was from an index close to the national average to 8% above, and the fall took the index to a level 19% below the national average (see Table 46).

Table 44. Percentage distribution of the farm labor force among regions and selected states of Brazil, 1940, 1950 and 1960[a]

	N	NE	CE	E	MG	S	SP	CW	BR[b]
1940	3.31	27.30	6.14	35.42	16.37	30.80	17.18	3.16	100.00
1950	2.97	26.35	4.54	35.52	16.99	31.66	13.93	3.51	100.00
1960	3.46	29.41	5.26	31.46	11.97	31.29	10.84	4.38	100.00

[a]Source: IBGE (6, Vols. 6, 16, and 24).

[b]See footnote b in Table 15.

Table 45. Percentage distribution of tractors and plows among the Brazilian regions and selected states of Brazil, 1940, 1950, 1960[a]

	N	NE	CE	E	MG	S	SP	CW	BR[b]
					Tractors				
1920	.41	3.28	.12	13.72	8.97	82.47	23.51	.12	100.00
1940	.77	5.24	1.09	14.76	7.49	78.40	41.71	.83	100.00
1950	.73	3.87	.38	17.48	9.11	76.27	45.62	1.66	100.00
1960	.42	3.65	.50	12.26	7.91	80.04	44.26	3.63	100.00
					Plows				
1920	.08	2.21	.09	16.47	12.40	81.06	19.77	.18	100.00
1940	.03	1.24	.14	12.14	9.86	86.38	33.56	.21	100.00
1950	.05	1.26	.11	13.07	10.36	85.17	31.49	.43	100.00
1960	.03	1.47	.13	11.05	9.02	86.31	27.77	1.14	100.00

[a]Source: IBGE (6, Vols. 6, 16 and 24).

[b]See footnote b in Table 15.

In Minas, the indices for equipment rose from 1940 to 1950, and remained at this new level in 1960. The increases tended to be larger per farm terms than in per cultivated area terms (Table 47).

It is interesting to compare these trends with those of Sao Paulo and of the three less-developed regions. Sao Paulo showed during the 1940-60 period a declining trend in percentage participation in the agricultural labor force and in the number of plows. The percentage participation in the number of tractors showed a rising trend.

Sao Paulo, as did Minas, showed a declining trend in the participation of the number of farms, farm area and cultivated area. The less-developed regions showed an increasing trend for these items with the exception of cultivated area, of which there was first a decline and than a restoration of the 1940 level.

Relative indices, in terms of the national averages, of labor and equipment per farm and per area are provided in Tables 46 and 47. With respect to labor Minas showed first a rise and then a decline, both in per farm and per hectare terms. Sao Paulo showed a decline in per area terms, and stability followed by a decline in per farm terms. The less-developed regions showed a trend opposite to that of Minas and more accentuated in per area terms.

Table 46. Relative labor indices for the regions and selected states of Brazil, 1940, 1950 and 1960; national average = 100[a]

Year	N	NE	CE	E	MG	S	SP	CW[b]
				Number of Workers per Farm[c]				
1940	78	109	125	105	109	92	130	91
1950	78	100	108	111	132	93	130	91
1960	84	102	144	110	108	93	114	92
				Number of Workers per 1,000 Hectares of Farmland[d]				
1940	26	189	141	132	97	121	183	15
1950	30	147	103	138	108	135	170	15
1960	28	170	123	127	81	138	143	19

[a]Source: IBGE (6, Vols. 6, 16 and 24).

[b]See footnote b in Table 15.

[c]The nation's average numbers of workers per farm in these three years were 5.9, 5.3, and 4.6, respectively.

[d]The nation's average numbers of workers per 1,000 hectares of farmland are 59, 47 and 58.

Table 47. Relative farm equipment indices for the regions and selected states of Brazil, 1940, 1950 and 1960; national average = 100[a]

Year	N	NE	CE	E	MG	S	SP	CW[b]
				Tractors per 1,000 farms[c]				
1940	18	21	22	44	50	235	315	24
1950	19	15	9	55	71	224	425	43
1960	10	13	14	43	71	237	465	76
				Tractors per 1,000 hectares of cropland[d]				
1940	16	23	16	49	50	204	182	22
1950	35	18	7	61	61	173	215	42
1960	27	15	11	51	60	180	300	64
				Plows per 1,000 farms[e]				
1940	1	5	3	36	66	259	253	6
1950	1	5	3	41	81	250	293	11
1960	1	5	4	39	81	256	292	24
				Plows per 1,000 hectares of cropland[f]				
1940	1	6	2	40	65	224	146	5
1950	2	6	2	46	69	194	149	11
1960	2	6	3	46	69	194	188	20

[a]Source: IBGE (6, Vols. 6, 16 and 24).

[b]See footnote b in Table 15.

[c]Brazil had 1.7, 4.0 and 18 tractors per 1,000 farms in 1940, 1950 and 1960, respectively.

[d]The Brazilian average numbers of tractors per 1,000 hectares of cropland were 0.2, 0.4 and 2.1, respectively.

[e]The nation's average numbers of plows per 1,000 farms for the years under consideration were 263, 345 and 308.

[f]Brazil had 39, 37 and 34 plows per 1,000 hectares of cropland in 1940, 1950 and 1960, respectively.

With respect to equipment, Minas showed first a rise and then stability. Sao Paulo showed an increasing trend, with the exception of the indices for plows, which had a trend similar to that of Minas; that is, an increase followed by stability. The less-developed regions followed a trend opposite to that of Minas. They experienced stability followed by a rise in tractors per cultivated area and in plows per farm. They followed, as did Sao Paulo, a rising trend in plows per cultivated area. In tractors per farm, they had a decline, and then a restoration to the 1940 level.

It is significant to point out that one of the less-developed regions, the Central West, attained in 1960 indices of tractors per farm and per cultivated area superior to those of Minas, and much superior to those of the Eastern region. Since it has a favorable topography, and is experiencing a substantial demographic expansion, the Central West region is likely to make great progress in the future with respect to motor mechanization. With respect to plows per farm and per cultivated area, the Central West has taken long strides, while there has been relative stability in Minas Gerais. The gap between their respective indices is still large, however.

The comments made in this section about farm equipment in Minas Gerais were indications of the technological level of the state in this respect. The breakdown of expenditures shows the relatively-low level of the state in the use of better seeds and of fertilizers.

III. THE ANALYTICAL MODEL, STATISTICAL PROCEDURES AND HYPOTHESES

The present chapter is divided into three parts. The first part presents a general analytical frame of reference on which the analysis is based. The second part elaborates the hypotheses to be tested, and the hypothesized directions of influence. The third part presents the statistical procedures to be used in the analysis, and a discussion of the data.

A. The Analytical Model

Economic development, although a rapidly-growing field, still is far from developing a general theory.[1] Consequently, empirical research on developing countries has to draw eclectically on existing theories, and attempt to extend and integrate them to the extent possible.

The present research is concerned with the interrelations among the various sectors of the economy, and more importantly, with discovering insights into the mechanism by which economic growth is transmitted from one sector to the other. It has been suggested that the interaction between the modern and the traditional sector of an economy is probably the key to the development problem. Hence the analytical model to be sketched out here will have its fulcrum in such an interaction.

1. The development process

At the beginning of the development process, the structure of the economy is in general not very differentiated. There tends to be a small and prosperous modern sector and a huge traditional sector. In

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[1] Some authors doubt the feasibility of such a task. See, for example, Higgins (25).

general the former depends largely upon foreign markets, and exerts very little influence upon the latter.

The essence of economic development consists of the modern sector acquiring a dynamics of its own through interaction with and dynamization of the traditional sector. Viner (52) argued that the problem of underdevelopment is not one of industry versus agriculture. Both industry and agriculture tend to be underdeveloped in the less-advanced countries. The sectoral differentiation of a country is, however, one of the characteristics of the development process.

A number of writers have speculated on the expected evolution of the agricultural and industrial sectors as economic development takes place. Heady (24), for example, predicts that agriculture will have basically the same development pattern the world over. Even in the very dissimilar appearances of the agricultural problem among nations at different stages of development, he sees a common element. This common element is the absolute or relatively-low value productivity of resources in agriculture. The difference among nations is that economic growth in the advanced nations makes the absorption of labor liberated by technical improvements in agriculture much easier. In his book he studies the structural changes undergone by American agriculture during the process of development.

Hoffmann (26) using data from several different nations, found a pattern for the development of the manufacturing industry. He concluded: "Whatever the relative amounts of the factors of production, whatever the location factors, whatever the state of technology, the structure of the

manufacturing sector has followed a uniform pattern. The food, textile, leather and furniture industries which we define as consumer-good industries always develop first during the process of industrialization. But the metal-working, vehicle-building, engineering and chemical industries--the 'capital-goods industries'--soon develop faster than the first group." Hoffman divided the process into four stages, according to the ratio of the net output of the consumer goods industries to that of the capital goods industries. These ratios are: 5 ($\pm$ 1): 1 for the first stage, 2.5 ($\pm$ 1): 1 and 1.0 ($\pm$ 0.5): 1 for the second and third stages. In the fourth stage, the ratio is below 0.5.

These paths of agricultural and industrial development make the problem of regional inequalities an ubiquitous one. Studies of this problem *a fortiori* center upon the question of intersectoral relations. This is the topic to be discussed next.

2. Intersectoral relations

A number of writers have speculated on intersectoral relations as economic development takes place. Among these are Clark (21), Fisher (22 and 23), and Sauvy (39). The theory used in the present analysis is drawn primarily from Schultz and extensions of this theory, however. For this reason, the discussion is focused on this.

The basic elements of the theory were laid out in Chapter I, together with the results of testing the theory empirically. In this section, extensions of the theory as postulated by Schultz, and some of the problems inherent in using it are considered.

In the first place, perspective must be maintained on the context in which the Schultz hypotheses were developed. He was writing from

the standpoint of a mature economy, but an economy in which there were substantial regional income disparities within the agricultural sector. All of the tests of the hypothesis have been in this context, including Nicholls'[2] test with the use of Sao Paulo data. The state of Sao Paulo has a strong industrial sector, and one in which wage rates are much higher than can be obtained in the agricultural sector.

When one is in this in some sense fortunate situation, then the question becomes, "How can the gains from industrial development be distributed in as wide a base as possible?" In the U. S. economy, the empirical work on the Schultz hypothesis has led researchers to argue that local economic development programs should be tied to nearby growth centers. It is not clear, however, whether the same conclusions will follow when the hypothesis is tested with data from Minas Gerais--a state with an economy much less developed, and in which economic activity is much more dispersed in its distribution.

Bryant (20) extended by two the list of causal variables originally suggested by Schultz. In doing this he takes issue with the role of market imperfections, which had been stressed in earlier empirical work. Nicholls especially, in both his U. S. work and his analysis of the Sao Paulo data, has given a major role to the contribution of industrial growth in reducing the imperfections in the factor- and product-markets.

Bryant (20) argues that the role of imperfections has been overplayed in these analyses. He demonstrates on the one hand that many of

[2]See herein, pp. 7-8.

the observed relationships in the United States case can be understood as effects of influx of outside capital into the industrial sector, and that no appeal needs to be made to the reduction of imperfections in the markets. In fact, he argues that the evidence for a reduction in market imperfections is just not there.

A second point that Bryant makes is that the effect of industrial-urban development is in large part a result of agglomeration and its effect on agriculture. The literature on agglomeration emphasizes the effects of economies of scale, location economics, and urbanization economies on firms in industrial-urban complexes. The counterparts in the agricultural case are as follows:

(i) Expansion of the nonfarm labor market increases the numbers and kinds of jobs available to prospective migrants. This speeds up the migration process as the opportunity costs of labor rises and thereby forces the reorganization of agriculture.

(ii) Similar forces work in the credit market, with more credit at lower interest rates being made available to agriculture.

(iii) Local demand for farm products grows as the urban population expands. At some point the market becomes large enough so that local agriculture can operate at a lower average cost--either because of increased specialization or because of the realization of economies to size.

(iv) With agglomeration, more social overhead capital is provided. This includes such things as roads which lower transportation costs, and improved educational facilities and increased education expenditures which increase labor mobility and raise labor productivity.

To the extent possible, considerations such as these will be taken account of in analyzing the data from Minas Gerais. In this sense, the analytical model used in this study represents an expansion of the models used in previous studies of the same vein.

Heady (24, p. 197) makes a somewhat different point in another context. Referring to cases of extreme lag of adjustment to economic development, he attributes the cause not to the lack of industrialization per se, but to a communication void. This void exists in the market communication for the basic resources of agriculture. The relevance of this point to the present study can be seen by turning the proposition around. A consideration of the conditions prevailing in underdeveloped countries, where markets for commodities and resources have little or no organization, suggests that industrialization and the accompanying urbanization do constitute a step in the direction of organizing channels for market communication.

This argument is in line with studies made by McClelland (31) on the role of the achievement motive for economic development,[3] and is also in agreement with MacLuhan's theory of the effect of communication on social changes (32 and 33).[4] In addition, the argument receives support from Boulding's view of the process of social change (5).

Before turning to a consideration of the specific conditions in Brazil under which the model will be tested, one further analytical con-

[3] McClelland suggests investment criteria which take into account the need to change traditional values hindering development.

[4] MacLuhan's theory is actually much broader. It deals with the depth of changes in man's perceptions and outlook brought about by technology.

sideration should be considered. This is the question of causality. Previous studies in the tradition of the present study have argued that causality flows from industrialization, with the latter being a factor exogenous to the agricultural sector.

This frame of reference was probably reasonably valid for the studies carried out in the U.S.--especially those in the Southeastern U.S. The agriculture at the beginning of the study period was largely stagnant, and a process of industrialization was imposed from the outside largely as an exogenous shock on the system. This appeared to have an impact on the agricultural sector, and the a priori evidence on the direction of causality was rather clear.

For Nicholls' analysis of the Sao Paulo data, however, the case was not nearly so clear, as Schuh (41) pointed out in his discussion of the Nicholls paper. Sao Paulo is blessed with an excellent endowment of agricultural resources, and the agricultural sector has been dynamic and rapidly growing, with rather large increases in total factor productivity over time.

Moreover, the evidence is rather clear that agriculture contributed heavily to the development of the industrial complex of Sao Paulo. The government transferred substantial capital from agriculture to industry through an ingenious use of multiple exchange rates and outright confiscation of exchange earnings. In addition, agricultural entrepreneurs invested rather heavily in the industrial sector. This makes one question whether the line of causality could be assumed to run in the direc-

tion that Nicholls postulated.[5]

In the state of Minas Gerais, the picture is somewhat less clear. In general this state is not blessed with the agricultural resources of Sao Paulo. With the exception of a couple of important regions, the terrain is rough, the soils lacking in basic fertility, and the agriculture is of a rather traditional organization. In addition, it would appear that in general the industrialization that has taken place in the state has been more exogenous (albeit not completely) to the agricultural sector, and more oriented towards other resources bases.

In any case, an effort will be made in the present study to unravel the direction of causality. This will be done by a consideration of the time lags, since we do have three censuses to work with. However, it is difficult to analyze this problem definitively, since it is always possible that both the agricultural and industrial development are the result of a more fundamental set of factors, and directly related to each other. The reader should keep this in mind throughout the remainder of the thesis.

3. An interpretation of the development experience in Brazil

As an aid to the reader in understanding the setting in which the empirical analysis to follow is placed, an interpretation of the development experience in Brazil is attempted in this section. It is hoped that this will set the analysis in a larger frame of reference, and pro-

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[5] It is interesting to note that Nicholls' analysis is in some respects a test of this alternative hypothesis. He correlated industrialization of 1950 with agricultural development of 1940 and 1950. Clearly the first correlation is more consistent with the direction of causality running from agricultural development to industrialization.

vide some insights into the results obtained below. No attempt is made to empirically document the interpretation provided.

Brazil (and Minas Gerais, for that matter) has the following characteristics:

(i) A large territorial area;

(ii) Great reserves of natural resources in areas of incipient settlement;

(iii) A population that is small compared to the potential of the country;

(iv) A concentration of the majority of the population in an area that was settled long ago;

(v) A limited, but rapidly-growing system of transportation and communication;

(vi) An industrial sector that is in many respects on the road to maturity;

(vii) An economy that has been characterized by chronic inflation.

Insights into the inter-sectoral relations can be obtained by dividing the country (or economy) into three sectors, according to their advanced, intermediate, and incipient stages of industrial-urbanization. For brevity in exposition, these sectors will be called advanced, intermediate, and incipient sectors.

a. The advanced industrial-urban sector In the beginning, the dynamic thrust for this sector was export agriculture. At that time, declines in export prices were met with currency devaluation, which allowed the exporting sector to maintain its relative income level. The

maintenance in this way of the domestic income level, in the presence of a fall in the external purchasing power of the currency, provided the conditions for growth of the industrial sector. This was further reinforced by government purchases of the surpluses of export products, financed with printed money, which in essence constituted an open-market operation, but with commodities rather than bonds being the item traded for money.

At a later stage, when the industrial sector achieved some importance and the country was facing balance of payments difficulties, the government adopted policies favoring industries that would replace imports. This had two important side effects. It further accelerated the process of urbanization, which caused the agricultural sector to become more capital intensive, and at the same time caused the agricultural sector to allocate an increasing share of its resources to production for the domestic market. The agricultural labor which left the farms either went to cities within the sector, or to the agriculture of the other two sectors.

b. The sector of intermediate industrial urbanization A similar interaction between agriculture and industry occurred in this sector, but with a time lag and to a somewhat lesser extent than in the former sector, where the conditions were more favorable to industrialization. A comparison of the two sectors is useful.

In the advanced sector, the fall in export prices and the currency devaluation harmed the importing sector while benefiting directly the export sector and indirectly the import-substituting industries and related commerce. In the intermediate sector, the industrial sector

benefited from the growing importance of the domestic market in the nation's economy. Existing industries in the sector were those processing local agricultural products and mineral resources, which prospered with the growth of the domestic market. This prosperity, in turn, caused a growth in the sector's demand for industrial products from the advanced sector. The growing trade among the advanced and intermediate sectors brought about an improvement in the transportation and communication systems, which further reinforced the inter-sectoral trade and facilitated the spread to the intermediate sector of the demonstration effect both in production and in consumption.

The agriculture of the intermediate sector felt the impact of these changes also. Alternatives and markets[6] open to farmers became more widely known. Labor mobility also increased with the improvement in transportation[7] and communication facilities, and as the large urban centers attracted farm workers. The opening of the hinterland, with its promise of quick economic success, also claimed immigrants from this sector.

The exodus of the farm labor, a growing domestic market for agricultural products, the availability of new agricultural inputs, and the improvement in the transportation and communication systems brought about pressures to modernize the agriculture of the intermediate sector.

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[6]These markets were for both farm products and for new and improved inputs.

[7]The return trips of trucks to the advanced sector constitute a relatively-cheap form of transportation for labor looking for better living conditions and employment opportunities in the great urban centers and in the agriculture surrounding these centers.

With the growth of the local economy, the threshold for the establishment of new industries was reached. This again resulted in a feedback to the agriculture of the sector.

Hence, one sees in broad general terms that there was an interaction between the advanced and intermediate sectors which was beneficial to the latter. In the next section it will be seen that the growth of the incipient sector was also beneficial to the intermediate sector, since it constituted a new source of products and an expansion of the market.

c. The sector of incipient industrial-urbanization In the beginning, the industrial urban complex of this sector is relatively very small. It therefore does not have much of an impact on the agricultural sector, which produces, in addition to subsistence crops, export crops for the other industrial-urban sectors or for the foreign markets.

As communication with the other sectors increases, and the migratory process increases, urbanization begins to accelerate. The growth of the domestic market provided by the other two industrial-urban sectors causes some shift in the agricultural production of this sector. The share of production for the domestic market begins to grow. The greater stability of this market makes for a more even development of the local economy. The flow of labor from the rural sector to the urban sector increases the size of the local market, which is a prerequisite for a diversification of the economic structure of the sector.

d. A concluding statement The above discussion suggests the importance of interrelations between the sectors of the economy, and indicates some of the pertinent channels. There is a constant interaction

among the several industrial-urban sectors, as well as an interaction among the farm and non-farm sectors. In a very real sense there is a circularity, with the various sectors interacting and stimulating each other.

B. Hypotheses to be Tested

The model implied in the above analytical discussion will be tested with data from the state of Minas Gerais. This state has the third largest industrial sector in the country, and is bordered by the two states having the first and second most important industrial sectors. The state partakes of each of the three sectors discussed in the above section; viz., advanced, intermediate, and incipient industrial-urbanization.

Discussion in the previous section suggested that there was a circularity among the farm and non-farm sectors of the economy. This thesis, however, is concerned primarily with the loop going from the urban-industrial sector to the agricultural sector. It makes an important departure from previous studies of this kind though, in that it gives greater attention to the importance of the commercial sector as a link between industrial and agricultural development. It is argued that it is through the commercial sector that industry effects agriculture within a given industrial-urban sector (see above), and that the various industrial sectors influence each other. To capture this, variables on commercial and demographic concentration, as well as the conventional industrial variables will be tested as important urban variables influencing the agricultural sectors.

1. Identification of the variables

Before describing the variables, a comment on terminology is in order. It helps to understand not only the meaning of the variables, but also the difference between some of the concepts to be discussed later in this chapter.

An index is understood here to be a variable which consists of the rank of a given zone with respect to one characteristic or proxy (simple index)[8] of the average of the zone's ranks according to various characteristics or proxies (composite index). Indices, in the sense just described, were used only for the urban sector, but not for the agricultural sector.

The urban indices which are hypothesized to be correlated with the agricultural variables may be grouped into general urban indices and sectoral indices. The general urban indices, which represent the urban sector as a whole, are:

X1 is the overall urban index. This is the composite index par excellance. It is the average of the zone's rankings in characteristics which compose the other urban indices to be described. It should be noted that there was some difference among the censuses as to the number of urban characteristics for which information was available. So, the overall urban index is the average of 21 proxies in 1940, 35 in 1950 and 29 in 1960. This divergence is duly considered in the interpretation of the results. In the definition of the other composite indices the difference in the number of the proxies is also pointed out.

[8] It is obvious that the rank correlation coefficient obtained through the use of simple indices is the same as that resulting from the use of the corresponding proxies. There is, however, great difference between the coefficients of dispersion of a proxy and that of the corresponding simple index. (Cf. Appendix A.)

X2, demographic density, is a simple index based upon the population per km2.

X3, the index of all nonagricultural enterprises consists of the average of the zone's ranks in the following characteristics: per capita and per employee payrolls in all the urban enterprises, per capita inventories, and per capita fixed capital in the same enterprises. The 1940 census lacks information on the latter two characteristics.

The sectoral indices are:

X4, per capita value added by manufacturing. This is the index used by Nicholls in his Sao Paulo study (36 and 37). The abbreviation pcVAM will be used for this index.

X5, a general industrial index, is a composite index consisting of the zone's ranks in per capita, per worker and per establishment value added by manufacturing, per establishment and per employee fixed capital in the industrial enterprises (no 1960 data exist for the latter two characteristics), number of employees per establishment, number of production workers per establishment (no data in 1940), annual wages per worker, number of horsepowers of motive energy per establishment and per worker (no 1940 data for the last two characteristics).

X6 is the wholesale trade index. The characteristics on which this index is based are: per capita and per employee gross receipts in all wholesale enterprises, per employee and per establishment fixed capital and inventories (no data in 1940 for the latter four characteristics), number of employees per establishment, and annual wages per worker in all wholesale trade enterprises.

X7 is the retail trade index. It is based upon characteristics for which data were available in all three censuses: per capita, per establishment and per employee gross receipts, per establishment and per employee inventories, number of employees per establishment and annual wages per worker in all retail trade establishments.

X1 was based also upon characteristics other than those composing the indices already described. These other characteristics are the basis of two other indices, X8 and X9, which were not used for the urban-agricultural study because no inter-coefficient[9] could be computed for them.

X8 is the index of services and trade other than wholesale and retail trades. It is a simple index based upon the annual wages per worker in these types of enterprises.

X9, banking index, is based on per capita deposits and loans, and upon receipts as percentages of deposits and of loans.

The agricultural variables, which are 107 in number (X10 to X116), are defined below. Some of the variables consist of percentages. Most of these percentage variables constitute pairs of variables, one expressed in terms of the number of farms having a given characteristic, the other in terms of the area of these farms. In these cases, the first symbol refers to the percentage of the number and the second to the percentage of the area. The 107 variables may be grouped into three classes. These classes are formed according to their being re-

[9] See beginning of Chapter IV for definition of inter-coefficients.

lated to the human element, to the productive structure, and to the size or scale of the farm enterprises.

a. Variables concerning the human element in agriculture This class of variables consists of variables dealing with the legal organization (or type of farm ownership), the type of farm operator, and labor.

1. Legal organization Four types of ownership were considered: individual (X10, X14); partnership (X11, X15); ownership by corporations and cooperatives[10] (X12, X16); and public ownership (X13, X17).

2. Farm operator The following types are considered: owner (X18, X24); tenant (X19, X25); sharecropper (X20, X26); tenant or sharecropper; i.e., renter (X21, X27); occupant[11] (X22, X28) and administrator (X23, X29). Data for X19, X25, X20 and X26 exist for 1960, but not for 1950. The reverse is true for X21 and X27.

3. Farm labor All the variables relative to labor are expressed in the percentage of the total farm labor force. Two of the variables refer to the participation of the two sexes in the labor force: X30 (percentage of all males) and X31 (percentage of all females). All the several types of labor are represented by two variables, the first referring to the percentage of males of that class in the total labor force, and the second, the corresponding percentage of females. These pairs of variables are: family labor (X32, X33); permanent employees (X34, X35); temporary employees (X36, X37), sharecroppers living on the

[10] For brevity, this type of ownership will be referred to as corporate farming.

[11] Those who occupy the land without having title to it.

farm (X38, X39); sharecroppers living off the farm (X40, X41); and other types of labor (X42, X43). There are no 1950 data for X42 and X43, and no 1960 data for X40 and X41.

b. Variables concerning the productive structure of agriculture

This class comprises variables dealing with land use (pasture, crops, etc.) type of farming represented by the dominant farm enterprise(s), and type of power represented by the source of energy used in farming and in processing farm products.

1. Land use The various types of land use are expressed as percentages of the area of the farms with respect to the total farmland of the zone. The types considered are the following: permanent crops (X44); temporary crops (X45); natural pastures (X46); planted pastures (X47); natural woods (X48); reforested land (X49); utilized arable land (X50); unproductive land (X51); and irrigated land (X52). Data on the latter variable exist only for 1960.

2. Type of farming Variables in this subclass are percentages of the number of farms and percentages of the area of these farms in the following types of farming: crop farms (X53, X63); crop-livestock farms (X54, X64); crop and crop-livestock farms (X55, X65); livestock-breeding farms; (X56, X66), livestock-feeding farms (X57, X67), other types of farm (X58, X68); horticultural and floricultural farms (X59, X68); poultry farms (X60, X70); extractive farms (X61, X71); and research farms (X62, X72). The 1950 census separated the crop farms from the crop-livestock farms, while the 1960 census took these two types as only one. On the other hand, while the latter census provided information on horticultural and floricultural farms, poultry, extractive

and research farms, the 1950 census aggregated these types under the designation of other types of farms.

3. Type of power All the variables of this subclass are expressed in terms of the percentage of the number of farms. Both for 1950 and 1960 there are data for the following types of power used in farming: animal (X73); mechanical (X74); animal and mechanical (X75); and human power (X76). In 1960 data were provided also for the type of power used in the processing of farm products and for the farms having electricity. There were three types of power for processing farm products: animal (X77); mechanical (X78); and a combination of animal and mechanical power (X79). As to electricity, one variable, X80, represents the percentage of all farms having such a source of power. Three other variables refer to: farm-produced electricity (X81); purchased electricity (X82); and a combination of production and purchase of electricity (X83).

c. Variables relative to the size or scale of the farm enterprises The groups of variables under this heading are classes of farm size, hectare per farm in different types of farm and the classes of cropland size. The components of these groups are as follows:

1. Classes of farm size Percentages of the number of farms and of their area in the following classes were considered: less than 2 hectares (X84, X89); from 2 to 99 hectares (X85, X90); greater than 500 hectares (X86, X91); greater than 1,000 hectares (X87, X92); and greater than 5,000 hectares (X88, X93).

2. Average farm size in different types of farms Legal organization, farm operator and classes of farm size constituted the

types of farm analyzed in the present work. Thus, the farms considered were: those operated by their owners (X94); by renters (X95); by tenants (X96); by sharecroppers (X97); by occupants (X98); by hired administrators (X99); those owned by individuals (X100); by partners (X101); by corporations or cooperatives (X102); and by the government (X103); those greater than 2 hectares (X104); between 2 and 99 hectares (X104); 100 hectares and over (X106); and all sizes (X107).

3. Classes of cropland size Only the percentages of farms in the different classes were considered. The following were the lower limits of the classes: 2 hectares (X108); 5 hectares (X109); 10 hectares (X110); 20 hectares (X111); 50 hectares (X112); 100 hectares (X113); 200 hectares (X114); 500 hectares (X115); and 1,000 hectares (X116).

2. Expected correlations

The expected correlations are discussed in two parts. The first part considers the expected correlation within the urban sector, while the second part considers the hypothesized directions of relations between the urban and the farm sector.

a. Among the urban indices The overall urban index, being based upon all the other urban indices, is expected to have high positive correlation with all of them. The higher the several urban indices (population density, all nonagricultural enterprises, etc.), the higher the overall urban index.[12]

[12]The nature and the number of the proxies chosen for the several urban variables are expected to influence the magnitude of the respective correlation coefficients.

Since population is an element both in production and in consumption, demographic density would be expected to have high positive correlation with the other urban variables. There are, however, some reasons to expect that the correlations are not very high.

First, what counts is not the sheer number of people but their education level,[13] the amount of capital at their disposal, and their purchasing power. Second, since demographic density refers to the whole population, rural and urban, there is a difference between the case of concentration in a few big urban centers and that of a thinly spread population. People in the rural areas and in small towns tend to have little participation in the economic life of the cities and towns. Third, areas in decadence or in the earlier stages of settlement have a high demographic density compared to their volume of economic activities. Finally, the fact that some highly-populated zones are located near the industrial centers of the neighboring states is expected to lower the correlation between demographic density and the industrial indices.

The index of all nonagricultural enterprises is expected to have high positive correlation with the sectoral indices. This is so because the proxies for all nonagricultural enterprises are aggregates of data from the various urban sectors.[14]

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[13]This is relevant both in consumption and in production.

[14]As in the case of the overall urban index, the nature and the number of the proxies chosen for the several urban sectors are expected to influence the magnitude of the respective correlation coefficients.

The correlation among the industrial indices is expected to be high. The correlations between the industrial indices and the remaining sectorial indices are not expected to be very high. This is so because zones around the most industrialized zone of the state and in the neighborhood of the industrial states do have advanced service sectors compared to their local industry.

The correlation among the various types of trade is not expected to be very high. Predominantly agricultural zones have proportionately much more wholesale trade than retail trade.

b. Expected correlations between the urban and the agricultural variables

1. Legal organization Reserves of government land are expected to be found in less-developed zones. Thus, the correlation of public land with the urban indices is expected to be negative and high.

The urbanization process, on the one hand, breaks sociological and psychological barriers to cooperation and, on the other hand, makes advisable the pooling of economic resources to take advantage of the improved-market situation. So, while the correlation of individual farms is expected to be negative, those of farms owned in partnership and by cooperatives and corporations are expected to be positive.

2. Type of farm operator Due to their more advanced stage of land settlement, the more urbanized zones are expected to have less farms operated by occupants. The existence of urban employment and education opportunities, coupled with the attractions of city life, result in conditions favorable to absenteeism in the more urbanized zones. Renters (tenants and sharecroppers) and administrators, although at-

tracted by the city, lack the financial reserves to attempt to move to urban areas, where they are less likely to find employment with status comparable to that they have on the farm. Thus, a higher proportion of renters and administrators and a smaller proportion of owner-operators and occupants are expected in the more urbanized zones.

3. Farm labor In a country with relatively-large families and without domestic labor-saving devices, there is a great demand for female hired-help for housework. As urbanization proceeds, housewives whose husbands are climbing up the social ladder begin to feel the need of hiring maids. A house-maid becomes, for families at certain rungs in the social ladder, a status symbol, with the pressures for others to "keep up with the Joneses."

In many other areas in the service sector there is a great demand for female work: hotels, restaurants, hospitals, laundries, offices, shops, etc. Many of these jobs require skills that are very easy to obtain. To these jobs girls emigrating from rural areas have good access. For jobs requiring more complex skills, the rural girls are at some disadvantage. But even here there is some repercussions affecting them favorably. City girls getting these jobs will require services of unskilled or semi-skilled girls.

In some industries there is a great demand for female labor. Textiles, manufacture of clothes, some phases of coffee processing (sorting out of impurities and classification of the product), and the food and beverage industries are some of those in which females have a comparative advantage. Some of these industries, mainly textiles and

coffee processing, exist in the urban areas of the less-developed zones.

For reasons similar to those presented to explain the expected absenteeism, family labor is expected to be negatively correlated with urban development. The hired labor groups to which farming offers some security, such as permanent labor and sharecroppers, are expected to be positively correlated with urban development. On the other hand, groups without strong ties to the farm, such as temporary labor and other types of labor,[15] are likely to be negatively correlated with urban development.

In all these groups, the correlation of the female labor is expected to be either more-intensively negative or less-intensively positive, according to the group at hand.

4. Land use The greater the degree of urbanization the better the market opportunities for farm products. Thus, urbanization implies, on the one hand, higher percentages of farmland in permanent and temporary crops, in natural and artificial pastures, and also in irrigated land. On the other hand, a lower percentage of uncultivated arable land is expected in the more urbanized zones.

Since the demand in towns and cities for firewood and lumber for construction is greater, the percentage of the area in natural woods is expected to be lower and that of reforested land greater in the more urbanized zones. In these zones, the percentage of unproductive land is expected to be lower due to the fact that eucalyptus constitue a good farm enterprise to use land otherwise unsuitable for farming.

[15] These other types include labor who get a piece of land they can farm on their own and for which they pay by working a certain number of days for the farmer. They also include people who receive just housing privileges in exchange for caring for the farmer's property.

5. Type of farming In the more urbanized areas one expects to find more specialization in agricultural production due to better market opportunities. Thus, negative correlation is expected between the urban indices and the mixed (crop-livestock) farms.

Crop farms; i.e., those farms producing basic foodstuffs, are expected to be positively correlated with urban development because of the favorable market conditions. For livestock farms, a distinction must be made between livestock-breeding and livestock-feeding. It is expected that livestock-breeding enterprises will be more concentrated in the less-developed zones and livestock-feeding (finishing) enterprises in the more-urbanized zones.

With an increase in urbanization and a rise in the income level, more and more agricultural resources are expected to be diverted to the production of agricultural commodities other than the basic foodstuffs. Such products are vegetables, meat, dairy and poultry products. Thus high positive correlation is expected between the urban indices and the relative importance (in percentage of the number of farms and of their area) of poultry and horticultural production.

Research farms are expected to be found mostly in the more-urbanized zones. Extractive agriculture (extraction of firewood, lumber, and forest products used in industry) is also expected to have a positive correlation with the urban indices, largely because the wood is a source of cash income.

6. Type of power Urbanization is expected to be correlated with the use of more efficient types of power in agriculture. Thus, the correlations of the urban indices with the percentages of farms using

animal or mechanical power, or the combination of these two types of power, are hypothesized to be positive and high. On the other hand, the correlation of the urban indices with the percentage of farms using exclusively human power is expected to be negative.

Also, the correlation of the urban indices with the percentage of farms using only animal power for processing farm products is expected to be negative. On the other hand, the correlations of the urban indices with the percentages of farms using mechanical power alone or in combination with animal power for such purposes are hypothesized to be positive and high.

The correlation of the urban indices with the percentage of farms having electricity is expected to be positive and high. As to the source of this electricity (purchase, production on the farm, or both) the answer is not so clear. It depends on the possibility of production on the farm (waterfall or use of thermal energy) and with the possibility of purchasing electrical energy.

Farm production of electrical energy through the transformation of thermal or of hydraulic energy (in case of existence of waterfall) requires capital investment that is not likely to be made where electricity can be purchased. This is expected to be the case in the more-urbanized zones.

Thus, the correlation of the urban indices with the percentage of farms purchasing all their electricity is expected to be positive. The correlation of these indices with the percentage of farms producing all or part of their electricity is expected to be negative.

7. Classes of farm size Urbanization, by definition, consists of a concentration of people and economic activities in cities and towns. Such a concentration puts pressure upon the rural sector to supply the food and raw materials needed in the urban areas.

Land, as an immobile resource, undergoes a lot of pressure. Under economic conditions approaching the subsistence level, the tendency towards subdivision of the land through the inheritance system is, in part, counteracted by the tendency of the family members to continue farming in a joint operation, thus maintaining the farm size.

The urbanization process brings about forces that complicate the whole situation. On the one hand, it creates conditions favorable for people leaving farms to sell their tracts of land to neighbors who remain in agriculture. This counteracts the tendency towards smaller farms. On the other hand, the improved market for agricultural products increases the demand for agricultural land, mainly in the neighborhood of urban centers and, at the same time, makes feasible the economic exploration of smaller plots of land. The latter effect is expected to be greater than the former. Consequently, it is hypothesized that the correlation of the urban indices with the percentage of farms in a given size group, and their area, is negative for the large-size classes and positive for the small-size classes. No hypothesis is made on which size would constitute a demarcation line between the small- and the large-size classes. It is expected that the correlation study can provide the elements for such a demarcation.

8. Hectares per farm according to other classifications

The same reasoning used in the above item provides the basis for expecting that the average size of farms in the various classifications (legal organization, type of farm operator, and size) is negatively correlated with the urban indices.

9. Cropland size In the more-urbanized zones, farms tend to be more commercialized. Thus, the percentage of farms with relatively large cropland is expected to be greater. On the other hand, the less-urbanized zones, where there are larger farms, are expected to have a larger percentage of farms with extremely-large cropland.

C. Statistical Procedures and Data Problems

Material in this section is divided into two parts. The first discusses the statistical procedures to be used in testing the hypothesis. The second part discusses some problems with the data.

1. Statistical procedures

The Spearman rank correlation was used for testing the hypothesis of correlation between the urban and the agricultural variables. The choice between the Pearsonian correlation and the rank correlation depends on the specific problem one is studying. As Kendall (30, p. 17) has put it, "it is worth emphasizing that there are occasions when the use of variates,[16] though in a sense more accurate, may be more mislead-

[16]By variates Kendall means the actual values of the variables, as opposed to their ranks.

ing than ranks because they do not correspond exactly to the relationship which we are really trying to measure."

In the present study the concern is with analyzing the intersectoral relations as they occur in the various zones of the state of Minas Gerais. As pointed out above, there is a great disparity in the stages of development among the various zones. For many characteristics, there is an enormous difference between the values shown by the most-advanced zones and the other zones. For cases such as this, the following observation made by Kendall is pertinent: "In any discussion of relationship based on these variate-values, we have to be careful that one or two large items do not swamp the effect of the smaller ones. By ranking the individuals we do something to restore the balance and to give each country a more equal voice, as it were, in the discussion." (Ibid.) These comments were made when Kendall was comparing the coefficients he obtained by applying both Pearson's and his own rank correlation methods to study the relationship between population and foreign trade (exports plus imports) of a group of countries. Because of the great disparities among the countries with respect to these two variables, the Pearsonian coefficient was 0.006, while Kendall's coefficient was 0.22, significant at the 1% level.

The two most commonly-used methods of computing rank correlation coefficients are those of Kendall and Spearman. See Siegel (46). The power of these two rank correlation methods is 91% of that of the Pearsonian coefficient, when the latter method is applicable. For situations in which the use of ranking methods implies very small loss of power, see reference given by Kendall (30, p. 166).

The numerical values of the coefficients estimated by these two methods are different. This is due to their different underlying scales and prohibits a direct comparison. There is, however, a relation among the two coefficients. In practice, when neither coefficient is very close to unity, the Spearman coefficient is about 50 percent greater than the Kendall coefficient.

Since both rank correlation methods have the same power,[17] it would seem that either statistic could be used for the test of the correlation hypotheses. The Spearman method was chosen for this thesis, primarily in order to facilitate the comparison with the Sao Paulo study.

2. Data problems

Data for this thesis were obtained from references 11-17. When the variables were defined above, it was seen that for some variables there was no information in some of the censuses. This leads to some incompleteness in the analysis.

Another data problem stems from the fact that the politico-geographical zones on which the census data are aggregated do not necessarily coincide with the economic zones formed according to the criteria of economic influence. Municipios (counties) of a given zone may indeed have their economic life connected to some other zone, either within the state or in one of the border states.

The large size of the state and its great heterogeneity also clouds the picture of intersectoral relations. Minas, as a whole, can be classified in the country's classification of intermediate urbanization.

[17] For a study of the advantages of each of these two methods, see, among others, Kendall (30) and Siegel (46).

However, the state partakes as was pointed out above, of all three classifications; viz., advanced, intermediate and incipient urbanization.

Another problem with the data is the shortness of the time series. Only the last three censuses contain information of relevance for the study, which reduces the amount of temporal analysis which can be made.

Still another problem is the change in the number of zones from 1950 to 1960. This causes the analysis of the two censuses not to be directly comparable.[18]

All of these problems produce deficiencies in the study. However, the use of a ranking statistical procedure diminishes the extent to which these problems affect the test of the hypotheses. Furthermore, this preliminary study, taking the state as a whole, may provide useful guidelines for future, more detailed studies of homogeneous zones within the state.

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[18]The 13 and 17 zone classifications were reconstituted for 1940 and the corresponding urban data of that year were correlated with the 1950 and 1960 data.

IV. RESULTS

It should be remembered that the work is based upon data from the 1940, 1950 and 1960 censuses for the urban sector and on data from the latter two censuses for the agricultural sector. The 1940 data, contrary to those from the 1950 and 1960 censuses, did not come aggregated into zones. Moreover, the 1950 census adopted a 13-zone classification, while that of 1960 used one of 17 zones. Data for 1940 were synthesized by aggregating municipio (county) data into both 13 and 17 zones. For 1950 these data were already aggregated into 13 zones, and for 1960 into 17 zones.

The coefficients of correlation among data from the same census are called intra-coefficients, while the coefficients of correlation of the 1940 urban data with either urban or agricultural data from the remaining two censuses are called inter-coefficients. For brevity, the inter-coefficients are designated as 1950 or 1960 inter-coefficients.

The results for the urban and for the agricultural sectors are discussed in the next two sections. These results are of two types. One refers to statistics for which comparisons are possible with Sao Paulo.[1] The other consists of rank correlations both within the urban sector and between the urban indices and the agricultural variables.

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[1] Sao Paulo data are from Nicholls' study (36 and 37). The statistics involved are the average, the median, and the coefficients of dispersion and of correlation with the pcVAM. The coefficient of dispersion, the least known of these statistics, is explored in Appendix A.

A. The Urban Sector

Seven indices[2] were constructed on the basis of the zones' ranks in several urban characteristics. These characteristics are discussed briefly in Appendix B. The present section is concerned with the dispersion of these indices and the rank correlation among them.

1. Coefficients of dispersion for the urban indices

Table 48 contains the coefficients of dispersion for the urban indices. For each index, three coefficients are given. The first, CD, is the coefficient of the index itself;[3] the second, ACD, is the average of the coefficients of dispersion for the characteristics the index is composed of; and the third, ACCD, is the average of the coefficients of dispersion of the proxies for which data were available in all three censuses.

The effect of changes in zone classification upon the coefficient of dispersion can be observed for 1940 in Table 48. It is noted that only for demographic density, X2, was there a decline in the geographical concentration in consequence of the increase in the number of zones from 13 to 17. For all the other indices the subdivision of the zones resulted in greater geographic concentration of the corresponding characteristics.

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[2] These indices are defined in Chapter III. They are indices of overall urban level (X1), demographic density (X2), all non-agricultural enterprises (X3), per capita value added by manufacturing (X4), industry (X5), wholesale and retail trades (X6 and X7).

[3] The coefficient of dispersion of a simple index is expected to be 0.5 (cf. Appendix A). Divergences from such a value indicate ties among the zones whose ranks enter in the computation of the coefficient (first and third quartiles). As to the coefficients of the composite indices, the closer the coefficient is to 0.5 (allowing for the effect of ties), the greater is the consistency (footnote continued on next page)

Table 48. Coefficients of dispersion of the urban indices in Minas Gerais, 1940-60

	1940						1950			1960		
	13 Zones			17 Zones								
	CD[a]	ACD[b]	ACCD[c]	CD[a]	ACD[b]	ACCD[c]	CD[a]	ACD[b]	ACCD[c]	CD[a]	ACD[b]	ACCD[c]
Overall Urban Index (X1)	.331	.348	.353	.260	.402	.421	.301	.352	.340	.300	.365	.361
Demographic Density (X2)	.500	.606	.606	.500	.576	.576	.500	.659	.659	.500	.545	.545
All Non-agricultural Enterprises (X3)	.424	.522	.522	.479	.562	.562	.473	.552	.514	.504	.488	.551
Per Capita Value Added by Manufacturing (X4)	.500	.831	.831	.500	.893	.893	.500	.811	.811	.500	.806	.806
Industry (X5)	.393	.383	.416	.396	.465	.485	.333	.362	.412	.272	.433	.424
Wholesale Trade (X6)	.216	.340	.340	.439	.480	.480	.286	.254	.318	.240	.298	.306
Retail Trade (X7)	.417	.231	.231	.347	.392	.392	.426	.208	.208	.523	.273	.273

[a]Coefficient of dispersion of the index.

[b]Average of the coefficients of dispersion for the characteristics the index is composed of.

[c]Average of the coefficients of dispersion for the characteristics for which data exist for the three censuses.

It is also relevant to compare the trends of the coefficients of dispersion over time. For such a comparison, the averages of the coefficients of the proxies available in all three censuses are the most appropriate. It is noted that in the 1940-50 period, only demographic density had an increase in geographical concentration. Trade, both wholesale and retail, had the largest decrease in geographical concentration. The per capita value added by manufacturing had some decline, while industry as a whole retained its level of geographical concentration. There were small declines in the coefficients of dispersion of the overall urban index and of the index for all non-agricultural enterprises. In the 1940-60 period, as a whole, it is seen that there was a decline in the geographical concentration of all urban indices, including those of demographic density and industry.

2. Test of the hypotheses

The coefficients of rank correlation among the urban indices are given in Table 49. In comparing the coefficients for different years, one should remember two points. First, in some cases, an index for one year differs from the corresponding index for another year both in the number and in the nature of some of the characteristics on which they are based.[4] Second, the 1950 and 1960 coefficients were computed on the basis of 13 and 17 zones respectively, and therefore are not

(footnote continued from preceding page) among the ranks of the zones in the corresponding characteristics. Likewise, the closer the coefficient is to zero, the greater is the inconsistency. (Cf. Appendix A).

[4]Cf. Chapter III, where the composition of the various indices is discussed. See also Appendix B for the coefficients of correlation of these characteristics with the pcVAM.

Table 49. Intra- and inter-coefficients[a] of Spearman rank correlation among the urban indices in Minas, 1940, 1950 and 1960

	X1	X2	X3	X4	X5	X6	X7[b]
			1940 Intra-coefficients (13 Zones)				
X1	1.000**						
X2	.544*	1.000**					
X3	.942**	.518*	1.000**				
X4	.901**	.725**	.923**	1.000**			
X5	.918**	.615*	.923**	.923**	1.000**		
X6	.822**	.633**	.792**	.766**	.882**	1.000**	
X7	.754**	.121	.670**	.575*	.528*	.454	1.000**
			1940 Intra-coefficients (17 Zones)				
X1	1.000**						
X2	.560**	1.000**					
X3	.943**	.577**	1.000**				
X4	.910**	.686**	.901**	1.000**			
X5	.923**	.524*	.910**	.887**	1.000**		
X6	.778**	.511*	.639**	.707**	.751**	1.000**	
X7	.711**	.260	.633**	.581**	.517*	.316	1.000**
			1950 Intra-coefficients				
X1	1.000**						
X2	.440	1.000**					
X3	.927**	.454	1.000**				
X4	.896**	.478*	.935**	1.000**			
X5	.889**	.429	.862**	.897**	1.000**		
X6	.824**	.291	.646**	.659**	.671**	1.000**	
X7	.956**	.372	.945**	.860**	.789**	.777**	1.000**

[a] For the definition of intra- and inter-coefficient, see the beginning of this chapter.

[b] For the designation of the indices, see Table 48. They are defined in Chapter III.

Table 49 (continued)

	X1	X2	X3	X4	X5	X6	X7
			1950 Inter-coefficients				
X1	.758**	.484*	.802**	.852**	.692**	.542*	.633**
X2	.467	.962**	.457	.670**	.533*	.586*	.121
X3	.891**	.531*	.950**	.938**	.875**	.720**	.620*
X4	.874**	.566*	.876**	.945**	.868**	.656**	.644**
X5	.710**	.536*	.720**	.847**	.735**	.573*	.453
X6	.626*	.286	.554*	.588*	.462	.415	.699**
X7	.821**	.402	.884**	.840**	.714**	.592*	.706**
			1960 Intra-coefficients				
X1	1.000**						
X2	.475*	1.000**					
X3	.929**	.516*	1.000**				
X4	.870**	.615**	.929**	1.000**			
X5	.828**	.495*	.707**	.800**	1.000**		
X6	.748**	.144	.564**	.444*	.652**	1.000**	
X7	.892**	.436*	.895**	.772**	.568**	.604**	1.000**
			1960 Inter-coefficients				
X1	.833**	.438*	.752**	.881**	.798**	.757**	.540*
X2	.557**	.973**	.588**	.681**	.554*	.541*	.208
X3	.896**	.517*	.856**	.952**	.828**	.732**	.630**
X4	.833**	.588**	.850**	.953**	.840**	.723**	.453*
X5	.637**	.387	.581**	.715**	.736**	.752**	.152
X6	.457*	.060	.302	.453*	.471*	.638**	.259
X7	.841**	.453*	.760**	.846**	.701**	.625**	.799**

directly comparable.[5]

The effect of the change in the zone classification upon the significance level of some of the coefficients can be studied for 1940. The increase in the number of zones from 13 to 17 caused the correlation of demographic density with the overall urban index and with the index for all non-agricultural enterprises to change from significant to highly significant. The same change, i.e., from significant to highly significant, occurred in the correlation of per capita value added by manufacturing with retail trade. An opposite change; i.e., from highly significant to significant, was observed in the correlation of demographic density with wholesale trade.

Such changes provide some information about the new zones.[6] In these zones, in comparison with the old ones, demographic density is more correlated with the overall urban index and with all non-agricultural enterprises and less correlated with wholesale trade. Likewise, in the new zones, per capita value added by manufacturing is more closely associated with retail trade than in the old zones.

The great majority of the coefficients of Table 49 confirm the hypotheses made on the correlations among the urban indices. The discussion of the cases of nonsignificiance is made first for the intra-coefficients and then for the inter-coefficients.

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[5]The 5% level of significance is .476 for 13 zones and .412 for 17 zones. The 1% level of significance is .633 for the 13 zones and .557 for the 17 zones. These significant levels will be indicated, as usual, by one and two asterisks respectively.

[6]By new zones it is meant those of the 17 zones which originated from the subdividion of some of the 13 zones. Old zones refer to the zones which were not subdivided in the change from 13 to 17 zones.

Among the nonsignificant intra-coefficients, only one case did not involve demographic density. This was the 1940 correlation between wholesale and retail trades. This held true for both classifications. The explanation for this case resides in the fact that the 1940 wholesale trade consisted for the most part of agricultural products, and was not correlated with the purchasing power of the population as measured by the retail trade index.

In 1940, retail trade was also not correlated with demographic density, the explanation being that the purchasing power of the population was low. Although in 1940 demographic density was significantly correlated with all but one of the urban indices, in 1950 it remained significantly correlated only with per capita value added by manufacturing. By 1960, however, demographic density had again become significantly correlated with all urban indices except one. The exception this time was wholesale trade.

The reasons for expecting somewhat lower correlations between demographic density and the other urban indices were given in Chapter III. The results have shown that these correlations were lowest in 1950. This is explained by the great change in the population distribution occurring between 1940 and 1950. In this period, demographic density was the only urban index to have its geographical concentration increased, while the opposite was occurring in the other indices. Only per capita value added by manufacturing remained significantly correlated with demographic density. The 1940 coefficient had been highly significant. By 1960, demographic density was, as was all the other urban in-

dices, becoming more dispersed among the zones. This resulted in significant correlations of demographic density with all other urban indices except wholesale trade. As already noted, this type of trade involves agricultural products for most of the zones and, therefore, is not closely associated with demographic density. It should be remembered also that the correlation between these two indices was the only one to decrease in significance in 1940 when the 13 and the 17 zone classifications were compared. It was noted above that this indicated that in the new zones, as compared to the old ones, demographic density is less correlated with wholesale trade. The 1960 census followed the 17 zone classification.

The cases of nonsignificance among the inter-coefficients involve the lack of relationship of the 1940 indices with the 1950 and 1960 indices. While the 1950 demographic index was not correlated with either the 1940 overall urban index, the index for all non-agricultural enterprises, or retail trade, the 1960 demographic index lacked a significant correlation only with the 1940 retail trade. Here the zone classification effect has to be taken into account. In 1940 the intra-correlations of demographic density with the overall urban index and with the index for all non-agricultural enterprises were stronger (highly significant as compared to significant) for 17 than for 13 zones.

The 1950 industrial index was not correlated with the 1940 retail trade, while the 1960 industrial index was not correlated with the 1940 demographic density. This seems to indicate that the 1940 purchasing power, as represented by that year's retail trade, was not a good indicator of the potential for industrialization. The same can be said of

the 1940 demographic density, and probably in large part because of the enormous changes that it has undergone in the period following World War II.

Neither the 1950 nor the 1960 wholesale trade indices were correlated with the 1940 demographic density. Wholesale trade, as already stated, consists largely of agricultural products for most of the zones. Agricultural production is associated more with other market conditions than with demographic density, although this appears to be more the case in the new zones than in the old ones, as evidenced by the comparison of the 1940 intra-coefficients for the 13 and the 17 zones.

While the 1950 wholesale index was not correlated with the 1940 industry and wholesale indices, the 1960 wholesale index was not correlated with the 1940 indices for all non-agricultural enterprises and for retail trade. This was once again due, apparently, to the content of wholesale trade. Because of this, changes in the correlation of wholesale trade with other urban indices do not reflect greatly the changes in the structure of the urban sector.

The 1950 retail trade was not correlated with the 1940 demographic density, but the 1960 retail trade was correlated with all 1940 urban indices.

Having seen all the cases of nonsignificance, it is interesting to call attention to an index that had significant correlations with all variables, the per capita value added by manufacturing. Thus, if one were to choose one index or variable to represent the urban sector, this would be the most indicated. This supports the procedure used by Nicholls in his Sao Paulo study (36 and 37).

Considering only the inter-coefficients, one sees that, while the 1940 per capita value added by manufacturing was the only index correlated with all 1950 urban indices, other 1940 indices also (overall urban index, industry and wholesale trade) had significant correlation with all the 1960 urban indices. On the other hand, all the 1940 urban indices were significantly correlated with both the 1950 and the 1960 overall urban index, all non-agricultural enterprises, and per capita value added by manufacturing, and also with the 1960 retail trade.

B. The Agricultural Sector

This section contains the crux of the empirical investigation on the validity of the urban-industrial hypothesis for the state of Minas Gerais. The rank correlation coefficients are used to test this hypothesis.

Two tables will be shown for each of the nine subclasses of agricultural variables. The first table is mostly for comparative purposes,[7] but also contains coefficients of rank correlation of the pertinent variables with the per capita value added by manufacturing in 1950 and 1960. These coefficients permit a comparison of the test of the urban-hypothesis in the two states of Minas and Sao Paulo.

The second table contains the intra- and the inter-coefficients[8] of rank correlation between the various urban indices and the agri-

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[7] Coefficients of dispersion are provided, but it should be noted that they are not directly comparable because of scale effect. (Cf. Appendix A, where this point is discussed and guidelines, including a table, are given for making meaningful comparisons.)

[8] It is recalled that intra- and inter-coefficients are used as short-hand expressions to (footnote continued on next page)

cultural characteristics. This table shows which urban indices, with or without time lag, are more closely related to the agricultural characteristics under consideration.

1. Legal organization

Table 50 shows that Minas has lower percentages of farms owned in partnership and by corporations, both in number and in area of farms, than Sao Paulo and the nation as a whole. The opposite holds true with respect to the percentage of farms owned by individuals. As to public ownership of land, Minas occupies an intermediate position between Sao Paulo and the nation, the latter having the highest percentage.

One notices cases in which the median is much below the average, indicating distributions that are skewed to the left. This occurs with the percentage of the area in corporate farms and the percentages (both of the number and of the area) of public land.

Considering the rank correlation coefficients of this set of variables with the per capita value added by manufacturing, one sees that, in Sao Paulo,[9] the significant coefficients tend to support the hypotheses for individual ownership (percentage of the farms) and for partnership, but not for corporation. In Minas Gerais, the opposite

(footnote continued from preceding page) indicate the coefficients of correlation computed on the basis of data from the same year and on the basis of 1940 data for the urban indices and 1950 or 1960 agricultural data (1950 or 1960 inter-coefficients).

[9]No coefficient of public ownership is available for Sao Paulo.

Table 50. Comparative basic statistics on variables indicating the farm legal organization in Brazil, Sao Paulo and Minas Gerais, 1950 and 1960[a]

	Averages					
	Brazil[b]		Sao Paulo		Minas	
	1950	1960	1950	1960	1950	1960
A. Percentage of the Total Number of Farms						
Individual (X10)	84.64	86.55	85.87	88.83	91.33	94.20
Partnership (X11)	7.18	4.11	12.05	9.65	7.21	4.30
Corporation (X12)	0.43	0.58	1.38	0.92	0.21	0.22
Public (X13)	--	8.48	--	0.44	1.08	1.20
B. Percentage of Total Farmland Area						
Individual (X14)	78.75	85.39	73.62	76.06	86.01	88.95
Partnership (X15)	12.49	7.19	18.85	17.06	9.86	6.54
Corporation (X16)	3.47	3.88	6.43	5.78	2.18	2.26
Public (X17)	--	3.39	--	0.95	1.81	2.15

[a]Source: IBGE (16) and Nicholls (36, p. 153).

[b]For Brazil only, the averages are available.

[c]1960 coefficients not available for Sao Paulo.

Medians		Coefficient of Dispersion			Rank Correlation		
Minas		S.P.[c]	Minas		S.P.	Minas	
1950	1960	1950	1950	1960	1950	1950	1960
90.62	94.57	.033	.034	.013	-.399*	-.038	.123
8.52	4.29	.259	.366	.230	.498**	.082	.248
0.17	0.14	.497	.629	.717	.323	.313	.784**
0.36	0.33	--	.770	.811	--	-.451	-.441*
89.29	90.75	.060	.059	.043	-.339	-.335	.022
8.67	5.87	.192	.176	.236	.613**	.412	.326
0.65	1.00	.316	.972	.934	.281	.500*	.544*
0.28	0.45	--	.851	.849	--	-.352	-.350

is true. That the coefficients of corporate farms were significant for Minas[10] and not for Sao Paulo seems to be due to the fact that in the latter state, corporate ownership of farms is more widespread than in the former, as can be seen in the different magnitudes of their averages. The significance of the coefficient of partnership for Sao Paulo and the nonsignificance of the corresponding coefficients for Minas seem to reflect the different nature of the partnership farms in these two states. In Sao Paulo, with its higher level of development, partnership farms are more likely to be founded upon a more commercial basis than in Minas. Also, the difference in the stage of development of these two states probably explains why the coefficients of individual ownership was significant in Sao Paulo while those in Minas were not. It is exactly such a difference in development level that justifies the computing of the correlation coefficients of the agricultural variables with other urban indices.

These other coefficients are given in Table 51. One notices that the coefficients relative to the percentage of the number of farms differ very much from those relating to the percentage of farmland. The general explanation for this is that the total farmland area is somewhat fixed,[11] while the total number of farms varies greatly. Changes in the percentage of the number of farms of a given type are not always due to changes from one type to another. Consider, for example,

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[10]The only exception was the 1950 coefficient of the percentage of the number of farms of such a type.

[11]Indeed, the farmland area increases by settlement of new land.

Table 51. Intra- and inter-coefficients[a] of Spearman rank correlation between the urban indices and the variables indicating the farm legal organization in Minas, 1950 and 1960

	X1	X2	X3	X4	X5	X6	X7[b]
			1950 Intra-coefficients				
			Percentage of the Number of Farms				
X10[c]	.121	-.429	.113	-.038	.039	.033	.127
X11	.159	-.456	.085	.082	.091	.286	.110
X12	.330	.093	.325	.313	.366	.236	.314
X13	-.407	.022	-.330	-.451	-.215	-.571*	-.485*
			Percentage of the Area				
X14	-.269	-.555*	-.162	-.335	-.245	-.335	-.231
X15	.505*	-.066	.448	.412	.308	.522*	.499*
X16	.467	.385	.377	.500*	.517*	.407	.430
X17	-.379	-.093	-.479*	-.352	-.206	-.126	-.482*
			1950 Inter-coefficients				
			Percentage of the Number of Farms				
X10	-.132	-.418	-.011	-.137	-.038	-.089	-.267
X11	-.016	-.363	.025	-.121	.038	-.006	.127
X12	.198	.214	.281	.214	.264	.393	.107
X13	-.429	.066	-.419	-.330	-.253	-.072	-.732**
			Percentage of the Area				
X14	-.297	-.527*	-.179	-.341	-.137	-.210	-.468
X15	.363	-.016	.402	.264	.341	.373	.514*
X16	.291	.407	.328	.423	.291	.354	.303
X17	-.341	-.055	-.534*	-.440	-.379	-.083	-.237

[a] See footnote a in Table 49.

[b] See footnote b in Table 49.

[c] For the designation of the agricultural variables see Table 50. See also their definition in Chapter III.

Table 51 (continued)

	X1	X2	X3	X4	X5	X6	X7
			1960 Intra-coefficients				
			Percentage of the Number of Farms				
X10	.109	.007	-.009	.123	.237	.147	-.042
X11	.245	-.064	.384	.248	-.001	.117	.368
X12	.750**	.466*	.768**	.784**	.749**	.560**	.642**
X13	-.315	-.255	-.392	-.441*	-.316	-.107	-.287
			Percentage of the Area				
X14	.002	.078	.006	.022	-.085	.048	.064
X15	.258	-.118	.376	.326	.189	.034	.201
X16	.534*	.243	.464*	.544*	.677**	.480*	.289
X17	-.213	-.150	-.302	-.350	-.232	-.081	-.184
			1960 Inter-coefficients				
			Percentage of the Number of Farms				
X10	-.052	-.012	-.082	.083	-.007	.049	-.370
X11	.179	.047	.107	.260	.091	.102	.493*
X12	.648**	.373	.643**	.713**	.683**	.690**	.319
X13	-.336	-.287	-.277	-.475*	-.289	-.165	-.218
			Percentage of the Area				
X14	-.049	.179	-.107	.074	-.157	.026	-.120
X15	.221	-.066	.201	.260	.216	.168	.257
X16	.402	.125	.357	.400	.475*	.652**	-.039
X17	-.237	-.184	-.180	-.375	-.204	-.112	-.125

the individually-owned farms. The division of farms of this type into many others of the same type results in an increase in the percentage participation of this type of ownership, without involving changes of type. Thus, through divisions of this kind, as in the inheritance system, the percentage of individually-owned farms increases, while the percentage of farmland under such a type of ownership remains the same.

Changes from one type of ownership to another affect their respective percentages of area in a proportionate way, while the percentage of the number of farms may be affected in a nonproportionate way. One example of this is the dissolution of a partnership into several individually-owned farms.

One should keep in mind these considerations when analyzing the intra- and inter-coefficients. Caution is needed also in comparing the coefficients for 1950 and 1960, because of the zone classification effect. There is no a priori indication as to the nature and the magnitude of such an effect.

a. Percentage of the number of farms In 1950, significant cases were found only for public ownership, and the urban indices involved were those of trade (X6 and X7). In 1960, this type of ownership had a significant negative correlation with pcVAM. Assuming no zone classification effect, one possible explanation is the spreading of industrialization to zones previously commercialized and the spreading of trade activities to pioneer zones. In 1960, the percentage of corporate farms was positively correlated with all the urban indices.

There was an increase in the number of farms of such a type proportional to that in the total number of farms (its percentage participation remained constant). The significance of the coefficients indicates that this increase was greater in the more urbanized zones. Only public ownership had significant inter-coefficients both in 1950 and in 1960. In 1950 it was with retail trade and in 1960 with pcVAM. Corporate ownership did have significant 1960 inter-coefficients with all urban indices with the exception of demographic density and retail trade. Partnership farms had a 1960 significant inter-coefficient with retail trade.

b. Percentage of the farmland While all types of ownership had at least one significant 1950 intra-coefficient, only corporate ownership had significant 1960 intra-coefficients. All the significant coefficients were of the expected signs.

The significant coefficient of individual ownership was with demographic density. Partnership and public ownership had significant coefficients with retail trade. The former was also significantly correlated with the overall urban index, and the latter with all non-agricultural enterprises and wholesale trade. The two industrial indices were significantly correlated with corporate ownership (1950 and 1960 intra-coefficients). This type of ownership had also significant 1960 intra-coefficient with the overall urban index, all non-agricultural enterprises and wholesale trade. One sees, then, that while the other types of ownership are more correlated with non-industrial variables--mainly trade--corporate ownership is more associated with industrial variables.

There were fewer significant inter-coefficients than intra-coefficients. They were also in support of the hypotheses. In 1950, individual ownership was significantly correlated with demographic density and public ownership with all non-agricultural enterprises. These types of ownership were thus not directly associated with industrial or trade variables. The two 1960 significant coefficients were those of corporate farms with industry and wholesale trade.

c. Conclusions Only for corporate farms did the correlation with the urban indices increase from 1950 to 1960. (In the latter year, the great majority of the coefficients supported the hypothesis with respect to corporate farming.) The reverse was observed for the other types of legal organization.

Usually the percentage of the number of farms was less correlated with the urban indices than the percentage of their area. For corporate farms, the reverse held true.

From 1950 to 1960, the variables representing the legal organization of agriculture became more correlated with pcVAM, industry, wholesale trade, the overall urban index and the index for all non-agricultural enterprises. The reverse was observed with respect to the correlation with retail trade and demographic density. Retail trade had been the urban index with the largest number of significant coefficients in 1950.

2. Type of farm operator

Data on this variable are presented in Table 52. In terms of the percentage both of the number of farms and of their area, the following

Table 52. Comparative basic statistics on variables referring to the type of farm operator in Brazil, Sao Paulo and Minas Gerais, 1950 and 1960[a]

Type of Farm Operator	Averages					
	Brazil[b]		Sao Paulo		Minas	
	1950	1960	1950	1960	1950	1960
A. Percentage of the Total Number of Farms						
Owner (X18)	75.24	66.96	64.57	52.89	88.43	85.04
Renter (X21)	9.05	17.38	23.97	37.42	3.35	6.00
Tenant (X19)	--	(9.80)	--	(16.51)	--	(3.47)
Sharecropper (X20)	--	(7.58)	--	(20.91)	--	(2.53)
Occupant (X22)	10.11	10.68	3.47	2.75	2.47	2.88
Administrator (X23)	5.59	4.98	7.94	6.95	5.75	6.07
B. Percentage of the Total Farmland Area						
Owner (X24)	66.52	64.48	59.93	58.64	78.21	76.49
Renter (X27)	5.58	7.25	5.23	8.67	2.18	4.26
Tenant (X25)	--	(5.23)	--	(5.27)	--	(3.28)
Sharecropper (X26)	--	(2.02)	--	(3.40)	--	(0.98)
Occupant (X28)	4.28	3.64	1.32	.98	1.51	2.16
Administrator (X29)	23.62	24.63	33.43	31.71	18.10	17.10

[a]Source: Brasil (16) and Nicholls (36, p. 153).

[b]For Brazil only, the averages are available.

[c]1960 coefficients not available for Sao Paulo.

Medians		Coefficient of Dispersion			Rank Correlation		
Minas		S.P.[c]	Minas		S.P.	Minas	
1950	1960	1950	1950	1960	1950	1950	1960
88.80	86.58	.109	.014	.044	-.068	-.324	-.113
3.35	--	.643	.629	--	.141	.670**	--
--	3.33	--	--	.545	--	--	.762**
--	1.82	--	--	.491	--	--	.559**
2.14	1.96	.544	.388	.656	-.550**	-.890**	-.652**
5.70	6.14	.280	.242	.261	-.633**	.143	.017
80.99	78.14	.113	.042	.079	-.321	-.033	.078
2.34	--	.517	.676	--	-.107	.824**	--
--	3.02	--	--	.664	--	--	.777**
--	0.67	--	--	.497	--	--	.304
1.33	1.07	.592	.413	.563	-.836**	-.516*	-.520*
15.32	16.64	.222	.233	.426	.361*	0.000	-.059

relative positions of the average for the states of Minas and Sao Paulo and for the nation are found:

i. On owner-operated farms, Minas occupies the leading position, being followed by the nation.

ii. On renter- and occupant-operated farms, Minas occupies the third position, with Sao Paulo leading in the former case and the country in the latter case.

iii. On farms operated by administrators, Minas occupies an intermediate position, with Sao Paulo leading in terms of the percentage of the number of farms and the nation in terms of the percentage of the area of the farms thus operated.

In Minas, one notes that usually the medians are relatively close to the averages. Cases of the median being somewhat smaller than the average, thus indicating a distribution skewed to the left, are those of the percentage of sharecroppers and of occupants.

a. Owner-operated farms Neither in Sao Paulo nor in Minas was the pcVAM significantly correlated with either the percentage of the number of owner-operated farms or their area (Table 52). Nor was any significant intra-coefficient found for these variables (Table 53). This seems to be due to the time lag needed for the effect of urbanization to work itself out. Among the inter-coefficients, no significant coefficient was found for the percentage of the area, but some coefficients for the percentage of the number of farms were significant. The more urbanized zones have a smaller percentage of farms operated by their owners, but such farms do not constitute a significantly-smaller percent-

Table 53. Intra- and inter-coefficients[a] of Spearman rank correlation between the urban indices and the variables referring to the type of farm operator in Minas Gerais, 1950 and 1960

	X1	X2	X3	X4	X5	X6	X7[b]
			1950 Intra-coefficients				
			Percentage of the Number of Farms				
X18[c]	-.313	.077	-.344	-.324	-.333	-.429	-.375
X21	.533*	.181	.627*	.670**	.685**	.500*	.537*
X22	-.802**	-.434	-.754**	-.890**	-.696**	-.736**	-.780**
X23	.280	.016	.140	.143	.066	.445	.314
			Percentage of the Area				
X24	-.088	.324	-.006	-.033	-.168	-.187	-.022
X27	.725**	.670**	.754**	.824**	.735**	.549*	.697**
X28	-.346	-.341	-.319	-.516*	-.212	-.495*	-.331
X29	.033	-.368	-.003	-.000	.074	.148	.019
			1950 Inter-coefficients				
			Percentage of the Number of Farms				
X18	-.484*	.016	-.303	-.264	-.324	-.440	-.470
X21	.698**	.308	.639**	.659**	.687**	.454	.369
X22	-.769**	-.440	-.730**	-.802**	-.676**	-.476*	-.779**
X23	.192	-.071	.091	.071	-.011	.185	.589*
			Percentage of the Area				
X24	.038	.209	.116	.148	.055	-.122	-.132
X27	.747**	.698**	.777**	.890**	.747**	.531*	.553*
X28	-.516*	-.313	-.408	-.445	-.440	-.285	-.567*
X29	0.000	-.258	-.069	-.170	-.027	.174	.176

[a] See footnote a in Table 49.

[b] See footnote b in Table 49.

[c] For the designation of the agricultural variables, see Table 52. cf also Chapter III.

Table 53 (continued)

	X1	X2	X3	X4	X5	X6	X7
			1960 Intra-coefficients				
			Percentage of the Number of Farms				
X18	-.232	-.039	-.323	-.113	.080	-.231	-.355
X19	.724**	.252	.823**	.762**	.444*	.445*	.775**
X20	.682**	.162	.681**	.559**	.551*	.507*	.615**
X22	-.555**	-.328	-.684**	-.652**	-.429*	-.175	-.507*
X23	.130	.007	.195	.017	-.044	.162	.174
			Percentage of the Area				
X24	-.025	.203	-.022	.078	.013	-.077	.007
X25	.626**	.395	.743**	.777**	.369	.184	.694**
X26	.410	.333	.357	.304	.299	.490*	.306
X28	-.412*	-.091	-.535*	-.520*	-.378	-.101	-.377
X29	.067	-.382	.055	-.059	.092	.223	-.012
			1960 Inter-coefficients				
			Percentage of the Number of Farms				
X18	-.466*	-.037	-.436*	-.218	-.381	-.331	-.490*
X19	.690**	.284	.661**	.755**	.565**	.559**	.480*
X20	.649**	.211	.487*	.571**	.614**	.754**	.377
X22	-.519*	-.350	-.518*	-.652**	-.417*	-.296	-.417*
X23	.191	-.012	.056	.037	.027	.244	.404
			Percentage of the Area				
X24	-.152	.299	-.144	.118	-.151	-.145	-.194
X25	.557**	.461*	.600**	.752**	.483*	.389	.414*
X26	.266	.353	.179	.358	.232	.468*	-.044
X28	-.400	-.120	-.409	-.490*	-.358	-.195	-.355
X29	.042	-.451*	-.107	-.157	-.023	.221	.115

age of the farmland. This seems to indicate that the owner-operated farms are larger in the more urbanized zones. But, as shown in the section on hectares per farm, this correlation is not significantly different from zero.

Significant (negative) inter-coefficients for owner-operated farms were the 1950 and the 1960 correlations with the overall urban index and the 1960 coefficients of all non-agricultural enterprises and of retail trade. However, none of the industrial indices had a significant effect upon the percentage of farms in this class.

b. Renter-(tenant- and sharecropper-) operated farms In Sao Paulo, contrary to Minas, the percentage of renter-operated farms was not significantly correlated with pcVAM. This may be explained by the more-advanced level of Sao Paulo, where industrialization is correlated more with administrator-operated farms than with renter-operated farms.

Most of the urban coefficients were positive and significant, thus supporting the hypotheses made about the correlation between urban development and renter- (tenant- and sharecropper-) operated farms. The exceptions involved mainly demographic density. This urban index did not have a single significant coefficient with the percentage of farms under these types of farm operator. With the percentage of the area of such farms, however, demographic density had three significant coefficients; i.e., the two 1950 coefficients for renter and the 1960 inter-coefficient for tenant.

Wholesale trade had some nonsignificant coefficients in cases where most of the urban indices had significant coefficients; viz., the 1950 inter-coefficient for the number of renter-operated farms, and both 1960 coefficients for the area of renter-operated farms. On the other hand, wholesale trade was the only urban index to have significant correlation with the percentage of the farmland operated by sharecroppers (1960). This means that, while the more urbanized zones had higher percentage of sharecropper-operated farms, these farms did not represent a significantly-higher percentage of the farmland area, except in the zones where the wholesale trade is of greater importance. This seems to indicate that sharecropper-operated farms are larger in the zones with higher rankings in wholesale trade. However, as will be seen in the section on hectares per farm, this correlation is not significant.

c. Occupant-operated farms Both in Minas and in Sao Paulo, the pcVAM had negative and significant coefficient of correlation with this type of farm operator, expressed both in terms of the percentage of the number of farms and of the area. With percentage of the number of occupant-operated farms, only demographic density, both in 1950 and in 1960, and wholesale trade in 1960 did not have a significant negative correlation. However, with the percentage of the area, the number of urban indices significantly correlated was smaller. They were: wholesale trade (1950 intra),[12] overall urban index (1950 inter and 1960 intra), retail trade (1950 inter), all non-agricultural enterprises (1960

[12] 1950 and 1960 intra or inter are used herein as shorthand expressions for the 1950 and 1960 intra- or inter-coefficients.

intra) and per capita value added by manufacturing (both 1960 coefficients). This suggest that, while the more urbanized zones have a significantly-smaller percentage of occupant-operated farms, these farms represent a significantly-smaller percentage of the total farmland only in the zones with the urban characteristics represented by the indices above, and at the time the coefficients refer to.

d. Administrator-operated farms It is noted that not a single intra-coefficient had statistical significance, while there were two cases of significant inter-coefficients. They are the 1950 inter-coefficient of retail trade with the percentage of the number of farms and the 1960 inter-coefficient of demographic density with the percentage of the area occupied by the farms under this type of farm operator.

e. Concluding remarks Contrary to the case of legal organization, there is not a tendency for the number of significant coefficients to increase from 1950 to 1960. It is noted that in 1950 all the intra- and inter-coefficients for the percentage of the area of renter-operated farms were significant, while there were some nonsignificant coefficients among those for the percentage of the number of such farms. In 1960, the reverse was observed for tenant- and sharecropper-operated farms and more so for the latter. For occupant-operated farms also there were more nonsignificant coefficients for the percentage of the area than for the percentage of the number of this type of farms.

The overall urban index, the index for all non-agricultural enterprises, and the pcVAM were the indices with greatest number of significant coefficients. Industry and retail trade, followed by wholesale

trade, also ranked high. Demographic density had only four significant coefficients.

3. Farm labor force

Table 54 contains statistics on the farm labor force in the states of Minas and Sao Paulo. In percent participation of males in the total farm labor force, Minas occupies an intermediate position between the nation and Sao Paulo, where this participation is the largest.

Family labor of either sex constituted a greater share of the farm labor in the country as a whole than in both states. The relative position of the two states reversed according to sex, with Minas having a greater share of family females working on the farm and Sao Paulo a greater share of family males in the same kind of activity.

In percent participation of permanent labor of either sex, Sao Paulo leads by far Brazil and Minas, with the percentages for the latter two being relatively close. Minas leads the nation and Sao Paulo, the latter by a big margin, in the percent participation of temporary employees. In the participation of sharecroppers living on the farm, the percentages of Minas were higher than those of Sao Paulo, which in turn, were higher than those of the country. In 1960, however, the percent participation of the females in this category was higher in Sao Paulo than in Minas.

With respect to labor living off the farm, the percentage for Minas was higher than that for the nation and for Sao Paulo. The gaps between these percentages were greater for males than for females.

Table 54. Comparative basic statistics on variables relating to farm labor in Brazil, Sao Paulo and Minas Gerais, 1950 and 1960[a]

	Averages					
	Brazil[b]		Sao Paulo		Minas	
	1950	1960	1950	1960	1950	1960
Percent of all Males (X30)	73.48	71.07	78.58	77.54	76.30	76.37
Percent of all Females (X31)	26.52	28.93	21.42	22.46	23.70	23.63
Operator & Family Labor						
Male (X32)	34.65	41.22	30.00	35.76	27.46	34.72
Female (X33)	17.52	21.78	9.44	12.83	12.59	15.73
Permanent Employees						
Male (X34)	10.92	7.44	27.08	19.59	10.13	9.46
Female (X35)	2.40	1.71	6.77	4.71	2.16	1.67
Temporary Employees						
Male (X36)	19.12	15.68	10.47	14.46	23.19	20.68
Female (X37)	4.00	3.41	1.66	2.50	4.84	3.76
Sharecroppers on Farm						
Male (X38)	6.93	4.53	10.15	6.08	11.19	9.54
Female (X39)	2.23	1.32	3.33	2.00	3.52	1.85
Sharecroppers off Farm						
Male (X40)	1.86	--	0.88	--	4.34	--
Female (X41)	0.37	--	0.22	--	0.59	--
Other Labor						
Male (X42)	--	2.21	--	1.66	--	1.97
Female (X43)	--	0.71	--	0.43	--	0.62

[a]Source: Brasil (16) and Nicholls (36, p. 168-169).

[b]For Brazil only, the averages are available.

[c]1960 coefficients not available for Sao Paulo.

Medians			Coefficient of Dispersion			Rank Correlation		
S.P.	Minas		S.P.[c]	Minas		S.P.	Minas	
1950	1950	1960	1950	1950	1960	1950	1950	1960
79.43	78.23	77.28	.021	.084	.065	.302	.764**	.510*
20.57	21.77	22.72	.081	.240	.200	-.302	-.764**	-.510*
29.02	27.95	36.13	.253	.079	.109	-.388*	-.467**	-.141
8.39	12.11	16.41	.354	.383	.197	-.567**	-.791**	-.368
28.67	6.38	6.02	.420	.220	.312	.629**	.720**	.527*
6.25	1.35	1.36	.552	.299	.265	.679**	.121	.176
11.22	27.10	21.52	.382	.198	.215	-.458*	-.071**	-.007*
1.65	5.25	3.55	.251	.352	.476	-.264	-.643**	-.426*
7.74	6.38	6.47	.641	.534	.643	.085	.604*	.593**
2.34	2.12	1.04	.700	.321	.633	.284	.170	-.005**
0.63	3.66	--	.444	.746	--	.296**	.731**	--
0.13	0.55	--	.486	.610	--	.605**	.593*	--
--	--	2.27	--	--	.379	--	--	-.510*
--	--	0.79	--	--	.643	--	--	-.603**

In the participation of other types of labor (1960), Minas occupied a position above that of Sao Paulo and below that of the nation.

Comparisons of the magnitudes of the medians with those of the corresponding averages can be made for the various percentage participations. For Minas, the case of the median being much smaller than the average occurs for the male permanent employees, indicating a distribution very much skewed to the left.

a. Farm labor force according to sex In Minas, the correlation of pcVAM with the percentage of females in the farm labor force was negative and significant. In Sao Paulo, the correlation, although of the same sign, was not significant. This difference may perhaps be explained by the fact that the arguments presented in support of the hypothesis on the female participation in the labor force are not as strong when applied to Sao Paulo as in the case of Minas. This might be because Sao Paulo is at a more-advanced stage of development. In Sao Paulo the pace of life is faster, and people are less concerned with hiring housemaids as a status symbol. On the other hand, the agriculture is more commercialized in Sao Paulo and the pressures are greater for a more intensive use of the labor resources, including female labor.

From 1950 to 1960, one notes that the significant evidence in favor of the hypothesis of negative correlation between urban development and female participation in the labor force decreases (Table 55). This seems to indicate that Minas' agriculture is tending to become, as in Sao Paulo, more commercialized. This observation and its explanation hold true for the various classes of labor.

Table 55. Intra- and inter-coefficients[a] of Spearman rank correlation between the urban indices and the variables relating to farm labor in Minas, 1950 and 1960

	X1	X2	X3	X4	X5	X6	X7[b]
			1950 Intra-coefficients				
X30[c]	.747**	.330	.773**	.764**	.685**	.511*	.782**
X31	-.747**	-.330	-.773**	-.764**	-.685**	-.511*	-.782**
X32	-.412	-.049	-.327	-.467	-.503*	-.247	-.270
X33	-.692**	-.390	-.737**	-.791**	-.666**	-.374	-.697**
X34	.495*	.319	.619*	.720**	.528*	.247	.567*
X35	-.011	-.049	.066	.121	-.132	-.082	.127
X36	-.225	-.522*	-.099	-.071	-.094	-.319	-.248
X37	-.808**	-.308	-.660**	-.643**	-.674**	-.830**	-.796**
X38	.709**	.357	.542*	.604*	.657**	.654**	.650*
X39	.467	.231	.212	.170	.264	.725**	.399
X40	.698**	.148	.655**	.731**	.718**	.516*	.625*
X41	.599*	-.099	.435	.593*	.649**	.599*	.468
			1950 Inter-coefficients				
X30	.714**	.357	.747**	.780**	.599*	.351	.688**
X31	-.714**	-.357	-.747**	-.780**	-.599*	-.351	-.688**
X32	-.110	-.126	-.149	-.286	-.264	-.172	-.072
X33	-.626*	-.412	-.672**	-.775**	-.626*	-.387	-.481*
X34	.676**	.352	.650**	.687**	.626*	.512*	.583*
X35	.165	-.022	.138	.044	.044	.105	.308
X36	-.110	-.390	-.052	-.176	.044	-.133	-.022
X37	-.621*	-.319	-.532*	-.593*	-.363	-.315	-.674**
X38	.401	.335	.383	.560*	.291	.160	.410

[a] See footnote a in Table 49.

[b] See footnote b in Table 49.

[c] For the designation of the agricultural variables, see Table 54.

Table 55 (continued)

	X1	X2	X3	X4	X5	X6	X7
X39	.104	.137	.074	.154	.022	.136	.204
X40	.566*	.258	.579*	.637**	.484*	.147	.611*
X41	.341	.049	.253	.341	.220	.019	.479*
			1960 Intra-coefficients				
X30	.291	.289	.535*	.510*	.039	-.237	.451*
X31	-.291	-.289	-.535	-.510*	-.039	.237	-.451*
X32	-.199	-.164	-.191	-.142	-.352	-.285	-.091
X33	-.134	-.390	-.384	-.368	-.013	.264	-.262
X34	.328	.475*	.585**	.527*	.121	.011	.422*
X35	.153	.279	.174	.176	.222	.288	.184
X36	-.110	-.152	.007	-.007	.064	-.131	-.076
X37	-.466*	-.159	-.567**	-.426*	-.002	-.049	-.703**
X38	.659**	.333	.703	.593**	.351	.298	.674**
X39	.209	.157	.129	-.005	.086	.167	.235
X42	-.434*	-.463*	-.470*	-.510*	-.283	-.218	-.488*
X43	-.573**	-.365	-.633**	-.603**	-.373	-.274	-.613**
			1960 Inter-coefficients				
X30	.509*	.348	.639**	.569**	.454*	.061	.490*
X31	-.509*	-.348	-.639**	-.569**	-.454*	-.061	-.490*
X32	-.134	-.088	-.056	-.120	-.126	-.343	-.105
X33	-.380	-.417*	-.471*	-.449*	-.381	-.047	-.373
X34	.632**	.490*	.703**	.608**	.569**	.374	.471*
X35	.260	.199	.204	.194	.276	.413*	.025
X36	.050	-.191	-.022	-.042	.070	-.026	.221
X37	-.538*	-.230	-.607**	-.537*	-.396	-.031	-.770**
X38	.494*	.360	.455*	.650**	.402	.246	.515*
X39	.125	.105	.031	.096	.070	- 021	.350
X42	-.449*	-.581**	-.409	-.608**	-.472*	-.390	-.260
X43	-.558**	-.488*	-.539*	-.667**	-.504*	-.479*	-.294

Within a given year, one notices that, in general, whenever the hypothesized correlation is positive (or negative), the significant evidence for female labor is weaker (or stronger), or even opposite to that expected. The explanation for this is in the arguments given in Chapter III to justify the hypothesis of smaller participation of females in the farm labor force.

One notices that demographic density and wholesale trade constitute exceptions not only for the case under discussion, but also for cases still to be covered. So, a general comment should be made at this point. The study of the urban sector has shown that demographic density was significantly correlated with all the other urban indices in 1940, only with pcVAM in 1950 and with all the other urban indices, except wholesale trade, in 1960. Reference should be made also to the arguments stated in Chapter III for expecting low correlation between demographic density and the other variables, both from the urban and from the rural sector. As to the wholesale trade, the explanation seems to be that coffee, a crop in which the participation of female labor is quite high, carries a large weight in the volume of wholesale trade of several zones.

b. Operator and family labor Both in Sao Paulo and in Minas, the percentage of the female family labor had a stronger negative correlation with pcVAM than the percentage of the male family labor. The latter's 1950 coefficient for Minas approached but did not reach the significance level.

The percentage of male members of the family in the farm labor force had only one significant coefficient, the 1950 intra-coefficient for industry. Female family labor, on the other hand, had only four coefficients that were nonsignificant in 1950, but in 1960 it had only three significant coefficients.[13]

The four nonsignificant coefficients in 1950 involved wholesale trade and demographic density. The former was the only urban index not having a single significant correlation with the percentage of the family females in the farm labor force. An explanation for these cases was already given above.

The three 1960 significant coefficients were all inter-coefficients. They were the coefficients for demographic density, all non-agricultural enterprises, and pcVAM. Thus, zones that in 1940 had high rankings in these characteristics had in 1960 a significantly smaller percentage of female family members in their labor force. It is noteworthy that while the 1950 inter-coefficient for demographic density was nonsignificant, the 1960 inter-coefficient was significant. This suggest that, abstracting from the possible zone classification effect, a longer time lag is required for the effect of this variable to be felt.

c. Permanent farm labor The hypotheses that the correlation between this type of labor and the indices of urban development be positive, and that the correlation for the percentage of males be stronger than that for the percentage of females, are confirmed by the results obtained. In Sao Paulo the coefficients were both significant, while in Minas the corresponding coefficient for males was significant and that

[13]The explanation is the same as that for sex in the labor force.

for female was not. The reason for this difference was presented above.

In Minas, out of 28 coefficients for the percentage of females, only one, the 1960 inter-coefficient for wholesale trade, was significant. The explanation for the relationship between female labor and wholesale trade was also given. The nonsignificant coefficients for the percentage of males usually involved demographic density and wholesale trade, cases already discussed.

d. Temporary farm labor The hypothesis made about the correlation of the percentage of labor of this type and the urban indices is accepted for females, but not for males. The reverse held true in Sao Paulo, using pcVAM as the urban index.

In Minas, the percentage of male temporary labor had only one significant coefficient. This was the 1950 intra-coefficient for demographic density. The nonsignificant cases for the percentage of females involved industry, besides the familiar cases of demographic density and wholesale trade. For many of the zones, the processing of coffee beans represents a relatively-important industrial activity. Temporary female labor is used for harvesting coffee.

e. Sharecroppers living on the farm In Minas, the pcVAM was significantly correlated with the percentage of male sharecroppers living on the farm, but not with the percentage of females. In Sao Paulo, neither of the two correlations was significant.

Considering the correlation with the several urban indices, one notices that the case of the percentage of males in this category paralleled somewhat that of the percentage of female temporary labor, with the opposite signs. The same can be said of the percentage of fe-

male sharecroppers and the percentage of male temporary labor.[14] The differences are:

i. While the only negative coefficient for male temporary labor was the 1950 intra-coefficient of demographic density, the only significant positive coefficient for female sharecroppers was the 1950 intra-coefficient of wholesale trade.

ii. While the only significant 1950 inter-coefficient for male sharecroppers was that of pcVAM, there were four significant coefficients for female temporary labor: the overall urban index, the index for all non-agricultural enterprises, the pcVAM, and retail trade.

f. Sharecroppers living off the farm (1950) As expected, the correlations of the urban indices with this class of farm labor were stronger for males than for females. While the former had only one non-significant coefficient, that of demographic density, the latter had two others besides this. They were the coefficients of all non-agricultural enterprises, and retail trade. On the other hand, males had only two nonsignificant inter-coefficients (demographic density and wholesale trade) and females had only one significant coefficient, that of retail trade.

In Sao Paulo, the reverse was observed, the correlation of the percentage of female sharecroppers living off the farm with the pcVAM was highly significant, while the correlation of the percentage of males in this class was not significant.

[14] These parallels confirm the hypothesis that when a negative (positive) correlation is expected between the urban indices and the percentage of given class of farm labor, the correlation is expected to be stronger (weaker) for the percentage of female labor than for the percentage of male labor.

g. Other types of farm labor (1960). The hypothesis of negative correlation between the percentage of labor in this class and the urban indices is accepted. The nonsignificant intra-coefficients were those of industry and wholesale trade for both males and females, and demographic density for the latter. On the other hand, the nonsignificant inter-coefficients were those of retail trade for both males and females, and also all non-agricultural enterprises and wholesale trade for the former.

h. General comments In 1960, there were fewer significant coefficients than in 1950. Although the number of significant inter-coefficients increased (from 32 to 38), that of significant intra-coefficients suffered a reduction of almost 50%. Such a large reduction was due to changes such as the following ones. Industry and wholesale trade changed from 9 and 7 significant coefficients respectively in 1950 to none in 1960. The number of significant coefficients of the overall urban index changed from 8 in 1950 to 4 in 1960. No change occurred in the number of significant coefficients for the index of all non-agricultural enterprises and the pcVAM.

Taking both years together, X4 had 30 out of the 143 significant coefficients. X3 and X7 followed with 26 significant coefficients. The remaining significant coefficients were thusly distributed: 25 for X1, 19 for X5, 10 for X6, and 7 for X2.

4. Land use

Minas occupies the last place in percentage of area in permanent and temporary crops, in reforested land and in natural woods. Brazil occupies

the first position with respect to the latter, while Sao Paulo leads in the others (Table 56).

On the other hand, Minas occupies the leading position in natural pastures and in unproductive land, with Sao Paulo in the last place with respect to the latter characteristic. As to unutilized arable land, Minas had approximately the same percentage as Sao Paulo in 1950, but in 1960 had a somewhat higher percentage, while Brazil led in both censuses.

In Minas, the average is much greater than the median for permanent crops, indicating a distribution skewed to the left.

a. Crops In 1950, the correlations between the pcVAM and the percentages of land in permanent and in temporary crops were not significant in Minas. In Sao Paulo, the coefficients of permanent crops was significant, but that of temporary crops was not.

In Minas, the percentages of permanent and of temporary crops were highly correlated with demographic density. Thus, crop production was closely associated with population density. With respect to permanent crops, only two other urban indices each had one significant coefficient of correlation. These coefficients were the 1960 inter-coefficients of the pcVAM and of wholesale trade (Table 57). On the other hand, four urban indices had at least one significant coefficient of correlation with temporary crops. The pcVAM had three significant coefficients: the 1950 inter-coefficient and both 1960 coefficients. The 1960 intra-coefficients of the overall urban index, the index of all non-agricultural enterprises, and of industry were all significant.

Table 56. Comparative basic statistics on variables indicating land use in Brazil, Sao Paulo and Minas Gerais, 1950 and 1960[a]

	Averages					
	Brazil[b]		Sao Paulo		Minas	
	1950	1960	1950	1960	1950	1960
	Percent of Total Farmland Area					
Permanent Crops (X44)	1.90	3.12	8.23	8.71	1.85	2.23
Temporary Crops (X45)	6.33	8.37	14.17	15.99	6.16	7.15
Natural Pastures (X46)	39.90	40.93	26.06	26.39	51.09	56.99
Planted Pastures (X47)	6.45	8.03	19.44	24.75	11.50	10.68
Natural Woods (X48)	23.63	22.36	13.01	12.12	9.13	8.48
Reforested Land (X49)	0.49	.83	1.57	2.29	0.35	0.58
Unutilized Arable Land (X50)	14.78	11.28	12.38	5.89	11.84	7.54
Unproductive Land (X51)	6.52	5.08	5.14	3.87	8.09	6.35
(Irrigated Land) (X52)	--		--		--	0.48

[a]Source: Brasil (16) and Nicholls (36, pp. 151-152).

[b]For Brazil only, the averages are available.

[c]1960 coefficients not available for Sao Paulo.

Medians		Coefficient of Dispersion			Rank Correlation		
Minas		S.P.[c]	Minas		S.P.	Minas	
1950	1960	1950	1950	1960	1950	1950	1960
0.76	0.89	.635	.903	.816	.533*	.165	.400
5.55	7.07	.297	.472	.524	.253	.308	.502*
49.58	56.79	.497	.341	.259	.427*	.527*	.382
11.22	9.10	.663	.356	.438	.259	.022	-.083
7.49	7.97	.595	.497	.369	-.328	-.621*	-.385
0.25	0.48	.424	.509	.477	.703**	.313	.164
10.47	7.30	.429	.432	.553	-.400*	-.478*	-.218
6.85	5.21	.352	.297	.315	.315	-.549*	-.645**
--	0.04	--	--	.838	--	--	.017

Table 57. Intra- and inter-coefficients[a] of Spearman rank correlation between the urban indices and the variables indicating land use in Minas, 1950 and 1960

	X1	X2	X3	X4	X5	X6	X7[b]
				1950 Intra-coefficients			
X44[c]	.126	.890**	.143	.165	.165	-.016	.066
X45	.275	.901**	.245	.308	.336	.192	.179
X46	.467	-.159	.418	.527*	.396	.451	.460
X47	-.011	.033	.242	.022	.030	-.297	.190
X48	-.555*	-.143	-.545*	-.621*	-.446	-.456	-.565*
X49	.319	.802*	.363	.313	.363	.253	.314
X50	-.412	.077	-.415	-.478*	-.294	-.291	-.474
X51	-.527*	-.440	-.492*	-.549*	-.470	-.456	-.543*
				1950 Inter-coefficients			
X44	.154	.819**	.132	.385	.242	.362	-.187
X45	.225	.824**	.215	.484*	.341	.401	-.154
X46	.434	-.082	.399	.379	.286	-.061	.677**
X47	.236	.038	.375	.187	.253	.376	.069
X48	-.560*	-.159	-.567*	-.577*	-.434	-.061	-.669**
X49	.385	.769*	.399	.495*	.456	.697**	.030
X50	-.429	.022	-.438	-.385	-.253	.041	-.674**
X51	-.522*	-.368	-.477*	-.610*	-.412	-.296	-.583*
				1960 Intra-coefficients			
X44	.256	.890	.325	.400	.221	-.012	.287
X45	.474*	.730**	.429*	.502*	.492*	.218	.382
X46	.353	-.083	.529*	.382	-.059	.074	.549*
X47	-.025	.047	-.166	-.083	.278	.222	-.164

[a] See footnote a in Table 49.

[b] See footnote b in Table 49.

[c] For the designation of the agricultural variables, see Table 56.

Table 57 (continued)

	X1	X2	X3	X4	X5	X6	X7
X48	-.340	-.078	-.529*	-.385	.033	-.052	-.525*
X49	.282	.441*	.120	.164	.517*	.481*	.194
X50	-.174	.373	-.345	-.218	.130	-.056	-.324
X51	-.656**	-.260	-.744**	-.645**	-.248	-.196	-.740**
X52	-.043	.417*	-.196	.017	.267	.070	-.282
			1960 Inter-coefficients				
X44	.367	.917**	.394	.480*	.304	.432*	.064
X45	.406	.757**	.356	.532*	.361	.571**	.017
X46	.359	-.017	.423*	.419*	.249	-.048	.615**
X47	-.015	-.042	-.029	-.100	.116	.199	-.385
X48	-.298	-.152	-.331	-.451*	-.130	.083	-.520*
X49	.132	.390	.018	.194	.246	.467*	-.120
X50	-.244	.358	-.307	-.179	-.161	.043	-.458*
X51	-.627**	-.319	-.664**	-.696**	-.505*	-.282	-.574**
X52	-.223	.373	-.167	-.017	.015	.099	-.598**

b. Pasture In 1950, both in Sao Paulo and in Minas, the correlations of the pcVAM were positive and significant with respect to the percentage of natural pastures, but not with that of planted pastures. In Minas, planted pastures did not have a single case of significance, but natural pastures had several such cases. Both 1960 coefficients of all non-agricultural enterprises were significant. PcVAM had another case of significant correlation in addition to that of the 1950 intra-coefficient: the 1960 intra-coefficient. Retail trade had both inter-

coefficients significant, as was the 1960 intra-coefficient.

c. Natural woods and reforested land Although in Sao Paulo, the 1950 pcVAM was not significantly correlated with the percentage of land in natural woods; in Minas it was. On the other hand, reforested land had a highly significant coefficient in Sao Paulo and a non-significant one in Minas. The explanation seems to be that the settlement process in Sao Paulo is at a more-advanced stage.

In Minas, the lower percentage of natural woods has been associated mostly with retail trade and to a lesser extent with the index of all non-agricultural enterprises and the pcVAM. Reforested land, on the other hand, is more correlated with demographic density and wholesale trade. The correlation with the former was greater in 1950 than in 1960. The reason for this is probably that there has been a shift away from the use of wood for cooking purposes.

d. Unutilized arable land and unproductive land. In Minas, the 1950 pcVAM had a significant negative correlation with the percentage of these types of land. In Sao Paulo, only the unutilized arable land had a significant coefficient.

In Minas, the percentage of unutilized arable land has been correlated mostly with retail trade, which had only one case of non-significance, the 1950 intra-coefficient. Two other urban indices, the overall urban index and the pcVAM, had significant coefficients, the 1950 intra-coefficients.

All the coefficients of correlation of unproductive land with the overall urban index, the index of all non-agricultural enterprises, the pcVAM and retail trade were negative and significant. Industry had one

significant coefficient, the 1960 inter-coefficient.

e. Irrigated land (1960) Only two significant coefficients were found and they had opposite signs. The intra-coefficient of demographic density was positive and the inter-coefficient of retail trade was negative. The former case is in agreement with the hypothesis. As to the latter case, one should keep in mind that the 1940 retail trade index had little correlation with the other urban indices of that year.

f. Concluding comments The number of significant coefficients increased from 29 in 1950 to 36 in 1960. Industry, which did not have a single significant coefficient in 1950, had three in 1960. Wholesale trade passed from one significant coefficient in 1950 to four in 1960. These two changes were in the opposite direction to that which occurred with the labor force.

PcVAM and retail trade had about the same number of significant coefficients, and their total was almost half of the total number of significant coefficients. It is noteworthy that demographic density had a large number of significant coefficients, and slightly more than the index of all non-agricultural enterprises.

5. Type of farming

Sao Paulo led in 1950, both in percentage of the number of crop farms and in the percentage of the area occupied by crop farms. Minas lagged behind the national average in percentage of the number, but matched the nation's average in percentage of the area (Table 58).

In livestock-breeding farms, Minas led both the nation's and Sao Paulo's averages in percentage of the number of such farms, but occupied

Table 58. Comparative basic statistics on variables referring to the type of farming in Brazil, Sao Paulo and Minas Gerais, 1950 and 1960[a]

Type of Farming	Averages					
	Brazil[b]		Sao Paulo		Minas	
	1950	1960	1950	1960	1950	1960
A. Percentage of the Total Number of Farms						
Crop Farms (X53)	60.03	--	65.20	--	50.69	--
Crop-Livestock Farms (X54)	29.00	--	22.22	--	36.06	--
Crop and Livestock Farms (X55)	(89.03)	(79.81)	(87.42)	83.38	(86.75)	65.01
Livestock-Breeding Farms (X56)	16.65	16.10	5.29	12.57	8.67	32.89
Livestock-Feeding Farms (X57)	1.40	0.75	2.00	1.41	3.81	1.25
Other Types of Farms (X58)	1.10	3.34	1.56	2.64	0.77	0.85
B. Percentage of All Farmland						
Crop Farms (X63)	19.26	--	33.08	--	19.37	--
Crop-Livestock Farms (X64)	36.43	--	44.96	--	48.47	--
Crop and Livestock Farms (X65)	(55.69)	41.24	(78.04)	59.03	(67.84)	39.50
Livestock-Breeding Farms (X66)	36.26	47.12	16.97	36.85	29.73	57.13
Livestock-Feeding Farms (X67)	1.86	0.92	3.84	1.77	1.82	1.36
Other Types of Farms (X68)	6.19	10.72	1.15	2.35	0.61	2.01

[a]Source: Brasil (16) and Nicholls (36, p. 151).

[b]For Brazil only, the averages are available.

[c]1960 coefficients not available for Sao Paulo.

Medians		Coefficient of Dispersion			Rank Correlation		
Minas		S.P.[c]	Minas		S.P.	Minas	
1950	1960	1950	1950	1960	1950	1950	1960
43.95	--	.112	.289	--	-.146	.082	--
40.86	--	.286	.166	--	.043	-.225	--
--	59.82	--	--	.206	--	--	-.279
10.53	38.59	.387	.582	.355	.293	-.088	.223
2.94	1.07	.467	.597	.672	.360*	.500*	.348
.14	--	.685	.603	--	.483**	.736**	--
21.10	--	.206	.430	--	-.185	.132	--
49.48	--	.198	.113	--	.266	.357	--
--	37.01	--	--	.275	--	--	.064
27.76	59.80	.467	.546	.160	-.201	-.412	-.039
1.49	1.09	.634	.418	.387	--	.099	-.056
--	--	.685	.924	--	.290	.527*	--

an intermediate position in percentage of the area occupied by this type of farm. In percentage of the livestock-feeding farms, Minas lagged behind Sao Paulo by a great deal in 1950, but not in 1960. In percentage of the area of type of farm, Minas did not lag behind Sao Paulo by very much in 1960.

In 1950, Minas led in crop-livestock farms in percentage both of their number and of their area. Taking the crop and crop-livestock farms together, the percentage of the number of farms was about the same in 1950 for the nation and the two states. By 1960 Sao Paulo was leading Minas by a large margin. In percentage of the area occupied by such types of farms, Minas occupied an intermediate position in 1950 and about matched the national average while Sao Paulo was leading.

Of the agricultural variables of this class for which data were available in 1950, only the percentage of livestock-feeding farms, and both the percentage of the number and of the area of farms classified as having other types of farming, had significant coefficients of correlation with the pcVAM. This is true for both Minas and Sao Paulo, with one exception. The Sao Paulo coefficient of the percentage of the area of "other" farms was not significant.

a. Crop farms (1950) Demographic density was the only urban variable significantly correlated with this type of farming, and it was correlated both with the percentage of the number of farms and of their area. The signs of these coefficients were positive, as hypothesized (Table 59).

Table 59. Inter- and intra-coefficients[a] of Spearman rank correlation between the urban indices and the variables referring to type of farming in Minas, 1950 and 1960

	X1	X2	X3	X4	X5	X6	X7[b]
1950 Intra-coefficients							
Percentage of the Number of Farms							
X53[c]	.027	.764**	.025	.082	.118	-.044	-.107
X54	-.132	-.874**	-.129	-.225	-.231	-.104	-.019
X56	-.044	-.742**	-.030	-.088	-.124	.038	.094
X57	.379	0.000	.432	.500*	.305	.170	.460
X58	.648**	.440	.757**	.736**	.798**	.264	.634**
Percentage of the Area							
X63	.115	.863**	.091	.132	.143	.033	.028
X64	.231	.374	.330	.357	.272	.060	.242
X66	-.412	-.874**	-.344	-.412	-.421	-.269	-.298
X67	.082	-.247	.121	.099	-.083	.082	.240
X68	.604*	.280	.613*	.527*	.699**	.269	.573*
1950 Inter-coefficients							
Percentage of the Number of Farms							
X53	0.000	.725**	-.006	.236	.209	.310	-.432
X54	-.203	-.835**	-.118	-.407	-.313	-.368	.190
X56	.027	-.698**	.006	-.231	-.198	-.279	.448
X57	.440	.049	.477*	.434	.297	.008	.616*
X58	.626*	.593*	.691**	.742**	.670**	.614*	.297
Percentage of the Area							
X63	.060	.786**	.074	.313	.198	.318	-.314
X64	.335	.407	.433	.456	.390	.111	.074
X66	-.236	-.819**	-.275	-.538*	-.346	-.307	.129
X67	.247	-.214	.212	.049	-.022	-.100	.594*
X68	.335	.390	.490*	.511*	.418	.440	.113

[a] See footnote a in Table 49.

[b] See footnote b in Table 49.

[c] For the designation of the 1950 agricultural variables X53 through X58 and X63 through X68, see Table 58. (Footnote continued next page)

Table 59 (continued)

	X1	X2	X3	X4	X5	X6	X7
			1960 Intra-coefficients				
			Percentage of the Number of Farms				
X55	-.210	.108	-.383	-.279	.140	.091	-.426*
X56	.142	-.120	.324	.223	-.205	-.162	.375
X57	.264	.074	.471*	.348	-.114	-.045	.515*
X59	.829**	.504*	.884**	.854**	.539*	.478*	.911**
X60	.726**	.414*	.816**	.807**	.579**	.381	.771**
X61	.443*	.194	.625**	.534*	.310	.242	.461*
X62	.393	.034	.542*	.358	.190	.437*	.453*
			Percentage of the Area				
X65	.106	.326	-.070	.064	.308	.313	-.081
X66	-.135	-.196	.074	-.039	-.352	-.426*	.108
X67	-.009	-.245	.031	-.056	-.070	.042	.002
X69	.827**	.568**	.859**	.839**	.587**	.481*	.893**
X70	.557**	.706**	.629**	.677**	.480*	.234*	.654**
X71	.519*	.368	.630**	.561**	.468*	.431*	.444*
X72	.325	-.132	.254	.213	.210	.285	.267
			1960 Inter-coefficients				
			Percentage of the Number of Farms				
X55	-.249	.064	-.351	-.314	-.151	.223	-.529*
X56	.205	-.074	.314	.265	.101	-.289	.517*
X57	.331	.135	.393	.417*	.175	-.079	.532*
X59	.744**	.526*	.754**	.878**	.658**	.523*	.668**
X60	.656**	.444**	.629**	.817**	.617**	.474*	.498*
X61	.472*	.275	.458*	.532*	.432*	.457*	.309
X62	.283	.051	.233	.350	.227	.323	.368

(Footnote continued from preceding page) The 1960 variables resulting from the breakdown of the group "other types of farms" are the following: horticultural and floricultural farms (X59 and X69), poultry farms (X60 and X70), extractive farms (X61 and X71), and research farms (X62 and X72). All the variables are defined in Chapter III.

Table 59 (continued)

	X1	X2	X3	X4	X5	X6	X7
				Percentage of the Area			
X65	-.054	.292	-.160	.037	.027	.376	-.392
X66	.074	-.145	.183	.022	-.063	-.437*	.426*
X67	-.054	-.331	-.004	-.176	-.142	.031	-.015
X69	.693**	.571**	.704**	.856**	.615**	.510*	.598**
X70	.567**	.758**	.495*	.711**	.520*	.600**	.407
X71	.407	.377	.382	.522**	.403	.575**	.157
X72	.087	-.110	.039	.091	.082	.322	.105

b. Crop-livestock farms (1950) Demographic density was also the only urban index with significant negative correlation with this variable, but only in terms of the percentage of the number of farms. Thus, the hypothesis is accepted for this index but not for the others.

c. Crop and crop-livestock farms taken as a whole (1960) It was seen above that crop farms had a positive significant coefficient with demographic density, and that crop-livestock farms had a negative significant coefficient with this urban index. When the two types are taken together, the coefficients of demographic density are positive but not significant.

Retail trade was the only urban index to have significant correlation with the percentage of this type of farms, and the coefficient was negative. No index had a significant correlation with the percentage of the area of these farms.

d. Livestock-breeding farms In 1950, demographic density had a high negative correlation with both the percentage of the number and of the area in farms of this type. PcVAM had a significant inter-coefficient with the percentage of area in 1950. These significant coefficients are in agreement with the hypotheses made.

In 1960, both coefficients for the correlation of wholesale trade and the percentage of the area of livestock-breeding farms were in agreement with the hypothesis. On the other hand, the inter-coefficients of retail trade with the percentage of the number and of the area of such farms, were against the hypothesis.

e. Livestock-feeding farms Only retail trade had a significant correlation with the percentage of the area in this type of farming, and this was the 1960 inter-coefficient. Two other urban indices had at least two significant correlations with the percentage of the number of farms. The only nonsignificant coefficient of retail trade was the 1950 intra-coefficient. The 1950 intra- and the 1960 inter-coefficients of pcVAM were significant. So were the 1950 inter-coefficients and the 1960 intra-coefficients of all non-agricultural enterprises.

f. Other types of farming: horticulture, poultry, extractive agriculture and research In 1950 several types of farming were grouped under the name of "other" types of farming. This group as a whole had significant coefficients, both in percentage of the number of farms and of their area, with the pcVAM in Minas. In Sao Paulo, only the percentage of the number of farms had significant coefficients. This difference reflects the different stages of settlement of these two states.

All the urban indices had significant coefficients with the percentage of the number and of the area of the horticultural farms. Poultry farms had some cases of nonsignificance. They were the intra-coefficients of wholesale trade with the percentage of the number, and of the area of such farms, and the inter-coefficient of retail trade with the percentage of area. All the inter-coefficients of pcVAM with extractive farming were significant. The overall urban index and the index for all non-agricultural enterprises had only one case of nonsignificance with the percentage of the area of extractive farms. Wholesale had one case of nonsignificance with the percentage of the number of such farms. Research farms had only three significant coefficients. They were the intra-coefficients of correlation of the percentage of the number of farms with the indices of all non-agricultural enterprises, wholesale and retail trades.

g. Concluding comments The increase in the number of significant coefficients from 1950 to 1960 is, in great part, due to the breakdown of the group "other." Only demographic density had a decrease in the number of coefficients, from 11 to 8. The largest increase of all was fron one to thirteen in the case of X6. Very large increases also were observed in X7 from four to sixteen, and in X1 from three to eleven. Other increases were from five to thirteen in X3, and from six to fourteen in X4.

Taking both years, X4 and X7 had 20 significant coefficients each. Variables X2 and X3 had 19 and 18, respectively. Finally, X1, X5 and X6 had 14, 13 and 13, respectively.

It is interesting to compare the situation as described with that resulting from the elimination of the group "other" in 1950, and its components in 1960. In this case, X1 and X5 do not present a single significant coefficient. Variable X2 leads with 10 coefficients and is followed by X7 with eight. Variable X4 has three and X3 and X6 have two each. The 10 significant coefficients of X2 are all from 1950, and they are evenly divided between intra- and inter-coefficients. Six of the 8 significant coefficients of X7 are from 1960, four of them being inter-coefficients. The two significant 1950 coefficients of X7 are also inter-coefficients.

Considering the group "other" in 1950, and its components in 1960, one sees that the differences between the various indices with respect to the number of significant coefficients decreases. Considering both years together, X4 and X3 led, the first with 17 and the second with 16 significant coefficients. Variables X1, X5, X7, X6 and X2 have 14, 13, 12, 11 and 9 significant coefficients, respectively.

6. Type of power

Table 60 provides statistics on the percentages of farms using the various types of power. Both in 1950 and in 1960, Minas was below even the national average in the percentage of farms using animal power, mechanical power and a combination of these two types of power.

In Minas, the median was much below the average for the percentage of farms using mechanical power (in 1960) and in the percentage of farms using both animal and mechanical power (in 1950 and in 1960). Thus, these distributions were skewed to the left.

Table 60. Comparative basic statistics on variables relating to type of power used for farming in Brazil, Sao Paulo and Minas Gerais, 1950 and 1960[a]

Type of Power	Averages					
	Brazil[b]		Sao Paulo		Minas	
	1950	1960	1950	1960	1950	1960
Percentage of Farms Using:						
Animal Power (X73)	26.85	21.99	52.23	51.12	20.80	19.87
Mechanical (X74)	0.03	0.51	0.13	2.14	0.01	0.47
Animal and Mechanical (X75)	0.27	0.91	1.07	4.00	0.22	0.66
Only Human Power (X76)	72.85	76.59	45.57	42.73	78.97	79.00

[a]Source: Brasil (16) and Nicholls, (37, p. 45).

[b]For Brazil only, the averages are available.

[c]1960 coefficients not available for Sao Paulo.

Medians			Coefficient of Dispersion			Rank Correlation		
S.P.	Minas		S.P.[c]	Minas		S.P.	Minas	
1950	1950	1960	1950	1950	1960	1950	1950	1960
48.32	23.67	15.07	.530	.891	.896	.405*	.835**	,728**
0.11	0.01	0.26	.550	1.000	.506	.132	.626*	.657**
1.34	0.10	0.26	.723	.808	.710	.369*	.814**	.730**
51.09	76.11	84.36	.401	.187	.206	-.471*	-.842**	-.738**

In Minas, most of the correlations of the per capita value added by manufacturing with the percentages of farms using the various types of power were highly significant and of the expected sign. In Sao Paulo, the coefficients were also of the expected sign, and significant for all except one case. The exception was the coefficient of correlation for the percentage of farms using mechanical power.

Table 61 gives the coefficients of correlation of the urban indices with the percentages of farms using the several types of power for farming and for processing farm products. Coefficients are also shown of the correlation between the urban indices and the percentage of farms having electricity.

Most of the urban indices have coefficients which are significant and of the hypothesized signs. Demographic density, however, was not significantly correlated with any of the types of power used in farming. Two other urban indices, wholesale and retail trades, also did have cases of nonsignificance among the inter-coefficients.

It is interesting to note that from 1950 to 1960 the urban indices, in general, tended to become more correlated with the percentage of farms using mechanical power alone or in combination with animal power. On the other hand, in the same period, the strength of the coefficients of correlation of the urban indices with the percentages of farms using either animal or human power alone tended to decrease.

As to the type of power used for processing farm products (1960), only retail trade had a significant negative coefficient of correlation with the percentage of farms using only animal power--the inter-coefficient. All the other urban indices had significant correlations with

Table 61. Intra- and inter-coefficients[a] of Spearman rank correlation between the urban indices and the agricultural variables indicating the type of power used in Minas' agriculture, 1950 and 1960

	X1	X2	X3	X4	X5	X6	X7[b]
	Percentage of Farms Using the Various Types of Power for Farming						
	1950 Intra-coefficients						
X73[c]	.791**	.352	.781**	.835**	.790**	.533*	.714**
X74	.629*	.047	.691**	.626*	.476*	.500*	.713**
X75	.848**	.404	.902**	.814**	.689**	.604*	.924**
X76	-.801**	-.382	-.785**	-.842**	-.787**	-.547*	-.721**
	1950 Inter-coefficients						
X73	.676**	.445	.694**	.791**	.632*	.290	.561*
X74	.664**	.079	.657**	.565*	.538*	.337	.466
X75	.812**	.418	.864**	.842**	.717**	.556*	.610*
X76	-.682**	-.465	-.699**	-.803**	-.638**	-.302	-.573*
	1960 Intra-coefficients						
X73	.699**	.176	.749**	.728**	.484*	.439*	.652**
X74	.745**	.203	.798**	.657**	.419*	.611**	.784**
X75	.709**	.181	.855**	.730**	.426*	.497*	.740**
X76	-.710**	-.130	-.763**	-.738**	-.499*	-.474*	-.657**
	1960 Inter-coefficients						
X73	.508*	.206	.540*	.711**	.527*	.327	.321
X74	.639**	.206	.573**	.667**	.513*	.578**	.520*
X75	.665**	.201	.638**	.728**	.564**	.511*	.566**
X76	-.525*	-.150	-.557**	-.708**	-.549*	-.354	-.331

[a] See footnote a in Table 49.

[b] See footnote b in Table 49.

[c] For the designation of the variables referring to type of power used in farming, see Table 60. The designations for the variables concerning the type of power used in processing farm products are as follows: animal power (X77), mechanical power (X78) and both animal and mechanical power (X79). (Footnote continued on next page)

Table 61 (continued)

	X1	X2	X3	X4	X5	X6	X7
	Percentage of Farms Using the Various Types of Power for Processing Agricultural Products						
	1960 Intra-coefficients						
X77	-.048	-.252	-.196	-.093	.219	.172	-.252
X78	.681**	.681**	.822**	.821**	.481*	.175	.718**
X79	.696**	.564**	.700**	.708**	.600**	.418*	.684**
	1960 Inter-coefficients						
X77	-.244	-.294	-.247	-.248	-.048	.140	-.436*
X78	.700**	.723**	.746**	.838**	.624**	.565**	.431*
X79	.646**	.574**	.615**	.713**	.676**	.657**	.483*
	Percentages Relative to Farms Having Electrical Power						
	1960 Intra-coefficients						
X80	.661**	.713**	.817**	.787**	.413*	.196	.738**
X81	-.015	-.132	.118	.051	-.059	-.075	-.076
X82	.281	.471*	.284	.331	.152	.012	.375
X83	-.470*	-.596**	-.622**	-.711**	-.352	.066	-.456*
	1960 Inter-coefficients						
X80	.710**	.752**	.741**	.848**	.616**	.519*	.505*
X81	-.120	-.137	-.160	-.074	-.264	.039	-.069
X82	.439*	.475*	.605**	.436*	.452*	.114	.306
X83	-.482*	-.608**	-.593**	-.654**	-.391	-.322	-.294

(Footnote continued from preceding page) All these variables are expressed in the percentage of the total number of farms. The variables concerning electricity in farms are the following: X80 (farms having electricity as percentage of the total number of farms), X81, X82 and X83 (percentages of the farms having electricity which respectively produce all their electrical energy, purchase it or produce part and purchase part of it).

the percentages of farms using mechanical power alone (except the intra-coefficient of wholesale trade), or in combination with animal power.

Only wholesale trade did not have a significant intra-coefficient with the percentage of farms having electricity.[15] None of the urban indices was significantly correlated with the percentage of farms producing their own electricity. Only demographic density had a significant, positive intra-coefficient of correlation with the percentage of farms purchasing all their electricity. All the urban indices, except for X6 and X7, had significant inter-coefficients with this percentage. On the other hand, the general urban indices (overall urban index and all non-agricultural enterprises), demographic density, per capita value added and retail trade[16] had significant negative coefficients with the percentage of farms of which the source of electricity was a mixture of purchase and production.

It is interesting to note that, while X2 did not have a single significant coefficient of correlation with the percentage of farms using the various types of power for faming, it was the urban index with the greatest number of significant coefficients (six coefficients) of correlation with the variables related to electricity. It was followed by X1, X3, and X4 with five significant coefficients each. Industry and retail trade had three significant coefficients each. Wholesale trade had only one significant coefficient.

[15] The inter-coefficient was significant.

[16] In the case of retail trade, this is true only for the intra-coefficient.

7. Farm size

Table 62 shows that in 1950 and in 1960 Minas had the highest, and Sao Paulo the smallest, percentage of farms over 500 and 1,000 hectares. As to the percentage of farms over 5,000 hectares, Minas occupies an intermediate position between that of Sao Paulo and that of the country.

The percentages of farms smaller than two hectares were about the same in Sao Paulo and in Minas in both 1950 and 1960. Although Minas had in 1960 a smaller percentage of farms between two and 99 hectares than either the nation or Sao Paulo, in 1960 the percentage of farms in this group matched that of the nation, and was smaller than that of Sao Paulo.

In percentage of the area occupied by the various classes, Minas occupied in 1960 an intermediate position between the nation and Sao Paulo. Sao Paulo had the smallest percentage for all classes above 500 hectares, and the largest for the class from two to 99 hectares. In 1960, Minas retained second place only for the classes over 500 hectares and over 1,000 hectares. In the remaining classes Minas' averages were the lowest.

Cases of the average being much greater than the median in Minas are: the percentage of the number of farms under two hectares (1960) and the percentage of areas of farms over 500, over 1,000 and over 5,000 hectares. These are cases of distributions skewed to the left.

Table 62. Comparative basic statistics on variables referring to classes of farmland size in Brazil, Sao Paulo and Minas Gerais, 1950 and 1960[a]

Classes of Farm Size	Averages					
	Brazil[b]		Sao Paulo		Minas	
	1950	1960	1950	1960	1950	1960
A. Percentage of the Total Number of Farms						
Less than 2 Hectares (X84)	7.94	12.29	1.25	3.61	2.30	3.57
2 - 99 Hectares (X85)	84.16	77.18	85.49	86.12	73.27	76.05
More than 500 Hectares (X86)	3.67	2.19	2.74	1.89	4.65	3.38
More than 1000 Hectares (X87)	1.72	0.97	1.16	0.77	1.92	1.30
More than 5000 Hectares (X88)	0.22	0.42	0.09	0.27	0.15	0.09
B. Percentage of Total Farmland Area						
Less than 2 Hectares (X89)	--	0.19	--	0.06	0.01	0.04
2 - 99 Hectares (X90)	16.55	21.23	24.69	27.49	16.89	13.46
More than 500 Hectares (X91)	62.15	55.52	46.80	43.49	52.34	46.43
More than 1000 Hectares (X92)	50.88	44.15	34.05	30.54	38.39	32.23
More than 5000 Hectares (X93)	26.73	34.08	10.91	19.33	14.06	10.36

[a]Source: Brasil (16) and Nicholls 36, p. 152).

[b]For Brazil only, the averages are available.

[c]1960 coefficients not available for Sao Paulo.

Medians		Coefficient of Dispersion			Rank Correlation		
Minas		S.P.[c]	Minas		S.P.	Minas	
1950	1960	1950	1950	1960	1950	1950	1960
2.06	2.05	.538	.806	.844	.230	.538*	.473*
70.62	74.04	.093	.173	.176	-.151	-.203	-.103
4.17	3.34	.505	.734	.758	.340	.088	-.282
1.59	1.06	.480	.835	.850	.215	.027	-.346
0.05	0.05	.643	.900	.831	-.144	-.104	-.336
0.003	0.03	--	.824	.961	--	.297	.463*
18.45	14.98	.295	.615	.541	-.268	.005	.123
42.64	38.85	.225	.366	.389	.200	-.203	-.336
28.03	24.75	.301	.505	.478	-.037	-.242	-.292
5.49	5.11	.570	.611	.666	-.354*	-.412	-.213

Using only the per capita value added by manufacturing as the urban index, the situation with respect to this variable is not well defined.[17] The only significant coefficients for Minas Gerais are those of the percentage of farms under two hectares in size, and the area occupied by them.[18] The only significant coefficient for Sao Paulo was the negative coefficient of the percentage of the area occupied by farms with and area greater than 5,000 hectares.

In Table 63, one can see that demographic density is the urban variable most correlated with the percentages of farms in the various classes of size, and with the percentages of the area occupied by them. In general, positive correlations are found for farms under two hectares and for the two to 99 hectares class. Negative correlations are found for the other classes. One notices also that the significant coefficients are fewer for the percentage of the area than for the percentage of the number.

The only exceptions to the statements above are the following. Demographic density did not have significant correlation in 1960 with the percentage of farm in the two to 99 hectares class. Retail trade had significant inter-coefficients, with signs opposite to those expected, with the percentage of the number of farms in the two to 99 hectares class (1950 and 1960), and with the percentage of the number of farms in the classes above 500 hectares and above 1,000 hectares (1950).

[17] It should be remembered here that the hypotheses made on the correlation between the urban indices and the various percentages of the number of farms and of their area did not specify when the correlations were expected to change from positive to negative.

[18] In this last case, this is true only in 1960.

Table 63. Intra- and inter-coefficients[a] of Spearman rank correlation between the urban indices and the variables concerning the classes of farmland size in Minas, 1950 and 1960

	X1	X2	X3	X4	X5	X6	X7[b]
			Percentage of the Number of Farms 1950 Intra-coefficients				
X84[c]	.407	.648**	.503*	.538	.490*	.280	.347
X85	-.236	.599*	-.242	-.203	-.127	-.242	-.331
X86	.082	-.703**	.129	.088	-.011	.115	.209
X87	.038	-.725**	.069	.027	-.003	.126	.149
X88	-.066	-.841**	-.058	-.104	-.074	.005	-.003
			Percentage of the Area				
X89	.247	.896**	.250	.297	.327	.236	.129
X90	.016	.786**	-.033	.005	.074	-.027	-.091
X91	-.198	-.901**	-.165	-.203	-.204	-.099	-.107
X92	-.225	-.929**	-.198	-.242	-.242	-.104	-.129
X93	-.412	-.901**	-.421	-.412	-.325	-.203	-.391
			Percentage of the Number of Farms 1950 Inter-coefficients				
X84	.549*	.725**	.559*	.676**	.659**	.459	.143
X85	-.236	.538*	-.231	-.022	-.071	.028	-.616*
X86	.176	-.643**	.174	-.082	.005	-.116	.558*
X87	.121	-.648**	.113	-.132	-.038	-.149	.495*
X88	-.066	-.758**	-.063	-.291	-.170	-.263	.311
			Percentage of the Area				
X89	.319	.890**	.256	.489*	.429	.484*	-.091
X90	-.077	.703**	-.069	.187	.071	.202	-.440
X91	-.137	-.835**	-.138	-.379	-.236	-.340	.228
X92	-.165	-.868**	-.171	-.423	-.275	-.362	.201
X93	-.385	-.841**	-.419	-.610*	-.407	-.398	-.121

[a] See footnote a in Table 49.

[b] See footnote b in Table 49.

[c] For the designation of the agricultural variables, see Table 62. These variables are defined in Chapter III.

Table 63 (continued)

	X1	X2	X3	X4	X5	X6	X7
			Percentage of the Number of Farms 1960 Intra-coefficients				
X84	.466*	.534*	.450*	.473*	.303	.228	.517*
X85	-.056	.373	-.188	-.103	.115	.256	-.203
X86	-.201	-.696**	-.167	-.282	-.281	.055	-.142
X87	-.236	-.760**	-.212	-.346	-.305	.056	-.191
X88	-.184	-.775**	-.207	-.336	-.210	.108	-.159
			Percentage of the Area				
X89	.412*	.603**	.372	.463*	.363	.173	.409
X90	.071	.654**	.006	.123	.190	-.018	.005
X91	-.240	-.762**	-.229	-.336	-.265	.052	-.216
X92	-.175	-.755**	-.191	-.292	-.201	.137	-.162
X93	-.043	-.657**	-.139	-.213	.039	.296	-.103
			Percentage of the Number of Farms 1960 Inter-coefficients				
X84	.383	.642**	.362	.534*	.309	.419*	.199
X85	-.174	.360	-.242	-.076	-.087	.286	-.525*
X86	-.197	-.767**	-.189	-.363	-.211	-.284	.140
X87	-.235	-.816**	-.256	-.419*	-.253	-.289	.105
X88	-.238	-.843**	-.290	-.414*	-.265	-.284	.091
			Percentage of the Area				
X89	.326	.691**	.306	.507*	.313	.422*	.064
X90	.083	.701**	.076	.213	.135	.258	-.262
X91	-.229	-.816**	-.270	-.426*	-.231	-.235	.088
X92	-.207	-.819**	-.254	-.385	-.200	-.214	.103
X93	-.195	-.752**	-.243	-.309	-.130	-.169	.025

Variable X2 is by far the urban index most correlated with the percentage of farms in the various classes of size. It had 38 significant coefficients. Variable X4 is the index with the second largest number of significant coefficients (11 coefficients). All the other urban indices had four or less significant coefficients.

8. Hectares of farmland per farm

Minas, as a rule, had a greater number of hectares per farm, according to the various classifications, than Sao Paulo and the nation, (Table 64). The reverse holds true for Sao Paulo. One notes that the average size of farms operated by occupants in Minas increased from 1950 to 1960 while the nation's and Sao Paulo's averages decreased. On the other hand, Minas underwent the largest decrease in the average size of farms operated by hired administrators.

Cases of the average being much greater than the median are: corporation-owned farms and public farms (1950 and 1960); farms operated by occupants (1960) and by hired administrators (1960); and farms over 100 hectares (1950). The opposite case is found for farms operated by administrators (1960). The distribution is skewed to the right in the latter case and to the left in the former cases.

In Sao Paulo no significant correlation was found between per capita value added by manufacturing and the average size of the farms in the various types of legal organization, type of farm operator and farm-size classes. In Minas two significant positive coefficients were found. They were the 1950 coefficients for corporation and public farms.

Table 64. Comparative basic statistics on variables indicating the size per farm of different types of farms in Brazil, Sao Paulo and Minas Gerais, 1950 and 1960[a]

	Averages					
	Brazil[b]		Sao Paulo		Minas	
	1950	1960	1950	1960	1950	1960
A. Type of Farm Operator						
Owner (X94)	99.4	72.1	79.6	67.4	122.0	92.7
Renter (X95)	69.3	--	18.7	--	89.9	--
Tenant (X96)	--	39.9	--	19.4	--	97.4
Sharecropper (X97)	--	20.0	--	9.9	--	39.7
Occupant (X98)	47.7	25.5	32.6	21.7	84.2	290.2
Administrator (X99)	474.7	370.3	361.2	277.7	434.0	77.5
B. Average Size of Different Types of Farm (Hectares) According to Legal Organization						
Individual (X100)	104.6	73.9	73.5	52.1	129.9	97.4
Parnterships (X101)	195.5	131.1	134.6	107.5	188.6	156.7
Corporations (X102)	902.2	497.7	402.2	380.1	1467.9	1051.7
Public (X103)	--	29.9	--	132.1	232.0	184.5
C. Classes of Farm Size						
More than 2 Hectares (X104)	122.1	85.2	86.9	63.1	141.2	106.9
2-99 Hectares (X105)	24.0	20.6	25.1	19.4	31.8	18.2
More than 100 Hectares (X106)	644.0	565.3	451.0	429.8	469.2	437.4

[a]Source: IBGE (6) and Nicholls, (36, p. 166).

[b]For Brazil only, the averages are available.

[c]1960 coefficients not available for Sao Paulo.

Medians			Coefficient of Dispersion			Rank Correlation		
S.P.	Minas		S.P.[c]	Minas		S.P.	Minas	
1950	1950	1960	1950	1950	1960	1950	1950	1960
80.7	112.0	97.83	.346	.598	.644	-.061	-.011	-.284
35.4	90.4	--	.592	.451	--	.042	.159	--
--	--	123.0	--	--	.641	--	--	-.157
--	--	30.1	--	--	.537	--	--	-.325
28.1	77.0	59.3	.392	.678	.641	-.247	.165	-.223
345.5	308.8	272.5	.349	.594	.583	-.232	-.132	-.294
82.2	115.0	101.0	.402	.612	.659	.036	.110	-.309
121.1	181.6	126.7	.352	.528	.646	.074	.352*	-.172
725.4	604.5	631.7	.572	.947	.665	.058	.533*	.098
--	86.6	84.1	--	.577	.678	--	.489*	.091
95.7	123.2	105.0	.345	.592	.605	.103	-.005	-.275
27.2	34.6	20.8	.152	.152	.193	.080	-.165	-.238
427.0	388.6	441.6	.196	.322	.218	.068	-.247	-.363

a. Average size according to the legal organization In 1950, the only inter-coefficients of retail trade were positive and significant (Table 65). The industrial indices (X4, per capita value added by manufacturing and X5, industry) had positive and significant intra-coefficients with the average size of corporation-owned farms and of public farms. The overall urban index and the indices of wholesale and retail trades also had positive and significant intra-coefficients with the average size of the public farms.

In 1960, only demographic density had a significant correlation with the size of farms according to the legal organization. Both the intra- and inter-coefficients were negative and highly significant for individually-owned farms and for farms owned in partnership. For corporation-owned farms only the inter-coefficient was negative and significant.

b. Average size according to the type of farm operator Only demographic density had significant (negative) correlations with the average size of the owner-, occupant-, and administrator-operated farms in both 1950 and 1960. Although the average size of renter-operated farms was not correlated with any of the urban indices in 1950, in 1960 there were some significant correlations for tenant- and sharecropper-operated farms. The average size of the tenant-operated farms was negative and significantly correlated with demographic density (both coefficients) and with wholesale trade (inter-coefficient). The number of hectares per sharecropper-operated farm had negative and significant correlations with demographic density, and with the overall urban index, all non-agricultural enterprises, and the industrial indices (inter-

Table 65. Intra- and inter-coefficients[a] of Spearman rank correlation between the urban indices and the agricultural variables indicating the average size of different types of farms in Minas, 1950 and 1960

	X1	X2	X3	X4	X5	X6	X7[b]
Average Farm Size According to the Type of Farm Operator							
1950 Intra-coefficients							
X94[c]	.016	-.775**	.039	-.011	-.080	.038	.132
X95	.335	-.297	.146	.159	.151	.308	.311
X98	.264	-.599*	.179	.165	.198	.253	.292
X99	-.082	-.813**	-.096	-.132	-.061	.082	-.036
1950 Inter-coefficients							
X94	.049	-.731**	.050	-.192	-.126	-.238	.459
X95	-.060	-.335	.047	.005	-.159	-.299	.448
X98	.060	-.549*	.074	-.038	-.077	-.199	.451
X99	-.082	-.725**	-.102	-.308	-.165	-.230	.256
1960 Intra-coefficients							
X94	-.199	-.642**	-.157	-.284	-.284	.017	-.137
X95	-.163	-.424*	-.065	-.157	-.357	-.196	-.083
X97	-.253	-.544*	-.288	-.326	-.331	.049	-.270
X98	-.125	-.512*	-.076	-.223	-.311	.025	-.083
X99	-.184	-.767**	-.200	-.294	-.173	.087	-.199
1960 Inter-coefficients							
X94	-.170	-.716**	-.152	-.336	-.172	-.317	.159
X96	-.139	-.466*	-.015	-.201	-.139	-.420*	.233
X97	-.511*	-.551*	-.539*	-.412*	-.560**	-.404	-.196

[a] See footnote a in Table 49.

[b] See footnote b in Table 49.

[c] The designations of the agricultural variables are given in Table 64. X107 is the 1960 average (footnote continued on next page)

Table 65 (continued)

	X1	X2	X3	X4	X5	X6	X7
X98	-.120	-.576**	-.080	-.243	-.132	-.302	.147
X99	-.208	-.836**	-.242	-.395	-.191	-.235	.059
			Average Farm Size According to Legal Organization				
			1950 Intra-coefficients				
X100	.027	-.341	.055	.110	.025	.044	.149
X101	.225	-.099	.297	.352	.171	.176	.369
X102	.423	.066	.352	.533*	.528*	.363	.405
X103	.533	-.071	.413	.489*	.487*	.681**	.573*
			1950 Inter-coefficients				
X100	.198	-.324	.121	.027	-.060	-.177	.547*
X101	.445	-.071	.397	.297	.220	.102	.704**
X102	.324	.099	.317	.401	.247	.108	.523*
X103	.445	-.022	.369	.313	.214	.227	.660**
			1960 Intra-coefficients				
X100	-.231	-.652**	-.191	-.309	-.304	-.015	-.174
X101	-.172	-.651**	-.094	-.172	-.227	-.047	-.145
X102	.202	-.331	.121	.098	.199	.347	.059
X103	.106	-.174	.179	.091	-.076	-.009	.176
			1960 Inter-coefficients				
X100	-.205	-.725**	-.182	-.368	-.204	-.339	.125
X101	-.071	-.635**	-.022	-.240	-.052	-.233	.145
X102	.055	-.436*	-.032	-.049	.025	.217	.000
X103	.053	-.199	.136	.034	.001	-.110	.238

(footnote continued from preceding page) size for all farms. All these variables are defined in Chapter III.

Table 65 (continued)

	X1	X2	X3	X4	X5	X6	X7
			Averages of the Various Farm-Size Classes				
			1950 Intra-coefficients				
X104	.055	-.775**	.047	-.005	0.000	.049	.118
X105	-.005	-.637**	-.080	-.165	-.124	.104	.072
X106	-.231	-.912**	-.209	-.247	-.237	-.044	-.140
			1950 Inter-coefficients				
X104	-.011	-.703**	.003	-.209	-.137	-.219	.382
X105	-.110	-.659**	-.132	-.297	-.280	-.196	.363
X106	-.148	-.846**	-.171	-.423	-.247	-.318	.190
			1960 Intra-coefficients				
X104	-.194	-.681**	-.162	-.275	-.265	.027	-.152
X105	-.237	-.498*	-.147	-.238	-.342	-.337	-.118
X106	-.207	-.794**	-.256	-.363	-.232	.133	-.213
X107	-.194	-.681**	-.162	-.275	-.265	.027	-.152
			1960 Inter-coefficients				
X104	-.200	-.755**	-.189	-.355	-.208	-.300	.120
X105	-.142	-.529*	-.066	-.267	-.226	-.517*	.289
X106	-.235	-.843**	-.307	-.444	-.229	-.198	.025
X107	-.200	-.755**	-.189	-.355	-.208	-.300	.120

coefficients). Thus, one notices that the average size of the share-cropper-operated farms had at least one significant coefficient with all urban indices, with the exception of the trade indices.

c. Average size according to the various classes of size Demographic density was the only urban index to have all negative and significant coefficients of correlation with the average size of farms in the various classes of farm size. Among the 1960 inter-coefficients, two other urban indices had significant coefficients. Wholesale trade had a significant negative correlation with the average size of the farms in the 2 to 99 hectares class, and per capita value added by manufacturing had a significant negative correlation with the average size of the farms over 100 hectares in size.

d. Concluding remarks It is observed that X2 is by far the urban index most correlated with the average size of farms in the various types of farm operator and with the various classes of size. As to the correlation with the average farm size in the various types of legal organization, X2 in 1950 did not have significant coefficients, but in 1960 it was the only urban index having significant coefficients. In 1950, besides X2, only X3 did not have significant coefficients. In that year, X7 had five significant coefficients, of which four were inter-coefficients.

9. Cropland size

Sao Paulo occupied first place in the percentage of farms in the various classes of cropland size.[19] Minas held the second place in

[19]This is possible because there is overlapping of the classes.

classes up to "over 100 hectares" in 1950, and up to "over 50 hectares" in 1960, (Table 66). There were no cases of extremely great discrepancy between the averages and the medians.

In Sao Paulo, only the percentages of farms in the classes above two and five hectares of cropland were not significantly correlated with the pcVAM. In Minas, nonsignificance was found in 1950 only for the percentage of farms with more than two hectares of cropland. In 1960, however, only three classes; viz., those above 50, 100 and 200 hectares, were significantly correlated with the pcVAM. The coefficient of the over 20 hectares almost attained the significance level.

Considering the correlation of these agricultural variables with all the urban indices (Table 67), one notices the following points.

i. In 1950, a lack of significance was found only for the "more than two hectares of cropland" class. Among the 1960 intra-coefficients, nonsignificance is observed for the more than two, five and ten hectares classes. Finally, among the 1960 inter-coefficients, significance is found only in the more than 50, 100 and 200 hectare classes.

ii. The overall urban index, the index for all non-agricultural enterprises, per capita value added by manufacture, industry and retail trade, had significant intra-coefficients in 1950. As to the 1950 inter-coefficients, significance for these indices was found for different ranges of cropland size. Per capita value added by manufacturing had the greatest number of significant coefficients, followed by the all non-agricultural enterprises. The overall urban index and the index for industry had significant coefficients for "more than 20 hectares" to "more

Table 66. Comparative basic statistics on variables indicating classes of cropland size in Brazil, Sao Paulo and Minas Gerais, 1950 and 1960[a]

Cropland Size	Averages					
	Brazil[b]		Sao Paulo		Minas	
	1950	1960	1950	1960	1950	1960
Percentage of the Total Number of Farms						
More than 2 Hectares (X108)	74.59	76.89	93.89	93.00	82.32	85.53
More than 5 Hectares (X109)	40.66	42.00	65.23	57.29	49.05	48.53
More than 10 Hectares (X110)	18.98	20.29	38.90	31.05	25.57	24.68
More than 20 Hectares (X111)	6.57	7.61	17.97	14.40	10.61	10.39
More than 50 Hectares (X112)	1.67	2.05	5.60	4.72	2.62	2.68
More than 100 Hectares (X113)	0.64	0.83	2.45	2.08	0.81	0.87
More than 200 Hectares (X114)	0.22	0.31	0.95	0.85	0.21	0.25
More than 500 Hectares (X115)	0.04	0.06	0.18	0.18	0.03	0.04
More than 1000 Hectares (X116)	0.01	0.01	0.04	0.04	0.01	0.01

[a]Source: Brasil (16) and Nicholls (36, p. 154).

[b]For Brazil only, the averages are available.

[c]1960 coefficients not available for Sao Paulo.

Medians		Coefficient of Dispersion			Rank Correlation		
Minas		S.P.[c]	Minas		S.P.	Minas	
1950	1960	1950	1950	1960	1950	1950	1960
82.88	87.11	.047	.065	.094	-.061	.291	-.100
45.92	45.66	.313	.134	.235	.119	.533*	.042
21.56	22.42	.440	.334	.370	.370*	.654**	.164
7.89	9.88	.502	.548	.433	.458*	.709**	.407
1.76	1.88	.647	.703	.537	.571**	.764**	.576**
0.51	0.52	.754	.834	.594	.602**	.775**	.549*
0.10	0.18	.735	.856	.639	.549**	.830**	.490*
0.01	0.03	.758	1.000	.808	.445*	.723**	.339
0.00	0.01	.857	1.000	1.000	.544**	.557*	.372

Table 67. Intra- and inter-coefficients[a] of Spearman rank correlation between the urban indices and variables indicating classes of cropland size in Minas, 1950 and 1960

	X1	X2	X3	X4	X5	X6	X7[b]
			1950 Intra-coefficients				
X108[c]	.368	.038	.319	.291	.330	.192	.391
X109	.599*	.297	.586*	.533*	.602*	.291	.601*
X110	.736**	.522*	.677**	.654**	.699**	.478*	.714**
X111	.769**	.467	.743**	.709**	.715**	.522*	.780**
X112	.775**	.385	.757**	.764**	.663**	.577*	.815**
X113	.780**	.390	.751**	.775**	.680**	.599*	.807**
X114	.753**	.302	.790**	.830**	.729**	.511*	.785**
X115	.593*	.181	.739**	.723**	.668**	.226	.646**
X116	.383	-.081	.531*	.557*	.531*	.074	.373
			1950 Inter-coefficients				
X108	.104	.060	.179	.198	.110	.194	.044
X109	.341	.308	.433	.527*	.368	.337	.138
X110	.473	.511*	.537*	.687**	.451	.379	.300
X111	.571*	.445	.636**	.742**	.538*	.440	.415
X112	.659**	.368	.694**	.758**	.560*	.376	.589*
X113	.648**	.374	.686**	.764**	.466*	.357	.564*
X114	.692**	.335	.730**	.786**	.659**	.429	.523*
X115	.577*	.226	.708**	.695**	.701**	.535*	.286
X116	.436	0.000	.461	.490*	.557*	.307	.202

[a]See footnote a in Table 49.

[b]See footnote b in Table 49.

[c]The designation of the agricultural variables is found in Table 66. They are defined in Chapter III.

Table 67 (continued)

	X1	X2	X3	X4	X5	X6	X7
			1960 Intra-coefficients				
X108	.021	.020	.004	-.100	.119	.232	-.059
X109	.074	.125	.196	.042	-.064	.064	.086
X110	.185	.154	.320	.164	-.018	.152	.199
X111	.428*	.267	.535*	.407	.218	.323	.390
X112	.562**	.238	.679**	.576**	.293	.405	.549*
X113	.497*	.169	.633**	.549*	.208	.340	.564**
X114	.555*	-.010	.645**	.490	.188	.428*	.635**
X115	.456*	-.174	.434*	.339	.132	.524*	.506*
X116	.467*	-.227	.456*	.372	.172	.496*	.462*
			1960 Inter-coefficients				
X108	.049	-.083	-.094	-.074	.039	.190	-.017
X109	.177	.086	.118	.100	.067	.117	.228
X110	.218	.130	.169	.194	.061	.200	.238
X111	.365	.243	.315	.412	.261	.388	.257
X112	.492*	.235	.455*	.566**	.422*	.478*	.353
X113	.479*	.181	.450*	.529*	.397	.441*	.439*
X114	.508*	.000	.477*	.485*	.417*	.393	.539*
X115	.326	-.172	.258	.297	.259	.354	.388
X116	.313	-.256	.297	.299	.266	.269	.361

than 500 hectares." Retail trade had significant coefficients from "more than 50" to "more than 200 hectares."

Of the 1960 intra-coefficients, those of the overall urban index and the all non-agricultural enterprises were significant for all the classes above 20 hectares. The coefficients for retail trade were significant for the classes above 50 hectares. Per capita value added by manufacturing had significant coefficients for the classes above 50 to above 200 hectares. Finally, the inter-coefficients for the overall urban index, all non-agricultural enterprises and per capita value added by manufacturing were significant for the classes above 50 to above 200 hectares.

a. Concluding comments In 1950, pcVAM was the urban index with the largest number, 16, of significant coefficients with the percentage of farms in the various classes of cropland size. It was followed by X3 and X5, with 14 significant coefficients each. Variables X1 and X7 followed with 12 and 10 significant coefficients, respectively. Variable X6 had six and X2 only two significant coefficients. In 1960, X1 and X3 each had nine significant coefficients, while X7 had seven and X6 five. The industrial indices were among the indices with the smallest number of significant coefficients: X4 with three and X5 with two. Variable X2 did not have a single significant coefficient. Taking both years together, the general indices, X3 and X1, led with 23 and 21 significant coefficients, respectively. They were followed by X4, X7 and X5 with 19, 17 and 16 significant coefficients, respectively. Variable X6 had 11, and X2 only two significant coefficients.

V. CONCLUSIONS AND SUGGESTED RESEARCH

In this chapter, the main conclusions of the study are presented. Also, suggestions for further research are given.

A. Conclusions

1. Influence of zone classification

Zone classification was found to influence substantially[1] the significance level of some of the correlations, but not that of others. This influence was studied only within the urban sector and for the year 1940.

Given characteristics of the rank correlation method as pointed out in Chapter III, the zone classification effect, or its absence, provided indications of differences between the new and the old zones.[2]

It was observed that in the new zones, as compared to the old ones, demographic density was more correlated with the overall urban index and with the index for all non-agricultural enterprises and less correlated with wholesale trade.[3] Likewise, the correlation between re-

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[1] By substantial effect is meant that the change is from the significant to the highly significant level and vice versa.

[2] New zones are those which originated from the subdivision of others. Old zones are those which did not undergo subdivision.

[3] The general composite urban indices, X1 and X3, are, in the old zones, more correlated with urban indices other than demographic density. The reverse holds true for the new zones. On the other hand, in these zones, wholesale trade, consisting mostly of agricultural products, is less correlated with demographic density than in the old zones. In the latter zones, wholesale trade is more related to the local market and, thus, with demographic density.

tail trade and per capita value added by manufacturing was greater in the new than in the old zones.[4] No significant differences between the new and the old zones were found for the other correlations.

2. Correlations within the urban sector

Differences were found among the various urban indices in the extent to which each of them was correlated with the remaining urban indices. The overall urban index, X1, the index for all non-agricultural enterprises, X3, and the pcVAM index,[5] X4, were the indices most correlated with the other urban indices. It is interesting to note that X4, a simple index, was as good[6] an index of urbanization as any of the two general composite indices, X1 and X3. Thus, the more urbanized zones had greater per capita industrial productivity.

In the other extreme, demographic density, X2, and wholesale trade, X6, were the indices least correlated with the other urban indices. The poor performance of X2 is explained by the fact that it is not the demographic density per se, but the extent to which people participate in the money economy that is relevant. Wholesale trade, in the less-advanced zones, consists mostly of agricultural products and thus is not very closely associated with urban development.

[4] It seems that the purchasing power in the new zones, as measured by the retail trade index, is more correlated with the intensity of the zone's industrialization than with other urban characteristics.

[5] This, it should be remembered, is the index used by Nicholls in his Sao Paulo study (36 and 37).

[6] Goodness here means high correlation with the remaining indices. In this sense, X4 indeed was better than X1 and X3 because each of the latter had one case of nonsignificance (the 1950 intra-correlation with X2), while the former did not have a single case of nonsignificance.

Between these two extremes are the indices for retail trade and industry. Retail trade ranked high as to the number of significant intra-coefficients, but had a medium rank as to the number of significant inter-coefficients. The reverse is true of the industrial index. In other words, in a given year, retail trade reflects, better than industry, the stage of urban development. On the other hand, industry reflects, better than retail trade, the potential for urbanization.

Explanation of these results seemed to be as follows. In the less-urbanized zones, industry usually consisted of small enterprises processing agricultural products. Thus, the industrial index showed not the degree of contemporaneous urban development, but the potential for such development. On the other hand, the retail trade index, measuring the zones' purchasing power, was a reasonably good indicator of contemporaneous development. This purchasing power, however, could be the manifestation of short-run influences upon the economy and, so, might not represent a trend for future development.

3. Urban-rural correlations

a. Comparisons of the urban indices X4, the pcVAM index, has percentages of significant correlations with the agricultural variables as a whole and with the various classes of them above the average[7] in practically all cases.[8] In the other extreme, X5, the industrial index, and X6, the wholesale trade index, were always below the average per-

[7] By average is understood the percentage corresponding to all indices taken as a whole.

[8] The only exception is the intra-coefficient for the class of variables indicating the size or the scale of the farm enterprise.

centage of significant correlations. Thus, it is not industry per se that is correlated with the agricultural variables, but a high value added by manufacturing in per capita terms.

There is a set of urban indices that for all correlations and for the intra-correlations, with the exception of those with the variables indicating the size or the scale of the farm enterprises, had an above average percentage of significant correlations with the agricultural variables. This set is constituted by X1, the overall urban index, X3, the index for all non-agricultural enterprises, and X7, the retail trade index. As to the percentage of significant inter-correlations, the situation of the variables in this set was as follows. The whole set was below the average for variables indicating the size or the scale of the farm enterprises. X1 was around the average for all agricultural variables as a whole and below the average for variables indicating the agricultural productive structure. X3 was above the average with the exception of the case where the whole set was below the average. X7 was below the average for the agricultural variables taken as a whole and for the variables relating to the human element in agriculture.

One can see that X3 is the index that, after X4, is most correlated with the agricultural variables. Thus, after the intensity or the efficiency of the industrialization, it is the level of economic activities of the non-agricultural enterprises that is most correlated with the agricultural variables. X1 and X7 come next, with the former having a slight edge over the latter.

It is interesting to compare the cases of retail and wholesale trades. While the former in most cases was above the average, the latter was always below the average. In view of the fact that the rank correlation gives equal weight to every zone and that the number of less-advanced zones is large, the characteristics of the retail and wholesale trades in these zones are of utmost importance. In these zones, retail trade is a good index of the people's participation in the money economy. On the other hand, their wholesale trade consists mostly of export-agricultural products. Thus, one can conclude that the correlation of agricultural development is greater with the degree to which people participate in the money economy than with the volume of export agricultural products.

Finally, demographic density was much above the average percentage of significant correlations with the size or scale variables. Because of this, it was also above the average for the agricultural variables as a whole. One interesting point is that demographic density had a much below the average percentage of significant correlations with the variables relative to the human element in agriculture.

Additional comparisons of the urban indices are made later when each of the subclasses of agricultural variables is discussed.

b. Comparison of the agricultural variables Urbanization is more correlated with variables indicating the agricultural productive structure (40% of significant coefficients) than with the variables concerning the human element in agriculture (33% of significant correlations, the same overall percentage of significant correlations between urbanization and the agricultural variables as a whole), and

much more than with the variables indicating the size or scale of the farm enterprises (25% of significant coefficients).

But within each of these classes of variables there are large differences in the extent to which each of the subclasses are correlated with urbanization. The type of power was the subclass with the highest percentage (70% of significant correlations). In the other extreme, was the subclass of average farm size with only 15% of significant coefficients. Somewhat above this there were the subclasses of "farm size" and legal organization, with about 20% of significant coefficients. In between these two extremes, there was a set of subclasses with percentages of significant coefficients somewhat close to the average percentage of significant correlations between urbanization and the agricultural variables as a whole. This set consists of the following subclasses: labor and cropland size (40% of significant coefficients), type of farming and farm operator (35%) and land use (a little under 30%).

Thus, it can be seen that all subclasses of variables indicating the agricultural productive structure had percentages of significant correlations varying from the neighborhood of the average to a percentage much above the average. Of the subclasses of variables con cerning the human element only, legal organization, was below the average. Finally, with the exception of "cropland size," the size or scale variables had percentages of significant coefficients below the average. The "cropland size" variables were somewhat above the average.

Now, some comments are made on each of the subclasses.

1. Legal organization It is remembered that only for corporate ownership did the correlation with the urban indices increase from 1950 to 1960. (In the latter year, the great majority of the coefficients supported the hypothesis with respect to corporate farming.) The reverse was observed for the other types of legal organization.

It is noted also that with the exception of corporate ownership the percentages of the number of farms were less correlated with the urban indices than the percentages of their areas.

The correlation of X2 and X7 with this group of variables decreased from 1950 to 1960, while the opposite occurred with the remaining urban indices.

2. Farm operator Contrary to the case of legal organization, there was not a tendency for the number of significant coefficients to increase from 1950 to 1960. It is noted that in 1950 all the intra- and inter-coefficients for the percentage of the area of renter-operated farms were significant, while there were some nonsignificant coefficients among those for the percentage of the number of such farms. In 1960, the reverse was observed for tenant- and sharecropper-operated farms and more so for the latter. For occupant-operated farms also there were more nonsignificant coefficients for the percentage of the area than for the percentage of the number of this type of farms.

The overall urban index, the index for all non-agricultural enterprises, and the per capita value added by manufacturing were the indices with the greatest number of significant coefficients. Industry and re-

tail trade, followed by wholesale trade, also ranked high. Demographic density had only four significant coefficients.

3. Farm labor From 1950 to 1960, the number of significant intra-coefficients increased somewhat, whereas the number of significant inter-coefficients suffered a decline of about 50%. This decline was due to the failure of X5 and X6 to remain significantly correlated with these variables, and to a 50% reduction in the number of significant coefficients of X1.

4. Land use Per capita value added by manufacturing and retail trade, with approximately the same number of significant coefficients in 1950 and in 1960, were responsible for almost 50% of the significant correlations with the variables in this group. Demographic density also had a large number of significant coefficients and slightly more than the index of all non-agricultural enterprises. The increase in the correlation of industry and wholesale trade with this group of variables from 1950 to 1960, brought about an increase of the number of significant coefficients in this period.

5. Type of farming The subdivision in 1960 of the 1950 group "other types of farming" was responsible for the increase in the number of significant coefficients. Very great increases occurred in the number of significant coefficients of the trade variables, X6 and X7, and of the general composite indices, X1 and X3. The number of significant coefficients of per capita value added by manufacturing more than doubled. On the other hand, there was a small reduction in the number of significant coefficients of demographic density.

Per capita value added by manufacturing, retail trade, demographic density and all non-agricultural enterprises were the leading indices when all the coefficients of the two years are combined.

With the exclusion of the group "other types of farming" and its components, demographic density and retail trade led the urban indices in the number of significant coefficients, while the overall urban index and industry did not have a single significant coefficient.

6. Type of power Demographic density was the only index not having a single significant coefficient with the type of power used for farming, but it was, as the other indices, highly correlated with the percentage of farms using mechanical power alone or in combination with animal power for processing farm products.

7. Farm-size classes Demographic density had the highest number of significant correlations with this set of variables. In general, the correlations are negative for all the classes except those under 2 hectares and from two to 99 hectares.

8. Average farm size Again, demographic density had the greatest number of significant correlations with the average size of farms under the various types of operator and in the various farm-size classes. As to the correlation with the average farm size in the various types of legal organization, X2 in 1950 did not have significant coefficients, but in 1960 it was the only urban index having significant correlations.

9. Cropland-size classes In 1950, the leading indices in the number of significant correlations were the industrial indices, X4 and X5, the general composite indices, X1 and X3, and the retail trade

index.

From 1950 to 1960 there was a general decline in the number of significant correlations with the percentage of farms in the various classes of cropland size. The decline was greatest for the industrial indices. In 1960, the leading positions in significant correlations were occupied by the general composite indices and by the trade indices.

Combining, however, both years, the leading indices were the same as those in 1950.

c. Intra- versus inter-correlations There were some cases of the percentage of significant intra-coefficients being much greater than that of significant inter-coefficients.

Retail trade was the urban index in which such a phenomenon achieved the greatest proportions. This was observed in the correlations of retail trade with farm labor and with "cropland size." Other urban indices also had the percentages of significant intra-correlations with "cropland size" substantially greater than that of significant inter-correlations. These indices are the general composite indices, X1 and X3, and the wholesale trade index, X6. On the other hand, the reverse held true for X4.

B. Suggested Research

Four types of suggestions are presented. One refers to the improvement of the urban indices. A second one concerns the increase in the coverage of the agricultural variables. The third suggestion deals with the reconstitution of the 13, 15[9] and 17 zones for the three years and with the study of the agricultural sector in 1940. Finally, it is

[9]This is the most recent zone classification.

suggested that the hypothesis opposite to the urban-industrial hypothesis also be studied.

As to the first type of suggestion, much could be learned from a study of the correlations of the various urban proxies. Such a study would show directions for improvement in the indices. Some improvements, however, could be made without a detailed study. Thus, for instance, forming induces on the basis of proxies for which data are available in the three censuses would make more meaningful the inter-year comparisons of the coefficients. Another improvement would be the replacement of the demographic density index by one that would put greater emphasis upon the urban population. Such an index could be, for instance, the number of cities with population above some specified limit.

Available data permit the expansion of the number of variables representing the productive structure of agriculture. Among such variables, the following ones may be mentioned: variables measuring the productive efficiency (yields of crops, milk per cow, eggs per hen, etc); composition of the herd (proportion of the dairy cattle, of the beef cattle, etc.); capital structure (items of the expenditures and of the various classes of farm capital expressed in per farm or per hectare or per worker terms, according to the case at hand; equipment and work animals also expressed in appropriate terms). For 1950 there are data on large-scale farming, a size or scale variable.

The reconstitution of the 13, 15 and 17 zones for all the three censuses would permit very meaningful analyses. In the present thesis, the inter-year comparisons are hindered by the different number of zones

in 1950 and in 1960. It is recalled that the 1940 urban study showed that the zone classification did exert a very great impact upon the significance level of the correlation between some urban indices. The change over time of this impact seems to tell much about the relative structural changes occurring in the various zones with respect to the characteristics at hand.

Finally, the study of the opposite hypothesis could allow very interesting comparisons of the coefficients to determine in which direction the correlation would be stronger. This test of the two contrary hypotheses would indeed be a test of Myrdal's causal circularity (34).

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VII. ACKNOWLEDGEMENTS

The author wants to thank the help received from the Campanha de Aperfeicoamento de Pessoal de Ensino Superior, the Organization of the American States, and the Universidade Rural do Estado de Minas Gerais. A great debt is owed also to Dr. Earl O. Heady for the time and encouragement given to the author.

The Department of Agricultural Economics of Purdue University, headed by Dr. Charles E. French, provided the author with the opportunity and means of preparing this thesis. Dr. G. Edward Schuh was responsible for this opportunity. As good friends, he and his wife, Sra. Maria Ignes Angeli Schuh, went out of their way to help the author.

With the cooperation of Dr. William H. Nicholls and of Vanderbilt University Library, the author was able to get access to the 1940 and 1950 Brazilian Censuses. Dr. Nicholls was very kind to share with the author his experiences with this type of research.

The author owes enormous debt to a large number of people for encouragement and/or technical help. Among them are the following persons: Dr. Eliseu Roberto de Andrade Alves, Dr. Raymond R. Beneke, Dr. Paul D. Doak, Dr. Don J. Hunter, Dr. Earl Kehrberg, Dr. Wallace E. Ogg, Dr. Antonio Rafael Teixeira Filho, Dr. Robert W. Thomas, Jr., Dr. D. Woods Thomas, Dr. Erik Thorbecke, and Dr. J. William Uhrig.

Thanks are due to several personal friends who much encouraged the author during trying periods of his graduate studies. Special mention should be made of the Honorable and Mrs. Ray C. Cunningham.

VIII. APPENDIX A

Since the coefficient of dispersion is not a very well-known statistic, some of its characteristics are discussed here. The coefficient of dispersion for a given variable is the ratio between the difference and the sum of the first and the third quartiles. Its range of variation is between zero and one. Since the data in the present research are from the various zones of a state, the coefficient of dispersion measures the geographical concentration of the variable in that state.

The magnitude of the coefficient of dispersion is influenced by a scale effect. Table 68 shows this effect for various values of the inter-quartile sums and differences[1] and provides an approximate way to take into account such an effect. It is a two-way table specially constructed for possible values of the inter-quartile sums and differences, for the case of ranks of percentages.[2] The values of inter-quartile differences are given at the top of the columns and those of the inter-quartile sums at the left of the rows.

Assuming that twice the median[3] represents approximately the inter-quartile sum, one can enter the corresponding row of the inter-quartile sum and determine where the coefficient of dispersion would be

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[1]The phrase inter-quartile sums and differences are used as shorthand expressions for sums and differences between the first and the third quartiles.

[2]Ranks of percentages were considered because most of the agricultural variables are expressed in percentages.

[3]In case of great divergence between the average and the median, one can average them out and multiply the result by two to have an estimate of the inter-quartile sum.

Table 68. Coefficients of dispersion corresponding to some possible values of the inter-quartile sums (head of the rows) and of the inter-quartile differences (head of the colums)

	1	10	20	30	40
200	0.0050	0.0500	0.1000	0.1500	0.2000
190	0.0053	0.0526	0.1052	0.1578	0.2104
180	0.0056	0.0556	0.1112	0.1668	0.2224
170	0.0059	0.0588	0.1176	0.1764	0.2352
160	0.0063	0.0625	0.1250	0.1875	0.2500
150	0.0067	0.0667	0.1334	0.2001	0.2668
140	0.0071	0.0714	0.1428	0.2142	0.2856
130	0.0077	0.0769	0.1538	0.2307	0.3076
120	0.0083	0.0833	0.1666	0.2499	0.3332
110	0.0091	0.0909	0.1818	0.2727	0.3636
100	0.0100	0.1000	0.2000	0.3000	0.4000
90	0.0111	0.1111	0.2222	0.3333	0.4444
80	0.0125	0.1250	0.2500	0.3750	0.5000
70	0.0143	0.1429	0.2858	0.4287	0.5716
60	0.0167	0.1667	0.3334	0.5001	0.6668
50	0.0200	0.2000	0.4000	0.6000	0.8000
40	0.0250	0.2500	0.5000	0.7500	1.0000
30	0.0333	0.3333	0.6666	1.0000	
20	0.0500	0.5000	1.0000		
10	0.1000	1.0000			
1	1.0000				

50	60	70	80	90
0.2500	0.3000	0.3500	0.4000	0.4500
0.2630	0.3156	0.3682	0.4208	0.4734
0.2780	0.3336	0.3892	0.4448	0.5004
0.2940	0.3528	0.4116	0.4704	0.5292
0.3125	0.3750	0.4375	0.5000	0.5625
0.3335	0.4002	0.4669	0.5336	0.6003
0.3570	0.4284	0.4998	0.5712	0.6426
0.3845	0.4614	0.5383	0.6152	0.6921
0.4165	0.4998	0.5831	0.6664	0.7497
0.4545	0.5454	0.6363	0.7272	0.8181
0.5000	0.6000	0.7000	0.8000	0.9000
0.5555	0.6666	0.7777	0.8888	1.0000
0.6250	0.7500	0.8750	1.0000	
0.7145	0.8574	1.0000		
0.8335	1.0000			
1.0000				
⋮				

located[4] in the row, and from this determine the corresponding value of the inter-quartile difference. This inter-quartile difference corresponds to the number of percentage points between the first and third quartiles. An example is provided to illustrate the explanations above.

Suppose that the median of a given variable is 40%. The approximate inter-quartile sum is, then, 80%. If the C.D.[5] of the variable is 0.250, the inter-quartile difference, as given at the top of the column, is 20 percentage points. In other words, the difference between the percentages of the first and the third quartiles is 20%. If the C.D. were 0.875, the inter-quartile difference would be 70 percentage points.[6]

For the case of variables not expressed in percentage, the same assumption that twice the median equals the inter-quartile sum permits a rough estimate of the inter-quartile difference. The latter would be the product of the C.D. by twice the median.

The coefficients of dispersion of the urban indices refer to the series of ranks (simple indices) or of averages of ranks (composite indices). Ranks consist of the sequence of the natural numbers and, thus, have a coefficient of dispersion of 0.5. However, when there are

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[4] Interpolations are appropriate because there is straight proportionality between the several values.

[5] C.D. is the abbreviation used herein for coefficient of dispersion.

[6] If the distribution were not skewed, values of the first and of the third quartiles would be 50% and 30% for the first example, and 75% and 5% for the second example.

ties[7] involving the first and/or the third quartile, the coefficient of dispersion diverges a little from 0.5.

In the case of composite indices, if there were perfect consistency in the various characteristics among the ranks for every zone, and if there were no ties among the ranks, the case would be the same as that of the simple indices without ties. Disregarding the case of ties, which was discussed above, it is necessary to consider the case of lack of consistency among the ranks of the various zones. What matters here is to consider the case of extreme inconsistency in order to determine the other expected limit[8] for the range of variation of the coefficient of dispersion.

Suppose there are n zones and just two characteristics, x and y. The ranks of the zones according to these two characteristics form two vectors of n elements each. For such a case, the greatest inconsistency occurs when the zone with the first rank in one of the characteristics, say x, has rank n in the other characteristic, y and the zone with second rank in x has rank n-1 in y and so on. Generalizing, the ranks are such that their sum is equal to n+1.[9]

The average rank for each zone is (n+1)/2. Hence, the coefficient of dispersion is:

---

[7] When there are ties among zones, the tied zones receive ranks corresponding to the averages of the ranks they would receive if there were no ties.

[8] One limit (case of perfect consistency) is in the neighborhood of 0.5. Discrepancies from this limit are due to the existence of ties.

[9] Ranks with such a characteristic will be called complementary.

$$C.D. = \frac{(n+1)/2 - (n+1)/2}{(n+1)/2 + (n+1)/2} = 0$$

Suppose there are n zones and m characteristics. The ranks form an n x m matrix. The greatest inconsistency occurs when the elements of such a matrix are such that the matrix can, after the necessary transpositions, be partitioned into submatrices composed each of identical vectors, which are complementary, in the sense previously defined, to the identical vectors of the other submatrix. Thus, the case of several characteristics is reduced to that of two characteristics.

In sum, then, the lower limit of the range of possible values of the coefficient of dispersion is zero, as in the case of simple indices. The upper limit, also as in the previous case, is in the neighborhood of 0.5, the discrepancy from this value being due to the existence of ties.

Another piece of information which can easily be obtained from the coefficient of dispersion is the ratio between the first and the third quartiles. The formula for this ratio is:

$q_1/q_3 = (1+z)/(1-z)$, where z is the coefficient of dispersion and q_1 and q_3 are the first and the third quartiles, respectively.[10]

---

[10]The derivation of the formula is the following: From the definition of coefficient of dispersion $(q_1 - q_3) / (q_1 + q_3) = z$, it follows that $q_1 - q_3 = z\,(q_1 + q_3)$. Hence: $(1 - z)q_1 - (1 + z)\,q_3$ and $q_1 / q_3 = (1 + z) / (1 - z)$.

IX. APPENDIX B

The Urban Sectors in Minas Gerais and Sao Paulo

Table 69 contains the averages and medians of various urban characteristics of Minas Gerais and Sao Paulo, and the national averages of these characteristics for the years of 1940, 1950 and 1960.

With three exceptions, Minas' averages are below the national average. The exceptions are demographic density, value of the inventories in retail trade per person employed (slightly above the national average in 1940 and in 1950), and annual wages per non-administrative employee (in 1940) in the same type of trade.

Both for Minas and for Sao Paulo, the medians of the various urban characteristics are below the averages, indicating a distribution skedwed to the left.

Table 70 gives the coefficients of dispersion[1] of the urban characteristics and the intra-year coefficients of rank correlation of these characteristics with per capita value added by manufacturing.[2]

One series of rank correlation coefficients for Sao Paulo[3] and two for Minas are presented in the table.

Most of these coefficients are highly significant statistically. The exceptions are discussed herein.

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[1] Due to a scale effect, the coefficients of dispersion are not directly comparable. See discussion of this point in Appendix A.

[2] For brevity, the coefficients will be designated by the characteristic correlated with the pcVAM.

[3] Nicholls' 1940 coefficients, not reproduced here, refer to the correlation of the various 1940 characteristics with the 1950 per capita value added by manufacturing.

Table 69. Averages and medians of some urban characteristics in Brazil, Sao Paulo and Minas Gerais, 1940, 1950 and 1960[a]

	Averages					
	1940			1950		
	BR	SP	MG[b]	BR	SP	MG
Demographic Density						
Population/ Kilometer	4.85	29.04	11.76	6.10	36.98	13.11
Non-Agricultural Enterprises						
Payroll/Capita	76.1	157.1	32.0	489	1156	190
Payroll/Employee	2209	2567	1567	9232	13132	5680
Inventories/Capita	--	--	--	900	1838	515
Fixed Capital/Capita	--	--	--	1676	3703	877
Industry						
Value Added by Manufacturing/Capita	187.7	416.3	91.0	1059	2832	457
Value Added by Manufacturing/Worker	8061	9075	6764	42675	52391	35619
Value Added by Manufacturing/Establishment	156.7	210.1	97.4	596.0	1034.1	304.3
Fixed Capital/ Employee	18772	23444	13388	35071	39832	34295
Fixed Capital/ Establishment	364.9	542.8	192.7	578.3	918.5	354.6
Employee/Establishment	19.4	23.2	14.4	16.5	23.1	10.3
Workers/Establishment	--	--	--	13.9	19.5	8.5
Annual Wages/Worker	2332	2602	1919	10512	12147	6778
Horsepower/Establishment	--	--	--	30.6	45.4	20.8
Horsepower/Worker	--	--	--	2.14	2.30	2.43

[a]Source: Nicholls (36, p. 119-121); Brasil (12, 15 and 17).

[b]See footnote b in Table 15.

Medians								
1960			1940			1950		1960
BR	SP	MG	SP	MG 13 Zones	MG 17 Zones	SP	MG	MG
8.34	52.34	16.67	23.66	8.90	8.55	24.35	10.07	10.70
2358	6025	1343	30.7	9.0	7.0	228	105	372
50933	62203	44026	1329	847	886	7135	3877	25375
3280	6380	2185	--	--	--	740	352	1198
1999	2814	1300	--	--	--	1238	577	770
7805	23269	3421	121.9	17.0	17.0	590	237	1346
388473	464432	292968	7962	4834	4925	40815	34286	299262
5001.0	8327.7	2723.0	69.1	38.9	45.5	257.0	169.0	1825.0
--	--	--	17635	9784	9353	41291	35431	--
--	--	--	159.6	87.3	87.3	285.5	220.8	--
16.2	22.9	11.4	8.9	8.1	8.4	6.2	6.4	10.0
12.9	17.9	9.3	--	--	--	5.0	5.2	8.1
67981	77277	55159	1744	1247	1152	7412	5041	41000
46.4	73.0	34.3	--	--	--	19.3	13.8	20.4
3.6	4.1	3.7	--	--	--	2.89	2.44	3.65

Table 69 (continued)

	Averages					
	1940			1950		
	BR	SP	MG	BR	SP	MG
Wholesale Trade						
Gross Receipts/Capita	811.9	1366.4	136.0	2229	4997	635
Gross Receipts/Employee	216.0	254.4	363.9	607.9	786.5	396.5
Fixed Capital/Establishment	--	--	--	177.7	227.3	94.0
Fixed Capital/Employee	--	--	--	25060	26079	18763
Inventories/Establishment	--	--	--	861.1	1393.1	449.2
Inventories/Employee	--	--	--	121.5	159.8	89.7
Employees/Establishment	6.33	8.03	4.2	7.09	8.72	5.0
Annual Wages/Worker	3915	4862	2746	20368	23574	11666
Retail Trade						
Gross Receipts/Capita	196.1	403.7	109.0	1228	2236	816
Gross Receipts/Establishment	50.3	79.6	33.9	257.4	404.3	195.9
Gross Receipts/Employee	26.5	40.6	19.2	124.7	174.6	106.1
Inventories/Establishment	18.4	22.6	17.4	91.7	140.3	86.1
Inventories/Employee	9680	11490	9918	44410	60615	46630
Employees/Establishment	1.90	1.96	1.76	2.06	2.32	1.85
Annual Wages/Worker	955	1166	1379	8357	10815	5370
Other Types of Commerce and Services						
Annual Wage/Employee	--	--	--	1954	10080	4745
Banking						
Deposit/Capita	--	--	--	1484	2995	869
Loans/Capita	--	--	--	1277	2223	935
Receipts/Deposit .100	--	--	--	11.54	10.35	13.49
Receipts/Loans .100	--	--	--	13.41	13.95	12535

			Medians					
			1940			1950		1960
BR	SP	MG	SP	MG 13 Zones	MG 17 Zones	SP	MG	MG
9428	24835	3648	106.2	69.0	69.0	457	336	1284
3025	3711.5	2594.5	76.8	74.0	66.6	375	316	2148
1364.3	2036.1	831.2	--	--	--	96.5	81.3	581.4
177643	195523	114116	--	--	--	29086	22422	149281
3368.7	4991.6	2339.7	--	--	--	347.6	298.5	1203881
438.6	479.3	405.7	--	--	--	78.7	88.6	353.0
7.7	10.4	5.8	2.95	3.4	2.9	3.51	3.73	3.27
117056	126702	100494	1583	2033	1675	10977	8482	64759
8000	14817	5934	224.3	68	69	1331	569	3546
1706.5	2711.4	1433.9	56.1	26.2	27.2	267.4	142.5	955.0
766.1	1063.9	707.8	31.0	16.1	16.8	140.7	85.0	561.3
382.8	535.7	368.7	21.4	16.0	16.1	132.0	72.2	276.6
171880	210191	182009	10306	8983	9656	54435	43732	164558
2.23	2.55	2.03	1.79	1.63	1.63	1.95	1.7	1.70
75081	85500	61713	644	987	1083	6436	4210	51602
32938	38754	18503	--	--	--	6104	3527	11842
--	--	--	--	--	--	1189	357	--
--	--	--	--	--	--	805	464	--
--	--	--	--	--	--	9.4	13.1	--
--	--	--	--	--	--	14.55	12.73	--

Table 70. Coefficients of dispersion and Spearman coefficients of rank correlation between the per capita value added by manufacturing and other urban characteristics in Sao Paulo and Minas Gerais, 1940, 1950 and 1960[a]

	Relative Dispersion					
	1940			1950		1960
	SP	MG[b] 13 Zones	MG[b] 17 Zones	SP	MG	MG
Demographic Density						
Population/kilometer	.402	.606	.576	.405	.659	.545
Non-Agricultural Enterprises						
Payroll/Capita	.668	.706	.769	.516	.723	.739
Payroll/Employee	.291	.337	.355	.161	.304	.362
Inventories/Capita	--	--	--	.261	.474	.435
Fixed Capital/Capita	--	--	--	.497	.708	.414
Industry						
Value Added by Manufacturing/Capita	.792	.831	.893	.692	.811	.806
Value Added by Manufacturing/Worker	.341	.298	.307	.279	.286	.292
Value Added by Manufacturing/Establishment	.570	.441	.621	.489	.475	.443
Fixed Capital/Employee	.379	.183	.281	.168	.202	--
Fixed Capital/ Establishment	.523	.423	.549	.299	.373	--
Employee/Establishment	.391	.274	.374	.326	.333	.430
Workers/Establishment	--	--	--	.339	.405	.520
Annual Wages/Worker	.148	.234	.229	.099	.153	.149
Horsepower/Establishment	--	--	--	.499	.415	.580
Horsepower/Worker	--	--	--	.283	.165	.247
Wholesale Trade						
Gross Receipts/Capita	.490	.501	.661	.612	.602	.627
Gross Receipts/Employee	.249	.225	.426	.367	.175	.217
Fixed Capital/Establishment	--	--	--	.420	.208	.309
Fixed Capital/Employee	--	--	--	.202	.157	.195
Inventories/Establishment	--	--	--	.459	.264	.418
Inventories/Employee	--	--	--	.443	.135	.238
Employee/Establishment	.391	.340	.355	.282	.178	.187
Annual Wages/Worker	.148	.295	.476	.167	.315	.194

[a]Source: Nicholls (36, p. 119-121), Brasil (12, 15 and 17).

[b]See footnote b in Table 15.

Rank Correlation				
1940		1950		1960
MG 13 Zones	MG 17 Zones	SP	MG	MG
.725**	.686**	.742**	.478**	.615**
.956**	.971**	.930**	.962**	.953**
.901**	.765**	.719**	.901**	.951**
--	--	.751**	.918**	.833**
--	--	.936**	.923**	.838**
1.000**	1.000**	1.000**	1.000**	1.000**
.896**	.833**	.488**	.401	.081
.909**	.750**	.933**	.907**	.676**
.648**	.490**	.044	.385	--
.791**	.789**	.763**	.824**	--
.670**	.630**	.701**	.703**	.716**
--	--	.658**	.687**	.699**
.824**	.701**	.550**	.791**	.748**
--	--	.858**	.687**	.809**
--	--	.154	.286	.277
.736**	.775**	.719**	.874**	.816**
.648**	.677**	.519**	.742**	.439**
--	--	.344	.401	.343
--	--	-.299	-.379	-.150
--	--	.611**	.687**	.439*
--	--	.620**	.412**	.216**
.478**	.586**	.597**	.726*	.596**
.736**	.714**	.103	.577*	.365

Table 70 (continued)

	Relative Dispersion					
	1940			1950		1960
	SP	MG 13 Zones	MG 17 Zones	SP	MG	MG
Retail Trade						
Gross Receipts/ Capita	.341	.430	.464	.271	.510	.495
Gross Receipts/ Establishment	.313	.245	.234	.257	.256	.392
Gross Receipts/ Employee	.201	.222	.205	.176	.206	.293
Inventories/ Establishment	.314	.251	.176	.270	.159	.290
Inventories/ Employee	.222	.175	.186	.209	.114	.205
Employee/ Establishment	.102	.057	.061	.090	.057	.106
Annual Wages/ Worker	.368	.235	.240	.178	.153	.129
Other Types of Commerce and Services						
Annual Wages/ Employee	--	--	--	.204	.287	.323
Banking						
Deposits/Capita	--	--	--	.712	.782	--
Loans/Capita	--	--	--	.434	.727	--
Receipts/ Deposit	--	--	--	.217	.280	--
Receipts/Loans	--	--	--	.130	.266	--

Rank Correlation				
1940		1950		1960
MG 13 Zones	MG 17 Zones	SP	MG	MG
.857**	.855**	.810**	.918**	.895**
.588**	.478**	.747**	.874**	.779**
.632**	.451**	.742**	.890**	.770**
.319**	.373**	.607**	.857**	.775**
.341**	.252**	.430*	.797**	.706**
.247*	.270**	.737**	.654**	.882**
.824**	.757**	.572**	.808**	.630**
--	--	.589**	.874**	.699**
--	--	.840**	.890**	--
--	--	.594**	.835**	--
--	--	.091	.038	--
--	--	.227	.088	--

The coefficients of the value of fixed capital per employee and of the number of horsepower per worker were nonsignificant, both in Minas and in Sao Paulo. It is interesting to note that the two corresponding variables expressed in a per establishment basis had highly significant coefficients in both states. Thus, the size of the industrial establishments in the various zones, as measured by the fixed capital and by the number of horsepower per establishment, and not the industrial investment per employee as measured by the same variables expressed in a per employee basis, is closely related to the industrial development of the zones, as measured by the pcVAM.

In Minas, there was in industry another case of nonsignificance. It was the 1960 coefficient of the per worker value added by manufacturing, while the corresponding 1950 coefficient had been highly significant. This seems to indicate that the industrial development, as measured by the pcVAM, has not been accompanied in Minas by an increase in the labor efficiency, as measured by the per worker value added by manufacturing.

The coefficients of value of the fixed capital (per establishment and per employee) and of the annual wages per non-administrative employee in wholesale trade were nonsignificant in Sao Paulo and in Minas.[4]

[4]For Minas, the coefficient of annual wages per worker was not significant in 1960, but significant in 1950.