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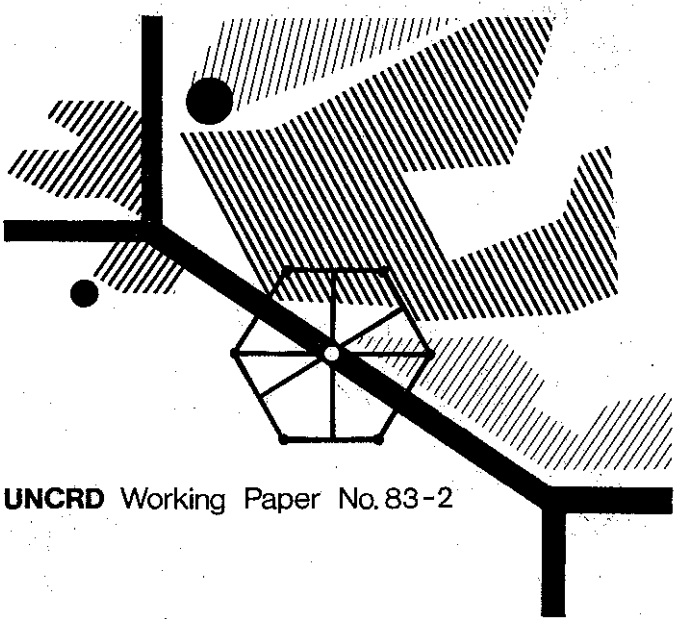

UNCRD Working Paper No. 83-2

United Nations Centre for Regional Development
Nagoya Japan

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February 1983

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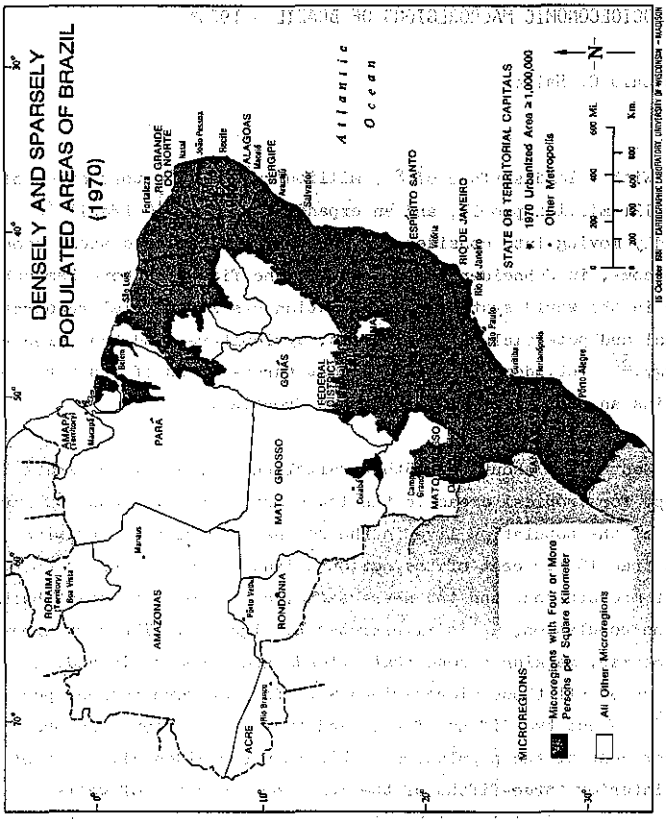
Archibald O. Haller

With a land surface of 8.5 million km^2, a 1980 population of over 121 million people, and an expanding economy,[1] Brazil is rapidly moving into considerable world prominence, and seems soon to become, in Schneider's apt phrase, "the first Southern Hemisphere star in the world system."[2] The nation has substantial resources -- actual and potential -- in minerals, agriculture, and hydroelectric energy.[3] Yet, down to today, almost three-fifths of its territory remains an essentially untapped open frontier.

South from about the 15th parallel the climate is moderate except for tropical areas in the low coastal lands. About 60 per cent of the population live in the southerly region, comprising less than 13 per cent of the nation's land surface. Indeed both the temperate zone and the near-coastal areas hold the great bulk of the population, as is illustrated by figure 1. The dark area of the map, marking a zone that extends about 600 km inland, is made up of all those microregions with four or more persons per km^2.[4] About two-fifths of the land surface thus contains over 90 per cent of the population. This is not accidental. Most of the interior three-fifths of the territory consists of well-watered lowlands lying within 15 degrees or so of the equator, and settling it requires considerable effort. Even in the populous near-coastal areas, however, the levels of living of the population vary markedly, both among and within regions. Regional inequalities have been discussed at length, and regional criteria are used by the government to aid development decision making.

Figure 1


DENSELY AND SPARSELY POPULATED AREAS OF BRAZIL (1970)
Atlantic Ocean
MICRORREGIONS
Microregions with Four or More Persons per Square Kilometer
All Other Microregions
STATE OR TERRITORIAL CAPITALS
1970 Urbanized Area ≥ 1,000,000
Other Metropolis
Km.
RORAIMA
AMAPÁ
PARÁ
AMAZONAS
ACRE
RONDÔNIA
MATO GROSSO
GOIÁS
FEDERAL DISTRICT
ESPÍRITO SANTO
RIO DE JANEIRO
Fortaleza
RIO GRANDE DO NORTE
PARAÍBA
ALAGOAS
SERGIPE
Salvador
São Paulo
Belém
Manaus
Cuiabá
Goiânia
Porto Alegre

The South is relatively well-to-do, while the Northeast is widely believed to be the "largest area of poverty in South America."[5/] At the microeconomic level, too, Brazil's inequality is pronounced and growing, reaching G=.60, one of the highest gini coefficients in the world, by 1976.[6/]

IDENTIFYING AND DELINEATING BRAZIL'S MACROREGIONS

Main Current Conceptions

A series of factors make Brazil of special concern to geographers and planners. Some of these are its large land surface, its range of climates, its as yet but partly tapped natural resources, its uneven settlement pattern, its expanding economy, and its extremes of wealth and poverty both within and among regions. This interest is shared by basic geographical research workers as well as the Brazilian government, especially its national statistical service, Instituto Brasileiro de Geografia e Estatistica (IBGE) (Brazilian Institute of Geography and Statistics) and by many other public and private organizations both in Brazil and abroad.

More specifically, considerable research effort has gone into attempts to identify Brazil's macroregions. No one appears to doubt the utility and feasibility of doing so. On the contrary there appears to be a solid consensus that the potential benefits are well worth the effort and that indeed Brazil may be best conceived as composed of several large, identifiable areas. There are thought to be at least three such areas, and perhaps as many as a half-dozen or so, and there is widespread agreement on their composition. There is the Northeast whose delineations vary but which always include seven specific states: Ceará, Rio Grande do Norte, Paraiba, Pernambuco, Sergipe, Alagoas, and Bahia. There

is Amazônia, which always includes the states of Amazonas and Pará, if not others. And there is the South, often broken down into the Far South (Rio Grande do Sul through Paraná) and the Centre-South (including at least São Paulo and Rio de Janeiro). Other states and territories may be fitted around these "nodes." To ordinary Brazilians, these are not merely meaningless directional terms; they connote intelligible socioeconomic and demographic characteristics. The Northeast means antiquated agriculture and large numbers of poverty-stricken people. Amazônia means vast reaches of tropical forests devoid of people, the "Inferno Verde" or "Green Hell," which nonetheless may hide untold natural wealth. The Centre-South means the modern sector, with huge urban centres of manufacturing, while the Far South means rich farming and productive pasture lands. As a whole the South means a large and well-to-do population.

From the beginning, about 1941, serious regionalization efforts have been carried out by the Brazilian government, mostly by IBGE, for its own policy purposes. At first such efforts emphasized the natural ecology -- climate, topography and the biosphere. In the last twenty-five years or so, economic and demographic criteria have played a more prominent role.[7] For the last decade or so, Brazilianist geographers, like their counterparts elsewhere, have employed more formal statistical models, especially factor analysis, to form indexes of broad, abstract constructs presumably underlying large numbers of comparable specific observations taken on areal subdivisions of the nation. These scores of indexes are then used to group contiguous sets of these subdivisions into larger units.[8] Usually, the small units are states and territories, so the larger regions turn out to be sets of contiguous states and territories, although they are sometimes built up from smaller units. Regional concepts, especially those of the five official "Grandes Regiões" -- the Southeast, South, Northeast, Central-West, and North -- are

regularly used in federal planning. They are briefly covered by several recent authors, most of whose observations need not be repeated at this point.[2/] Regional variations are so pronounced and so obviously influential that regional breakdowns are regularly invoked by Brazilianists interested in the nation's social, demographic, or economic structure. English language writers of today generally use the government's (IBGE's) five-way scheme or some minor variant of it. Briefly, the South-East contains the metropolises of São Paulo, Rio de Janeiro, the location of most of the nation's manufacturing and an area of productive modern agriculture. The South is mostly agricultural, again quite productive. The agricultural Northeast is seen as the main centre of poverty in the nation, the Central-West as a region of agricultural expansion, and the tropical Amazonian North as a region of as yet untapped resources. The composition of IBGE's present five-region scheme is as follows: Southeast -- Minas Gerais, Espírito Santo, Rio de Janeiro, and São Paulo; South -- Paraná, Santa Catarina, and Rio Grande do Sul; Central-West -- Goiás, the Federal District (including Brasília), Mato Grosso (do Norte), and Mato Grosso do Sul; Northeast -- Maranhão, Piaui, Ceará, Rio Grande do Norte, Paraiba, Pernambuco, Sergipe, Alagoas, and Bahia; North -- Amapá, Roraima, Pará, Amazonas, Acre, and Rondónia. (These regions may be traced on any of the maps herein, although they are not marked out on any of them.)

Methodological Considerations

Regionalization poses two basic research questions. One is to specify the relative sizes or types of small units which are to be areally aggregated into large units. The other is to determine the variables to be used to identify any given areal aggregation of small units and to distinguish among each of the larger units. Let us look at each of these in the Brazilian context, beginning with the question of the sizes of the small units.

IBGE's system is used with small variations to specify the jurisdictions of the various regional development planning agencies. It consists of five sets of contiguous states and territories. This system has the advantage of recognizing, not only economic and historical differences among regions, but also the states that are powerful political actors within the Brazilian Federation. Some, such as São Paulo, Rio Grande do Sul, Minas Gerais, and Pernambuco, seem to be especially influential. But what is an advantage from some points of view is a disadvantage from others.

On the whole, Brazil's states are too few and too big to fit the existing regional molds very well. In the late 1970s, Mato Grosso was divided into two states. Since that division and the earlier melding of Guanabara into Rio de Janeiro took place, continental Brazil has consisted of twenty-six "Federal Units"--two territories, the Federal District containing the capital of Brasília, and twenty-three states.[10/] Many of the states are highly varied and several are immense. The socioeconomically diverse state of Minas Gerais, for example, is more than half again the size of France, and four other states are even larger. So it is not surprising that Brazil's regional variations, so obvious to the trained observer, do not always fit neatly into regions bounded by state lines. In general, large numbers of small areal units are more useful than small numbers of large units. It is therefore useful to begin the regionalization process with smaller units than states, reaggregating them into larger regions whose boundaries might have little or nothing to do with state borders. After such a process has been completed, it is not difficult to reattribute whole states to the macroregions so delineated, as we shall show later on.

What about the variables to be used to array the small units? Obviously, a nation is a complex system. In theory, at least, its regions may be described by any or all of a very large number

of variables or of indexes of hypothetical dimensions ("factors" in the factor analysis sense) presumably underlying a multiplicity of specific variables, provided the latter are measured comparably on each of a set of small units which themselves are more or less comparable. It follows that any aggregation of smaller units into larger regions will be dependent upon the choice of variables. Since the dimensions that emerge from a factor analysis are dependent upon the choice of specific variables to be factored, this is as much a consequence of the use of factor weighted indexes as it is of the original variables. In other words, the regions that emerge from a statistical regionalization procedure are products of the variables on which the units are arrayed. The implication of this is, as in all uses of factor analysis, that in order to be of most use, the original choice of specific variables must be dictated by a clear conception, if not an explicit theory, of the structure of the factor or factors to be measured. This way each empirical measurement of a relationship of a variable to a factor or of multiple factors to each other, becomes a test of an hypothesis. When the scheme or theory is well conceived, reliable and valid measures of the initial variables will be found to be highly related to, or "saturated by" the expected factor or factors. In practice, such logically rigorous procedures are often not followed. Frequently, a large number of variables that "might be interesting" are factor analysed. This yields an outcome that makes the work of regionalization exceedingly difficult: large numbers of orthogonal factors, some of which account for much of the common variance among the correlations and all of which are hard to interpret.[11/]

In general, the most useful regionalizations will be those in which large regions are constructed from large numbers of small areal units whose similarities and differences are measured by means of very small numbers of well-conceived variables.

A NEW ATTEMPT TO SPECIFY SOCIOECONOMIC MACROREGIONS FOR BRAZIL

Henshall and Momsen appear to have developed what may be the most uncompromising attempt yet made to use rigorous algorithmic procedures to regionalize Brazil.[12/] Though many details are not presented, it is clear that they applied a principal component analysis to thirty-seven "socioeconomic" variables taken on each of Brazil's states and territories (including the Federal District), twenty-six federal units in all. Eight factors were extracted and orthogonally rotated. Factor I (F_I) (V = .31; 13 per cent of the total variance), they say, identifies "the heartland," dividing the city of Rio de Janeiro and the State of São Paulo from everything else. More specifically they report that it loads up in a number of variables which appear to tap urban population concentration. F_{II} (V = .14) is said to tap per capita services and tractors per ha. It apparently divides the relatively affluent South from the rest of Brazil. F_{III} (V = .13) distinguishes the populous coastal states from everything else. Indeed, it appears to measure total population. F_{IV} (V = .08) is said to identify the traditional Northeast. It measures income and infant mortality. The factors are used to regionalize the nation following the algorithm noted in Note 8.

The resulting regionalization is not wholly unrecognizable, but there are two ways it differs from most. First, it contains two sets of "regions" which contain widely separated sub-areas (e.g., Amapá in the far North and Rio Grande do Sul in the far South), while most researchers strive to obtain regions which are composed of contiguous units. Second, it defines all of the present State of Rio de Janeiro, one of the most highly developed in the nation, as part of a small "Eastern periphery", while most observers would consider that state as part of a national core.

To the reader it would appear that their regionalization is most useful when it conforms to IBGE's standard regions, and least useful where it is most novel. It leaves the coastal Northeastern states from Bahia to Ceará in their usual form -- the "poverty-stricken" traditional "Northeast." Most of the Amazon Basin is left together. They call it the "North," the "resource frontier." São Paulo and Minas Gerais, the Federal District, and the former state of Guanabara, are defined as "the Heartland." The parts that are especially novel are two so-called "regions." The first of these is the "Eastern Periphery," said to include Santa Catarina and Paraná on the one hand in the south, and Espírito Santo and Rio de Janeiro (less Guanabara) on the other. The last "region" is called the "Rimland" and is labeled "dynamic." It includes Rio Grande do Sul in the extreme south; Mato Grosso and Goiás in the west-central area, Maranhão and Piauí in the north, and the extreme northern territory of Amapá. The utility of this massive, heterogeneous "archipelago" is not at all obvious.

This work represents a major effort to review and update the standard regionalization of Brazil. Yet it does not seem to have worked very well. It appears to be most useful where it fits the standard regions best. Where it departs from these, it is hard to see how it could be used.

PURPOSE OF THE PRESENT PAPER

Nevertheless, it is clearly time for new attempts to be made to regionalize Brazil in ways which provide meaningful summaries of the socioeconomic aspects of the national territory. This might best be done by developing valid and reliable indexes of one or more distinct and conceptionally clear socioeconomic and demographic variables. Variables that are clear and distinct are meaningful in the sense that they are readily understood by

broad audiences of qualified readers. Clearly, these variables need to be measured in each of a set of geographical units which are much smaller and more numerous than most of Brazil's states and territories. This will allow refined specifications of the grand regions inferred from them to cut across states which, like Minas Gerais for example, are in fact not at all homogeneous socioeconomically or demographically. For those planning purposes that for political reasons must involve entire states or territories, the boundaries of such refined grand regions may easily be redrawn so as to locate the whole state in the refined great region where most of its population lives.

This paper presents the results of a new attempt to delineate macroregions of Brazil based upon socioeconomic and demographic variables measured on each of Brazil's 360 official continental microregions. They yield a system for regionalizing Brazil that appears to be meaningful from the point of view of researchers and policy planners. It seems simple yet comprehensive, rigorous yet flexible. It is mostly consistent with the main official IBGE regionalizations of Brazil; where it is inconsistent with them, it yields useful insights into the nation's socioeconomic and demographic regional structure which are not evident in former systems but which seem plausible. Its simplicity is due largely to the fact that its variables have been the subject of intensive theoretical and empirical research conducted by sociologists and demographers for half a century or more. The resulting concepts and operational definitions have been considered and refined by many minds. Its precision is due to its use of a large number of small areal units as its most disaggregated level of analysis, rather than a small number of larger units. Its flexibility is due to its conceptual and operational clarity, to a rigorous operational separation of its socioeconomic and demographic variables and to the ease with which the microregions may be classified and reclassified according to their scores on the

socioeconomic criterion. In a few words, it is to be hoped that the system may be simple, flexible, precise, reasonable, and useful.

METHOD

The present regionalization uses two basic variables. These are: 1) a unifactorial multivariate index of microregional socioeconomic development level (the SED), with a score for each of the 360 continental microregions of Brazil; and 2) a dichotomous variable distinguishing between microregions that have, from those that do not have, four or more residents per km^2. A third variable, microregional manufacturing intensity, is used for some purposes. It, too, dichotomizes the microregions, into the twenty which in 1970 had the largest number of workers in manufacturing versus all others.

Microregions

IBGE is the Brazilian federal entity that compiles and publishes statistical data on the nation. Geographic data on economic, social, political, agricultural, and other aspects of the nation are available on a machine-readable public-use magnetic tape for about 2,000 variables, aggregated at the levels of "municípios", microregions, mezzoregions, states and territories, and "grand" regions. The "município" is the smallest effective unit of Brazil's political system. Each consists of a central city and its immediate hinterland. "Municípios" are generated around new cities as they rise to prominence. They develop as divisions of previously existing "municípios". Microregions (MRs) are agglomerations of contiguous "municípios", so arrayed by IBGE as to be homogeneous regarding ecology, demography, agriculture, manufacturing, and transportation.[13] Most MRs appear to be

several thousand km^2 in size although some are hardly larger than 1,000 km^2. In the vast Amazonian backlands, some reach almost 300,000 km^2. Their populations vary from no more than a few thousand people in the dense jungle regions to millions in the highly urbanized areas. As indicated, we employ the 360 MRs on the continent of South America, ignoring the small group of islands called Fernando de Noronha. These are considered to be an MR, though they lie 345 km offshore.

The microregion is the most primitive unit of analysis employed herein. Yet it must be remembered that IBGE has formed each MR from the smaller "municipios". The statistical data on each MR were compiled by IBGE from the censuses of population, agriculture, commerce, and manufacturing, and from other public records. In other words, the most primitive data on each microregion were taken from firms, farms, households, and individuals. So "municipios" and even much smaller units entered the analysis in a subtle way. IBGE's mezzoregions and grand regions were not used at all. States and territories were not used in the analysis, but for some purposes macroregions employing state and territorial boundaries are presented.

Socioeconomic Development Data on Microregions

The present effort to regionalize Brazil is an essential part of a larger project analysing the ways the nation's stratification system varies among macroregions according to their levels of development. Variables measuring development were therefore sought at the microregion level so as to regionalize the nation as precisely as possible. Two such variables are prominent in the literature on international development -- gross national product per capita (or gross domestic product per capita) and electrical energy per capita (sometimes "total" energy per capita). The former, GNP/k, does not exist at the microregion level.

Neither does there exist a Brazilian analogue at that level. The latter, $EE/_K$, seems to be taken at face-value as a measure of development differences among nations. At that level it may be satisfactory on the whole, even though in the productive sphere it may bias the ordering of nations toward manufacturing and away from agriculture and commerce. Factories tend to use large amounts of electricity. Farms and vendors do not. Regarding the consumption behaviour of the population, however, there is less room for doubt. The greater the availability of electrical power to individuals the easier it is to do household tasks and to maintain contact with a wider world through the electronic media.

Yet manufacturing is an important aspect of development. One of the tacit hypotheses of the development literature takes the degree of industrialization to be synonymous with the degree of manufacturing and assumes that the average socioeconomic status of a population is a simple function of its level of manufacturing. In other words, it assumes that industry is manufacturing and nothing more, and that a people's well-being is due only to the production of its factories. It also assumes that $EE/_K$ is an excellent measure of development. The proportion of a population employed in agriculture is another variable often used as a measure of the inverse of development. The hypothesis here is that, among nations, the higher the percentage employed in agriculture the lower the level of development. At bottom, this reasoning seems to imply that manufacturing and industrialization are synonymous and that, so conceived, industrialization is the true engine of development. The use of such single-variable indicators as these assumes that they are interchangeable, implying that they are so highly correlated that the scores for anyone of them may be reproduced by a simple linear transformation of any other. In the real world, correlations among these variables are surely positive. But whether they are uniformly high is an inference which remains to be demonstrated.

Exactly the same reasoning is applicable at the level of subdivisions of a nation. The present research requires one or more measures of microregional development, each defensible on theoretical and empirical grounds. Substantial efforts were therefore undertaken to obtain valid and reliable quantitative data at the level of the microregion: of $EE/_k$, individual socioeconomic status per capita ($SES/_k$) and manufacturing emphasis per capita ($M/_k$), together with agricultural employment per capita ($A/_k$), the latter indicating underdevelopment rather than development. To these, the total value of commercial sales per capita ($S/_k$) was added on the hypothesis that commercial activity would be still another useful indicator of development.

To get a bit ahead of the story, it has been found that variables measuring all but one of these variables ($EE/_k$, which was not available) are theoretically appropriate but partially fallible measures of the same underlying dimension, which we are calling "socioeconomic development" (SED). Here is the reasoning that leads to this conclusion.

The aim was to obtain one or more well-measured variables describing the socioeconomic development levels of the microregions. Any one or any set of these which was available and which could be shown to be valid for this purpose would be sufficient. All appeared reasonably valid before examination. Yet to judge from the literature on development, especially in Brazil,[14] a valid indicator of $M/_k$ might be sufficient to stand by itself as a measure of SED. This would have to be demonstrated, of course, rather than taken on faith. If tests would be advisable for $M/_k$ and its indicators, they would be essential for the remainder of the variables. The case for face-validity of $SES/_k$ is promising in that its component variables would be microregional isomorphs of the kinds of variables which have long been known to be valid and sensitive measures of socioeconomic status at the household

level.[15] Under one name or another this line of research goes back at least fifty years, the variable sometimes being called SES, sometimes "social status" or "level of living," and occasionally "standard of living." It is known to work very well in at least one poor and isolated rural area of Brazil.[16] Nevertheless, the exact items available at the microregion level might differ slightly from those proven to work at the household level and in any case their relations might be different at the microregion level. So they, too, require testing. The same may be said of $S/_K$ and $A/_K$ (total commercial sales per capita and agricultural employment per capita) which have not been well established as indicators of development at the national level much less at the microregional level within nations.

It is thus essential, but perhaps not sufficient, to test each of the variables by correlating it with the others. Several logical outcomes are possible: 1) all variables might be very highly intercorrelated (say, r = + .98 or higher), in which case each one of them could be taken to be a valid indicator of the variable each is thought to measure -- development; 2) they could all have low correlations (say, r = + .30 or lower), implying that without other evidence none of them could be shown to be a valid indicator of development (although if a factor analysis were to show them to be unifactorial, an index comprising all of them might be satisfactory); 3) they might be a mixture of high and low correlations (say, + .95 down to + .10), meaning either that certain variables were poorly chosen or that the concept was not unifactorial; or 4) that the correlations were all moderately high (say, + .40 to + .90), in which case factor analysis might show them all to be rather good but individually imperfect measures of the socioeconomic development level of the microregions. In the 2nd and 4th cases a factor-weighted index employing all of them would be a better measure than any one of them.

With the cooperation of IBGE, data on each microregion were extracted from the above mentioned public-use tape, and were used to construct the following variables.

A. $M/_k$: Microregional Involvement in Manufacturing. Two measures of this variable were used, one to serve as the main measure of $M/_k$ and the other to check the validity of the first.

Variable 1. $MEmp/_w$ - Manufacturing Employment per Worker: The proportion of the MR's economically active population who were employed in manufacturing (31 December 1970).

Variable IA. $MEng/_k$ - Manufacturing Energy Potential per Capita: The total potential energy output, in horsepower, of all manufacturing machinery in place in the MR (1970).

B. $S/_k$: Microregional Involvement in Commerce.

Variable 2. $S/_k$ - Total value of all commercial sales per capita, in the MR (1970), in thousands of cruzeiros.

C. $A/_k$: Microregional Involvement in Agriculture.

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

D. $SES/_k$: Socioeconomic Status of the Population of the Microregion.

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. Television/$_k$ - 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).

Validity and Indexing

Because of the unique potential importance of manufacturing as an index of development, the two indexes of that variable, MEmp/$_k$ and MEng/$_k$, were correlated with each other over the 360 continental microregions to determine whether they would array the microregions in the same order. This is what would occur if both were highly valid indexes of the same measurable variable. The correlation coefficient describing the relationship between the two indexes is a measure of the degree to which they yield the same ordering. Note that the two indexes, manufacturing employees per worker (MEmp/$_w$) and manufacturing energy potential per capita (MEng/$_k$), are taken from counts of very different empirical phenomena: MEmp/$_w$ counts workers -- human beings; MEng/$_k$ counts units of energy -- horsepower. Yet each is intended as a measure of the degree to which each microregion is involved in manufacturing. A high positive correlation coefficient measured on two variables so different at the operational level of manifest content would constitute powerful evidence that they measure the same underlying conceptual variable. Indeed they do: $r = +.999$. It may therefore be concluded that either one of them provides a valid index of the degree to which each microregion is developed in the sense of its population's involvement in manufacturing. In the terms of the abbreviations presented above, MEmp/$_w$ and

$MEng/_K$ appear to be equally and highly valid measures of $M/_K$. They are interchangeable for purposes of indexing the population's involvement in manufacturing.

This still leaves unanswered the question of $M/_K$'s (or its indicators') ability to measure the even more fundamental conceptual variable, socioeconomic development (SED), or whether a multivariate measurement procedure would be required to measure it. It would be theoretically and technically efficient if the $M/_K$ measures would also serve as valid measures of SED: theoretically because it could be concluded that manufacturing is the key to understanding the socioeconomic development differences between the people of Brazil's various microregions, and perhaps even more broadly than Brazil; technically, because the $M/_K$ indicators are easy to grasp and to measure. But present evidence does not permit such a conclusion to be drawn. For the purpose of ordering the microregions on $M/_K$, the two measures ($MEmp/_W$ and $MEng/_K$) are interchangeable, the observed correlations of other variables with either being almost identical. Moreover, because they provide the available evidence regarding $M/_K$, the correlations of either with other indicators of SED also apply to $M/_K$'s correlations with other SED variables. Taking $MEmp/_W$ as the measure of $M/_K$, it may be seen that development in the sense of manufacturing is only moderately correlated with other measures of SED, ranging from $r = +.445$ with literacy/k to $r = +.687$ with Television/k (see table 1).

This implies that the whole set of SED indicators should be looked at together: first, at the matrix of their intercorrelations; and second, at the degree to which each can be considered to be a more directly observable manifestation of SED, the hypothetical socioeconomic development variable shared by all the specific variables, which is a factor analysis question; and, last, as individually fallible but collectively precise measures,

Table 1. Eight Microregional Socioeconomic Development Indicator Variables, 1970: Correlations, Means, and Standard Deviations (N = 360)

Variables	Correlations							Means	Standard Deviations
	2	3	4	5	6	7	8		
1. Manufacturing: $MEmp/_w$	.458	-.447	.511	.660	.687	.607	.445	.044	.051
2. Sales: $S/_k$, ($\frac{1}{7}$ Cr$1,000)		-.571	.663	.824	.779	.756	.635	.700	.864
3. Agriculture: $A/_k$			-.570	-.702	-.691	-.616	-.546	.270	.132
4. Radios/$_k$				.814	.749	.894	.907	.482	.202
5. Refrigerators/$_k$					.946	.894	.771	.128	.123
6. Television sets/$_k$						.867	.696	.096	.126
7. Automobiles/$_k$							.837	.053	.046
8. Literacy/$_k$								.721	.119

Source: Calculated from the 1970 IBGE public-use data tape, Arquivo a Nivel de Microregiões (Rio de Janeiro: Instituto de Geografia e Estatistica, 1970).

Definitions: Variable 1, $MEmp/_w$ - Microregional Involvement in Manufacturing: Proportion of the economically active population employed in manufacturing.

Variable 2, $S/_k$ - Microregional Involvement in Commerce: Total value of commercial sales per capita, in cruzeiros x 1,000.

Variable 3, $A/_k$ - Microregional Involvement in Agriculture: Total number of persons employed in agriculture per capita.

Variable 4, Radios/$_k$ - Proportion of the population residing in households with a radio.

Variable 5, Refrigerators/$_k$ - Proportion of the population residing in households with a refrigerator.

Variable 6, Television/$_k$ - Proportion of the population residing in households with a television receiver.

Variable 7, Automobile/$_k$ - Proportion of population residing in households with an automobile.

Variable 8, Literacy/$_k$ - Proportion of the population who are literate.

at their contributions to the measurement of SED, a factor-weighting question. (The fact that manufacturing emphasis, $M/_k$, does not work out to be a uniquely valid measure of SED has broad implications which will be discussed later.)

Table 1 presents the matrix of correlations of the eight variables selected as partial measures of microregional socio-economic development (SED), together with their respective means and standard deviations. There is little point in going into the details of the means and standard deviations. But before scanning the correlation coefficients, some general comments would be in order. Viewed from the perspective of the wealthy nations of Western Europe and North America, these data show a picture of widespread poverty. On the average, manufacturing is not highly developed, commerce is not lively, and large numbers of people are in farming, often at subsistence levels. About half have a radio available, but not many have access to refrigerators (12.8 per cent), television receivers (9.6 per cent), or automobiles (5.3 per cent). The average literacy rate is not high (72.1 per cent). Quite a few of the variables have low means and high standard deviations. This is a reflection of the degree to which the micro-regional distribution of most of the variables is skewed. To speak loosely, most microregions are peopled by the poor, but quite a few have relatively well-to-do populations.

It will help to think of the agricultural involvement variable as its opposite, non-agricultural involvement. This allows the reader to ignore the minus signs, all of which are connected with this variable. With this in mind, the pattern of correlations is informative and all are moderate to rather high: the lowest, manufacturing and literacy (Variables 1 and 8), is $r = + .445$; and the highest, television sets per capita and refrigerators per capita (Variables 5 and 6), is $r = + .946$. All of the signs are in the proper direction, implying that each variable varies directly with every other variable.

But such evidence is not sufficient to permit inferences to be drawn about socioeconomic development, the hypothetical conceptual variable that is the object of this essay. The way to determine whether these eight variables may be interpreted as empirical manifestations of SED is to check the factor analytic structure. If three conditions are met, it may be concluded that the data are consistent with the hypothesis that a single dimension, more fundamental than any of the eight variables, explains their intercorrelations. The three are: 1) that a single principal component accounts for a large part of the common variance of the eight items; 2) that no other principal component also accounts for a substantial proportion; and 3) that all items have reasonably high loadings on the first principal component.

To be thorough, all principal axes necessary to account for 100 per cent of the common variance were extracted. Eight were required. In fact, the first alone accounts for 74.5 per cent of the common variance, and its eigenvalue is 5.956. A widely accepted rule-of-thumb dictates that only those axes whose eigenvalues are equal to or greater than 1.00 be used. All of the other seven eigenvalues are less than 1.00, the largest being 0.700. In terms of the proportion of the common variance accounted for, the second largest factor yields 8.7, the third 6.6 per cent, and so on.

It is clear that one factor alone is sufficient to explain practically all of the common variance in the matrix and that variable may reasonably be denominated "microregional socioeconomic development." The factor loadings are presented in table 2. These values express the relationship of each individual indicator to the parent dimension. It will be noted that the factor loadings of all variables are at least moderately high and that there is no pattern sharply setting off some from others. The lowest, Involvement in Manufacturing ($MEmp/_{W}$), is .691, and the highest, Per Capita Access to Refrigerators, is .965. The items measuring

Table 2. Loadings of Eight Items on a Socioeconomic Development Factor: Brazilian Microregions, 1970

Variables	Loadings
1. Manufacturing: $MEmp/_w$	.691
2. Sales: $S/_k$ ($\div$ Cr$1000)	.831
3. Agriculture: $A/_k$	-.744
4. Radios/$_k$	.895
5. Refrigerators/$_k$	.965
6. Television sets/$_k$	.935
7. Automobiles/$_k$	.947
8. Literacy/$_k$	.856

Source: Calculated from table 1.
Eigenvalue: 5.956
Common variance explained: 74.5 per cent
Definitions: See table 1.

household socioeconomic status (Variables 4-7) weigh slightly more heavily in the factor than the rest. This means that the factor reflects and tends to emphasize the average material well-being of the microregions' families, as it should. The negative sign for Involvement in Agriculture ($A/_k$) is to be expected. The concept and the sign are to be reflected (reversed) to permit the variable's higher levels to be called "development" instead of "underdevelopment." This changes the nominal definition of the variable to Noninvolvement in Agriculture and makes the sign positive. The item-factor relationship may then be stated properly: + .744. With $A/_k$ properly reflected, all the item-factor loadings are high and positive.

A SOCIOECONOMIC DEVELOPMENT INDEX FOR BRAZILIAN MICROREGIONS

The foregoing amply demonstrates that in 1970 the microregions of Brazil could be arrayed and scored from highest to lowest in terms of a unidimensional variable, socioeconomic development (SED). Microregions may be so scored by assigning each a value which is a sum of its mean on each variable (standardized by dividing it by its standard deviation) multiplied by the loading the item has on the socioeconomic development factor.

The formula is: $I = F_z$

where: F is the matrix of factor loadings, and z is the vector of standardized values of the variables that have been factor analysed.

Specifically, let each of the variables in tables 1 and 2 be called V1, V2, ... V8 and assign to each the meaning it has in the tables. Then let SED_m be the Socioeconomic Development Index Score for the m^{th} microregion. Then

$$SED_m = \frac{.691}{.051}[V_{1m} - .044] + \frac{.831}{.864}[V_{2m} - .700] - \frac{.744}{.132}[V_{3m} - .270] + \frac{.895}{.202}[V_{4m} - .482]$$

$$+ \frac{.965}{.123}[V_{5m} - .128] + \frac{.935}{.126}[V_{6m} + .096] + \frac{.947}{.046}[V_{7m} - .053] + \frac{.856}{.119}[V_{8m} - .721]$$

In actual practice the resulting distribution of the original SED scores was proportionately transformed so that the lowest possible score was zero and the highest was 100. The transformed SED scores, ranging from zero to 100 are presented in Appendix A. They are grouped by quintiles and, within the highest quintile, by decile. The official identification number is given for each microregion along with its socioeconomic development score.[17/]

SOCIOECONOMIC MACROREGIONS OF BRAZIL

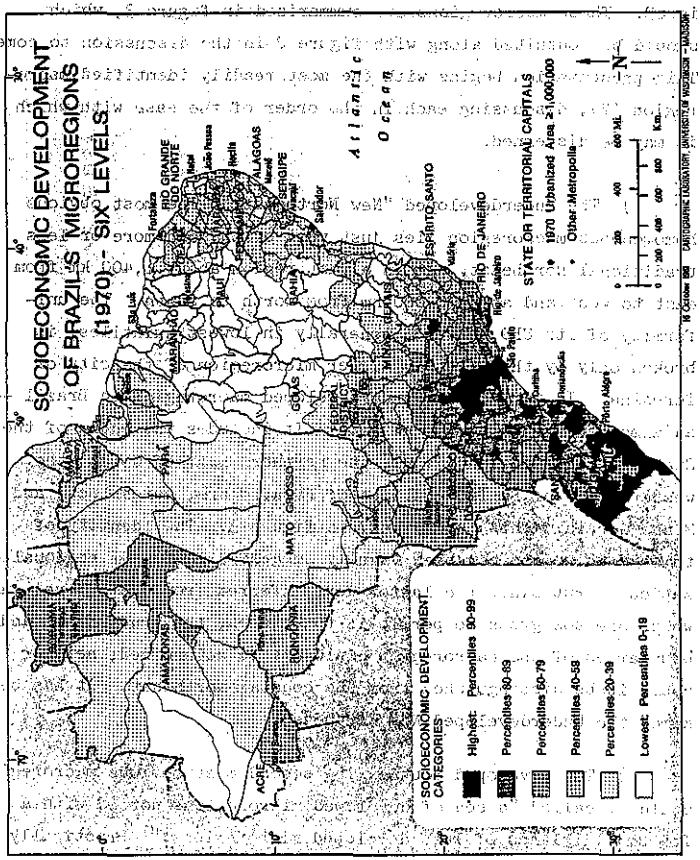
The SED scores provide most of the data from which maps of Brazil's macroregions were constructed.[18] Population density data were also used. In addition, data on employment in manufacturing were employed to provide a better understanding of the geographic relationship between manufacturing and socioeconomic development, and especially to call attention to the paucity of industrialized microregions and the resulting looseness of the relationship between manufacturing and socioeconomic development.

The Geographic Distribution of Socioeconomic Development

Figure 2 was constructed by grouping the 360 continental microregions into quintiles, seventy-two to a quintile, and dividing the highest or 5th quintile into its two deciles (the 10th or highest and the 9th or second highest), each containing thirty-six microregions. On the map, each microregion is assigned to its quintile or decile class according to its SED score. Macroregions were identified by isolating large sets of contiguous microregions which were classed almost without exception in the same quintile or an adjacent one, and then marking the remaining sets of contiguous microregions (whether or not the set was composed of microregions of the same SED class). This procedure will become clearer as we discuss the resulting distribution of the microregions according to their SED scores.

Five macroregions were identified in this way. They have been assigned names indicating both their location and their SED characteristics. Region I is the Developed South. The median SED score of its microregions is 78. Region II is the South's Developing Periphery. It swings across the top of the Developed South and then northwestward out along the border. Its median SED score is 54. Region III is the Unevenly Developed Old North-

Figure 2


SOCIOECONOMIC DEVELOPMENT
OF BRAZIL'S MICROREGIONS
(1970) - SIX LEVELS
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
N
RIO GRANDE DO NORTE
ALAGOAS
SERGIPE
ESPIRITO SANTO
RIO DE JANEIRO
MINAS GERAIS
GOIAS
MATO GROSSO
AMAZONAS
RONDONIA
ACRE
PARANA
Fortaleza
Natal
João Pessoa
Recife
Maceió
Aracaju
Salvador
Vitória
Rio de Janeiro
São Paulo
Curitiba
Florianópolis
Porto Alegre
Goiânia
Cuiabá
Manaus
Belém
São Luís
Teresina

east. Its median SED score is 31. Region IV is the Underdeveloped Amazonian Frontier. Its median SED score is 32.5. The last is Region V, the Underdeveloped New Northeast. Its median SED score is 13. These macroregions are summarized in figure 3, which should be consulted along with figure 2 in the discussion to come. This presentation begins with the most readily identified macroregion (V), discussing each in the order of the ease with which it may be discerned.

1) The Underdeveloped "New Northeast." The most obvious homogeneous macroregion lies just west of the old more or less traditional Northeast. It is a vast region about 1,400 km from east to west and about 2,000 km from north to south. The uniformity of its SED pattern, generally in lowest quintiles, is broken only by the slightly higher microregion of the city of Teresina. It is the most underdeveloped macroregion in Brazil -- an almost unbroken sea of poverty. It includes the whole of the States of Maranhão and Piauí, the northern half of Goiás, the western half of Bahia, and bits of Pará, Ceará, Pernambuco, and Minas Gerais. This is Region V in figure 3. The identity of this great region has been vaguely suggested in former regionalizations. But since the latter were inferred from state level data, which are too gross to permit it to be seen, the true extent and boundaries of the macroregion could not be determined; neither could it be distinguished from the coastal Northeast. It has been named the Underdeveloped New Northeast.

2) The Developed South. The second most obvious macroregion could be called "a sea of developed microregions dotted with a few small islands of less developed microregions." Practically all of the nation's most highly developed MRs are concentrated here, and almost all its MRs are at least in the highest two SED quintiles. It includes all of the southerly states of Rio Grande do Sul, Santa Catarina, Paraná, and São Paulo, all but a northern tip of Rio de Janeiro, and the most populous one-third of Minas Gerais. It is Region I in figure 3.

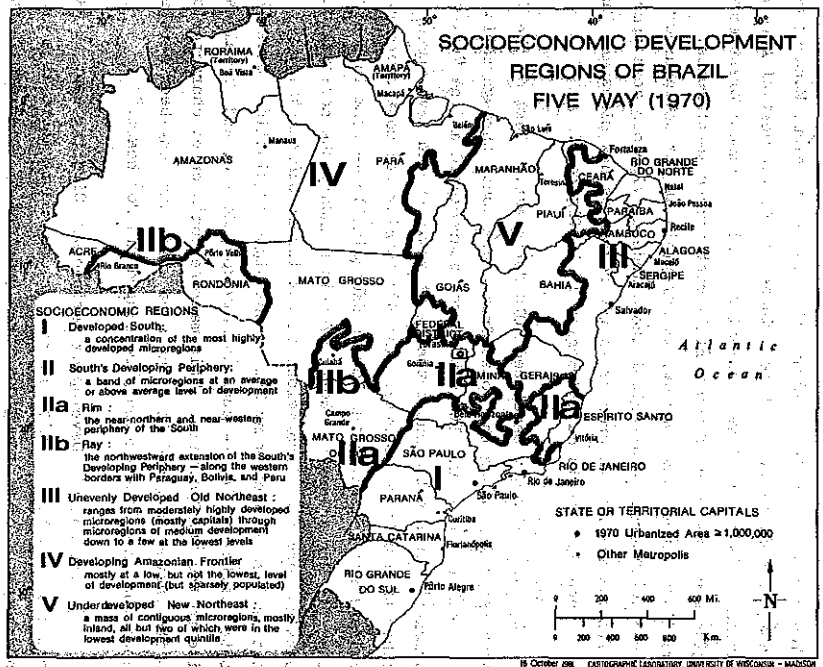

SOCIOECONOMIC DEVELOPMENT
REGIONS OF BRAZIL
FIVE WAY (1970)
SOCIOECONOMIC REGIONS
I Developed South:
a concentration of the most highly developed microregions
II South's Developing Periphery:
a band of microregions at an average or above average level of development
IIa Rim :
the near-northern and near-western 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
Atlantic Ocean
AMAZONAS
PARÁ
MARANHÃO
PIAUÍ
CEARÁ
RIO GRANDE DO NORTE
PARAÍBA
PERNAMBUCO
ALAGOAS
SERGIPE
BAHIA
MATO GROSSO
GOIÁS
MINAS GERAIS
ESPÍRITO SANTO
RIO DE JANEIRO
SÃO PAULO
PARANÁ
SANTA CATARINA
RIO GRANDE DO SUL
RONDÔNIA
ACRE
RORAIMA
AMAPÁ
Manaus
Belém
São Luís
Fortaleza
Natal
João Pessoa
Recife
Maceió
Aracajú
Salvador
Vitória
Rio de Janeiro
São Paulo
Curitiba
Florianópolis
Pôrto Alegre
Campo Grande
Cuiabá
Goiânia
Belo Horizonte
IIb
IIa
I
IV
V
III
0 200 400 600 Mi.
0 200 400 600 800 Km.
N
15 October 1986 CARTOGRAPHIC LABORATORY, UNIVERSITY OF WISCONSIN – MADISON

Figure 3

3) The Developing Amazonian Frontier. West of the New Northeast, stretching to the western and northern borders and covering about one-half of the total land surface, is a large set of microregions practically all of which are in the 2nd (or 2nd to lowest) SED quintile. Around the cities of Belém, Manaus, and Macapá, the SED rises a little. Those in the far west of Acre and Amazonas fall to the lowest quintile. This enormous forest-covered region contains some of the world's most remote settlements. Brazilians expect that one day it may yield as yet unmeasured riches in minerals and agriculture. Indeed, vigorous development activities are now in process in the region as new mines and lands are opened up. It is called Region IV in figure 3.

4) The Unevenly Developed "Old Northeast." East of the New Northeast lying along the coast from Ceará south through Bahia is a fourth macroregion. It is the area stereotyped as the "poverty stricken" Northeast. But actually it shows uneven development rather than uniform poverty. The MRs forming its most southerly boundary are indeed in the lowest SED quintile -- some in Bahia, others in Minas Gerais. North of this boundary the macroregion contains very few microregions in the lowest SED quintile. Neither does it have many MRs in the highest quintile. Several state capital cities -- such as Salvador, Recife, and Fortaleza -- rise to the 4th quintile. This macroregion's chief characteristic is its unevenness, and it is an area which has long been settled, hence the name "the Unevenly Developed Old Northeast."

5) The South's Developing Periphery. Circling east to west across the northern limit of the Developed South there is a nearly unbroken band of microregions three quarters of which are in the middle quintile. One part encompasses all of Espírito Santo, lapping down into Rio de Janeiro, and extending into eastern Minas Gerais. This sector separates the Developed South from the Unevenly Developed Old Northeast. Another part swings northwestward from south-central Minas Gerais, sweeping across southern

Goias and the Federal District, covering the whole of the State of Mato Grosso do Sul, and extending into the south of Mato Grosso do Norte. The eastern part of this band forms part of the separation between the Developed South and the Unevenly Developed Old Northeast. The central part of the band separates the South from the Underdeveloped New Northwest. The western part separates the South from the Undeveloped Amazonian Frontier. To this, the two large border microregions encompassing the Territory of Rondonia and the eastern half of Acre have been added. In figure 3 this interstitial macroregion is labeled Region II. It is divided into two parts, called the "Rim" and the "Ray." The "Rim" is the band that circles around the northern boundary of the South, and the "Ray" is the border projection out to Acre. As a whole, the region is distinct from the South in that the SED scores of practically all of its component microregions are lower than those of the South. It is distinct from the Amazonian Frontier in that wherever it touches the latter, its microregions have higher SED scores. This is also true of its "border" with the Underdeveloped New Northeast. The microregions of the inland fringes of the Unevenly Developed Old Northeast have rather low SED scores, usually in the 2nd (2nd to lowest) quintile. Where they touch the part of the South's Developing Periphery named the Rim their SED quintiles are lower than those of the adjacent microregions of the Rim.

Population Density, Socioeconomic Development, and Extensions of the Regionalization Process

As we have seen, figure 1 presents a summary of the geographic distribution of microregions of dense (≤ 4 inhabitants per km^2) and sparse (> 4 inhabitants per km^2) population. It illustrates what researchers have long noted: relatively few Brazilians have moved in to the deep interior far from the coast. This in itself is a way of regionalizing the nation, and it yields two regions, a densely populated near-coastal region and a sparsely populated interior.

Figure 2 depicts the geographic pattern of the distribution of socioeconomic development levels of Brazil's 360 continental microregions. Careful scrutiny of this distribution yields five identifiable macroregions. The boundaries of these five, discussed in the foregoing section of this paper, are presented in figure 3. The regionalization provided in figure 3 is both refined and unidimensional. It is refined in the sense that its demarcation lines are drawn along microregion boundaries rather than the boundaries of states and territories. It is unidimensional in that it is based upon a single, factor-analytically pure dimension describing the socioeconomic development levels of the microregions. Yet its refinement does not prevent its being used at the level of states and territories. Neither does its unidimensionality prevent its being used in combination with other variables, such as population density. Either may yield new insights into the human side of Brazil's regions.

SED Macroregions Composed of States and Territories

For some purposes, macroregions bounded by state and territorial lines are more useful than refined macroregional lines which dissect states or territories. States and territories are powerful political realities in Brazil. Macroregions based upon microregional lines, like those of figure 3, provide appropriate data by which to determine "multistate" macroregions. Indeed many of the nation's states and territories are already wholly encompassed by one or another of the five macroregions presented in connexion with the discussion concerning figures 2 and 3. Allocating each of the divided states or territories to an appropriate macroregion may be accomplished by simply assigning the whole state or territory to the adjacent macroregion containing most of its population. Here are the resulting multistate macroregions.

Region I, The Developed South: Rio Grande do Sul, Santa Catarina, Paraná, São Paulo, Minas Gerais, and Rio de Janeiro.

Region II, The South's Developing Periphery: Espírito Santo, the Federal District, Goiás, Mato Grosso do Sul, Rondônia, and Acre.

Region III, The Unevenly Developed Old Northeast: Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe, and Bahia.

Region IV, The Undeveloped Amazonian Frontier: Mato Grosso do Norte, Amazonas, Roraima, Amapá, and Pará.

Region V, The Underdeveloped "New" Northeast: Maranhão and Piauí.[19]

Redrawing the boundaries in this way will be useful, especially to policy makers concerned with treating states and territories as wholes. The main losses this incurs appear to be these. First, about half of Bahia and of Goiás, as well as bits of other states, are thus taken out of Region V, leaving it with Maranhão and Piauí, less than one-half its original territory. Second, Minas Gerais is regionally complex; four of the refined SED macroregions cut into it. Its complex regional development pattern is obscured by allocating the whole state to the South.

Three Basic Sociological Regions

For some purposes, a simple, conceptually clean regionalization will be useful. One of the most promising combines two dichotomizations of Brazil's 360 microregions, one in terms of population density and the other in terms of socioeconomic development. From figure 1 it is clear that two density macroregions may be identified, the Near-coast and the Interior. A close

reading of figure 2 will show that a reasonable SED dichotomization of the nation will divide the nation into a "Developed" region and an "Underdeveloped" region. Note that practically all of the microregions of the South are in the highest two SED quintiles (the 40th through the 99th percentiles) and practically all of the microregions outside the South are in the bottom three quintiles. The 40th percentile may be used as a cutting point in distinguishing "developed" and "underdeveloped" microregions from each other. These may be mapped, in effect separating the South from all the rest of the nation. This procedure defines as the Developed South that mass of contiguous southern microregions in the top two SED quintiles. As illustrated in figure 3, this includes Rio Grande do Sul, Santa Catarina Paraná, São Paulo, practically all of Rio de Janeiro, and the southern half of Minas Gerais. All the rest of the country would then be left as "underdeveloped."

Combining the two dichotomies yields four logical classes: 1) Developed and densely populated; 2) Developed and sparsely populated; 3) Underdeveloped and densely populated; and 4) Underdeveloped and sparsely populated. But the empirical fact is that only a few scattered microregions fit one of the logical classes; there is no region composed of developed but sparsely populated contiguous microregions. So a trichotomy remains, dividing the country among regions which are 1) developed and densely populated; 2) underdeveloped and densely populated; and 3) underdeveloped and sparsely populated. Brazil's "Basic Sociological Regions" are defined as the Developed South, the Underdeveloped Northeast, and the Undeveloped Frontier. The boundaries of these regions are presented in figure 4. This is a refined identification of regions in that it ignores the lines of states and territories, following those of microregions instead.

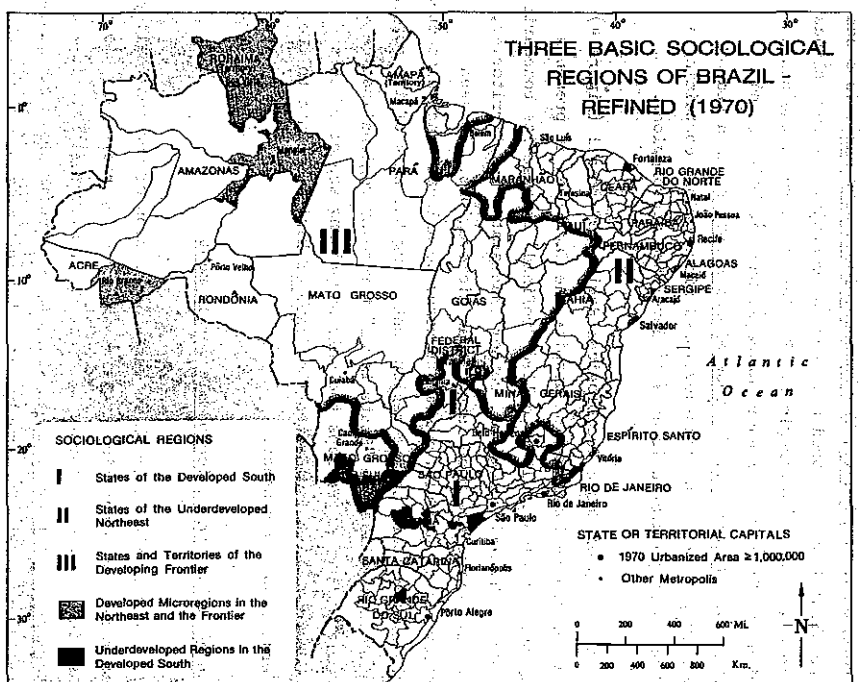

THREE BASIC SOCIOLOGICAL REGIONS OF BRAZIL - REFINED (1970)
SOCIOLOGICAL REGIONS
States of the Developed South
States of the Underdeveloped Northeast
States and Territories of the Developing Frontier
Developed Microregions in the Northeast and the Frontier
Underdeveloped Regions in the Developed South
STATE OR TERRITORIAL CAPITALS
1970 Urbanized Area ≥ 1,000,000
Other Metropolis
RORAIMA
AMAPÁ (Territory)
AMAZONAS
PARÁ
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
SÃO PAULO
PARANÁ
SANTA CATARINA
RIO GRANDE DO SUL
Atlantic Ocean
Fortaleza
Natal
João Pessoa
Recife
Maceió
Aracaju
Salvador
Belém
São Luís
Belo Horizonte
Vitória
Rio de Janeiro
São Paulo
Curitiba
Florianópolis
Porto Alegre
Porto Velho
Rio Branco
Manaus
Boa Vista
Macapá
Cuiabá
Goiânia
Campo Grande
0 200 400 600 Mi.
0 200 400 600 800 Km.
N
30 October 1985 CARTOGRAPHIC LABORATORY, UNIVERSITY OF WISCONSIN - MADISON

Figure 4

To continue a metaphor used earlier, Basic Sociological Region I, The Developed South, is a sea of populous and relatively developed microregions containing a few islands of less-developed microregions. Region II, The Underdeveloped Northeast, is a sea of populous less-developed microregions containing a few islands of more developed microregions. The latter surround the state capitals: Vitória, Salvador, Aracajá, Maceió, Recife, and Fortaleza. Region III, The Undeveloped Frontier, is a sea of sparsely populated and less-developed microregions containing a few sparsely populated islands of developed microregions.

This map of Basic Sociological Regions of Brazil (figure 4) is a refined regionalization despite the fact that it presents only three regions. It is called "refined" because its boundaries are drawn from microregions, rather than states and territories, which of course are much larger than microregions. As seen earlier, it is useful for some purposes to allocate each dissected state or territory to the region containing the bulk of its population. This yields the "State Level" three-way regionalization seen in figure 5. Perhaps the only surprising aspect of this procedure is that it locates the State of Espírito Santo to the Underdeveloped Northeast.

Manufacturing and Socioeconomic Development

Early in the paper there was a discussion of the possibility that modern manufacturing might be the most important variable measuring the socioeconomic development of microregions. It was determined that microregional emphasis on manufacturing was indeed a valid variable. Two conceptually distinct operational definitions (Manufacturing Employment per Worker [$MEmp/_W$] and Manufacturing Energy Potential per Capita [$MEng/_K$] were found to be correlated at $r = +.999$. But manufacturing emphasis turned out to be but one of a set of variables measuring microregional

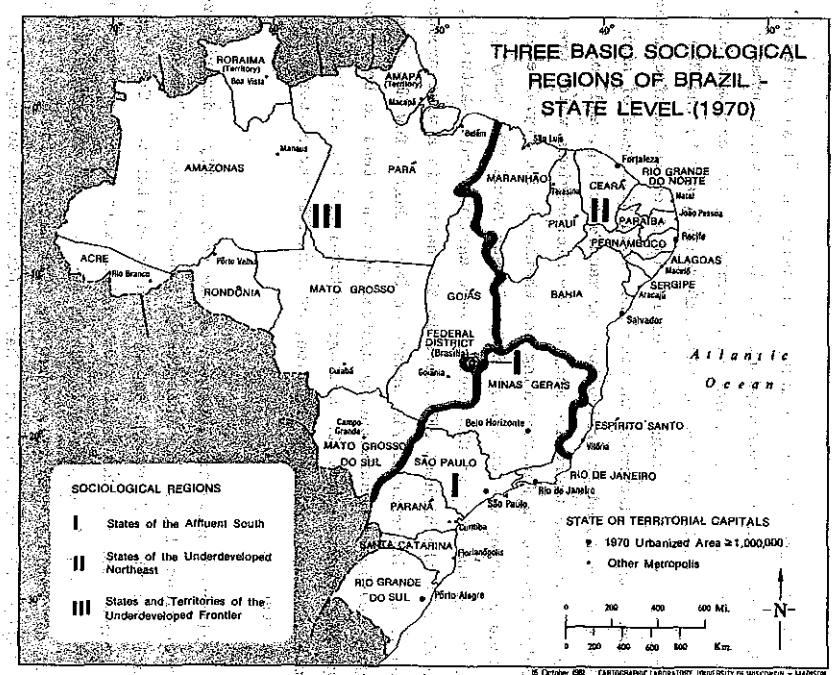

THREE BASIC SOCIOLOGICAL REGIONS OF BRAZIL - STATE LEVEL (1970)
RORAIMA
AMAPÁ
AMAZONAS
PARÁ
MARANHÃO
CEARÁ
RIO GRANDE DO NORTE
PIAUÍ
PARAÍBA
PERNAMBUCO
ALAGOAS
SERGIPE
ACRE
RONDÔNIA
MATO GROSSO
GOIÁS
BAHIA
FEDERAL DISTRICT (Brasília)
MINAS GERAIS
ESPÍRITO SANTO
MATO GROSSO DO SUL
SÃO PAULO
RIO DE JANEIRO
PARANÁ
SANTA CATARINA
RIO GRANDE DO SUL
Atlantic Ocean
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-
15 October 1980 CARTOGRAPHIC LABORATORY, UNIVERSITY OF WISCONSIN – MADISON

Figure 5

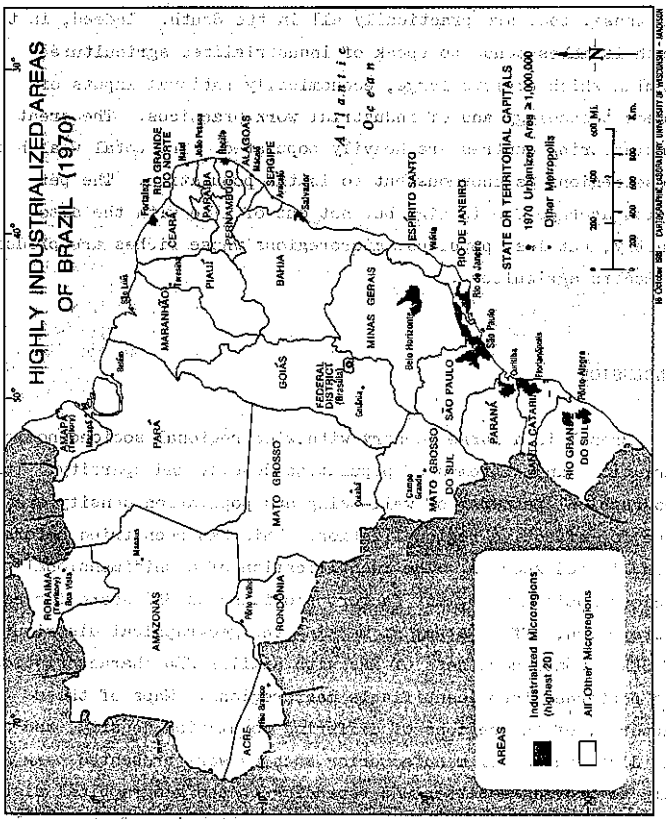
socioeconomic development. In a factor analysis it was found to contribute to the identification of the SED factor but other variables were still more sensitive definers of SED in that their item-factor loadings were higher.

The failure of manufacturing to provide the "lead variable" in the definition of microregional SED is a fact which demands explanation. A study was made to determine 1) the economic base of the microregions on the highest SED decile; and 2) the SED scores of the microregions most heavily involved in manufacturing. This was done to determine whether the productive base of high SED was to be found in agriculture or manufacturing, and to determine whether there are many or few microregions which are deeply involved in manufacturing and whether a deep involvement in manufacturing yields a high SED. It was found that many of the MRs in the highest SED deciles were agricultural. Actually, the MR with the highest SED score in the nation is a wine-producing area in the interior of Rio Grande do Sul. Only a few MRs have highly developed manufacturing systems and they tend to be in the high SED ranges. Most MRs are agricultural and the absolute number, though not the proportion, of high SED agricultural MRs is substantial.

Figure 6 shows the location of the most highly industrialized microregions (1970). In this case, "industrialization" means absolute number of persons employed in manufacturing. The highest, of course, was the São Paulo microregion, with almost one million persons (907,000) employed in manufacturing. But the numbers drop off rapidly. By this count the 20th microregion from the top in industrialization had less than 20,000 persons so employed.

This then is the explanation. While Brazil's manufacturing system is powerful, it is concentrated in but a few of the nation's 360 continental microregions. These are mostly in the South.

Figure 6


HIGHLY INDUSTRIALIZED AREAS OF BRAZIL (1970)
Atlantic Ocean
AREAS
Industrialized Microregions (Highest 20)
All Other Microregions
STATE OR TERRITORIAL CAPITALS
1970 Urbanized Area ≥1,000,000
Other Metropolis
AMAZONAS
PARÁ
MARANHÃO
PIAUÍ
CEARÁ
RIO GRANDE DO NORTE
PARAÍBA
PERNAMBUCO
ALAGOAS
SERGIPE
BAHIA
GOIÁS
MINAS GERAIS
ESPÍRITO SANTO
RIO DE JANEIRO
SÃO PAULO
PARANÁ
SANTA CATARINA
RIO GRANDE DO SUL
MATO GROSSO
MATO GROSSO DO SUL
RONDÔNIA
ACRE
AMAPÁ
RORAIMA
FEDERAL DISTRICT (Brasília)

Most of the rest of Brazil's MRs are agricultural and many of these are preindustrial, as much subsistence as commercial. But some of the nation's richest microregions are also agricultural and these, too, are practically all in the South. Indeed, in the South it makes sense to speak of industrialized agriculture, farming which employs large, economically rational inputs of modern technology and of industrial work practices. The great manufacturing centres are heavily populated. The total wealth in these regions is enormous but so is the population. The per-capita average SED is high but not out of line with the also wealthy, but less populous, microregions whose riches are produced by modern agriculture.

CONCLUSION

Brazil is a large country with wide regional socioeconomic variations and extremes of population density and sparsity. Its geographical patterns of well-being and population density are ripe for effective regionalization. This has been tried before, with limited success. The identification of a unidimensional socioeconomic development factor, providing an SED score for each microregion, offers a way of marking the geographical distribution of SED. Contiguous sets of MRs with similar SED characteristics are patterned into identifiable macroregions. Maps of these patterns, of the regions of differing population density, and of the distribution of manufacturing such as were presented here may help to provide a better understanding of the geographical distribution of differences in socioeconomic well-being of the people of Brazil. Perhaps, too, the methods illustrated herein may be useful in determining the socioeconomic development geography of other large, unevenly developed nations.

NOTES

* This paper was prepared as part of a project on Brazilian social stratification and development, which is supported by the National Science Foundation (Grant SES 78-07414), the University of Wisconsin College of Agricultural and Life Sciences, the Institute of Advanced Studies of the Australian National University, and the University of São Paulo, with the assistance of the Brazilian Institute of Geography and Statistics. I express my gratitude to the individuals at these institutions who have contributed to this project. The maps were prepared at the Cartographic Laboratory, University of Wisconsin-Madison. This paper was written while the author was in residence as Visiting Fellow in Sociology at the Institute of Advanced Studies of the Australian National University. It is an expanded version of another publication by the author, "A Socioeconomic Regionalization of Brazil," Geographical Review 72 (October 1982): 450-64. Parts are reprinted herein with the permission of the American Geographical Society.

1/ Werner Baer, "The Brazilian Growth and Development Experience" in Riorden Roett, ed., Brazil in the Seventies (Washington, D.C.: American Enterprise Institute for Public Policy Research, 1976), pp. 41-62; Werner Baer, "Evaluating the Impact of Brazil's Industrialization," and Fernando Homen de Mello, "Economic Policy and the Agricultural Sector in Brazil," both in Haller, Archibald O., ed., Socioeconomic Change in Brazil Luso-Brazilian Review (special issue) 15 (1978): 178-90 and 195-222; Stefan H. Robock, Brazil: A Study in Development Progress (Lexington, Mass.: Lexington Books, 1975); and Thomas W. Merrick and Douglas H. Graham, Population and Economic Growth in Brazil: 1800 to the Present (Baltimore: Johns Hopkins University Press, 1979), pp. 17-24.

2/ Ronald M. Schneider, Brazil: Foreign Policy of a Future World Power (Boulder, Colo.: Westview Press, 1976).

3/ John P. Dickenson, Brazil: Studies in Industrial Geography (Boulder, Colo.: Westview Press, 1978).

4/ The criterion of four or more inhabitants was chosen to be consistent with that of published demographic research distinguishing densely from sparsely populated regions. See Michael L. Yoder and Glenn V. Fuguitt, "Urbanization, Frontier Growth and Population Redistribution," Luso-Brazilian Review 16 (1979): 67-90.

5/ E. Robock, Brazil: Study in Development Progress, pp. 75-85.

6/ Marcos G. da Fonseca, "An X-ray of the Brazilian Income Distribution: Decomposing Gini Coefficients," Luso-Brazilian Review 17 (1981). For trend data, see Shail Jain, Size Distribution of Income - A Compilation of Data (Washington, D.C.: World Bank, 1975).

7/ Highlights of the history of Brazil's regionalization work are given in Janet D. Henshall and R. P. Momsen, A Geography of Brazilian Development (London: G. Bell, 1980?), pp. 59-61.

8/ See Ibid., pp. 61-2, who cite an algorithm from B. J. L. Berry, "A Method for Deriving Uniform Regions," Przeglad Geograficzny 33 (1961): 263-79. For other recent examples, see Olinda Vianna Mesquita, Rivaldo Pinto Gusmão, and Solange Tietzmann Silva, "Modernizão da Agricultura Brasileira," Revista Brasileira de Geografia 39 (No. 4, 1977): 3-65. The empirical outputs of such research are underlain by considerable theoretical discussion, as for example in Speridião Faissol, "Espaço, Geografia e Ciências Sociais," Revista Brasileira de Geografia 37 (No. 4, 1975): 3-22.

9/ Merrick and Graham, Population and Economic Growth in Brazil, pp. 8-10; Robock, Brazil: A Study in Development Progress, pp. xvi and 75-85; and Dickenson, Brazil: Studies in Industrial Geography, pp. xx and 153-208. For an influential view which is less socioeconomic and much more geopolitical than the foregoing see Golberg do Couta e Silva, Geopolítica do Brasil (Rio de Janeiro: Editôra José Olympio, 1967), pp. 39-48 and 98-133, especially pp. 129-31.

10/ This ignores the Island of Fernando de Noronha, a Federal Territory lying 345 km off the Northeast coast. It is part of the Federative Republic of Brazil, but because it is small (17.4 km^2) and has few residents (1,342 in 1980), it is usually excluded from regionalization analyses and later, if at all, added to the neighbouring Northeastern region. Our phrase "continental Brazil" includes all Federal Units, except this island.

11/ For example, a recent analysis (Mesquita, Gusmão, and Silva, "Modernizão da Agricultura Brasileira") of Brazil's agricultural regions was based upon twenty-eight variables measured on each of the 360 continental microregions. Five factors, presumably orthogonal, absorbed 68.84 per cent of the correlation matrix variance. Not one absorbed over 20 per cent and the smallest was 8.54 per cent. Only thirteen of the variables had factor loadings over $\pm$ .70. The authors' interpretations of each, together with my own reinterpretations in parentheses, are these: 1) "Field crop modernization" (stock farming technology intensity); 2) "Stock farm-

ing modernization" (stock farming technology intensity); 3) "Mechanization" (net capital intensity); 4) "Agricultural land use density" (land use intensity); 5) Elemental level of agricultural modernization (human labour vs. animal power intensity). A further factor analysis was performed on 257 microregions which were "not consistently highly modernized." It is important to note that practically all of the remaining 103 microregions are in the "Developed South," meaning that the "Consistently Modernized" microregions are almost all in that region. This yielded four even weaker factors: 1) "Stock farming modernization linked to agriculture" (net capital intensity?); 2) "Modernization of crop farming together with modernization in general" (human labour versus animal power intensity?); 3) "Modernization of dairying" (land use intensity?); 4) "Modernization of agricultural systems" (biotechnology intensity?). The authors were evidently aware of how awkward it would be to map all the factors of either set simultaneously, and wisely put each on a different map. Even so, their conclusions amount to dividing up Brazil into regions varying by degree of agricultural "modernization" (figure 11).

12/ Henshall and Momsen, A Geography of Brazilian Development, pp. 61-9. Speridião Faissol of IBGE in Rio de Janeiro is developing another regionalization of Brazil. Its guiding idea is that the concepts of core and periphery can be employed at several levels in the analysis of the enduring imbalances in the spatial organization of the economy and population of Brazil. He uses the concepts of core and periphery to make several distinctions: metropolitan areas vs. their hinterlands; nuclei of industrial development vs. their less developed surroundings; the vast populated near-coastal regions vs. the even vaster empty interior; and, within the populous, less developed regions, the "developing periphery," vs. the "depressed periphery." At the time of this writing, Faissol's system was available only in an intriguing but much too abbreviated preliminary version. It appears that when the full version is published it may offer a rigorously constructed, comprehensive, and reasonable representation of the territorial distribution of the population and of the productive system, as well as of the socioeconomic well-being of the population.

13/ Instituto Brasileiro de Geografia e Estatistica (IBGE), Divisão do Brasil em Microregiões Homogêneas (Rio de Janeiro: IBGE, 1970), pp. viii-ix.

14/ See Baer, "The Brazilian Growth and Development Experience," pp. 178-9; and Robock, Brazil: A Study in Development Progress, pp. 40-74.

15/ Perhaps the best single example of this research is to be found in William H. Sewell, The Construction and Standardization of a Scale to Measure the Socioeconomic Status of Oklahoma Farm Families (Technical Bulletin, No. 9) (Stillwater, Okla.: Oklahoma State University, Agricultural Experiment Station, 1940).

16/ See Archibald O. Haller and Hélcio Ulhôa Saraiva, "Status Measurement and the Variable Discrimination Hypothesis in an Isolated Brazilian Region," Rural Sociology 37: 325-51.

17/ The official microregion identification numbers are those given in IBGE, Divisão do Brasil em Microregiões Homogêneas. They are used extensively in IBGE's documents.

18/ The Federal Government made two changes in the legal standing of some of the states and territories after IBGE had collected the data. First, as we have seen, the former State of Guanabara was merged into Rio de Janeiro. Second, the former State of Mato Grosso was divided into two. These are now called "Mato Grosso do Sul" and "Mato Grosso." This article follows the state and territorial boundaries of 1981 rather than those of 1970. Also, the new State of Mato Grosso is referred to herein as "Mato Grosso do Norte" to avoid confusion with the former State of Mato Grosso. The maps also incorporate this convention.

19/ Fernando de Noronha, the tiny and faraway island, is not part of continental Brazil and thus, was not considered. The usual solution is to add it to the area we have called Region IV. This seems reasonable.

Appendix A. Continental Brazilian Microregional Socioeconomic Development Scores (Factor-weighted, theoretical range: 0-100)

Official Micro Region Number	SED Score	Official Micro Region Number	SED Score
A. Top Decile (Highest)		B. 9th Decile	
182	86	25	79
218	89	178	79
224	97	215	79
228	84	217	82
236	87	221	84
237	92	230	78
241	84	231	81
242	88	234	83
243	86	235	80
244	87	238	83
246	90	239	83
247	88	240	78
248	89	245	83
249	87	250	82
254	86	251	79
256	86	252	79
257	93	255	80
258	85	259	84
262	93	260	79
266	88	272	81
268	90	273	81
294	92	281	80
300	87	282	83
303	89	292	84
305	85	293	82
308	95	296	80
309	93	297	80
311	100	298	78
313	87	307	83
316	85	312	84
317	85	314	83
318	90	315	81
319	90	322	81
321	85	324	82
327	86	326	82
329	96	331	84

C. Fourth Quintile

Official Micro Region Number	SED Score	Official Micro Region Number	SED Score
3	61	253	77
10	63	261	76
11	62	263	62
59	65	267	67
111	70	269	71
120	64	271	68
129	67	274	61
150	76	275	65
170	73	276	71
172	62	278	67
177	64	279	75
179	63	280	71
183	64	283	72
186	76	284	66
187	74	285	66
190	65	288	65
194	71	289	66
195	67	290	72
196	62	291	73
197	78	295	74
198	69	299	63
199	62	301	73
200	78	302	74
201	64	304	72
202	73	306	77
207	75	310	70
213	67	320	70
216	61	323	75
219	78	325	68
220	65	328	77
222	71	338	63
223	69	342	75
225	76	354	63
226	73	361	76
227	76		
229	74		
232	68		
233	76		

D. Third Quintile

Official Micro Region Number	SED Score	Official Micro Region Number	SED Score
1	53	188	51
17	45	189	45
18	40	191	58
21	44	192	42
24	39	193	54
27	59	204	54
31	57	205	44
47	42	206	58
78	39	208	48
79	44	209	54
84	52	210	50
86	41	211	56
90	39	212	59
93	48	214	60
96	38	264	44
97	54	265	57
108	45	277	48
110	40	286	57
124	40	287	48
125	39	330	57
126	38	335	51
127	50	336	42
128	45	339	42
140	38	340	52
142	38	341	44
143	40	343	59
145	39	344	51
151	45	353	39
154	49	355	42
160	41	356	45
161	41	357	56
166	53	358	55
171	54	359	55
173	55	360	55
175	51		
180	59		
181	60		
184	43		

E. Second Quintile

Official Micro Region Number	SED Score	Official Micro Region Number	SED Score
6	26	107	33
7	30	109	33
8	32	112	36
9	36	113	30
12	38	115	28
13	26	116	27
14	29	119	33
15	37	121	35
16	30	123	34
22	32	130	31
28	29	137	30
60	28	138	35
61	34	141	26
63	34	144	32
64	29	146	29
65	28	147	34
66	28	148	33
67	32	149	25
68	29	152	33
70	31	153	30
71	26	158	26
73	33	162	31
74	31	168	32
76	28	169	28
81	31	174	31
85	27	176	33
87	25	185	34
89	28	203	34
92	28	270	33
94	31	332	32
95	34	333	31
98	27	334	33
99	26	337	35
100	26	350	33
103	34		
104	36		
105	26		
106	35		

F. First Quintile

Official Micro Region Number	SED Score	Official Micro Region Number	SED Score
2	20	75	23
4	15	77	19
5	11	80	15
19	23	82	25
20	16	83	25
23	19	88	19
26	13	91	21
29	5	101	21
30	12	102	22
32	6	114	23
33	5	117	15
34	7	118	22
35	14	131	9
36	15	132	13
37	5	133	10
38	19	134	20
39	4	135	23
40	10	136	21
41	5	139	23
42	6	155	24
43	1	156	21
44	8	157	18
45	20	159	13
46	15	163	12
48	11	164	19
49	12	165	18
50	20	167	24
51	15	345	12
52	3	346	13
53	0	347	1
54	11	348	17
55	2	349	5
56	12	351	19
57	20	352	6
58	22		
62	24		
69	24		
72	22		

Source: IBGE, Divisão do Brasil em Microregiões Homogêneos - 1968 (Rio de Janeiro, 1970).

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