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Regional Socioeconomic Development Levels in Brazil

by

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Camera-ready copies of the maps presented herein may be obtained by writing the author at this address: Brazil Projects, Department of Rural Sociology, 350 Agricultural Hall, University of Wisconsin, Madison, WI 53706. Phone: (608) 263-2899; Telex: 265452. Permission to republish the maps should be obtained from the Geographical Review (see Note 1).

This Symposium is designed to call attention to measurement issues implicated in efforts to induce development by enhancing the scientific and technological capacities of third world nations. Some of the relevant observations are clearer than others. It is obvious that most of the world's present capacity in science and science-based technology is located in developed countries, in the same way that most of the world's educational capacity is located there. Yet, just as in the case of education, it may not be clear to policy makers whether such capacities are causes or consequences of the development level of the richer countries. In the absence of evidence, some may conclude that such capacities are useless frills. Of course, a dramatic event like the first successful artificial satellite or the sudden appearance of genetically engineered new agricultural products might convince some of the skeptics. Still, the bases for doubt are complex, and pose a series of questions. Is development a consequence of science and technology (S & T)? Or is an elaborate S & T capacity a consequence of high development? Does science produce technology? Or does technology proceed more or less independently of science, as Price (1975:129) seems to think. Today no third world nation appears to contribute much to science (Arunachalam, 1985). What would be gained by investing enough to build an effective scientific establishment? Would it be useful to mount an innovative technological capacity? If so, is it science-based technology that is needed? Would this require prior investment in science? In technology, is small really beautiful (Schumacher, 1973)? High, low, or mixed--what kinds of establishments are needed to generate useful technologies?

Secure evidence of the developmental consequences of S & T would help answer such questions. This requires a logic and appropriate data linking the the capacity of science and/or technology to development variables. Many different specific research designs could turn out to be useful in this

regard. Data at the household level (Bates et al., 1985) would be useful for some such designs. For others, quite different data would serve, as in the case of estimating national returns to graduate training in agricultural sciences (Avila et al., 1985). Some designs will require, among other things, valid measures of development.

The present paper calls attention to a scale that was designed to measure the socioeconomic development (SED) of the populations of Brazil's 360 continental microregions. The paper presents data on the validity of the SED scale, showing how it reproduces aspects of former macroregionalizations of Brazil while showing the existence of development macroregions and other SED phenomena that had not previously been identified in the literature. The final part of the paper is taken from research now underway. It shows how, using municipio (county) level data, a similar SED scale may be used to test the effect of the work of an Agency designed to evaluate, generate, and disseminate science-based technology on the socioeconomic development of the population in the Agency's region of action.

A SCALE TO MEASURE 1970 SOCIOECONOMIC DEVELOPMENT LEVELS IN BRAZIL

Brazil is widely known to be one of the most unevenly developed countries in the world. The South, where about 60 percent of its 1970 population (now 130 million) lived is rather highly developed, with a rich agriculture and a productive manufacturing system. Poverty was and is especially widespread in the Northeast, where about 30 percent of the population reside. The remaining ten percent lived in a few cities and settlements in the vast Amazonian basin. Because of its exaggerated geographic economic and demographic disparities, the Brazilian government has long been interested in delineating macroregions and using them as the basis

for development policy. These efforts have mostly been based upon ecological criteria. Recently an attempt was made to test hypotheses about the impact of development on patterns of social stratification (Bills and Haller, 1984; Bills et al., 1985), requiring a delineation of socioeconomic development macroregions cutting across state lines. This resulting SED scale is the subject of this section.

Details of the SED scale and the macroregionalization of Brazil which it yields have been presented elsewhere (Haller, 1982, 1983). Here we wish only to present its bare outlines together with data on its validity. Each variable of the scale was constructed from data on individuals, aggregated to the level of the microregion and standardized to a per capita base. In official documents, Brazil has been divided into 360 continental microregions (Instituto Brasileiro de Geografia e Estatística, 1970). Each microregion is composed of from one to several continguous municípios (counties) which are homogeneous in topography and economy. Public Use Tapes, including large amounts of aggregated data, are available at the level of the município and the microregion as well as at more inclusive levels.

Variables. The variables employed in the analysis may be listed as follows (from Haller, 1982):

Variable 1. $M/_k$: microregional involvement in manufacturing.

Measure A. $MEmp/_w$: manufacturing employment per worker--the proportion of each MR's economically active population that was employed in manufacturing on December 31, 1970. This is the main measure of the variable. Measure B. $MEng/_k$: manufacturing energy potential per capita--the total potential energy output in horsepower of all manufactural machinery in the MR (1970). This checks the validity of Measure A.

Variable 2. $S/_k$: microregional involvement in commerce--total value of all commercial sales per capita in the MR (1970) in thousands of cruzeiros.

Variable 3. $A/_k$: microregional involvement in agriculture--total number of persons in the MR who were employed in agriculture per capita, either permanently or temporarily (1970).

Variable 4. $Radios/_k$: proportion of the MR's population residing in households where a radio receiver was available (1970).

Variable 5. $Refrigerators/_k$: proportion of the MR's population residing in households where a refrigerator was available (1970).

Variable 6. $Televisions/_k$: proportion of the MR's population residing in households where a television receiver was available (1970).

Variable 7. $Automobiles/_k$: proportion of the MR's population residing in households where an automobile was available (1970).

Variable 8. $Literacy/_k$: proportion of the MR's population that was literate (1970).

With one exception these variables are seen as straightforward expressions of variables commonly used to measure either 1) the development levels of nations (Variables 1A, 1B, 2, and 8) or 2) the socioeconomic status of households (Variables 4, 5, 6, 7, and 8). Both concepts--national development and household socioeconomic status--have long histories of research experience behind them. Applied at the levels of the microregion or macroregion, each would be expected to reflect a more general factor of socioeconomic development. One variable (2: commercial sales per capita) does not have a base in the development literature, but nevertheless is plausibly interpreted as a measure of the socioeconomic development level of the population of an area. Because Variable 1A (manufacturing employment per

capita) and 1B (per capita energy potential of installed manufacturing machinery) were designed to measure precisely the same specific variable (microregional involvement in manufacturing) and because in fact they do so ($r = +.999$), one of them (1B) was dropped from the analysis, except in that its correlation serves to validate 1A. Data for a ninth variable, $\log_n$ per capita consumption of electricity in 1970 ($\log_n KWH/_k$), were obtained at a later date and are used to check the validity of the SED scale constructed from Variables 1A, 2...8. Electrical consumption is one of the most widely accepted measures of the development level of nations.

Findings. Table 1 presents the correlations among the variables. In the analysis, Variable 3, per capita employment in agriculture, was reflected because lower employment in agriculture means higher development, leaving all signs positive. It is obvious to the eye that the correlation matrix is saturated by a single factor: the correlations are moderate to high, ranging from +.445 (Variables 1A x 8) to +.907 (Variables 4 x 8), and are unclustered. A principal components analysis bears this out (see Table 2). Actually eight components were needed to extract 100 percent of the common variance from the matrix. But only the first had an eigenvalue over 1.00 (it was 5.956) and it explained 74.5 percent of the variance, supporting the hypothesis that each specific variable may be seen as a partial representation of a single deeper factor indicating the level of socioeconomic development of the population of the microregions.

The Index of Microregional Socioeconomic Development (SED). An index of the 1970 (SED) applicable to each of the 360 Brazilian microregions was developed from the data in the two matrices (Tables 1 and 2), following standard procedures. The range of SED scores was arbitrarily set to vary from zero to 100. This proportional re-indexing was performed on original SED scores calculated such that a microregion's SED was set as the sum of the

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value for the sum of the microregion's standardized values for each of the eight variables. That is, $SED_n = \Sigma \omega_{v_n} (\frac{V_n - \bar{V}_n}{\sigma_{v_n}})$. Each of the 360 microregions was thus scored with an arbitrary metric between zero to 100, based upon the factor-weighted value of each of the eight variables used to measure socioeconomic development.

Validity: Internal Evidence. The pattern of the correlations and the resulting factor analysis may be considered as internal evidence of the validity of the SED scale. The question of validity refers to the degree to which an indicator measures the variable it is purported to measure. A putative scale of SED could be considered invalid if interitem correlations hypothesized as positive and at least moderately high actually turned out to be low, zero or negative. A pattern of such contrary evidence would mean either that hypothesis of a general SED factor was untenable in principle, or that the particular variables were poorly chosen, or that the data measuring the variables were improperly recorded. Any of these conditions would make it impossible to construct a valid measure of SED. In the present case, however, most of the variables are well known indicators of socioeconomic level and the data are of exceptionally high quality. In fact the pattern of correlations and the single-factor solution are in full agreement with the hypothesis that the items yield a valid measure of SED.

Validity: External Evidence. For most purposes such internal evidence would be sufficient. But it is often useful to run external checks of the validity of an indicator. Such tests may be "tight" or "loose." A "tight" test would employ the correlation of the scale with another indicator designed to measure the same factor. In effect, this is what was done in determining the correlation between measures 1A and 1B above, each of which was intended to measure manufacturing intensity. A "loose" test would focus on the capacity of the scale to identify phenomena already known and to detect new

phenomena. Both kinds of evidence are available to test the validity of the SED. In the "tight" test the correlation of the SED scores of the 360 microregions with the per capita consumption of electricity ($\log_n KWH/_k$) was determined. The correlation of SED and $\log_n KWH/_k$ is $r = +.84$ ($r^2 = .70$). This correlation clearly demonstrates the external validity of the SED instrument. Beyond this, the linear regression equation is $\hat{SED} = 2.93 + 27.24 \log_n KWH/_k$) (where $\hat{SED}$ is the estimated SED of the microregion). A perusal of the graph of SED x $\log_n KWH/_k$ (not presented here) shows a regression that is approximately linear but which may be overlain by a weak $2^{\underline{nd}}$ order sigmoid curve. The general conclusion of the "tight" test is that the SED scale is a valid indicator of the socioeconomic development differentials of Brazil's microregions as of 1970.

In the "loose" test the SED of Brazil's microregions is mapped and the macroregional pattern of SED examined to determine whether it reflects known distributions of development and whether it yields new insights concerning Brazil's development macroregions and related developmental phenomena. The evidence is presented in Figures 1-5. In Figure 1--the most important of all--the SED quintile of each microregion is coded and mapped (except for those in the highest quintile, which is divided into the $9^{\underline{th}}$ and $10^{\underline{th}}$ deciles). Five SED macroregions may be inferred from this figure. They are presented in simplified form in Figure 2. Figure 3 shows the microregional distribution of population in Brazil. The dark area includes all microregions averaging four or more persons per square kilometer. It highlights the contrast between the densely populated near-coastal lands and the immense unpopulated reaches to the west. The last two figures (Figures 4 and 5) combine information from the previous ones to yield a two-dimensional, three-regional view of the nation--developed and densely populated, impoverished and densely populated, impoverished and empty.

Figure 1, however, provides the data best testing the validity of the SED indicator by methods we called "loose validation." First, the figure faithfully records regional SED variations that are already well known. The south is known to be much more highly developed than the rest of the country and cities to be more so than the countryside. Figure 1 starkly reproduces this picture. All of the microregions in the highest SED decile (black) are in the south, and practically all of the microregions of the south are in the top two quintiles. In all the rest of the country--80 percent of its land surface--only eleven microregions rise above the third SED quintile. These contain the national capital of Brasilia and the capitals of 10 cities of the north and west.

Regarding the second criterion--yielding plausible new information--the figure provides a wealth of previously poorly understood items.

It shows the existence of a vast northern area, 1,600 kms. from north to south and 1,000 kms. from east to west in which only one microregion rises above the first or lowest quintile. That macroregion (V on Figure 2) includes all of Maranhao and Piaui, half of Bahia, two thirds of Goias and parts of Para, Ceara, Pernambuco and Minas Gerais. This impoverished macroregion is plausible to socioeconomic geographers but apparently has so far gone unnoticed in the literature.

The figure also shows several new items concerning the south. First, the south by this criterion extends up into southern Minas Gerais, including Belo Horizonte and the Triangulo Mineiro. Second, in terms of the SED of its population, much of Rio Grande do Sul appears to be on a par with the most developed parts of the State of Sao Paulo. These two areas are usually thought to be different in average SED terms, perhaps because the economic bases upon which the population's SED rests are quite different. Third, again in terms of the average SED of their populations, much of the agricultural south is on a par with the region's manufacturing areas. Indeed the highest

SED score in the nation is found in a wine-producing region of Rio Grande do Sul. On reflection it should not be surprising that parts of the rural south are so highly developed: much of the region's agriculture is technologically modern by any standard, rivaling in productivity the richest areas of the American midwest.

One of the most important new findings concerns the existence of a second previously unrecorded SED macroregion. It is a macroregion consisting of microregions in the mid-level quintiles ringing the northern edge of the developed south and running out along the nation's western border into Acre. On Figure 2, it is Microregion II (a and b). We have labeled it the South's Developing Frontier. It appears to be an area where southern capital and "know-how" have penetrated rather effectively.

Validity: Conclusions. In terms of what we have called a "tight" test of validity, internal cohesion and of the scale's high correlation with an appropriate external criterion the SED scale is highly valid." Yet we find the "loose tests" of the validity of the scale to be at least as impressive as the "tight tests." As we have seen, when mapped, the macroregional structure of the socioeconomic development of the people of Brazil's southern and northern microregions stands in stark relief, faithfully reproducing what was already well known. Furthermore the maps show important differences previously only dimly perceived.

Not only do these results strongly support this particular scale and its application to Brazil's microregions, they also support the rationale upon which the scale was based. It postulates that intra- or cross-national variations in the socioeconomic development levels of the populations of small geographical entities may be measured by means of factor-weighted indexes composed of per capita standardizations of variables drawn from the pool of those that have been successfully employed for many years to measure either

household socioeconomic status or national economic development. It is thus reasonable to expect similar techniques could be used to identify the boundaries of SED macroregions in other parts of the world such as North America, Western Europe, Eastern Europe, Japan, among developed areas, or such as Mexico, India, China and Indonesia among large developing nations, or cutting across several smaller nations whether developed or developing.

Similarly, if comparable measurements of the SED of local populations can be taken at different times in the areas of responsibility of scientific and/or technological research agencies it should be possible to monitor the effect of such agencies on the socioeconomic development of the people whose situations such centers may be expected to improve.

THE SED INFLUENCE OF AN AGRICULTURAL RESEARCH AND DIFFUSION AGENCY

Such an analysis is now being undertaken. Specifically, data are now being prepared to assess the net influence of an agricultural research and extension organization on the SED of the surrounding population. Data concerning the region, the type of agriculture and the agency are presented in another paper (Tourinho and Fliegel, 1985). A sketch of the essentials is presented here.

The areas. By the widest definition, the cacau region of southern Bahia consists of the 89 southern-most contiguous municípios (counties) in the Brazilian state of Bahia. This area is famed for its production of the bean from which chocolate is made. Today it produces about 95 percent of Brazil's substantial cacau crop. The cacau tree has a life-span of about 60 years and is most productive from about 15 to 40 years. The area was settled in the second and third decades of the century. So by 1960 or so the production of original trees was declining. At that time the national government formed a commission (called "The Agency" herein) to recuperate the Region's cacau

crop. By 1970, a cacau research center and an associated extension service of the Agency had been set up in the area. The Agency was assigned a budget proportional to the earnings from the exportation of cacau. This not only provided sufficient operating funds but also a strong incentive to work to increase production and marketing effectiveness. Today the total population of the 89 municípios is around 2.5 million. As of 1985, the research center has become a thoroughly modern unit and is concerned with all aspects of agrotechnological research bearing upon the main products of the 89 municípios. It publishes an international journal. Its staff includes a number of researchers trained through the Ph.D. degree. It also has modern units of statistical analysis and computation. The mission of the extension unit is to promote the diffusion of science-based agrotechnological knowledge (and other support information) to enhance the production and marketing of cacau and other regional products. The extension unit employs over 700 persons, more than half of whom are university trained agronomists. Local extension offices exist in many macroregions.

The SED Impact of the Agency: A Design. It appears that the Agency provides only the source of science-based agrotechnological information available in the region. The Agency's research center evaluates outside innovations in science-based agrotechnology and occasionally makes such discoveries itself. The Agency's extension service diffuses them. The mass media contain little if any such information. Neither do the private companies provide much if any such information. No other research station or an extension unit operates in the region. There is no agricultural college in the area, and the only agricultural high schools there are run by the Agency. It can be safely assumed that no science-based agricultural technology existed in the area prior to the establishment of the Agency and that the Agency processed, approved and diffused that all such information that has entered the area since then.

The activity of the Agency had matured by the early 1970s. Because measures of on-farm use of science-based and nonscience-based technologies were taken from a probability sample of farms in the early 1970s (T_1) and are about to be taken again on the same farms (T_2), it should be possible to determine the impact of the Agency on the use of both kinds of technologies. Measures of farm production (cacau and other) can be taken at the same time. So it should be possible to determine the direct, indirect and total effects of the use of science-based and nonscience-based technology at T_1 on similar variables at T_2, and of the effect of T_1 and T_2 technology and production at T_2. It should also be possible to measure these effects on the T_2 socioeconomic status of the personnel of the farms.

Such an analysis would provide evidence of the effect of science-based agrotechnology among farm personnel. It would not, however, show the effect of the Agency's activity on the SED of the population at large. SED measurements taken on the 89 municípios in 1970 and 1980 could provide the missing evidence.

Given sufficient numbers of cases in the corresponding cells, it should be possible to conduct a 3-way analysis of variance ($2^3 = 8$ cells), using SED scores as the dependent variable. Within the Region, the Agency maintains a headquarters campus, which includes the laboratories offices and experimental plots of the research unit, together with the central offices of the extension unit. This is located on a paved road in the heart of the cacau country, about 10 kilometers from each of the Region's two major cities--inland Itabuna, the commercial "capital" of the Region, and coastal Ilheus, where the cacau port facilities are located. Adjacent to the Agency's campus is the campus of an as yet unrecognized university which is supported in part by the Agency (but which has no agricultural component). Also, as noted earlier, in addition to its offices on the headquarters campus, the

extension unit maintains local offices in many municípios. The analysis will use 1970 and 1980 statistical data by which to measure the SED levels of the Region's 89 municípios. The independent variables, each a dichotomy, would be Time (1970 and 1980), Campus Proximity (near vs. far), and County Extension Office (Present vs. Absent). Test of the effects of each of these variables on SED scores should provide a rather definitive test of the association of Agency activity with the SED of the population.

Let us examine the possible effects of the independent variables. The Brazilian economy boomed over the 1970s. The economically active population grew 4 percent per year while the population grew but 2.5 percent per year. The incidence of extreme poverty plummeted (Haller, 1983; Pastore, Zylberstajn and Pagotto, 1983). The Time variable would show the total change in SED over 1970 and 1980, including the general national and regional rise in SED as well as those attributable to the Agency. The Campus Proximity and County Extension Office variables should identify the effects of the Agency. Assuming normal territorial processes of diffusion, net of the effect of the Time and County Extension Office variables, municípios closer to the Agency campus should have higher SED scores than those that are distant from it. Similarly, net of the effect of Time and Campus Proximity variables, municípios with a County Extension office should have higher SED scores than those without such offices. Three- and four-way interactions may also yield telling results, especially any that would show joint effects of Proximity and County Office on SED scores. Of course, it would still be theoretically possible that another causal pattern was operating, especially the possibility that the Agency might have located its facilities in places whose potential production of cacau was unusually promising--where the best soil or the youngest trees or the most farsighted, most diligent producers were already located. Possibilities such as these cannot now be assessed by quantitative

data. They may be tractable by means of historical data on soils, production, etc., however. In any case, the combination of the results of this analysis with that now being conducted on-site by Tourinho and Fliegel (1985) should provide rather convincing evidence of the effect of a science-based agrotechnological research and diffusion agency on the technology and development levels.

CONCLUSION

This paper has presented a rationale and a technique for measuring the socioeconomic development (SED) of the population of small regions, together with evidence of the validity of the technique and of the logic on which it is based. The technique yielded an SED scoring system. When the Nation's microregions were grouped (into quintiles or deciles) according to their SED scores and mapped, the results properly reproduced macroregional SED phenomena which were already known. More interesting, however, is the fact that the mapping showed macroregional SED phenomena not previously noted in the literature.

SED measurements might well be useful in assessing the impact of science or science-based technology on development in third world nations. This point was illustrated by presenting the main elements of the design of research in Brazil's cacau region which, in combination with other research on technology in use and related matters, would show the effect of an agrotechnology research and diffusion agency on the SED of the surrounding population.

Table 1. Variables Indicating Microregional Socioeconomic Development 1970

Variables	Correlations 2	3	4	5	6	7	8	Means	Standard Deviations (N=360)
Manufacturing MEmp/$_w$	.458	.447	.511	.660	.687	.607	.445	.044	.051
Sales S/$_k$(÷Cr$1000)		.571	.663	.824	.779	.756	.635	.700	.864
Agriculture A/$_k$			.570	.702	.691	.616	.546	.270	.132
Radios/$_k$				.814	.749	.894	.907	.482	.202
Refrigerators/$_k$					.946	.894	.771	.128	.123
Television sets/$_k$						.867	.696	.096	.126
Automobiles/$_k$							.837	.053	.046
Literacy/$_k$								.721	.119

Source: Calculated by author from 1970 IBGE public-use data-tape.

Table 2. Loadings on the Socioeconomic Development Factor for Brazilian Microregions 1970

Variables[a]	Loadings
Manufacturing MEmp/$_w$	.691
Sales S/$_k$(÷Cr$1000)	.831
Agriculture A/$_k$ (reflected)	.744
Radios/$_k$	.895
Refrigerators/$_k$	.965
Television sets/$_k$	.935
Automobiles/$_k$	.947
Literacy/$_k$	.856

Source: Calculated from Table 1.
[a]Eigenvalue: 5.956; common variance explained: 74.5 percent.

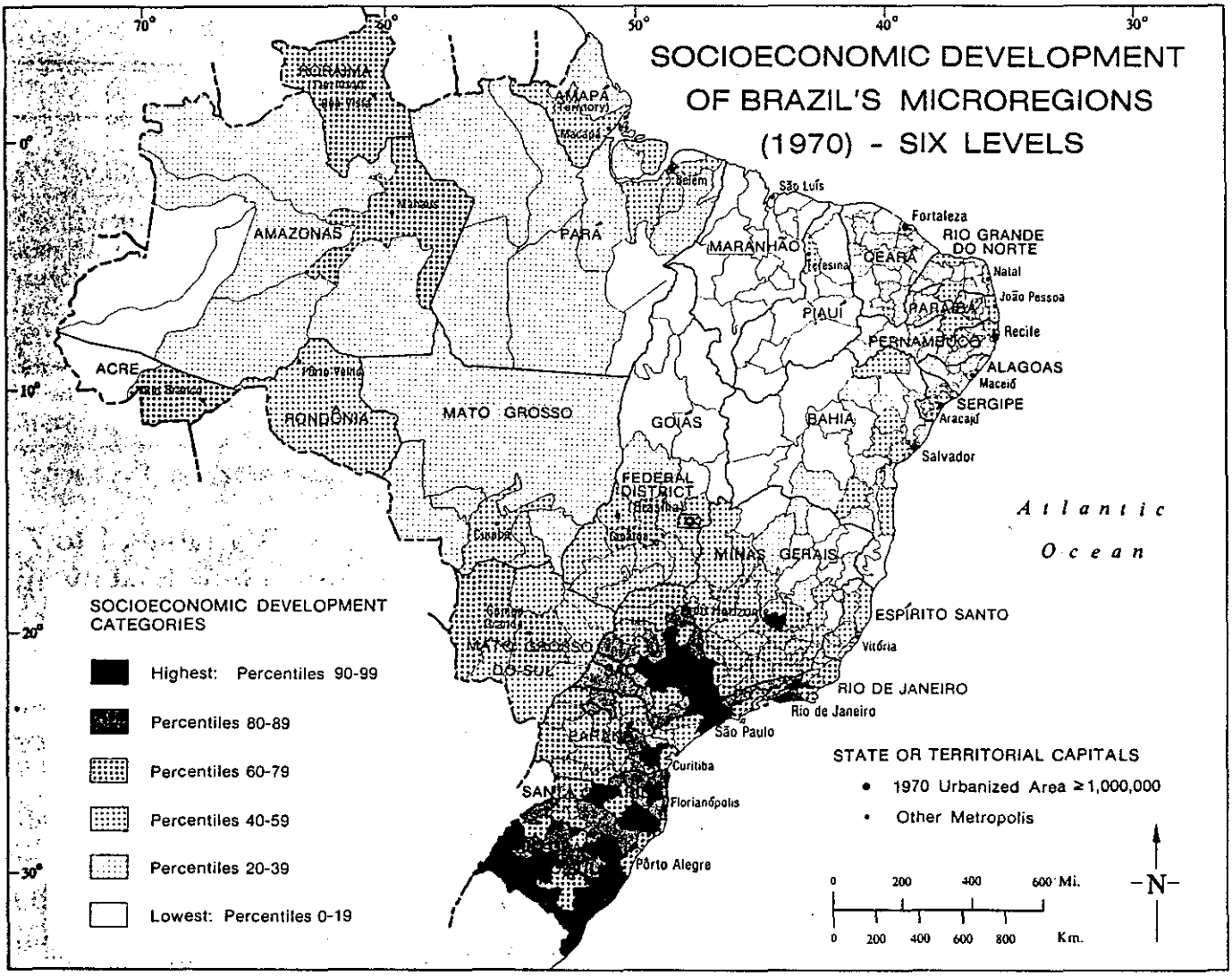
SOCIOECONOMIC DEVELOPMENT
OF BRAZIL'S MICROREGIONS
(1970) - SIX LEVELS
70°
60°
50°
40°
30°
0°
10°
20°
30°
AMAZONAS
PARÁ
AMAPÁ
MARANHÃO
PIAUÍ
CEARÁ
RIO GRANDE DO NORTE
PARAÍBA
PERNAMBUCO
ALAGOAS
SERGIPE
BAHIA
ACRE
RONDÔNIA
MATO GROSSO
GOIÁS
FEDERAL DISTRICT
MINAS GERAIS
ESPÍRITO SANTO
RIO DE JANEIRO
Belém
São Luís
Fortaleza
Natal
João Pessoa
Recife
Maceió
Aracajú
Salvador
Teresina
Vitória
Rio de Janeiro
São Paulo
Curitiba
Florianópolis
Pôrto Alegre
Atlantic
Ocean
SOCIOECONOMIC DEVELOPMENT CATEGORIES
Highest: Percentiles 90-99
Percentiles 80-89
Percentiles 60-79
Percentiles 40-59
Percentiles 20-39
Lowest: Percentiles 0-19
STATE OR TERRITORIAL CAPITALS
1970 Urbanized Area ≥1,000,000
Other Metropolis
0 200 400 600 Mi.
0 200 400 600 800 Km.
N

Figure 1

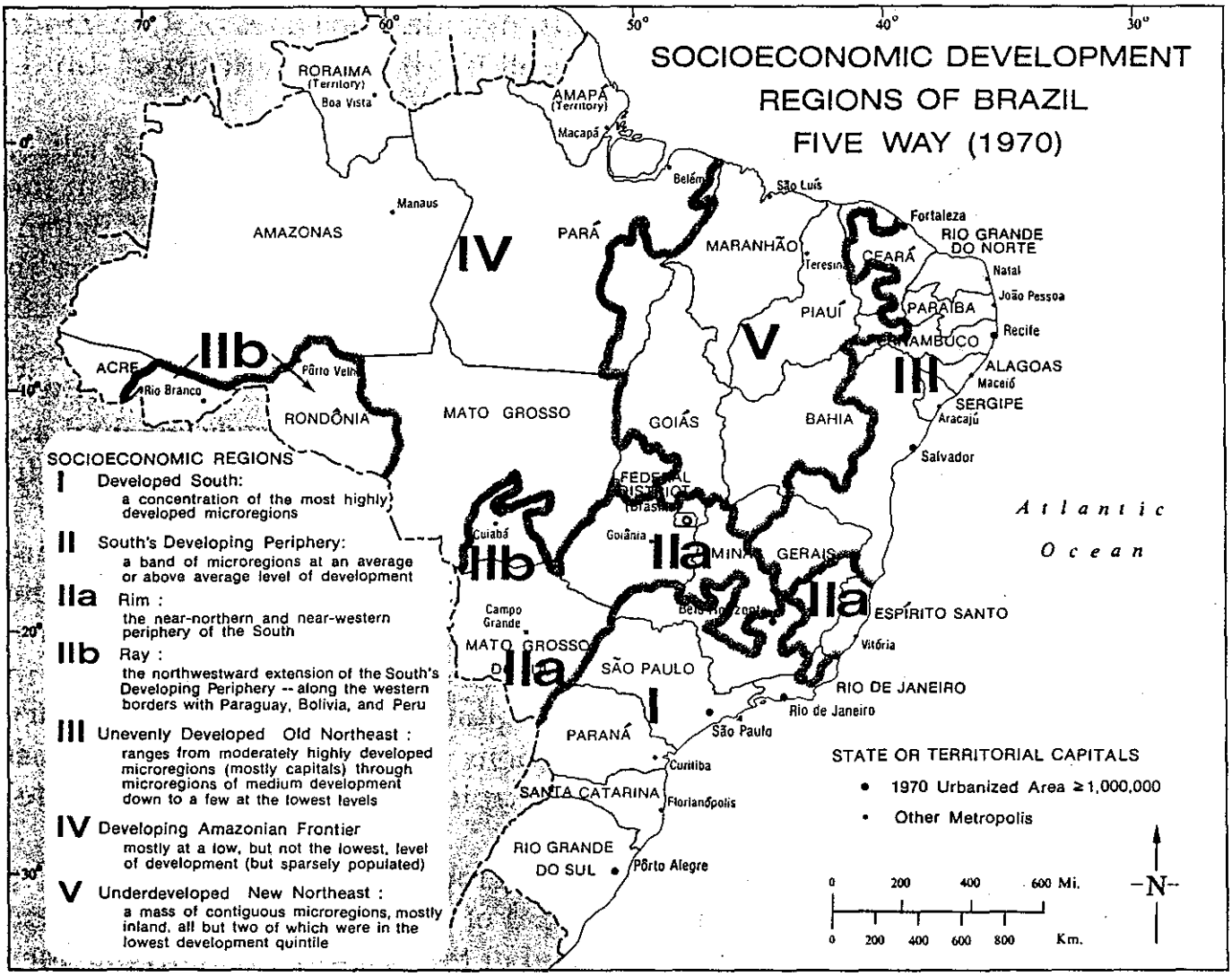
SOCIOECONOMIC DEVELOPMENT
REGIONS OF BRAZIL
FIVE WAY (1970)
SOCIOECONOMIC REGIONS
I Developed South:
a concentration of the most highly developed microregions
II South's Developing Periphery:
a band of microregions at an average or above average level of development
IIa Rim :
the near-northern and near-western periphery of the South
IIb Ray :
the northwestward extension of the South's Developing Periphery -- along the western borders with Paraguay, Bolivia, and Peru
III Unevenly Developed Old Northeast :
ranges from moderately highly developed microregions (mostly capitals) through microregions of medium development down to a few at the lowest levels
IV Developing Amazonian Frontier
mostly at a low, but not the lowest, level of development (but sparsely populated)
V Underdeveloped New Northeast :
a mass of contiguous microregions, mostly inland, all but two of which were in the lowest development quintile
STATE OR TERRITORIAL CAPITALS
1970 Urbanized Area ≥1,000,000
Other Metropolis
RORAIMA
Boa Vista
AMAPÁ
Macapá
AMAZONAS
Manaus
PARÁ
Belém
São Luís
MARANHÃO
Fortaleza
RIO GRANDE DO NORTE
CEARÁ
Natal
PIAUÍ
PARAÍBA
João Pessoa
PERNAMBUCO
Recife
ALAGOAS
Maceió
SERGIPE
Aracajú
ACRE
Rio Branco
Pôrto Velho
RONDÔNIA
MATO GROSSO
GOIÁS
BAHIA
Salvador
Cuiabá
Goiânia
MINAS GERAIS
Belo Horizonte
ESPÍRITO SANTO
Vitória
Campo Grande
MATO GROSSO DO SUL
SÃO PAULO
São Paulo
RIO DE JANEIRO
Rio de Janeiro
PARANÁ
Curitiba
SANTA CATARINA
Florianópolis
RIO GRANDE DO SUL
Pôrto Alegre
Atlantic Ocean
0 200 400 600 Mi.
0 200 400 600 800 Km.
N

Figure 2

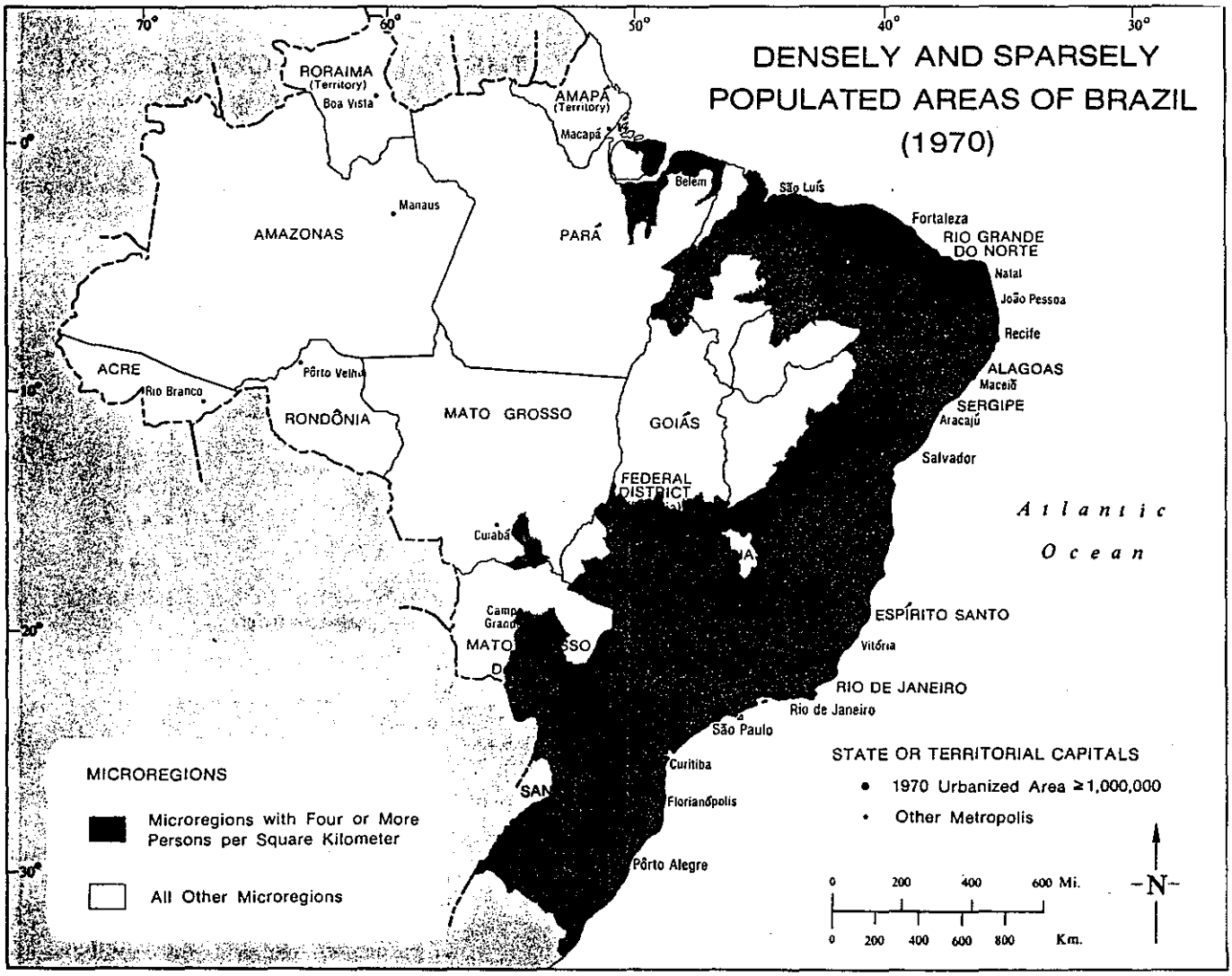
DENSELY AND SPARSELY POPULATED AREAS OF BRAZIL (1970)
70°
60°
50°
40°
30°
0°
10°
20°
30°
RORAIMA (Territory)
Boa Vista
AMAPÁ (Territory)
Macapá
Belém
São Luís
Manaus
AMAZONAS
PARÁ
Fortaleza
RIO GRANDE DO NORTE
Natal
João Pessoa
Recife
ALAGOAS
Maceió
SERGIPE
Aracajú
Salvador
ACRE
Rio Branco
Pôrto Velho
RONDÔNIA
MATO GROSSO
GOIÁS
FEDERAL DISTRICT
Cuiabá
Atlantic Ocean
ESPÍRITO SANTO
Vitória
RIO DE JANEIRO
Rio de Janeiro
São Paulo
Curitiba
Florianópolis
Pôrto Alegre
MICROREGIONS
Microregions with Four or More Persons per Square Kilometer
All Other Microregions
STATE OR TERRITORIAL CAPITALS
1970 Urbanized Area ≥1,000,000
Other Metropolis
0 200 400 600 Mi.
0 200 400 600 800 Km.
N

Figure 3

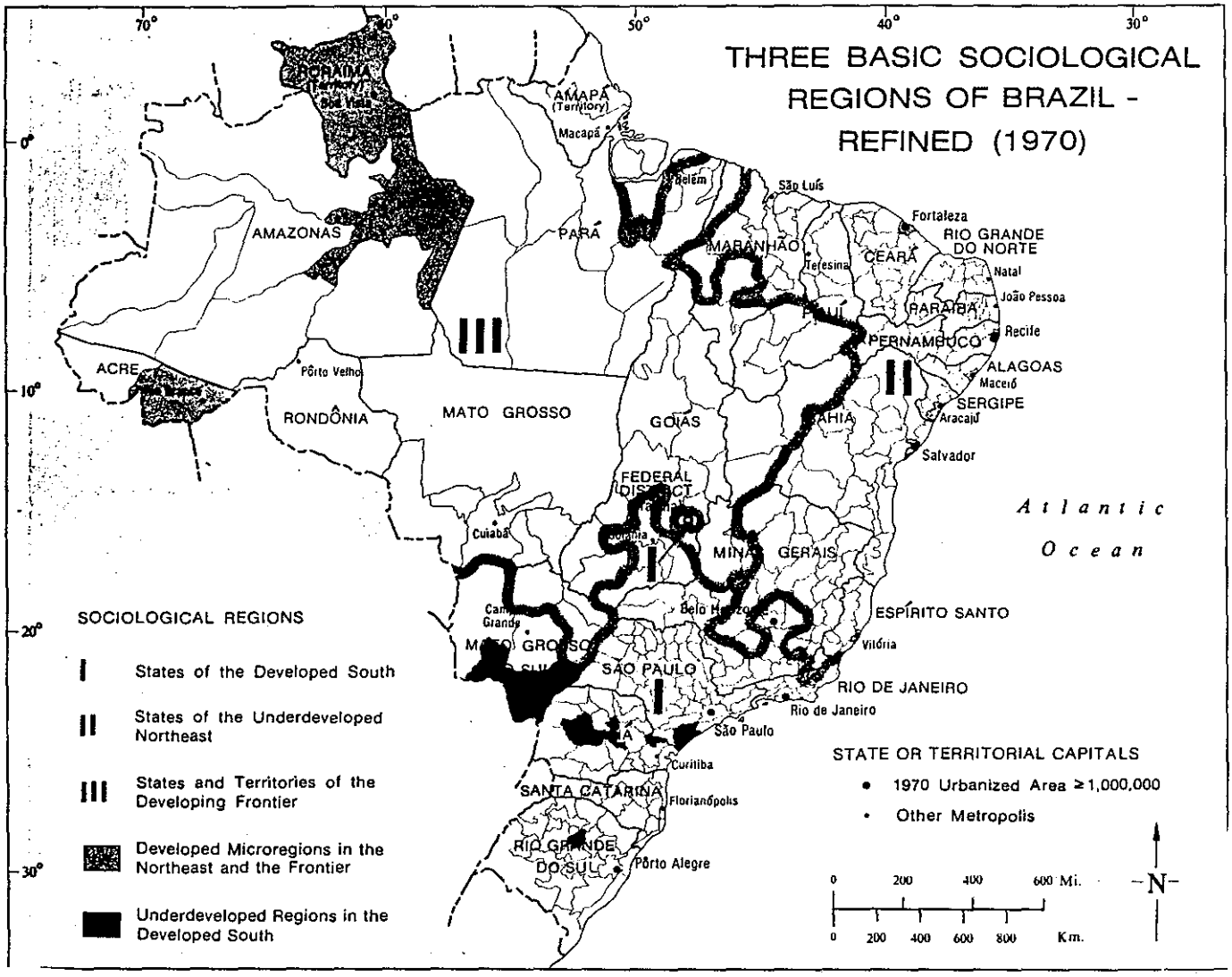
THREE BASIC SOCIOLOGICAL REGIONS OF BRAZIL - REFINED (1970)
70°
60°
50°
40°
30°
0°
10°
20°
30°
RORAIMA
AMAPÁ (Territory)
Macapá
AMAZONAS
PARÁ
Belém
São Luís
MARANHÃO
Fortaleza
RIO GRANDE DO NORTE
CEARÁ
Teresina
Natal
PARAÍBA
João Pessoa
PERNAMBUCO
Recife
ALAGOAS
Maceió
SERGIPE
Aracajú
BAHIA
Salvador
ACRE
Pôrto Velho
RONDÔNIA
MATO GROSSO
GOIÁS
FEDERAL DISTRICT
Cuiabá
MINAS GERAIS
ESPÍRITO SANTO
Vitória
SÃO PAULO
RIO DE JANEIRO
Rio de Janeiro
São Paulo
Curitiba
SANTA CATARINA
Florianópolis
RIO GRANDE DO SUL
Pôrto Alegre
Atlantic Ocean
SOCIOLOGICAL REGIONS
States of the Developed South
States of the Underdeveloped Northeast
States and Territories of the Developing Frontier
Developed Microregions in the Northeast and the Frontier
Underdeveloped Regions in the Developed South
STATE OR TERRITORIAL CAPITALS
1970 Urbanized Area ≥ 1,000,000
Other Metropolis
0 200 400 600 Mi.
0 200 400 600 800 Km.
N

Figure 4

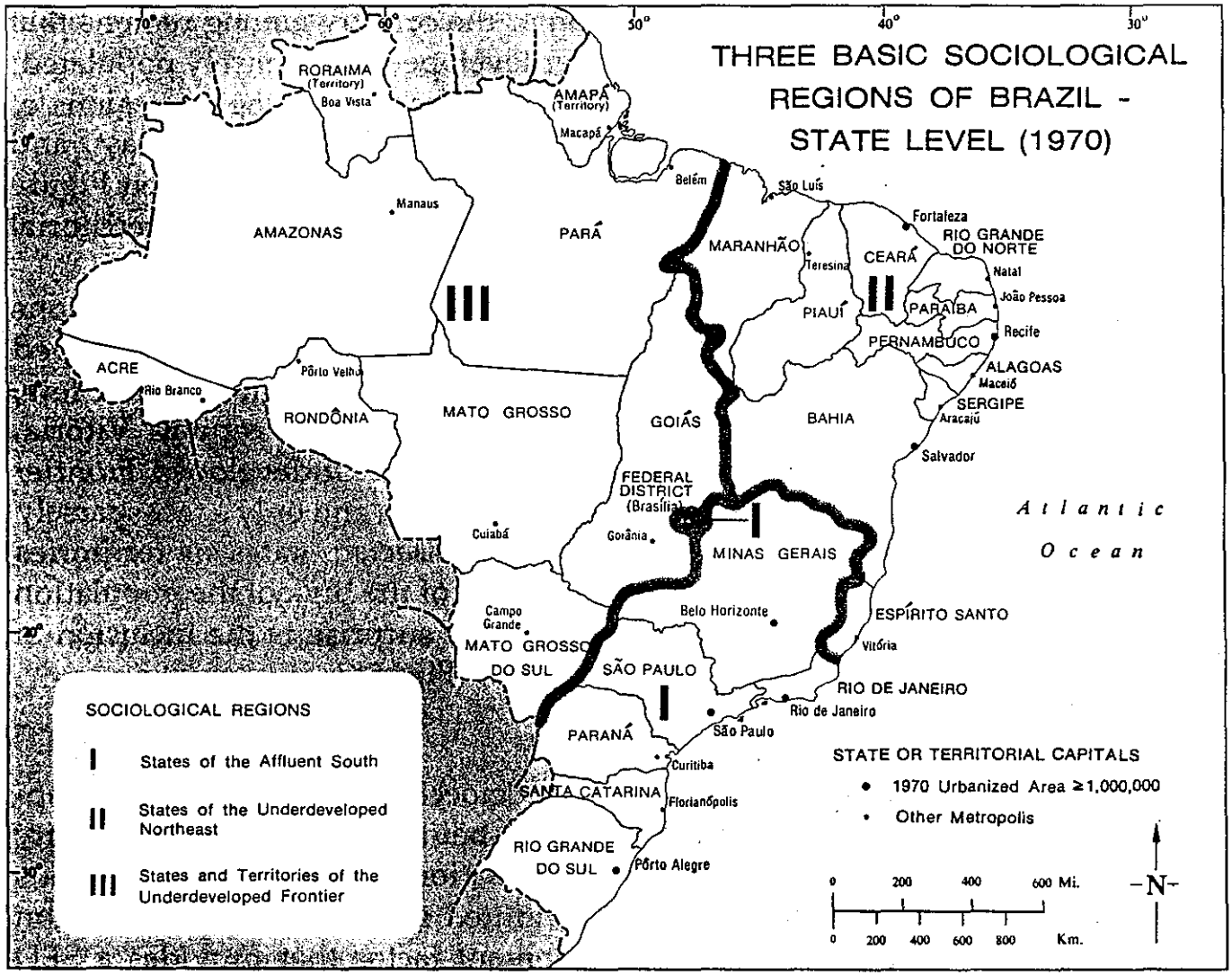
THREE BASIC SOCIOLOGICAL REGIONS OF BRAZIL - STATE LEVEL (1970)
70°
60°
50°
40°
30°
RORAIMA (Territory)
Boa Vista
AMAPÁ (Territory)
Macapá
Belém
São Luís
Manaus
AMAZONAS
PARÁ
MARANHÃO
Fortaleza
RIO GRANDE DO NORTE
Teresina
CEARÁ
Natal
João Pessoa
PIAUÍ
PARAÍBA
Recife
PERNAMBUCO
ALAGOAS
Maceió
ACRE
Pôrto Velho
Rio Branco
RONDÔNIA
MATO GROSSO
GOIÁS
BAHIA
SERGIPE
Aracajú
Salvador
FEDERAL DISTRICT (Brasília)
Cuiabá
Goiânia
MINAS GERAIS
Atlantic Ocean
Campo Grande
Belo Horizonte
ESPÍRITO SANTO
Vitória
MATO GROSSO DO SUL
SÃO PAULO
RIO DE JANEIRO
Rio de Janeiro
São Paulo
PARANÁ
Curitiba
SANTA CATARINA
Florianópolis
RIO GRANDE DO SUL
Pôrto Alegre
SOCIOLOGICAL REGIONS
I States of the Affluent South
II States of the Underdeveloped Northeast
III States and Territories of the Underdeveloped Frontier
STATE OR TERRITORIAL CAPITALS
• 1970 Urbanized Area ≥1,000,000
• Other Metropolis
0 200 400 600 Mi.
0 200 400 600 800 Km.
N

Figure 5

FOOTNOTE

Tables 1 and 2 and Figures 1-5 were reproduced with minor changes from Haller (1982) by permission of the Geographical Review. The support of the Spencer Foundation and the University's Ibero-American Studies Program is gratefully acknowledged, as is the cooperation of the Brazilian Institute of Geography and Statistics, the University of São Paulo and the Institute of Advanced Studies of the Australian National University. The original analysis was performed under Grant SES 78-07414 from the National Science Foundation. The figures were prepared by the Cartographic Laboratory of the University of Wisconsin-Madison. Special thanks go to Drs. Jose Pastore, Jonathan Kelley, David B. Bills and Mary B. Olson and to Research Specialist Rochelle Reimer.

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