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Spatial Configurations of the Brazilian States with Respect to Human Migration

by

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ABSTRACT

Functional regions underlying population redistribution in a spatial system can be defined as the clusterings of proximate administrative units characterized by large transactions of migrants in standardized and nonstandardized measures. Multidimensional scaling technique was applied to the Brazilian migration data in order to identify functional regionalization in the nation. An interstate migration matrix, augmented by intrastate moves, was constructed for males from the 1970 census. Three proximity matrices were derived from the migration matrix—a) nonstandardized matrix, b) standardized matrix unadjusted for intrastate moves, and c) standardized matrix adjusted for intrastate moves. To make interstate distances in a two-dimensional space robust against unestimable proportions of primary movers in the data, we imposed rank order transformation on the proximity information. The central regions were identified in three configurations around the clustering of the core states—Minas Gerais, Rio de Janeiro, Sao Paulo and Matto Grosso. Three semi-core states—Bahia, Parana and Distrio Federal—joined the core states in forming the central regions, though not consistently. Suggestions for future studies were made after discussion about the possible factors responsible for the observed clustrings and differentiation of the states.

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1. Introduction.

The states of Rio de Janeiro and Sao Paulo have been the major centers of development in Brazil and have attracted opportunity-seeking migrants across the nation. (See Figure 1 and Table 1 for a map and listing of the Brazilian states.) According to the 1970 census (IBGE,

Insert Figure 1 and Table 1 about here

1973) the two states together absorbed approximately 40 percent of all the interstate migrants. As is generally believed, the principal source of these flows originate in the impoverished, stagnant Northeast region, comprising approximately 45 percent of migration into the two states. However, such descriptions based on the statistics aggregated at the level of administrative regions seem to have limited practical value and to be misinformative about the functional regionalization formed through the exchanges of human resources.

The aggregated statistics, for example, tend to mask the significant streams flowing out Minas Gerais into Rio de Janeiro and Sao Paulo which far exceed in size that of any single state of the Northeast region. Also, they tend to conceal diversification among the states in the region with respect to migration patterns and links to the development centers. The figures shown in Tables 2.1 and 2.2

Insert Tables 2.1 and 2.2 about here

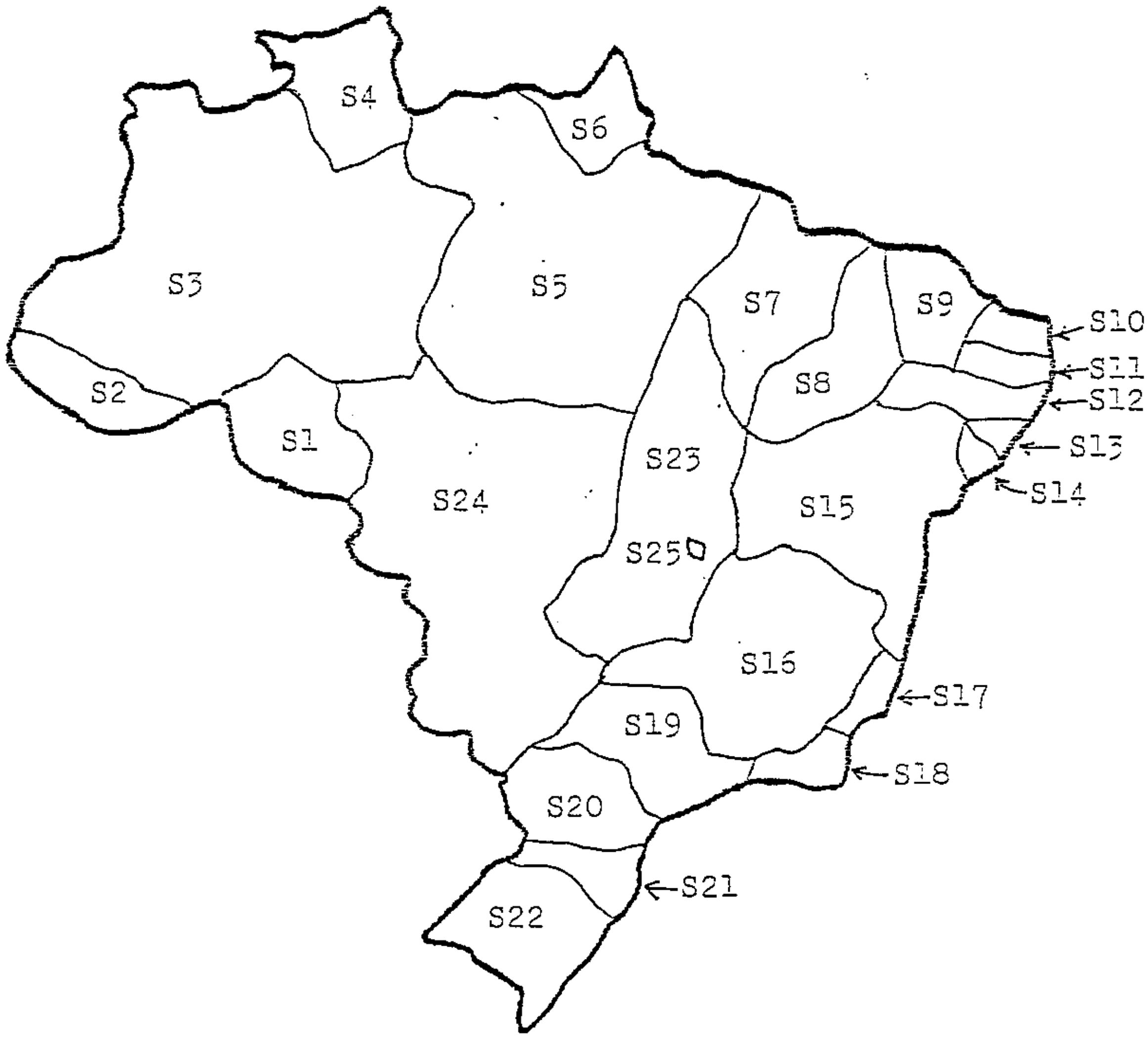

Figure 1. Brazilian States

Table 1.

Brazilian states

North	Southeast
S1 Rondonia	S16 Minas Gerais
S2 Acre	S17 Esprito Santo
S3 Amazonas	S18 Rio de Janeiro
S4 Roraima	S19 Sao Paulo
S5 Para	**South**
S6 Amapa	S20 Parana
Northeast	S21 Santa Catarina
S7 Maranhao	S22 Rio Grande do Sul
S8 Piaui	**Central-East**
S9 Ceara	S23 Mato Grosso
S10 Rio Grande do Norte	S24 Goias
S11 Paraiba	S25 Distrio Federal
S12 Pernambuco	
S13 Alagoas	
S14 Sergipe	
S15 Bahia	

Table 2.1

Rank order of the states of origin which account for more than 10 percent of immigration into Rio de Janeiro and Sao Paulo

	Destination			
Rank Order	Rio de Janeiro		Sao Paulo	
1	Minas Gerais	(30.9%)	Minas Gerais	(36.4%)
2	Esprito Santo	(12.6%)	Bahia	(19.5%)
3	Paraiba	(10.7%)	Pernanbuco	(10.6%)

Source.--Fundacao IBGE (Instituto Brasileiro de Estatistica), Departmento de Censos. (1973). Censo Demographico, 197o. Rio de Janeiro.

[Note.] Percentage figures in parentheses are the proportions of immigrants.

Table 2.2

Preference ranks accorded to Rio de Janeiro and Sao Paulo by emmigrants from the Northeast, based on the relative proportions of migration volumes.

	Destination			
Origin	Rio de Janeiro	Sao Paulo	Other States	
Maranhao	4 (1o.4%)	6 (3.3%)	Goias	1 (41.7%)
Piaui	6 (3.4)	3 (8.8)	Maranhao	1 (56.9)
Ceara	3 (12.5)	2 (16.3)	Maranhao	1 (21.2)
Rio Grande do Norte	1 (24.3)	2 (14.1)	Paraiba	3 (11.1)
Paraiba	1 (31.1)	3 (13.6)	Pernanbuco	2 (16.7)
Pernanbuco	2 (18.1)	1 (35.2)	Parana	3 (1o.1)
Alagoas	2 (14.2)	1 (4o.8)	Parana	3 (13.4)
Sergipe	3 (19.2)	1 (37.5)	Bahia	2 (21.4)
Bahia	3 (1o.2)	1 (47.2)	Parana	2 (12.4)

Source.--Fundacao IBGE (Instituto Brasileiro de Estatistica), Departmento de Censos. (1973). Censo Demographico, 197o. Rio de Janeiro.

[Note.] Figures enclosed in parentheses are relative proportions among emmigrants. Information about other highly preferred states are also shown for the comparative purposes.

will illustrate the points in question, though they pertain only to males. (Inclusion of females do not affect the generality of our argument.) An implication we can draw from Table 2.1 is that attempts to control influx into Rio de Janeiro and Sao Paulo will be effective if directed to the push-pull relationships with Minas Gerais rather than with the vast territory of the Northeast. Concerning Table 2.2, it is clear that attraction of the two states is weaker than that of much less developed Goias and Maranhao to those who left the northern three states of the region. Among emmigrants from the rest of the states in the region, either Rio de Janeiro or Sao Paulo enjoys the most preferred status as destination. Still, one should not overlook the importance of the states of Paraiba, Pernambuco, Bahia and Parana as receiving areas. The observed patterns appear to be the products of complex interactions of physical distance, various kinds of push-pull factors in addition to networks of transportation and information.

These preliminary findings gave us a strong impetus to conducting more systematic analysis of population movements among all the states in the nation. The objective of our initial study is to provide basic information about the functional spatial systems resulting either from or reponsible for, or both, population movements in the nation. Thus obtained knowledge, when combined with similar analysis on the flows of goods, capital and information, should help us gain deeper insight into the mechanisms underlying the phenomenon of human migration.

Rephrased in more concrete terms, our present purpose is to identify clusterings of the Brazilian states by migration volumes as measures of the interstate proximities. That is

$$o_{ij} = m_{ij} \qquad (1)$$

where o_{ij}, m_{ij} denote the proximity and migration volume from state i to j. Slater (1975, 1976) who shares the same basic interest with us proposed application of cluster analysis to find functional regionalization after adjusting migration volumes for size effects associated with origins and destinations. Although he maintained that his approach led to the discovery of previously unnoticed relationships among the administrtive units in Russia (1975) and Japan (1976), it lacks pursuasiveness because of the following problems:

1) Slater equated the migration volume with the distance between administrative units. This means that he assumed equal weight or importance attached to each person who belongs to the same element in the transaction matrix. (Whether the matrix is adjusted for row and column totals is not crucial at this point.) The assumption he tacitly made appears unrealistic when the presence of dependent migrants accompanying primary movers is also taken into consideration.

2) In his devisive clustering procedure, he failed to fully utilize asymmetry in the transaction matrix; for a given pair of units, the value of the critical link, c_{ij}, was a smaller volume of migrants exchanged between them. To put it formally,

$$c_{ij} = \underline{\min}\,(m_{ij}, m_{ji}), \qquad (2)$$

where m_{ij} is the volume of movers from unit i to j.

As a solution to the problems, we suggest the use of multidimensional scaling. The technique, developed by psychometricians (see, Kruskal and Wish, 1973; Takane, 1978), is designed for placing objects in a multidimensional space in which the distances between pairs of objects, $\underline{d}_{ij}$, correspond to their proximities:

$$\underline{d}_{ij} \sim \underline{f}\ (\underline{o}_{ij}) \qquad (3).$$

For technical reasons, proximity data must be first converted into disproximity data, o^*, for instance, by

$$\underline{o}^*_{ij} = \text{constant} - \underline{o}_{ij}\ . \qquad (4)$$

To maintain consistency, however, we will use the term proximity throught the paper, provided that readers understand that $\underline{o}^*_{ij}$ instead of $\underline{o}_{ij}$ enter the actual computations.

Suppose that we have obtained a reasonable configuration of all the states in a two-dimensional space, the position of state $\underline{i}$ can be indicated by its coordinates on the two axes ($\underline{x}_{i1}$, $\underline{x}_{i2}$).. The (squared) distance between two states in this space, $\underline{d}_{ij}$, will be

$$\underline{d}^2_{ij} = \sum_{\underline{a}}^{2} \underline{v}_{ia}\ (\underline{x}_{ia} - \underline{x}_{ja})^2, \qquad (5)$$

where $\underline{v}_{ia}$ is a weight on the $\underline{a}$th axis assigned to state $\underline{i}$ included to handle asymmetry in the proximity matrix, $\underline{O}$. Note that

$$\underline{d}_{ij} = \underline{d}_{ji} \text{ only if } \underline{v}_{ia} = \underline{v}_{ja}\ . \qquad (6)$$

We still need some device to relate proximity to distance. This will be done by defining $\underline{f}$ of equation (5) as monotonic transformation which preserves rank order information in the proximity matrix, $\underline{O}$. As a result, the following condition will be satisfied for all pairs of the states:

$$\underline{d}_{ij} > \underline{d}_{kl} \longleftarrow \underline{o}_{ij} < \underline{o}_{kl}\ . \qquad (7)$$

Because of monotonic transformation, the obtained configuration is less vulnerable, as compared with Slater's linear transformation approach, to some variations in the proximity data as long as rank orders in the data remain unaffected. Variations in the proximities may arise from sampling errors or from the differences in the estimated proportions of primary movers in $\underline{m}_{\underline{ij}}$. Common to the two approaches is an assumtion of constant death rates among migrants. The assumption is necessary in dealing with most published census data.

Before closing this section, we shall comment on standardization of migration volumes by the IPFP (iterative proportional fitting procedure). Descriptive studies (e.g., Castro, Neto, Grabois et al, 1976) often utilize nonstandardized raw migration volumes. The method is pertinent where interests lie in the assessment of the absolute size of the volumes. For instatnce, different public services may be required to accomodate incoming migrants depending on their numbers. However, standardization of the data is desirable if one wishes to base his study on hypothetical magnitudes that would have resulted had there been no differences in the total number of immigrants and emigrants for all states. The IPFP (see, Fienberg, 1970) is suitable for this purpose. In brief, given a table of cross-classified data, the IPFP alternatively scale internal cells such that they sum to desired marginal totals. The iteration for scaling will be repeated until cell values in two successive cycles agree sufficiently well. It is known that the IPFP preserves statistical interactions among cells defined by crossproduct ratios,

$$(\underline{m}_{\underline{ij}} / \underline{m}_{\underline{ik}})(\underline{m}_{\underline{hk}} / \underline{m}_{\underline{hj}}) \qquad (\underline{i} \neq \underline{h},\ \underline{j} \neq \underline{k}). \qquad (8)$$

By fitting a migration matrix to uniform row and column margins, we are able to analyze standardized migration flows from which the size effects associated with origins and destinations are removed. Besides the statistical advantage, the IPFP allows what is not usually embodied in the analysis of inter-unit migration: examination of inter-unit migration in light of intra-unit migration. Slater (1976) also recognized the merit of including intra-unit moves in standardizing migration matrices where possible. Introduction of the intra-unit moves in the IPFP for the Brazilian case enable us to evaluate proximities among the states adjusted for the gravity of the states holding opportunity-seekers within their boundaries. However, the method should not be considered, in any definite sense, superior to the other two methods discussed above: nonstandardized and standardized matrices with intrastate moves deleted. The relative utility of the methods depends on research purposes. Since our objective is to provide basic information for further investigations, it seems appropriate to present different spatial configurations of the Brazilian states resulting from the three proximity matrices.

2. METHOD.

Data.—The migration matrix shown in Table 3 was formed from the 1970 Population Census data (IBGE, 1973) on the moves for those who were living in municipios other than their birthplaces. To avoid confounding effects of sex, information about females was omitted from the analysis.

Insert Table 3 about here

Proximity matrix.—Three proximity matrices were prepared: A) nonstandardized matrix which is in fact the migration matrix with the diagonal cells deleted, B) standardized matrix without adjustment for intrastate migration, and, C) standardized matrix adjusted for intrastate migration. Standardization of the proximity matrices was performed by the IPFP to the uniform margins of 1000.

Multidimensional scaling.—Before computations, the proximities, o_{ij}, were converted into the disproximities, o^*_{ij}, by

$$o^*_{ij} = 1000 - o_{ij} .$$

The ASYMSCAL model in the ALSCAL program available in the SAS package was applied to the proximity matrices. We obtained two dimensional configurations for the ease of interpretations. The efficiency of scaling can be judged by Kruskal's stress 1 which measures how well a given configuration represents the data. Stress is a square root of the following quantity

$$\sum (f(o_{ij}) - d_{ij})^2 / \sum d^2_{ij} .$$

Functional regions.—Functional regions were operationally defined as clusters of more than one state all of which were located

Table 3.

INTRA- AND INTER-STATE MIGRATION VOLUMES IN BRAZIL, 1970:
MIGRATION DEFINED AS CHANGES OF MUNICIPIOS FROM BIRTH PLACES

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15
S 1	526	291	542	37	434	14	177	29	170	47	114	108	47	14	175
S 2	1937	3242	6728	105	1394	62	192	69	560	55	13	91	7	6	71
S 3	8459	5003	29700	1737	5244	144	393	100	1385	180	98	464	39	44	228
S 4	132	36	472	36	188	7	60	16	67	7	4	19	7	2	9
S 5	2104	839	9626	383	103638	20231	2584	238	1521	286	110	911	63	51	300
S 6	86	7	52	11	1804	430	106	45	138	11	7	41	1	2	46
S 7	1438	229	939	507	24819	279	210843	14595	3347	286	202	1226	60	93	497
S 8	546	209	380	126	5593	95	109616	74052	6440	203	244	3443	60	61	3062
S 9	5194	6572	9580	683	20151	759	82039	31946	261953	6037	5191	10474	1208	294	6627
S10	887	913	1158	206	2806	263	3925	680	13230	115300	16897	9699	574	196	2378
S11	769	494	959	173	2067	134	5800	1847	21593	31406	396977	54740	3561	480	11600
S12	628	306	846	86	1686	53	7915	3615	11571	3408	27783	129321	43952	2383	20484
S13	229	68	175	18	349	14	683	194	4943	415	954	25939	89213	10360	7697
S14	150	68	108	16	159	9	172	64	199	107	152	1162	3415	50493	29727
S15	617	122	241	46	2961	38	1687	3154	851	430	508	7111	1316	7794	493619
S16	1158	63	555	51	2233	70	1326	164	450	545	282	1058	409	175	39727
S17	559	18	54	6	618	9	405	31	57	51	47	204	98	88	3556
S18	280	162	820	75	1463	84	391	232	1309	1322	1364	4217	863	677	4020
S19	704	75	492	29	958	45	425	450	1632	595	855	4942	2631	1198	6831
S20	748	13	125	19	358	12	167	65	544	127	183	1140	571	223	1603
S21	57	14	53	17	106	6	30	9	45	57	18	176	25	46	207
S22	204	58	206	86	312	22	154	52	258	144	138	682	73	67	773
S23	1643	68	277	27	416	6	87	52	127	64	71	243	125	60	324
S24	251	24	120	23	9477	21	2188	197	145	103	95	185	33	10	756
S25	17	3	12	0	77	8	71	148	130	67	88	153	33	21	209

	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25
S 1	331	55	637	310	234	12	9	217	88	92
S 2	111	20	1712	819	712	100	94	201	127	233
S 3	375	67	7445	2252	200	33	92	414	179	537
S 4	25	1	108	90	19	1	12	23	21	48
S 5	603	122	16654	4273	409	75	250	813	2019	1492
S 6	41	5	336	195	61	1	3	119	27	85
S 7	960	89	13722	4322	401	66	162	2532	55055	6164
S 8	1204	91	6499	17015	2484	43	102	2299	20113	12792
S 9	3652	592	48833	62731	25626	207	496	13272	13882	10199
S10	12548	377	37002	21381	3426	131	310	2088	14592	6520
S11	6168	601	102183	44781	10603	116	283	4622	9286	14407
S12	8075	1090	89521	173723	50066	284	789	17371	9292	11066
S13	1808	884	30590	87694	20812	147	253	9469	1429	1651
S14	1835	1222	26597	52003	14076	80	159	4343	635	1468
S15	51378	18636	69142	319832	84301	336	680	35814	53391	17248
S16	1117091	76354	295220	595870	296109	1137	1620	50660	188826	49006
S17	22337	141090	120575	12237	20304	121	284	5222	1569	2707
S18	27185	13973	456314	62234	17470	1492	3703	2416	1677	17680
S19	41950	931	46178	2224582	411737	2089	4288	93018	21704	7839
S20	3433	345	6875	106926	677282	18443	3647	15383	1758	1788
S21	973	124	7851	17157	154326	241796	34607	1423	496	1172
S22	1757	241	18200	17777	177290	133577	760730	4673	681	1036
S23	1638	90	6979	24479	4091	391	782	82227	7148	1655
S24	10284	77	2143	8381	1239	114	164	19494	250440	31743
S25	591	68	1199	1070	493	58	132	191	1798	0

mutually within short distances ($\underline{d}_{ij}$ < .600). The criterion was chosen after several experiments on the results of our pilot study.

3. RESULTS.

The configurations (Configurations A, B and C) produced from the three proximity matrices are presented in Figures 2A, 2B and 2C. The

Insert Figures 2A, 2B and 2C about here

stress for each configuration was reasonably small (.232, .213 and .210 for Configurations A, B and C), indicating the satisfactory fit of the two-dimensional solution to the data. The interstate distances in these configurations are shown in Tables 4A, 4B and 4C. Short ($\underline{d}_{ij}$

Insert Tables 4A, 4B and 4C about here

≤ .400) and intermediate (.400 ≤ $\underline{d}_{ij}$ ≤ .600) distances are respectively, denoted by solid and broken lines in Figures 2A, 2B and 2C. The double headed arrows in the figures indicate that the interstate distances in both directions are within the same range. Standardization of the proximty data yielded similar configurations (Configurations B and C) with more distinctive clusterings than the one based on the nonstandardized data (Configuration A). This is reflected in the number of uni- and bilateral linkages in three configurations: (44, 42), (12, 49) and (18, 40) in order of Configurations A, B and C. The distinction between the short and intermediate distances was no longer made in finding functional regions. The size and constituent states of the regions identified in each configuration at the selected level ($\underline{d}_{ij}$ < .600) are listed in Table 5.

Insert Table 5 about here

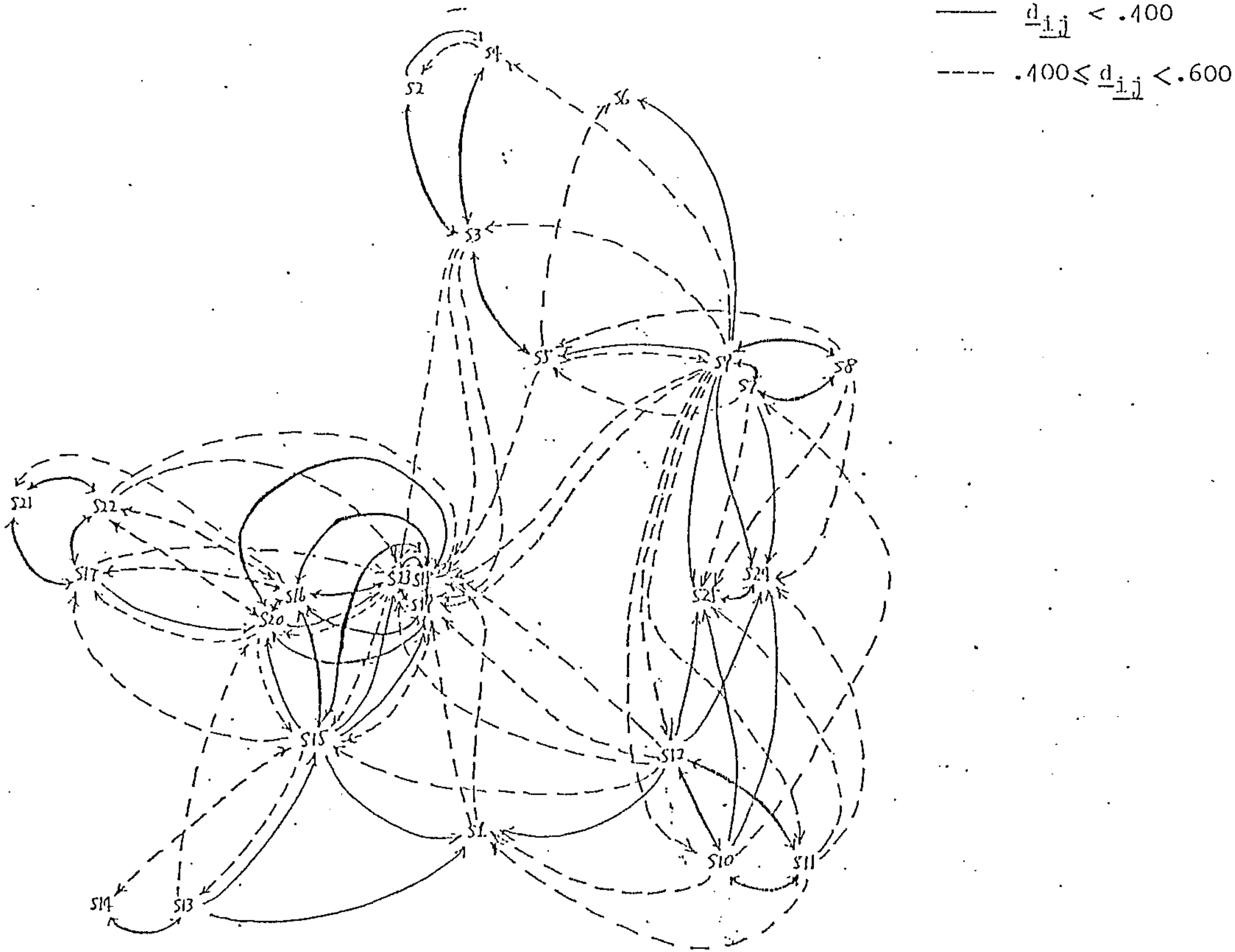

Figure 1 A. Configuration A of the Brasilian states based on the nonstandardized proximity matrix.

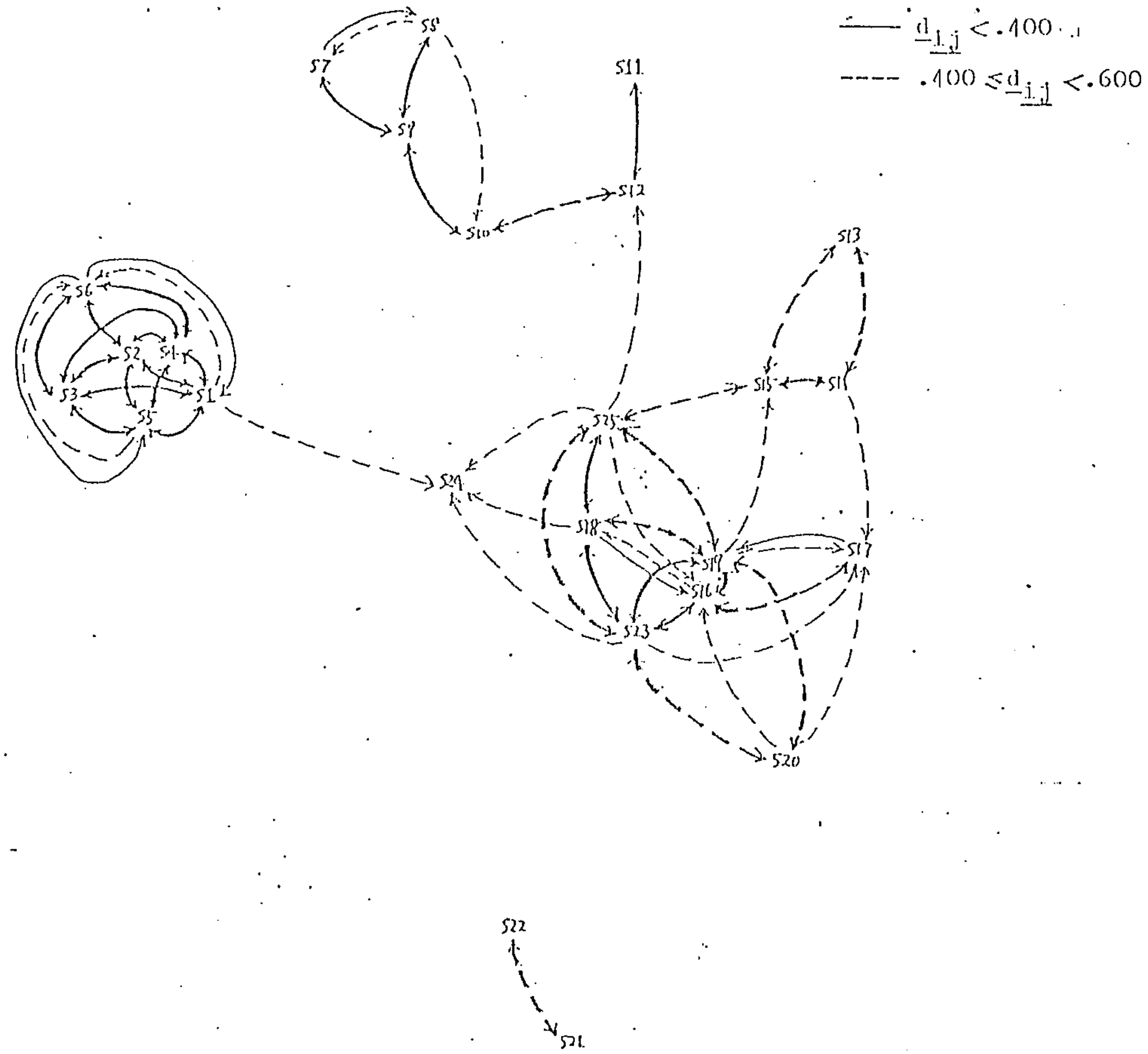

Figure 2.B. Configuration B of the Brazilian states based on the standardized proximity matrix without adjustment for intrastate migration.

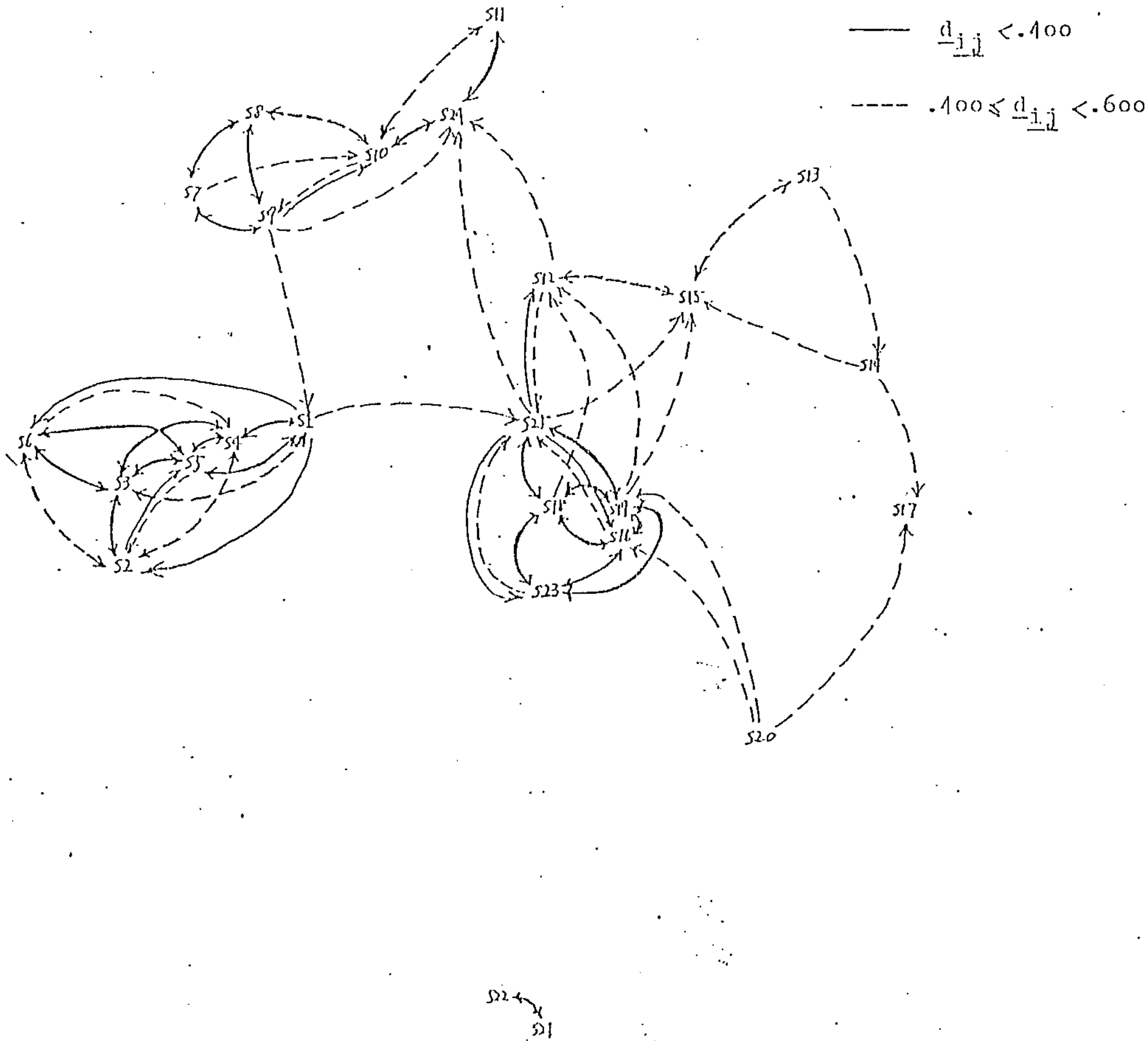

Figure 2 C. Configuration C of the Brazilian states based on the standardized proximity matrix with adjustment for intrastate migration.

Table 4A.

INTERSTATE DISTANCES IN BRAZIL BASED ON THE NONSTANDARDIZED PROXIMITIES

	S 1	S 2	S 3	S 4	S 5	S 6	S 7	S 8	S 9	S10	S11	S12	S13	S14	S15
S 1	0.0	1.482	1.137	1.402	0.943	1.529	1.532	2.010	1.475	1.200	1.665	0.997	1.446	1.900	0.847
S 2	1.385	0.0	0.367	0.274	0.604	0.775	1.372	1.724	1.304	1.042	2.085	1.600	1.673	1.654	1.225
S 3	0.881	0.350	0.0	0.271	0.319	0.623	1.150	1.573	1.077	1.409	1.710	1.181	1.489	1.790	0.960
S 4	1.593	0.447	0.376	0.0	0.700	0.840	1.777	2.373	1.669	2.264	2.609	1.939	2.439	2.862	1.695
S 5	0.991	0.671	0.306	0.631	0.0	0.571	0.635	0.952	0.501	1.176	1.338	0.946	1.520	1.727	1.027
S 6	1.667	1.014	0.756	0.669	0.657	0.0	0.878	1.274	0.800	1.694	1.096	1.443	2.645	3.000	1.965
S 7	1.084	0.944	0.655	0.870	0.451	0.646	0.0	0.234	0.044	0.967	0.980	0.708	1.602	1.752	1.177
S 8	1.174	0.981	0.743	0.903	0.500	0.660	0.206	0.0	0.232	1.015	0.990	0.864	1.651	1.732	1.260
S 9	0.685	0.637	0.459	0.561	0.322	0.376	0.032	0.207	0.0	0.574	0.596	0.469	1.090	1.227	0.815
S10	0.452	1.142	0.915	1.113	0.720	0.979	0.596	0.670	0.611	0.0	0.171	0.143	0.993	1.163	0.773
S11	0.493	1.216	0.989	1.204	0.804	1.070	0.655	0.686	0.676	0.137	0.0	0.238	0.932	1.068	0.760
S12	0.333	1.328	1.028	1.355	0.794	1.246	0.716	0.805	0.735	0.185	0.268	0.0	0.793	0.923	0.553
S13	0.356	1.645	1.363	1.719	1.166	1.675	1.214	1.326	1.225	0.603	0.704	0.622	0.0	0.102	0.358
S14	0.633	1.674	1.434	1.769	1.289	1.703	1.459	1.621	1.456	1.014	1.161	0.982	0.148	0.0	0.476
S15	0.352	1.358	1.073	1.442	0.892	1.430	1.069	1.250	1.065	0.770	0.930	0.659	0.409	0.519	0.0
S16	0.733	1.438	1.060	1.549	0.831	1.523	1.059	1.271	1.052	1.073	1.214	0.861	0.867	0.923	0.390
S17	1.197	1.878	1.428	2.032	1.179	2.008	1.437	1.663	1.431	1.562	1.699	1.306	1.227	1.211	0.749
S18	0.692	1.268	0.880	1.355	0.632	1.316	0.893	1.138	0.880	1.005	1.162	0.770	1.017	1.139	0.499
S19	0.642	1.485	1.062	1.579	0.776	1.517	0.966	1.194	0.962	0.951	1.101	0.710	0.974	1.089	0.430
S20	0.865	1.807	1.344	1.942	1.057	1.900	1.293	1.533	1.290	1.257	1.415	1.008	1.003	1.053	0.442
S21	1.516	1.876	1.450	2.051	1.257	2.063	1.595	1.030	1.579	1.910	2.056	1.626	1.520	1.489	1.034
S22	1.206	1.555	1.135	1.675	0.932	1.658	1.107	1.389	1.170	1.502	1.612	1.247	1.282	1.272	0.812
S23	0.842	1.642	1.177	1.766	0.916	1.777	1.396	1.768	1.364	1.434	1.707	1.145	1.250	1.457	0.560
S24	1.213	1.932	1.343	1.999	0.893	1.782	0.671	0.810	0.710	1.143	1.147	0.800	1.795	1.922	1.156
S25	1.329	2.486	1.746	2.587	1.177	2.338	0.976	1.171	1.029	1.208	1.314	0.847	2.031	2.184	1.239

	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25
S 1	1.060	2.072	0.593	0.540	1.165	2.395	2.040	0.641	1.419	1.181
S 2	1.018	1.487	0.883	0.951	1.080	1.639	1.400	0.914	1.552	1.438
S 3	0.898	1.666	0.530	0.586	0.993	1.895	1.603	0.597	1.261	1.100
S 4	1.579	2.638	1.109	1.188	1.709	2.958	2.537	1.196	1.991	1.780
S 5	0.890	1.444	0.566	0.633	0.968	1.599	1.383	0.641	0.779	0.698
S 6	1.879	2.768	1.365	1.432	1.996	3.020	2.682	1.475	1.187	1.123
S 7	1.069	1.475	0.797	0.843	1.129	1.580	1.426	0.861	0.358	0.424
S 8	1.154	1.503	0.914	0.957	1.208	1.590	1.456	0.972	0.441	0.532
S 9	0.779	1.110	0.567	0.591	0.824	1.201	1.080	0.613	0.226	0.257
S10	0.870	1.253	0.672	0.651	0.908	1.382	1.254	0.699	0.370	0.343
S11	0.855	1.161	0.705	0.681	0.802	1.271	1.171	0.722	0.419	0.406
S12	0.659	0.972	0.527	0.485	0.683	1.093	0.995	0.533	0.397	0.332
S13	0.618	0.671	0.712	0.640	0.587	0.781	0.771	0.663	0.939	0.862
S14	0.672	0.651	0.831	0.771	0.631	0.750	0.752	0.779	1.255	1.160
S15	0.293	0.549	0.394	0.324	0.278	0.700	0.608	0.340	0.872	0.770
S16	0.0	0.410	0.258	0.242	0.060	0.562	0.439	0.201	0.888	0.709
S17	0.403	0.0	0.638	0.646	0.377	0.213	0.190	0.595	1.263	1.171
S18	0.303	0.777	0.0	0.100	0.368	0.927	0.763	0.074	0.759	0.649
S19	0.276	0.741	0.109	0.0	0.329	0.902	0.752	0.073	0.745	0.628
S20	0.070	0.419	0.358	0.323	0.0	0.608	0.485	0.208	1.037	0.941
S21	0.631	0.229	0.843	0.882	0.613	0.0	0.150	0.814	1.508	1.422
S22	0.421	0.173	0.570	0.614	0.419	0.122	0.0	0.554	1.103	1.036
S23	0.367	1.109	0.104	0.100	0.460	1.342	1.092	0.0	1.253	1.060
S24	0.964	1.381	0.685	0.723	1.026	1.508	1.359	0.746	0.0	0.147
S25	1.031	1.552	0.707	0.728	1.102	1.725	1.548	0.768	0.101	0.0

Table 4B.

INTERSTATE DISTANCES IN BRAZIL BASED ON THE STANDARDIZED PROXIMITIES
WITHOUT ADJUSTMENT FOR INTRASTATE MIGRATION

	S 1	S 2	S 3	S 4	S 5	S 6	S 7	S 8	S 9	S10	S11	S12	S13	S14	S15
S 1	0.0	0.176	0.258	0.106	0.120	0.405	1.147	1.321	0.964	0.765	1.363	1.078	1.349	1.207	1.065
S 2	0.211	0.0	0.198	0.117	0.119	0.201	0.838	1.104	0.907	1.015	1.533	1.442	2.019	1.960	1.755
S 3	0.375	0.231	0.0	0.318	0.223	0.382	1.414	1.689	1.347	1.304	1.970	1.748	2.257	2.134	1.928
S 4	0.112	0.107	0.286	0.0	0.155	0.326	1.046	1.269	0.948	0.887	1.491	1.287	1.751	1.661	1.477
S 5	0.193	0.191	0.265	0.181	0.0	0.472	1.386	1.677	1.317	1.283	2.021	1.796	2.412	2.280	2.034
S 6	0.398	0.229	0.333	0.295	0.388	0.0	0.890	1.117	0.845	0.855	1.343	1.191	1.603	1.582	1.438
S 7	0.919	0.990	1.217	0.914	1.054	1.019	0.0	0.385	0.339	0.697	1.086	1.119	1.834	1.948	1.729
S 8	1.274	1.434	1.698	1.314	1.462	1.529	0.434	0.0	0.283	0.549	0.815	0.889	1.734	1.020	1.585
S 9	0.915	0.984	1.192	0.912	1.050	1.085	0.303	0.307	0.0	0.347	0.655	0.643	1.260	1.370	1.214
S10	1.042	1.215	1.454	1.094	1.227	1.333	0.740	0.655	0.394	0.0	0.697	0.510	1.208	1.244	1.036
S11	1.604	1.745	1.972	1.641	1.773	1.818	0.964	0.845	0.726	0.646	0.0	0.317	0.802	1.054	0.966
S12	1.722	1.946	2.209	1.801	1.933	2.098	1.220	0.093	0.866	0.578	0.330	0.0	0.833	0.949	0.766
S13	1.975	2.161	2.369	2.043	2.146	2.209	1.645	1.388	1.352	1.091	0.794	0.662	0.0	0.426	0.525
S14	1.800	2.002	2.183	1.883	1.959	2.166	1.814	1.665	1.401	1.122	1.184	0.872	0.493	0.0	0.213
S15	1.702	1.921	2.112	1.793	1.871	2.098	1.728	1.579	1.381	1.000	1.122	0.783	0.584	0.228	0.0
S16	1.838	2.108	2.223	1.975	1.968	2.390	2.576	2.572	2.102	1.696	2.219	1.742	1.596	1.003	0.884
S17	1.682	1.885	1.991	1.782	1.788	2.094	2.213	2.189	1.882	1.481	1.834	1.443	1.160	0.629	0.635
S18	1.255	1.491	1.648	1.364	1.404	1.704	1.562	1.511	1.259	0.905	1.296	0.975	1.147	0.855	0.649
S19	1.645	1.879	2.033	1.753	1.792	2.086	1.858	1.750	1.546	1.189	1.406	1.104	1.023	0.651	0.533
S20	1.679	1.871	1.980	1.771	1.787	2.051	1.908	1.819	1.657	1.370	1.520	1.287	1.127	0.811	0.785
S21	2.126	2.343	2.420	2.239	2.213	2.580	2.660	2.653	2.413	2.127	2.506	2.230	2.327	1.990	1.857
S22	1.796	2.041	2.153	1.920	1.909	2.293	2.304	2.298	2.048	1.761	2.198	1.918	2.153	1.833	1.642
S23	1.153	1.335	1.407	1.247	1.236	1.527	1.667	1.674	1.418	1.111	1.401	1.177	1.156	0.801	0.695
S24	1.199	1.538	1.780	1.352	1.424	1.833	1.633	1.647	1.284	0.919	1.670	1.324	1.976	1.736	1.406
S25	1.420	1.676	1.895	1.527	1.613	1.874	1.274	1.068	0.949	0.604	0.776	0.532	0.969	0.829	0.567

	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25
S 1	1.169	1.360	0.869	1.162	1.646	2.474	1.914	1.139	0.587	0.771
S 2	1.674	2.073	1.334	1.700	2.026	2.002	1.642	1.517	0.953	1.321
S 3	1.898	2.268	1.526	1.914	2.371	2.856	2.280	1.772	1.131	1.490
S 4	1.515	1.821	1.169	1.522	1.976	2.520	1.999	1.424	0.817	1.095
S 5	1.957	2.415	1.532	1.981	2.459	2.027	2.239	1.791	1.069	1.509
S 6	1.591	1.799	1.284	1.587	2.048	2.705	2.191	1.547	0.992	1.156
S 7	1.868	2.228	1.486	1.876	2.359	2.691	2.254	1.771	1.162	1.331
S 8	1.769	2.135	1.394	1.773	2.287	2.692	2.260	1.689	1.153	1.204
S 9	1.521	1.709	1.211	1.507	2.019	2.711	2.239	1.511	1.004	0.903
S10	1.325	1.579	0.975	1.312	1.885	2.661	2.146	1.310	0.797	0.719
S11	1.467	1.501	1.274	1.432	1.951	2.067	2.425	1.546	1.206	0.993
S12	1.213	1.363	1.002	1.183	1.747	2.660	2.210	1.201	1.090	0.708
S13	1.135	0.922	1.148	1.079	1.520	2.666	2.269	1.314	1.303	0.925
S14	0.816	0.582	0.854	0.752	1.263	2.557	2.084	1.016	1.197	0.601
S15	0.700	0.613	0.690	0.641	1.205	2.434	1.955	0.860	0.903	0.499
S16	0.0	0.543	0.458	0.078	0.726	2.191	1.565	0.268	0.910	0.777
S17	0.410	0.0	0.650	0.360	0.758	2.142	1.636	0.615	0.991	0.765
S18	0.390	0.826	0.0	0.410	0.800	1.620	1.172	0.311	0.424	0.206
S19	0.058	0.442	0.405	0.0	0.523	1.499	1.147	0.205	0.824	0.540
S20	0.406	0.469	0.698	0.418	0.0	0.949	0.800	0.479	1.014	0.847
S21	1.323	1.692	1.391	1.375	1.164	0.0	0.433	1.172	1.521	1.637
S22	1.106	1.614	1.054	1.167	1.134	0.449	0.0	0.885	1.120	1.306
S23	0.180	0.548	0.283	0.228	0.402	1.260	0.850	0.0	0.530	0.538
S24	1.162	1.820	0.616	1.205	1.756	2.100	1.577	0.927	0.0	0.606
S25	0.508	0.952	0.220	0.522	0.970	1.460	1.196	0.440	0.530	0.0

Table 4C.

INTERSTATE DISTANCES IN BRAZIL BASED ON THE STANDARDIZED PROXIMITIES WITH ADJUSTMENT FOR INTRASTATE MIGRATION

	S 1	S 2	S 3	S 4	S 5	S 6	S 7	S 8	S 9	S10	S11	S12	S13	S14	S15
S 1	0.0	0.583	0.419	0.170	0.259	0.507	0.733	0.995	0.621	0.831	1.343	0.683	1.337	1.226	0.904
S 2	0.639	0.0	0.234	0.448	0.352	0.444	1.069	1.375	1.050	1.353	1.090	1.418	2.191	2.129	1.722
S 3	0.569	0.329	0.0	0.341	0.228	0.310	1.053	1.444	1.035	1.396	2.055	1.450	2.327	2.253	1.795
S 4	0.225	0.488	0.340	0.0	0.115	0.610	0.788	1.079	0.709	0.997	1.575	1.073	1.925	1.926	1.438
S 5	0.383	0.439	0.258	0.130	0.0	0.570	0.965	1.325	0.906	1.256	1.924	1.345	2.309	2.288	1.749
S 6	0.600	0.478	0.241	0.446	0.381	0.0	0.899	1.256	0.906	1.222	1.790	1.234	1.937	1.855	1.514
S 7	0.679	0.974	0.753	0.661	0.693	0.806	0.0	0.321	0.252	0.502	1.066	1.121	1.925	2.168	1.583
S 8	0.770	1.180	0.992	0.818	0.876	1.112	0.316	0.0	0.208	0.425	0.842	1.065	1.806	2.190	1.557
S 9	0.548	1.009	0.796	0.619	0.684	0.804	0.224	0.329	0.0	0.339	0.850	0.770	1.487	1.693	1.173
S10	0.727	1.365	1.199	0.897	1.001	1.401	0.641	0.433	0.401	0.0	0.567	0.660	1.493	1.796	1.154
S11	1.192	1.902	1.776	1.415	1.536	2.030	1.235	0.933	0.989	0.570	0.0	0.637	1.245	1.650	1.005
S12	0.962	1.724	1.618	1.222	1.354	1.907	1.202	1.145	0.796	0.695	0.791	0.0	0.993	1.198	0.529
S13	1.592	2.212	2.129	1.806	1.913	2.360	1.791	1.607	1.569	1.256	0.982	0.809	0.0	0.506	0.475
S14	1.632	2.224	2.165	1.841	1.946	2.415	1.997	1.916	1.764	1.540	1.310	0.966	0.619	0.0	0.544
S15	1.340	2.043	1.964	1.507	1.710	2.247	1.693	1.661	1.425	1.134	1.076	0.494	0.559	0.628	0.0
S16	1.375	2.099	2.105	1.648	1.704	2.521	2.174	2.191	1.849	1.704	1.992	0.976	1.509	1.203	0.901
S17	1.661	2.115	2.114	1.831	1.915	2.379	2.259	2.331	2.033	1.957	2.194	1.328	1.345	0.602	0.992
S18	0.810	1.342	1.342	1.010	1.110	1.698	1.340	1.325	1.111	0.994	1.160	0.552	1.115	1.036	0.639
S19	1.201	1.871	1.872	1.459	1.585	2.232	1.749	1.631	1.458	1.199	1.196	0.506	1.049	1.026	0.539
S20	1.352	1.760	1.793	1.516	1.597	2.050	1.800	1.747	1.597	1.439	1.438	0.978	0.987	0.716	0.762
S21	1.724	2.090	2.200	1.877	1.958	2.585	2.407	2.424	2.169	2.100	2.317	1.728	2.300	2.134	1.803
S22	1.636	2.028	2.141	1.796	1.883	2.550	2.357	2.380	2.108	2.048	2.304	1.693	2.375	2.238	1.826
S23	0.961	1.515	1.543	1.174	1.281	1.093	1.591	1.580	1.330	1.222	1.435	0.777	1.412	1.316	0.888
S24	1.009	1.944	1.855	1.330	1.499	2.274	1.393	0.988	0.952	0.393	0.332	0.603	1.837	2.237	1.306
S25	0.694	1.270	1.253	0.912	1.019	1.530	1.099	0.988	0.861	0.642	0.668	0.240	0.946	1.054	0.528

	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25
S 1	0.727	1.320	0.610	0.720	1.356	2.048	1.844	0.741	0.997	0.482
S 2	1.336	2.150	1.193	1.354	1.796	1.822	1.636	1.151	1.564	1.188
S 3	1.452	2.324	1.289	1.461	2.097	2.504	2.261	1.318	1.648	1.221
S 4	1.152	2.027	0.988	1.160	1.793	2.120	1.908	1.033	1.218	0.890
S 5	1.398	2.387	1.214	1.409	2.103	2.443	2.199	1.248	1.514	1.123
S 6	1.301	1.933	1.178	1.302	1.874	2.415	2.196	1.243	1.436	1.092
S 7	1.563	2.392	1.407	1.558	2.245	2.491	2.300	1.509	0.832	1.201
S 8	1.569	2.437	1.414	1.563	2.264	2.457	2.285	1.521	0.659	1.193
S 9	1.247	1.933	1.119	1.235	1.923	2.397	2.211	1.261	0.573	0.889
S10	1.254	2.069	1.118	1.240	1.987	2.412	2.232	1.275	0.279	0.859
S11	1.259	1.965	1.177	1.238	1.929	2.412	2.263	1.351	0.300	0.941
S12	0.761	1.482	0.693	0.731	1.521	2.284	2.104	0.927	0.573	0.413
S13	1.044	0.905	1.117	1.008	1.379	2.322	2.207	1.296	1.046	1.012
S14	0.902	0.496	1.017	0.867	1.182	2.361	2.220	1.165	1.410	0.992
S15	0.703	0.962	0.763	0.660	1.268	2.284	2.128	0.907	0.971	0.633
S16	0.0	1.280	0.235	0.055	0.990	2.043	1.834	0.392	1.678	0.533
S17	0.800	0.0	0.944	0.785	0.895	2.280	2.106	1.024	1.935	1.082
S18	0.168	1.085	0.0	0.183	0.772	1.269	1.131	0.192	0.975	0.239
S19	0.035	1.110	0.224	0.0	0.710	1.253	1.150	0.332	1.074	0.387
S20	0.535	0.555	0.663	0.540	0.0	0.043	0.029	0.630	1.353	0.825
S21	1.228	2.024	1.209	1.263	1.217	0.0	0.179	1.027	2.108	1.417
S22	1.202	2.153	1.152	1.240	1.305	0.189	0.0	0.935	2.071	1.359
S23	0.298	1.330	0.203	0.332	0.837	1.130	0.922	0.0	1.212	0.436
S24	1.230	2.525	1.042	1.227	2.009	2.145	1.903	1.160	0.0	0.708
S25	0.307	1.175	0.182	0.308	0.871	1.078	0.974	0.300	0.559	0.0

Table 5.

Functional regions in Brazil identified in Configurations A, B and C.

Size	Constituent States
Configuration A.	
2	(S3, S5) (S5, S9) (S24, S25)
3	(S2, S3, S4) (S7, S8, S9) (S10, S11, S12) (S13, S14, S15) (S17, S21, S22)
4	(S16, S17, S20, S22)
6	(S15, S16, S18, S19, S20, S23)
Configuration B.	
2	(S9, S10) (S10, S12) (S11, S12) (S15, S25) (S21, S22)
3	(S7, S8, S9) (S13, S14, S15) (S16, S17, S19) (S19, S20, S23)
4	(S16, S18, S19, S23) (S18, S19, S23, S25)
6	(S1, S2, S3, S4, S5, S6)
Configuration C.	
2	(S12, S25) (S13, S15) (S21, S22)
3	(S7, S8, S9) (S10, S11, S24)
4	(S2, S3, S4, S5) (S2, S3, S5, S6) (S1, S3, S4, S5)
5	(S16, S18, S19, S23, S25)

Coherence among Minas Gerais (S16), Rio de Janeiro (S18), Sao Paulo (S19) and Mato Grosso (S23) persisted in all configurations. Also, these core states were located near the center in each configuration. Semi-core states which joined the core states in the formation of the central regions include Bahia (S15) and Parana (S20) in Configuration A, and Ditrio Federal (S25) in Configurations B and C. Despite the geographical proximity, no linkage was observed between Esprito Santo (S17) and Rio de Janeiro in any configuration. This holds, too, for the relatioships between Goias (S24) and Sao Paulo. The other persistent clustering of the states was found among Maranhao (S7), Piaui (S8) and Ceara (S9) in all configurations.

The six states of the North formed a cohesive and isolated region in Configurations B and C, though the cohesion was not perfect in the latter. Such correspondence between administrative and functional regions was non-existent with respect to these states in Configuration A, primarily due to the functionally detached position of Rondonia (S1) from the rest of the North. The state received large volume of migrants from five states in the eastern part of the Northeast—Rio Grande do Norte (S10), Paraiba (S11), Pernambuco (S12), Alagoas (S13) and Bahia (S15)—and sent out their own mobile populatin to Rio de Janeiro and Sao Paulo. However, none of these linkages were bilateral.

The Northeast dissolved into three functional regions which were remotely located from each other in Configuration A: a) Maranhao (S7), Piaui (S8) and Ceara (S9); b) Rio Grande Norte (S10), Paraiba (S11) and Pernambuco (S12), and; c) Alagoas (S13), Sergipe (S14) and Bahia (S15). Clustering of the first three states was most stable across all configurations. The reduction of the between-region distances in Configurations B and C was accompanied by some changes in the interstate linkages. First, concerning Configuration B, the states of the second group (b) no longer clustered into a region, although they did not disperse in the space. Because of the increased distances, the reciprocal linkage between Rio Grande do Norte and Paraiba was replaced by the one connecting the former with Ceara. Second, new clusterings of the states emerged in Configuration C around Rio Grande do Norte (S10) which constituted a region with Paraiba (S11) and Goias (S24). In addition, the region comprised of Maranhao, Piaui and Ceara would have been enlarged, had there been a closer linakge from Rio Grande do Norte to Maranhao. Due to the increased distances from Sergipe (S14) to Alagoas (S13), on the one hand, and from Bahia (S15) to Sergipe, on the other, regionalization by these three states was not found in Configuration C.

The states of the Southeast, South and Central-East fall in three classes: core states—Minas Gerais (S16), Rio de Janeiro (S18), Sao Paulo (S19) and Mato Grosso (S23); semi-core states—Parana (S20) and Distrio Federal (S25), and; peripheral states—Esprito Santo (S17), Santa Catarina (S21), Rio Grande do Sul (S22) and Goias (S24). Coherence of the core states was, as reported earlier, unsusceptible to the manipulations of the proximity data, though the internal formations changed. Unlike the other persistent cluster of Maranhao, Piaui and Ceara, the core states occupied central positions in all configurations. Each of the semi-core states contributed to the formation of central regions with the core states in one of the configurations, but not jointly. That is, Parana and Distrio Federal were bilaterally connected with the core states in Configurations A and C, respectively. In Configuration B, reciprocal linkages from Minas Gerais to these states were not present.

Concerning the peripheral states, neither Goias (S24) nor Federal Distrio (S25) exhibited any linkage, in Configuration A, not only with the core states but all other states except two groups of states of the Northeast—one consisted of Maranhao (S7), Piaui (S8) and Ceara (S9), and the other consisted of Paraiba (S10), Pernambuco (S11) and Alagoas (S12). Goias and Federal Distrio were, however, connected to each of these states only as recipients of emmigrants, i.e., the relationships were all unilateral. The statuses of the two states changed and differentiated in Configurations B and C. On the one hand, Distrio Federal joined the clusterings by the core states, though its full participation was not possible in the former configuration on account of the absence of a reciprocal linkage from Minas Gerais to it. In contrast. the sole status of Goias as a recipient of migrants continued in Configuration B. However, the sources of migrants changed to Rondonia, Rio de Janeiro, Mato Grosso and Distrio Federal. Only in Configuration C Goias reciprocated migration streams in a new region comprising Rio Grande do Norte and Paraiba both of which are physically most distant in the nation from Goias.

The region comprised of the other three peripheral states in Configuration A—Esprito Santo (S17), Santa Catarina (S21) and Rio Grande do Sul (S22) overpassed both Rio de Janeiro and Sao Paulo in spite of the intermediary geographical positions of the two states. A similar pattern was observed with regard to the region composed of Esprito Santo, Rio Grande do Sul, Minas Gerais (S16) and Parana (S20). In Configurations B and C, insulated regionalization by Santa Catarina (S21) and Rio Grande do Sul (S22) was noticable. The status of Esprito Santo (S17) differed in these configurations. While the state was marginally located and unrelated to any region in Configuration C, its mutual linkages with Minas Gerais and Sao Paulo in Configuration B were strong enough to form a region.

4. Discussion.

To the extent that people move in feasible distances, a migrtion volume represents the functional proximity between areas of origin and destination. In other words, areas which exchange large volumes of population form a functional region within a spatial system. Identification of such functional clusterings is of great value for the studies and planning of population redistribution. However, the task of identification is difficult to fulfil when population exchanges are asymmetrical and when the number of areas under study is not small. The situation becomes more complicated in the case of Brazil which embraces two develpment poles, namely, Rio de Janeiro and Sao Paulo. Furthermore, the two states do not have necessarily exercised centripetal forces in the population transaction field of the nation. That is, the Brazilian migration streams are essentially multidirectional. The best strategy under the circumstances is to use multidimensional scaling technique by which we may reconstruct a spatial map of the nation in accordance with the interstate proximity information derived from a migration matrix.

Concerning the proximity information, it is not uncommon to treat the size of a migration flow from state i to j as a measure of the proximity between the states. Though this interpretation may have relevance in some situations, it fails to take into account the strength of the interstate linkages relative to the total size of immigration and emmigration pertaining to the states. Suppose that state j received 100 migrants from each state i and k, and that the total number of migrants left the two states are 200 and 100,000, respectively. Then, it is obvious that state i is more proximate to state j than is state k to j. The same argument applies to the size effect of total immigration. The elimination of the size effects associated with origin (i.e., emmigration) and destination (i.e., immigration) was performed in our study by the IPFP to the uniform margins. A note seems in order here that the use of uniform margins is not mandatory in the IPFP procedure: an analyst can use nonuniform margins computed on some theoretical ground, if the research purpose is, for example, a projection of migration flows needed to achieve certain equilibrium in the population distributions (see for example Mackinnon and Skarke, 1977).

The spatial configurations we obtained from the ALSCAL algorithm with ordinal transformation markedly differed depending on whether the proximity matrices were statndardized (Configurations B and C) or not

(Configuration A). Compared to these differences, the adjustment for intrastate moves in the standardization procedure did not have significant effects on the clusterings of the states except for the changes occured in the locations of Pernambuco and Goias. The observed shifts of the other states and the associated changes in the distances were small. This means that the adjustment for intrastate moves did not greatly altered the rank order structure of the interstate proximities in our data.

In view of the present evidence, we can point out the fallacy of the popular notion about the Northeast as the primary source of migration into Rio de Janeiro and Sao Paulo. It appears so when other migration flows are not simultaneously considered. Our results, by sharp contrast, demonstrate the importance of the circulation of population among the four core states—Rio de Janeiro, Sao Paulo, Minas Gerais and Mato Grosso. Geographical proximities and levels of economic development are probably responsible for the clustering of these states. However, attribution to these factors alone fails to explain why emmigrants from Esprito Santo and Goais overpassed the neighboring Rio de Janeiro and Sao Paulo, respectively. Other well-known push-pull factors such as disparities in income and educational levels seem all inadequate as far as ecological inferences are made at the state level. A plausible explanation may be found in the operation of social networks. However, empirical evidence in this regard must be sought in data sources other than the census.

The principle of geographical proximity in determining feasible distances seems at work in the decomposition of the Northeast into three groups of the states most conspicuously seen in Configuration A: (Maranhao, Piaui, Ceara), (Rio Grande do Norte, Paraiba, Pernambuco), and (Alagoas, Sergipe, Bahia). However, there still remains a question to be answered as to why this particular grouping or differentiation occured among other possible combinations on the same principle. If transferability of job skills and expertise is a key factor in the migrant's decision function, within-group similarities with respect to, for instance, the production mode and market structures may account for the differentiation among the groups. Inquiries into contextual factors discriminating these groups from each other must be made in future studies. The present analysis uncovered another type of differentiation of the Northeast that has rarely received attention in previous studies: only one third of the states have linkages with Rio de Janeiro and Sao Paulo. They are Ceara, Pernambuco and Bahia. Besides differentiation among the three states and from the rest of the Northeast, thoerists, particularly those who emphasize opportunity discrepancies as the major determinants of migration, must provide adequate explanations about the links <u>to</u> Pernambuco and Bahia from Rio de Janeiro and Sao Paulo.

Internal differentiation of the officially defined regions was not limited to the Northeast. Or more precisely stated, the functional regions identified in the present study did not agree with the official divisions of the nation, chiefly due to the intercrossing linkages of the nations. The single exception to this rule is the correspondence between the official and functional regions observed

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with respect to the North in the configurations based on the standardized proximity matrices. Since all the points raised above regarding the operations of possible causes are relevant here, we shall not repeat them. We expect that the results of the present study offer valuable information and clues for both causal modeling and empirical research.

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