

# A spatial analysis of the population of the State of Minas Gerais, using data of 1950/80

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## 1. INTRODUCTION

During the period after World War II, the Brazilian economy, and particularly that of Minas Gerais, undergo significant changes relating to rapid modernization. Through this process, Brazil acquires an important position in the world economy. However, the means by which this process of modernization takes place, and the priorities it establishes, prove ineffective in the solution of specific regional problems, and in some cases even contribute to increasing contradictions inherent in the existing system.

Since the 19th century, the population in the State of Minas Gerais has had an out-migration tendency. This trend has not been altered by industrialization. On the contrary, after 1959 although the State begins to report various regions with a marked increase in its population, the rest of the State experiences an even higher rate of out-migration which results in a negative net balance.

In Part Two of this paper, by making use of the "potential model", it is possible to derive a spatial analysis of the evolution of the State's population distribution from 1950 to 1980. The model quantifies the geographic position of population evasion, stagnation, and growth within the region.

An analysis of the model's results identifies two regions of outstanding population growth and loss due to the migration process from 1950 to 1980:

- "Vale do Aço", which surpasses population growth in the Metropolitan Area of Belo Horizonte (RMBH) and moves the area from its insignificant ranking in 1950 to become by 1980 one of the State's most important poles of attraction in the direction Belo Horizonte-

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Vale do Aço;

- "Zona da Mata", which presents a steady population loss. Part Three presents a socio-economic analysis of the Vale do Aço Region. Part Four goes on to examine the stagnation process occurring in Zona da Mata and is divided into two parts:
- An analysis of the regional expansion process from 1820 to 1920, which makes the region the most important in the State at the beginning of the century;
- An evaluation, based on specific indicators, of the region's socio-economic situation after 1950 when the stagnation process becomes most evident.

## 2. SPATIAL EVOLUTION OF POPULATION DISTRIBUTION IN MINAS GERAIS FROM 1950 TO 1980

### 2.1. Introduction

Based on the potential model, this chapter provides a global vision of population growth in Minas Gerais. It takes into account the spatial distribution, that is, the growth differential that exists between regions based on census data from 1950 to 1980. A brief explanation of the methodology is presented, followed by a summary of the main results obtained through the model's application to the case of Minas Gerais.

### 2.2. Description of the data

Population censuses are the main source for the comprehensive study of population mobility in Minas Gerais. The data used in this study comes from the 1950, 1960, 1970 and 1980 censuses at the municipal level. All 722 municipalities in Minas Gerais were considered.

### 2.3. Potential model

Spatial interaction models deal explicitly with spatial questions. They have been widely used in empirical studies and well tested by statistical analysis. The current literature on spatial interaction models includes case studies on such developing countries as: Ghana (Beals, Leavy and Moses, 1967); Brazil (Sahota, 1968 and Abreu, 1982); Jamaica (Adams, 1969); India (Greenwood, 1971) and others.

The basic model used in this paper is:

$$U_j = \int \frac{1}{r} D^* dA \quad (1)$$

where  $D^*$  is density over an infinitesimal element of area  $dA$  and  $r$  is the distance.

The self potential is:

$$U_{jj} = 2D_j/(A/\pi)^{1/2} \quad (2)$$

Then total potential at  $j$  can be given as:

$$U_j = 2D_j/(A/\pi)^{1/2} + \sum_i D_i/r_{ij} \quad (3)$$

The program POTEN (Abreu, 1982) was used.

The curves of the demographic potential link point to the same constant value  $K$ . Drawn on a map of the region is the graphic representation of the potential model, which helps visualize the relation of forces between the various municipalities. In simplistic terms, "mountains" represent "popularizing" regions and "valleys" represent "polarized" regions. For an analysis of the relative variation of this potential in time, it is possible to make use of an index obtained by dividing the normalized potential of each municipality in 1980 by the normalized potential of each municipality in 1950. (The total of the potentials in Minas Gerais equals 100).

The results presented in the maps were obtained by dividing these indexes at four intervals of frequency. This subjectively defines the category of the municipality in terms of gains and losses in potential. The following gives the results obtained by the application of this methodology.

### 2.3. SPATIAL EVOLUTION OF THE POPULATION OF MINAS GERAIS THROUGH THE POTENTIAL MODEL (1950-1980)

The potential model described in the previous section was applied at the municipal level in the State of Minas Gerais. Two analyses were carried out:

- The first considers only the municipalities of Minas Gerais, based on the total population of the 1950, 1960, 1970 and 1980 censuses, in order to indicate the global trend of population movement from 1950 to 1980 and identify population concentration, evasion, and stagnation trends within the various regions; and the second introduces the potential of neighboring capitals (São Paulo, Rio de Janeiro, Salvador, Vitória and Brasília), in order to outline the polarizing cities' "areas of influence" both inside and outside the State boundaries. (This second analysis is not the aim of this paper.)

Maps 1 and 2 present the curves of demographic potentials for the population in Minas Gerais in the censuses of 1950 and 1980. The unit of potential adopted is inhabitant per meter, and the curves are drawn at an interval of five units. In the region near Belo Horizonte the concentration of curves is very high and appears almost as a "peak". For this reason these curves are not drawn in and only a numerical value of the potential for Belo Horizonte is presented.

Regardless of the year under analysis (map 1 or 2), the curves are generally concentric and aimed towards the Metropolitan Area of Belo Horizonte with inclined gradients as they approach the capital. It is possible

to divide the State into four "quadrants", which encompass the planning regions (defined in map 3): Metalúrgica and Campos das Vertentes; Mata; South and small parts of the Alto do São Francisco and Rio Doce regions. Some "local maximums" are recorded in the latest census (map 2, 1980), such as Vale do Aço (Ipatinga, Timóteo and Coronel Fabriciano) and Juiz de Fora.

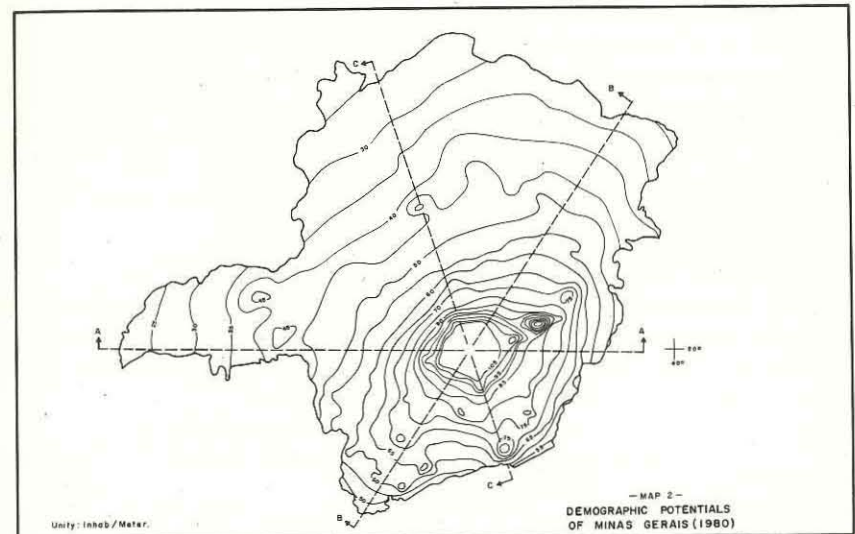
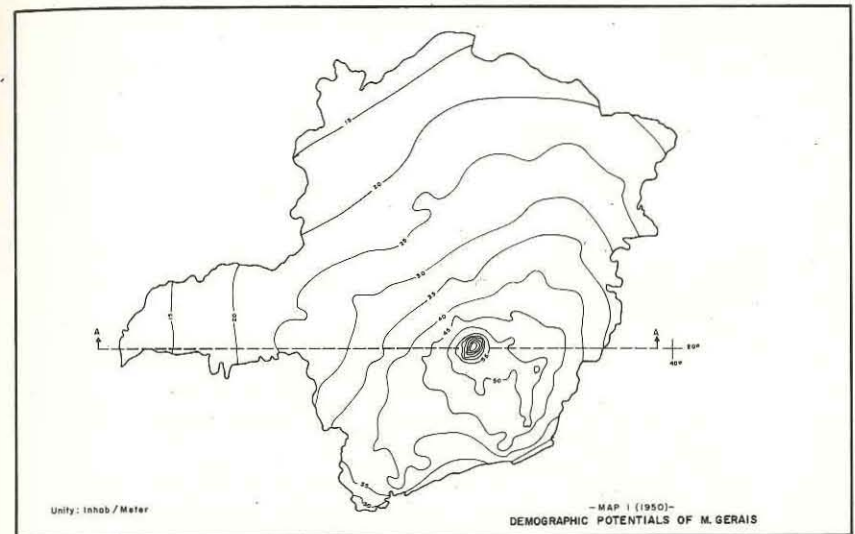
In map 1 (demographic potential curves in 1950), the following points stand out:

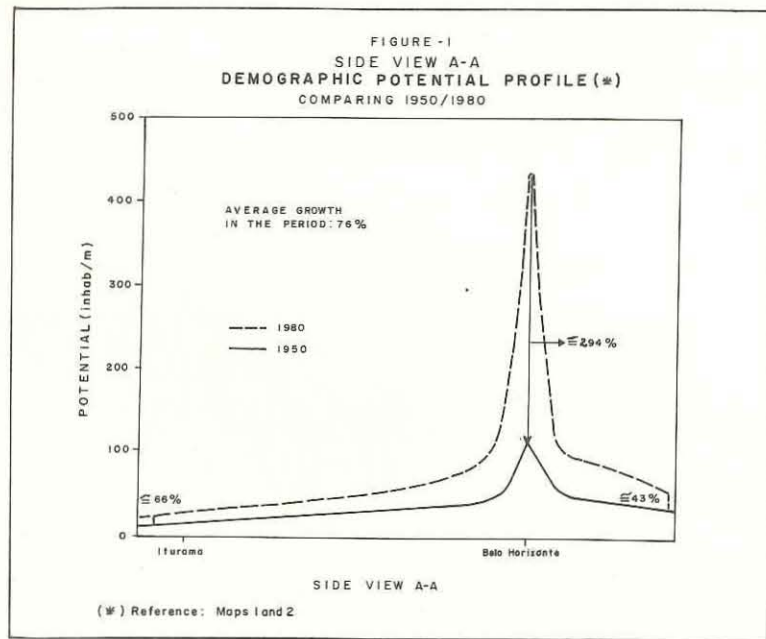
- Belo Horizonte is of major importance with a growing potential as it approaches the capital;
- Zona da Mata is the second most important region with a 50 curve surrounding the Metropolitan Area of Belo Horizonte and Zona da Mata. (This result may indicate a strong interaction between the two regions and partially explain their important positions within Minas Gerais in 1950).
- The local maximums are few, and when they occur the differential potential is very small in relation to the rest of their region (Lavras with a rate of 46 in a region with demographic potential between 40 and 45 and Ponte Nova with a rate of 55 near the demographic potential 50).
- Juiz de Fora, João Monlevade, Conselheiro Lafaiete and Itajubá do not present a local maximum, but only deviate the demographic potential curve that surrounds them;
- Uberaba and Uberlândia fail to significantly influence the contour of surrounding curves.

In 1980 demographic potential curves (in mapa 2) illustrate the consolidation of the State's new populational axis which moves from Belo Horizonte — Zona da Mata in 1950 to Belo Horizonte — Vale do Aço in 1980. The demographic potential curve 85 surrounds the two regions. In addition, the demographic potential curves show that:

- the positions of Uberlândia, Uberaba and Governador Valadares are those of consolidated regional centers;
- Juiz de Fora maintains its importance as a regional center, despite the population losses in Zona da Mata;
- Itajubá, São Lourenço/Caxambu, and Varginha (with low local maximums) and Poços de Caldas (which influences demographic curve 60), stand out as regional centers in the South of the State;
- Contagem, Betim, Divinópolis, Itaúna and Sete Lagos do not present local maximums as they fall under the area of influence of Belo Horizonte due to their proximity.

Although the importance of Belo Horizonte is already significant in the 1950 census, its potential grows 294% during the period 1950 to 1980 in relation to the State's average growth rate of 76%. This can be seen in chart 1, which presents the profile of the potential of side view AA (maps 1 and 2). This indicates the marked polarization of the Metropolitan Area of Belo Horizonte as the main attraction center in the State allows it to absorb the major part of the migratory flows from other regions.





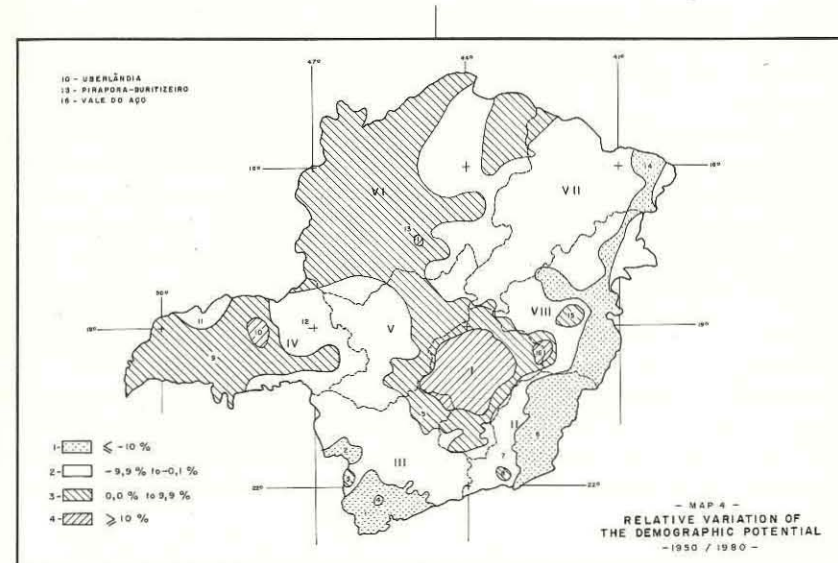
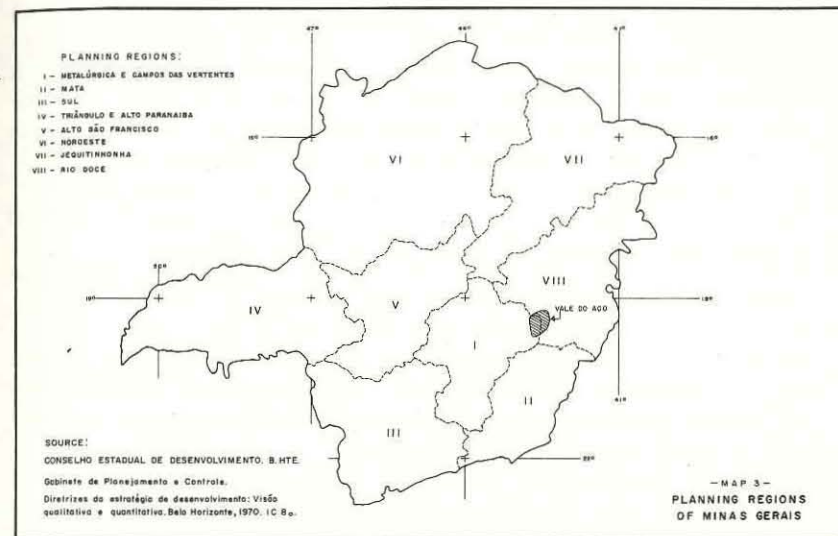
The demographic potential curves offer the advantage of a global vision of the transformation of the population's spatial distribution on a given date. However, it is a static model, which makes it rather difficult to derive a dynamic process of population movement by merely comparing two different dates. Only substantial changes, such as the dislocation of the Belo Horizonte-Zona da Mata axis in 1950 to Belo Horizonte-Vale do Aço in 1980 become evident. For a more detailed view of the process from 1950 to 1980, the relative variations of potential for each municipality were calculated. The results are presented on map 4, with the relative variations of potentials grouped in four intervals of frequency:

*Interval 1* — Over 10% of the relative loss of potential. These are regions with major losses of potential and high rates of population evasion, which usually result from the stagnation of productive activities and/or the inability of traditional activities to retain the population;

*Interval 2* — Between 0 and 10% in the loss of potential;

*Interval 3* — Relative gain of potential between 0% and 10%. These are regions with moderate gains of potential.

*Interval 4* — Relative gain of potential superior to 10%. These are regions that, given the dynamic nature of their production activities, obtain high rates of population growth and function as receiving centers for migratory flows from other parts of the State.



Observing map 4, one can draw the following conclusions:

- The great loss of potential takes place mainly along the far eastern line of the State, including the planning regions Mata, Rio Doce and Jequitinhonha.
- The far South of the State and Região Mogiana (1 and 2 on map 4) also presents a major loss of potential. With the same methodology and the introduction of São Paulo's influence, this region has a significant gain of potential. Observing the results of these two criteria, one notices that Region South diminishes its interaction with the rest of the State in relative terms, while the influence of São Paulo grows in this period and acts as an attracting force outside the State.
- The regions characterized by a moderate loss of potential include most of Jequitinhonha, Rio Doce, Mata, South and West.
- Despite the loss of potential in the regions of Rio Doce, Mata and South, the municipalities of Governador Valadares (15 on map 4), Juiz de Fora (8 on map 4) and Poços de Caldas (3 on map 4) present a gain of potential during the period which demonstrates that those municipalities (of medium size and of significant weight within the region's productive process) have been instrumental in retaining part of the rural population in the region.
- Besides the municipalities mentioned above, the Triângulo Mineiro, the Northwest and the areas surrounding the Metropolitan Area of Belo Horizonte-Vale do Aço axis demonstrate a moderate gain of potential.
- Belo Horizonte and its neighboring municipalities, Vale do Aço (Ipatinga, Timóteo and Coronel Fabriciano), Uberlândia and Pirapora are the regions with major gains in potential and are characterized by intense industrial activity that absorbs the migratory flows during the period.

In short, although Minas Gerais historically is considered a State with a negative migratory balance since the beginning of the century, a retrospective analysis broken down regionally, indicates that the process is differentiated in its geographic space. Thus, the socio-economic problems resulting from inefficient modes of rural production (in regions of evasion) and urban-industrial production (in regions of population growth) coexist within the State. Further studies focusing on each region would be useful in identifying their specific characteristics and would offer a basis for evaluating differentiated policies within the State.

The next Parts analyze the agglomerated Vale do Aço and Zona da Mata. The main objective is to take the conclusions drawn from this chapter and proceed to explain the causes of this axis change from RMBH-Zona da Mata in 1950 to RMBH-Vale do Aço in 1980.

### 3. EXPANSION OF VALE DO AÇO DURING THE PERIOD 1950 TO 1980

#### 3.1. Historical background

##### 3.1.1. The period prior to 1950

The subject of this chapter is the agglomerated Vale do Aço, an area composed of the following municipalities: Ipatinga, Coronel Fabriciano and Timóteo (see map 3, chapter 2). Located in the Rio Doce Valley, this area emerged from the division of the Antônio Dias municipality in 1948. Afterwards this division led to the creation of the Coronel Fabriciano municipality. With the establishment of ACESITA in 1944-46, and USIMINAS in 1956, the villages of Timóteo and Ipatinga were incorporated as municipalities through the Decree nº 2.764, dated December 30, 1962.

This area was untouched by the Portuguese colonization process due to the priority given to sugarcane production in the Northeast. The discovery of gold stimulated migratory flows to the mining regions. Generally mining economies were characterized by concentrations of urban population located in the less fertile areas. Therefore, the development of agricultural activities to supply the mining towns, was designated for areas of limited gold production and low levels of productivity (as is the case of the area under study).

With the depletion of gold reserves, the dynamics of consumer markets decreased and areas responsible for providing subsistence agricultural goods suffered decline and became isolated from the market economy. The first event to overcome this stagnation was the connection of the area's Minas-Vitória Railroad with the Central do Brasil Railroad in the 1920's.

The improvement of the transportation network and the transformation of the Brazilian development model in the 1930's, from an export economy of raw materials to an import substitution economy permitted the region to take advantage of its natural resource endowments (iron and manganese deposits, timber and waterfalls).

##### 3.1.2. Industrial Period after 1950

Largely due to the favorable conditions described above, ACESITA in Timóteo and USIMINAS in Ipatinga emerged in 1944-1946 and 1956, respectively. These two areas begin with traditional agricultural activities and eventually develop their economies around dynamic industries. This transformation occasioned substantial changes in the mechanisms for regional income generation and the distribution of the active labor force, which in turn strengthens the urbanization process. The previously analyzed "potential model" demonstrates this effect.

The analysis of Tables 3.1 and 3.2 verifies the region's population boom. In 1950, the region had a population of 22,186 of which 80% lived in the

rural sector. By 1980, the region's population had reached 276,911 with an urban index of 98%. The mean annual growth rate was 8.8% during the period from 1950 to 1980. This growth rate was superior to that of the Metropolitan Region of Belo Horizonte (RMBH) during the same period.

This urbanization process can be explained by at least two factors: the operation of the two urban steel industries which increased regional labor demands and the presence of the Belgo Mineira and ACESITA steel industries in the rural sector. The latter two companies bought large tracts of land in order to extract furnace coal from natural forests and then continued long-term extraction by reforesting the area. This extraction process required large amounts of land and reduced quantities of labor. This could easily have been the cause of much of the region's rural out-migration.

TABLE 3.1

VALE DO AÇO  
URBAN, RURAL AND TOTAL POPULATIONS

1950-1960-1970-1980

	1950			1960		
	Urban	Rural	Total	Urban	Rural	Total
C. Fabriciano	3,316	4,505	7,821	14,623	2,326	16,949
Timóteo	909	10,904	11,813	19,795	3,143	22,938
Ipatinga	236	2,316	2,552	7,185	1,929	9,114
Total	4,461	17,725	22,186	41,603	7,398	49,001
	1970			1980		
	Urban	Rural	Total	Urban	Rural	Total
C. Fabriciano	38,021	3,590	41,611	73,305	2,522	75,827
Timóteo	30,126	2,853	32,979	46,788	3,879	50,667
Ipatinga	45,156	3,216	48,372	149,272	1,185	150,417
Total	113,303	9,659	122,962	269,325	7,586	276,911

Source: FIBGE — Censos 1950, 1960, 1970 and 1980.

Although Coronel Fabriciano did not possess major industries, it was also affected. Coronel Fabriciano was granted a privileged position, given its close connection to the two centers and its highly developed urban structure, which had been in place prior to the creation of the steel industries.

In analyzing the location of these steel industries in the agglomerated Vale do Aço, it is necessary to take into consideration the difference of raw materials available for production. ACESITA uses furnace coal, while USIMINAS uses foundry coke. (For further details see LOCATELLI, R.L., 78).

TABLE 3.2

VALE DO AÇO — RMBH — MG  
COMPARISON OF TOTAL POPULATION GROWTH

	Average annual growth rate (%)			
	1950/60	1960/70	1970/80	1950/80
1. Vale do Aço	8.25	9.64	8.46	8.78
2. RMBH	6.48	6.18	4.74	5.80
3. Minas Gerais *	2.23	0.93	0.67	1.27
4. Minas Gerais — Total	2.56	1.56	1.43	1.85

\* Except Metropolitan Region of Belo Horizonte (RMBH) and Vale do Aço.  
source: FIBGE — Censos 1950, 1960, 1970 and 1980.

Rich iron ore deposits, large timber reserves and easy access to the Central do Brasil and Vitória-Minas railroads, played a major role in determining the ACESITA plant its proximity to raw materials necessary for its production process. The State government's industrial incentive programs as well as subsidies for railroad transport of iron ore and coal also served to justify the plant's location.

3.2. Impact on economic sectors

3.2.1. Primary Sector

In theory, the increases in regional income and rapid population growth, stimulate expansion in agricultural production. In turn, this leads to the incorporation of technological innovations which increase productivity and cause positive repercussions in the regional income. However, in actuality, this was not what occurred in Vale do Aço. Hilly topography and poor soil quality did not lead themselves to agricultural activities, and thus impeded regional production dynamics. Apart from this, the steel industries continued widening areas of reforestation, to the degree that a major portion of the region's subsistence production was replaced by reforestation and livestock activities. This led to both a decline in the production of agricultural goods and decreases in the number of rural jobs, that gave rise to a high rate of rural-urban migration throughout the region.

3.2.2. Secondary Sector

There exists a direct connection between the development of the two steel industries and the region's level of industrial diversification. Growth in

the steel industries caused the emergence of complementary enterprise which had a close technical link to metal production (backwash and spillover effects). Higher salary payments and purchases from other economic sectors increased local income. Therefore, these complementary industries became responsible for supplying the increased local demand (consumption effect).

In 1976, there were ten industries in the mechanical sector (foundries), three in the graphic sector, one in the clothing sector (overalls and uniforms), and one working with non-metallic minerals which emerged in connection with the steel industry's backwash effects. In terms of the steel industry's spillover effects, USIMEC and CIMENTO CAUÊ S/A are good examples. USIMEC purchases steel plates from USIMINAS and manufactures products for steel and cement industries, highway and railroad construction and hydroelectric power plants. CAUÊ produces heat resistant cement which is reinforced with steel from USIMINAS.

During the same period, approximately 189 industries could be considered the result of the "consumption effect". These industries varied in size and were distributed throughout a variety of economic sectors. Nevertheless, the majority tended to be small-scale enterprises involved in the production of industrial equipment for construction, furniture, and food industries, with an average of six employees, low production levels and low salaries. In 1976, despite the variety of economic activities undertaken by these small enterprises, the region's industrial diversification process continued to be unstable and the steel industry was still responsible for generating more than 80% of the region's employment.

The region's industrial structure, one which develops in counter to industrial labor demands, is characterized by modern production activities which utilize capital intensive technologies. In general, production levels increase without proportional job creation. In addition, the average salary in modern industry tends to be higher than that found in the traditional sector due to the additional skill requirements. As a result, regional income distribution within the working class becomes increasingly inequitable and begins to form a subclass.

Table 3.3. provides electrical consumption data that is useful in analyzing industrial diversification trends in Vale do Aço. The table shows the electric power consumption of the two steel industries (ACESITA and USIMINAS) versus "other industries" in the region from 1971 to 1980. In 1980, the electric power consumption of "other industries" represented only 2.5% of the two steel plants' electric power consumption. It should be taken into account that steel production is an energy intensive process and the aggregate value of its product per KWh is considerably smaller. Despite the low power consumption level of the region's group of "other industries", during the period there is an annual average increase of 13% in the number of industries as well as an annual average increase of 27.5% in the power consumption of this group of industries. This will be an important rate to observe in the future in order to determine the prime industries' ability to sustain industrial diversification in the Vale do Aço.

TABLE 3.3

ELECTRIC POWER CONSUMPTION AND NUMBER OF CONSUMERS — USIMINAS AND ACESITA VERSUS OTHER INDUSTRIES IN VALE DO AÇO

Year	Other Industries		Average	Steel	%
	Annual consumption (MWh)	Number of consumers	monthly consumption (MWh)	industries Annual consumption (MWh)	Ratio other/steel industries
1971	4,880	177	2,298	397,679	1.2
1972	6,206	178	2,905	434,538	1.4
1973	5,996	222	2,251	522,953	1.1
1974	7,194	256	2,342	596,245	1.2
1975	8,702	299	2,425	823,514	1.1
1976	22,298	381	4,877	1,030,017	2.2
1977	31,027	430	6,013	1,202,539	2.6
1978	—	—	—	1,254,532	—
1979	36,861	533	5,763	1,559,694	2.4
1980	43,469	531	6,822	1,786,016	2.5
	27.5%	13.0%	12.9%	17.7%	

3.2.3. Tertiary Sector

The sector which exhibits the most significant increase in labor force participation is the tertiary sector. On the whole, apart from generating a direct demand for certain types of services, industry tends to stimulate growth in the urban population which, in turn, increases the demand for virtually every type of service. In Vale do Aço the steel industry has been responsible for the marked expansion of the region's tertiary sector. Nevertheless, the region's tertiary sector is still quite fragile with a profusion of services directly linked to traditional activities. In general, services linked to the traditional sector leave a large percentage of the population subemployed, which is a common characteristic of industrial cities in developing countries and appears to be the emerging trend in Vale do Aço.

There are two important factors inhibiting the tertiary sector's diversification process in Vale do Aço. The first, relates to its proximity to Belo Horizonte, a city with a highly developed tertiary sector. Thus, the demand for more sophisticated services is attended by Belo Horizonte. The second involves the fact that the administrative offices for both steel industries are located in Belo Horizonte where such services as planning, sales, commercialization, publicity and research are already well in place. Both factors reduce the region's driving force for the diversification of services. Re-

ardless, Vale do Aço absorbs an important percentage of labor and will continue to experience impressive growth in the future.

Certain conclusions regarding the tertiary sector in Vale do Aço can be derived from analyzing data on the evolution of the commercial sector's electric power consumption from 1970 to 1980 given in Table 3.4. This table provides indicators: Commercial electric power consumers per 100 urban inhabitants and electric power consumption per commercial firm. The relative growth of commercial consumers per 1 000 inhabitants in Coronel Fabriciano and Timóteo was considerable during the period. It is worth pointing out that Ipatinga is a modern city whose 1970 power consumption levels will only be paralleled by other municipalities once their cities are further modernized. In the case of Coronel Fabriciano in 1980, there exists a large number of commercial establishments per inhabitant (21.3 per 1 000 inhabitants), a phenomenon which could be largely due to the municipality's high level of specialization within the tertiary sector. As far as the electric power consumption index per commercial consumer is concerned, in 1980 Timóteo and Ipatinga show a much higher per capita consumption than commercial industries in Coronel Fabriciano. This infers that more traditional production activities are being carried out in Coronel Fabriciano.

TABLE 3.4

ELECTRIC POWER INDICATORS FOR THE COMMERCIAL SECTOR — VALE DO AÇO

	Commercial consumers/ 1000 urban hab.		Commercial consumers/ 1000 urban hab.	
	1970	1980	1970	1980
Coronel Fabriciano	3.8	21.3	304	400
Ipatinga	13.9	15.6	324	626
Timóteo	3.0	16.3	—	768

Source: CEMIG — Banco de Dados dos Municípios Mineiros DGEIAA — 1984.

3.3. Conclusion and future concerns for research

The theory of export based development states that regional development is based on industrial production which responds to external market demands. Exports generate an income flow which when applied to the area itself, give rise to diversification within the local production structure. This diversification becomes the catalyst for regional development. In Vale do Aço, ACESITA and USIMINAS respond primarily to external market demands. On the one hand, when regional growth depends on the export sector, the internal economic structure does not experience the anticipated growth that is generally experienced with the introduction of a new industry. Instead, there is a stagnation tendency in the agricultural sector, inadequate levels of surplus production to reinforce local income, and weaknesses in the

development of domestic industries. In this context, although the tertiary sector grows, it never attains strength or force.

In the case of Vale do Aço, inadequate growth in the regional market can be attributed to two basic factors:

- Income leakage due to interest payments to the exterior, salaries designated for a board of directors who live outside the area (in Belo Horizonte), and the purchase of goods and the contracting of services outside the region; and
- income differentials within the company's salary structure that skew consumption patterns and limit the local population's purchases to basic products, while more sophisticated goods must be imported to other regions.

These two demand-determined supply factors, divert industrial production away from domestic goods and so restrict local investment options. This leads to another type of leakage which directs savings and capital to other regions. The industrialist's failure to identify with and collaborate with regional needs is another obstacle to economic diversification. This type of situation tends to create an elite that is insensative to local development needs.

The steel industries in Vale do Aço are quite typical of leading industries which adhere to the theory of export based development. There is no denying that the region's growth is a function of its response to external market demands. At the same time there appears to be no significant gain derived from promoting the regional production structure's diversification, given the limited regional consumption.

Considering all that has been said, the Vale do Aço growth potential is largely conditioned by the activities of USIMINAS and ACESITA. Regardless of the serious problems that the national steel industry currently faces, these two industries continue to be priority concerns that can be expected to fulfill their projected production goals. Over the middle term, it is expected that the region will continue to grow, but with a modest rate of population growth and a more limited potential for job creation. However, over the long term, if the local steel industry reaches its apex in the context of weak industrial diversification, almost without a doubt it can be assumed that the Vale do Aço economy will fall into general stagnation.

4. THE STAGNATION OF THE "ZONA DA MATA" FROM 1950-1980

4.1. Area location

The Zona da Mata is located in the southeast of the State of Minas Gerais. It covers an area of 38,683 km<sup>2</sup>, and includes 123 municipalities. (See Part 2, map 3, area II).

4.2. Historical background

Settlement began in the 1750's. Similar to other areas of Minas Gerais which were deprived of gold deposits, the Zona da Mata developed an agri-



culturally-based economy which supplied food to neighboring, mineral-rich settlements in Ouro Preto, Mariana, São João del Rey, Congonhas and others.

With the decline of the gold boom, the areas in charge of food supply were reduced to subsistence economies. However, the Zona da Mata escaped this fate and was able to specialize in coffee production, as a consequence of the following factors:

- a favorable location between mining areas and Rio de Janeiro which formed part of the route taken by those who abandoned mining and set out in search of other opportunities;
- the existence of large extensions of land appropriate for coffee cultivation; and
- access to a beneficial international market seeking coffee at high prices.

In the 19th century, the Zona da Mata experienced high rates of population growth with 20,000 inhabitants in 1822, 254,000 in 1872 and 430,000 in 1890. During this 68-year period, the average annual growth rate was approximately 4.6%. During this same period (according to Table 4.1), the annual average amount of coffee exported soared from 9,707 arrobas in 1819 to 2,500,000 in the 1870's.

Until the beginning of the 1860's, transportation conditions in the area were precarious, which caused an increase in the cost of products sent to the port of Rio de Janeiro. However, the high international price of coffee compensated for this extra expense. In 1861, the railroad from Juiz de Fora to Rio de Janeiro was opened (Estrada União e Indústria). It was not until 1875 that the railroad Dom Pedro II reached Matias Barbosa and Juiz de Fora. The Zona da Mata was integrated into the Leopoldina railroad line which reached as far as Rio Mono and Além Paraíba in 1874; Leopoldina in 1877; Cataguases in 1885 and Muriaé, Rio Pomba and Ponte Nova in 1886.

TABLE 4.1

COFFEE EXPORT IN THE ZONA DA MATA FROM 1810-1880

Year	Annual average of coffee exported in-Arrobas*
1819	9,707
1837	200,000
1860's	1,000,000
1870's	2,500,000

Source: Lima, J.S. "Café e Indústria em Minas Gerais, 1870-1920".

(\*) An arroba is equivalent to approximately 15 kilograms.

The capital surplus generated by coffee cultivation was employed in textile and food industries. In 1899, Juiz de Fora inaugurated the first public hydroelectric power station in South America, which was a decisive factor

in the area's industrial development. Juiz de Fora became the most dynamic urban center in the State of Minas Gerais by the end of the 19th century.

The economic growth in the Zona da Mata from 1820 to 1920, was principally due to coffee expansion. However, following 1920, coffee exports went into decline and reduced the levels of surplus capital in the Zona da Mata. Eventually, the region forfeited its prestigious position as the State's economic center. Relative to the State of São Paulo, the Zona da Mata possessed a significant less favorable position.

According to J.H. Lima (1977), the main reasons for the lagging surplus production in the Zona da Mata included the following:

- Predatory coffee cultivation which depended on the continual expansion of agricultural frontiers in the presence of soil depletion and reduced production;
- Reliance on an expanding slave labor supply which ended with abolition and led to increased labor cost that could only be reduced through owner and labor partnership agreements, e.g. "meieiro" and "parceiro" arrangements. In São Paulo, the migrants' manual work was exchanged for salaries. This capitalist work scheme generated wages as well as buyers for consumer goods. This in turn led to the production of more consumer goods and the establishment of complementary consumer markets. In Zona da Mata partnership agreements predominated. However, such partnership agreements proved less viable than manual work arrangements for a number of reasons. First of all, the tenant farmer produced his own subsistence goods within areas of commercial production, thus inhibiting coffee cultivation, reducing production levels, and accelerating the depletion of fertile lands. Secondly, tenant farming and similar labor agreements developed without wage components, and therefore failed to create labor markets demanding consumer goods. This further contributed to diminish surplus capital and consequently weakened the process of capital accumulation.
- Although coffee was the region's principal product, its cultivation competed with other agricultural products. Sugar cane, tobacco, rice, beans and corn were all cultivated on a large scale. All commercial farms attempted to be "self supporting". Furthermore, as the coffee export was the economic system's only link with the outside world, there was no social division of work which would have aided in increasing coffee production.
- "Minifundias" were (and still are) the typical landholding in the region. With this limited extension of land, the small producer was unable to generate surplus capital to buy additional land, fertilizer, seeds and other inputs needed to increase productivity. Consequently, the small producer's profits decreased over time, impeding a solid basis for capital accumulation.
- The structure of coffee trade had numerous leakage factors which tended to reduce surplus. Trade between small merchants and small farmers at the local level was limited. Trade between large producers

and merchants in Rio de Janeiro generated surplus capital that was not invested in the area, thus preventing the development of large-scale local trade and inhibiting the accumulation process.

From 1920 to 1950, the Zona da Mata lost its position of importance in relation to other parts of the State of Minas Gerais, and the area's economic backwardness assumed irreversible proportions in relation to the economic prosperity in São Paulo. Regardless of this decline, in 1950 the area was still the second most productive in Minas Gerais due to its role in the trade axis Belo Horizonte-Zona da Mata, which was the most important in the State. From 1950 to the present, the area has continued to lose its relative position and has been unable to reverse the stagnation process which started at the beginning of the century.

#### 4.3. Presente situation (1950 to 1980)

Although the Zona da Mata was strategically incorporated into the industrial axis São Paulo-Rio de Janeiro-Belo Horizonte, and provided with an efficient highway and extensive railroad network, the area still depends basically on agricultural production. Ironically, the area's natural conditions are relatively unfavorable for this kind of activity.

The area's industrial sector, although still growing, has limited economic potential with low levels of activity. The sector is centered around traditional industries involved in food, textile and wood production. As these industries are not labor-intensive, they fail to use available labor and are unable to stop the trend of continuous out-migration.

##### 4.3.1. Demographic Aspects

According to Table 4.2, in 1950 the Zona da Mata population consisted of roughly 1,337,000 people, and in 1980 the population increased to 1,637,000. The annual growth rate was 0.7% as compared to an overall growth rate of 2.1% in the State of Minas Gerais. The participation of the area in relation to the State decreased from 17.3% in 1950 to 12.2% in 1980.

TABLE 4.2

#### EVOLUTION OF THE TOTAL POPULATION ZONA DA MATA AND MINAS GERAIS

Year	Zona da Mata	(% a.a.) Growth Rate	Minas Gerais Excluding Zona da Mata	(% a.a.) Growth Rate	% ZM/MG
1950	1,337,289	—	6,390,055	—	17.3
1960	1,546,347	1.5	8,405,623	2.8	15.5
1970	1,579,925	0.2	10,035,665	1.8	13.6
1980	1,637,350	0.4	11,754,021	1.6	12.2

Source: CEMIG — Banco de Dados dos Municípios Mineiros  
DGE/AA — 1984

Empirical evidence suggests that the low rate of population growth in the Zona da Mata is largely due to high levels of out-migration. This out-migration is the consequence of the local economy's inability to generate new and suitable jobs for the younger populations.

#### 4.3.2. Agriculture and Cattle-Raising

In general, agricultural production in the Zona da Mata lacks diversity. Rice, corn, beans, tobacco, sugar-cane and coffee represents almost 100% of the cultivated soil's production.

In the South of Minas Gerais, cattle-raising is mainly for the purpose of milk production. This region supplies the Rio de Janeiro market with "in natura" milk as well as other dairy products. Once milk production develops into a continuous source of income, it is vital to the producers.

The Zona da Mata is characterized by a large concentration of "minifundias" (small farms). Table 4.3 compares the average size of agricultural properties in the State of Minas Gerais from 1950 to 1980. One observes that the properties in the Zona da Mata have an average area inferior to that of properties in Minas Gerais as a whole. In addition, the average size of these properties decreases over time (76.3 ha. in 1950 to 44.5 ha. in 1980).

TABLE 4.3

#### AVERAGE SIZE OF AGRICULTURAL PROPERTIES ZONA DA MATA AND MINAS GERAIS

1950-1980

Year	Region	Number of Agricultural Properties	Area of Agricultural Properties	Mean Area (Ha.)
1950	ZM	38,538	2,939,839	76.3
	MG	264,413	36,637,728	138.6
1960	ZM	54,633	3,076,446	56.3
	MG	365,637	38,442,448	105.1
1970	ZM	71,173	3,281,289	46.1
	MG	453,998	42,008,585	92.5
1975	ZM	69,797	3,319,827	47.6
	MG	463,515	44,623,330	96.3
1980	ZM	73,668	3,280,506	44.5
	MG	479,302	48,310,120	100.8

Source: FIBGE — Censo Agropecuário 1960, 1970, 1975 and 1980.

Table 4.5 demonstrates that both Zona da Mata and Minas Gerais experienced a proportional decrease in the number of tractors per hectare

during the period. However, this rate of decrease varied throughout the period. In 1950, the number of tractors per hectare in the Zona da Mata was double that of the State's average. The inverse was true in the 1970's.

#### 4.3.3. Industry

Traditional industries related to food, wood, paper, textile and footwear production predominated in the Zona da Mata. According to Panagides et alii (1973) about 95% of the region's industrial production and 85% of the labor employed belonged to these sectors. Regional labor unions, in general, did not consist of strong organizations engaged in the struggle for class interests and as a result the region's average wage was lower than other parts of the country.

In order to help characterize the Zona da Mata industrial profile as it compares with the rest of the State, Table 4.6 provides data relating to electric power consumption throughout a variety of industries. The Cataguases-Leopoldina electric company supplies 58 municipalities in the Zona da Mata region and CEMIG supplies the rest of the State. While traditional industries involved in the production of paper, cardboard, textiles and food, consume 87.6% of the electricity generated by Cataguases-Leopoldina, only 5.8% of the energy supplied by CEMIG goes to these types of industries. This difference suggests that CEMIG is supplying primarily modern industries throughout the rest of the State.

The existence of small properties implies low productivity, as a consequence of inefficient management and, therefore, the incapacity to generate surplus that could be applied to increasing productivity.

The number of tractors in agricultural areas, though not the only indicator, demonstrates the area's level of mechanization in its productive process. Table 4.4 provides ratios between the number of tractors in the Zona da Mata and the number of tractors in the State of Minas Gerais as a whole from 1950 to 1980. One observes that throughout the period, other areas underwent mechanization much more rapidly than the Zona da Mata which had 18.3% of the total number of tractors in 1950, and 5.6% in 1980.

TABLE 4.4  
NUMBER OF TRACTORS  
ZONA DA MATA AND MINAS GERAIS

	1950	1960	1970	1975	1980
(1) Zona da Mata	139	534	860	1,325	2,627
(2) Minas Gerais	761	4,723	10,187	22,685	47,123
(1)/(2)%	18.3	11.3	8.4	5.8	5.6

Source: FIBGE — Censo Agropecuário 1960, 1970, 1975 and 1980.

TABLE 4.5  
RATIO: AREA (HA)/TRACTOR  
ZONA DA MATA AND MINAS GERAIS

	1950	1960	1970	1975	1980
(1) Zona da Mata	21,150	5,761	3,815	2,506	1.249
(2) Minas Gerais	48,144	8,139	4,124	1,967	1.025
(2)/(1)	2.3	1.4	1.1	0.8	0.8

Source: Censo Agropecuário — 1960, 1970, 1975 and 1980.

TABLE 4.6  
PROFILE OF INDUSTRIAL ENERGY CONSUMPTION  
CATAGUASES-LEOPOLDINA AND CEMIG  
(1981)

Type of Industry	Cataguases-Leopoldina Consumption (MWh)	% Total Consumption	CEMIG Consumption (MWh)	% Total
Paper and Cardboard	47,531	35.1	82,063	0.7
Textile	45,359	33.5	282,355	2.2
Food	25,673	18.9	357,785	2.8
Others	16,959	12.5	11,730,293	94.2
Total	135,522	100.0	12,452,496	100.0

Source: Relatório Estatístico e de Operação — 1981 — CFLCL  
Relatório Estatístico — 1981 — CEMIG

It is possible to use other types of energy consumption data as indicators that illustrate the Zona da Mata economic decline relative to the rest of the State. Table 4.7 shows the number of residential and "other" consumers in the Zona da Mata and Minas Gerais, as well as the evolution of electric power consumption from 1952 to 1984. Within the category "others" industrial, commercial and rural consumers are the most significant, and mirror the region's level of economic activity.

If we extrapolate from the absolute figures, the per capita consumption of residential and "other" consumers, we can conclude:

- There is no significant difference between the residential per capita consumption in the Zona da Mata as it compares to the State's residential per capita consumption. In the 1950's, the Zona da Mata held an inferior position in terms of electric power consumption (56 MWh in contrast to 69 MWh held by the State). By 1984, the inverse is true and the Zona da Mata supersedes the State's per capita rate with 112 MWh as opposed to 108 MWh.
- With regard to the per capita consumption of "others" (which corresponds to the productive sector's consumption) over time, there is a widening margin of disparity in detriment to the Zona da Mata. In 1952, the Zona da Mata per capita consumption is slightly inferior to that of the State (496 MWh as compared to 568 MWh). BY 1984, the State's average consumption is 2.2 times greater than that of the Zona da Mata (2,194 MWh as opposed to 4,870 MWh). This suggests that the majority of modern industries and sophisticated commercial and agricultural enterprises (which require greater amounts of electrical power) are located outside the Zona da Mata.

#### 4.4. Conclusion and future considerations

The observations made in section 4.3 point to increasing stagnation in the Zona da Mata; however, this section does not examine the causes of this stagnation. At this point in time, the author cannot easily explain these causes without further research, which considers the following questions:

- Given the fact that the State capital has encouraged the development of industrial plants in areas experiencing economic recession as a means to increase profit levels, why has such a strategy not been implemented during the last 35 years in the Zona da Mata (where there is a low average wage and continued recession?)
- In view of Minas Gerais' State-induced industrialization which launches large industrial plants and agricultural projects through State political action, why has the State government failed to support these types of project in the Zona da Mata?

Before these two questions can be addressed the following points should be considered:

- The recent proposal to establish the Siderurgica Mendes Junior industrial headquarters in Juiz de Fora and the plan for a similar headquarters in the Vale do Aço, portend the emergence of "industrial enclaves", and perhaps a new industrial phase in the Zona da Mata.
- Although still somewhat vague, the New Republic's Agrarian Reform project for 1985, proposes to improve the Zona da Mata land tenure system, which will invariably lead to increased efficiency in agricultural and cattle-raising production for the Zona da Mata.

TABLE 4.7

### EVOLUTION OF ELECTRIC ENERGY CONSUMPTION AND THE NUMBER OF CONSUMERS ZONA DA MATA AND MINAS GERAIS<sup>1</sup>

Year	RESIDENTIAL			OTHERS		
	Consumption	Number of consumers	Monthly per capita consumption <sup>2</sup>	Consumption	Number of consumers	Monthly per capita consumption <sup>3</sup>
Zona da Mata						
1952	24,429	36,212	56	56,146	9,438	496
1960	41,563	51,835	67	103,048	14,249	603
1970	79,200	71,087	93	163,549	15,870	859
1981	177,286	147,279	100	506,062	24,540	1,718
1984	236,494	176,337	112	776,892	29,503	2,194
Minas Gerais						
1952	76,162	91,419	69	129,098	18,956	568
1960	202,376	196,751	86	1,028,677	39,645	2,162
1970	571,926	512,997	93	3,409,674	108,104	2,628
1981	1,787,027	1,389,022	107	14,762,724	243,330	5,056
1984	2,475,461	1,903,441	108	18,789,981	321,511	4,870

<sup>1</sup> Zona da Mata — Cataguases-Leopoldina and Mineiro Electric Company  
Minas Gerais — CEMIG and CFLMG supplied Belo Horizonte until 1973  
<sup>2</sup> MWh/yr.  
<sup>3</sup> kWh/mon.

Source: ELETTROBRAS — Dados Estatísticos do Setor Elétrico — 1973  
CEMIG — Banco de Dados dos Municípios Mineiros — DGE/AA — 1984  
CFCL — Relatório Estatístico e de Operação — 1973 to 1984

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**SUMMARY**: — This paper aims at studying the evolution of the population of Minas Gerais (1950/1980) and its spatial distribution. The 722 municipalities of the State are analyzed and the classical potential model is used. Two large regions stand out: that of "Zona da Mata", with successive losses of population, and that of "Vale do Aço" with significant gains.

Key words: spatial mobility, potential model, populational growth, populational loss, populational density in space.