

# **Migration diversity in Brazil: where are the poor people?**

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## **ABSTRACT**

Poverty levels in Brazil present a remarkable spatial heterogeneity. The greatest proportions of poor people were observed in the rural parts of the Northeast and the North regions, especially for individuals with low levels of formal education. Migration from and to rural areas may have an impact on poverty levels for these individuals. Based on this idea, this paper analyzed the urban/urban, rural/urban, urban/rural and rural/rural flows of migrants within and between states in Brazil. The aspects examined with the use of Cluster analysis are related to: age, sex ratio, civil status, ethnic groups and mean schooling and income levels. Some general tendencies were observed, as the higher socioeconomic level of urban/urban and distant flows, and the lower levels for these variables in rural/rural short step migrations. Most poor migrants were observed in flows with rural origin and/or destiny with destiny in the Northeast Region.

**Key words: migration, poverty, Brazil, Latin America.**

JEL: R23, J11, J60

## 1. INTRODUCTION

Despite the Brazilian general socioeconomic development in recent years, for instance the observed increase in schooling levels (Riani et al, 2004); poverty and income inequality did not present this same tendency. Between 1977 and 1999, indicators related to these two variables showed stable values with short term fluctuations (Barros et al, 2000), and just very recently that it was verified a slight advance on them (IBRE/FGV, 2005).

Hoffmann (2000) and Ferreira et al (2000) showed that poverty levels in Brazil presented a remarkable spatial heterogeneity. Among the five macroregions of the country, the Northeast Region had the greatest proportions of poor people; around 38.3% of its population was below the poverty line. For this same region, in rural areas, excluding the metropolitan regions of Fortaleza, Recife and Salvador, this number was much higher, 55%. The North Region followed the Northeast of Brazil; 30.7% of the population was poor in this region and in rural areas, Belém excluded, the number increased to 45%. In the other macroregions of Brazil, Southeast, South and Center-West, the numbers were smaller, but still quite expressive, between 11% and 20% for the population, and between 15% and 31% in rural areas.

There are many phenomena that may have an impact on regional poverty levels and migration from and to rural areas is one of them. The influence of migration on regional poverty depends on the magnitude of the flows and also on their composition. This paper discusses the similarities and differences between migrant flows - urban/urban, rural/urban, urban/rural and rural/rural – for different distances – intrastate, interstate between neighbor states and interstate between non-neighbor states, giving particular attention to the flows with low income and schooling levels, which might impact greatly on regional poverty levels.

In order to do this, this work was divided in five sections, including this introduction. In the next, it is briefly presented the human capital model, and also other perspectives of migration that will be the theoretical bases for the empirical analyses. Section 3 presents some descriptive data about migration in Brazil with also the objective of introducing a general quantitative and qualitative context for the rest of the presentation. After this, section 4 presents the empirical results for the different types of

flows with the multivariate technique of cluster analyses. Last section concludes the paper.

## 2. HUMAN CAPITAL MODEL AND OTHER PERSPECTIVES OF MIGRATION

Many models that analyze the relation between migration, income and poverty use the human capital model of migration as the theoretical foundation. The model assumes a rational individual migrates if the expected net return of migration is positive, and if so, he/she maximizes his/her utility among the possible destinies (Stillwell and Congdon 1991). The equation below presents this relation:

$$G_{ij} = \int_0^t (U_{jt} - U_{it})e^{-\rho t} dt - C_{ij} > 0,$$

where  $G_{ij}$  is the net return of migration between localities  $i$  and  $j$ ;  $U_{jt}$  is the utility (or expected wages) in  $j$ , which is a possible destiny of the migrant in time  $t$ ;  $U_{it}$  is the utility of the person in the currently origin  $i$  in time  $t$ ;  $\rho$  is the discount rate; and  $C_{ij}$  are the costs of migration between  $i$  and  $j$ .

It is believed that the costs of migration are an increasing concave function of the distance between the origin and the destiny of the migrant. Other factors besides the distance also influence the costs of migration, as the presence of effective social nets that may diminish decisively these costs by a series of reasons (Massey et al, 1993). Consequently, migration is strongly influenced by networks and these might have a decisive positive feedback effect, reinforcing the existence of future flows of migrants from the same origins to some specific destinations.

However, as migration implicate in monetary and other types of costs, the individual must hold a minimum amount of capital to have migration as an option. This may not be a feasible situation for all the population strata. Poor people, specially the extremely poor ones, may not have this possibility (Kothari 2002).

In the above perspective, migration is seen as an investment in which the rational agent seeks better economical conditions and higher levels of quality of life. However, anthropological and sociological literatures have a different approach to migration. They argue that migration is a last resource available for poor people in order to cope with the difficulties that were caused by economical, demographic or environmental shocks (Waddington and Sabates-Wheeler 2003).

Sustainable livelihood approach may be seen as an intermediate perspective between the two cited above. It considers that the implications of migration are better understood if the particular characteristics of the context of migration are taken into account. The idea of a permanent rural/urban migration dominated the specialized literature in the 1960s and 1970s. Nowadays, the circular nature of migration, and other types of migration, such as rural/rural and urban/rural, or return and multiple step migrations are also important fields of research (De Haan, 1999).

As mentioned in the introduction of this paper, Brazil is regionally unequal. This spatial heterogeneity influences the flows of migrants, both quantitatively and qualitatively. Hence, because of factors, such as, spatial localization of the origin and of the destiny, type of flow, distance of migration, etc., the flows may present remarkable differences in many aspects. Next section shows some specific descriptive data about flows of migrants in Brazil.

### **3. DESCRIPTIVE DATA**

This section presents some descriptive data about migration in Brazil and also introduces some topics that will be analyzed empirically, such as the differences observed for distinct types of migration. The information was obtained with the use of the Brazilian Demographic Census of 2000. This database has the information in where the person lived five years before the Census research and the current place of residence. Individuals that declared different municipalities were considered migrants in the period of 1995-2000 (see Carvalho et al, 1992, and Rigotti, 1999, for a methodological discussion about migratory data in Brazilian Census). Notice that only migrants with origin and destiny in one of the states in Brazil are included. These data does not include international migrants.

Table 1 shows the Brazilian states that had a positive sign for internal net migration in the period between 1995 and 2000 for each one of the macroregions in Brazil. As only internal migrants are included, total net migration is zero. Also, approximately, half of the states had positive net migration and the other half a negative number (including the Federal District as state). The majority of the states in the North Region had positive net migration, as Amapá, Amazonas, Rondônia, Roraima and

Tocantins, two of them; the first and the fourth had the highest relative figure among the Brazilian states. Only two states had negative net migration, which were Acre and Pará. The Northeast Region had a rather different profile. Among the nine states, the majority, eight out of nine, had negative net migration and only one, Rio Grande do Norte, showed a positive number. Three of them, Bahia, Maranhão and Pernambuco, had the greatest negative net numbers amongst the states in Brazil. On the contrary, all the states in the Southeast Region had positive values, and among them, with the highest positive net migration in Brazil was São Paulo. In the South Region, only Santa Catarina with a high relative figure had positive net migration, the other two Rio Grande do Sul and Paraná, had negative numbers. The Center-West Region had three states with positive figures, including Goiás with the second highest value in Brazil, and just one with negative figure, Mato Grosso do Sul (Golgher, 2006).

Table 1 – Sign of internal net migration for Brazilian states in the 1995/2000 period

Macroregion	States with positive net migration	States with negative net migration
North	Amapá, Amazonas, Rondônia, Roraima and Tocantins	Acre and Pará
Northeast	Rio Grande do Norte	Alagoas, Bahia, Maranhão, Paraíba, Pernambuco, Ceará, Piauí and Sergipe
Southeast	Espírito Santo, Minas Gerais, Rio de Janeiro and São Paulo	-
South	Santa Catarina	Paraná and Rio Grande do Sul
Center-West	Federal District, Goiás and Mato Grosso	Mato Grosso do Sul

Source: FIBGE, 2000.

Following the human capital model of migration, normally the closer two localities the greatest the interchange of population between them. As is shown in table 2, most of the internal migrants in Brazil changed the residence municipality in the same state, that is, they were intrastate migrants. Among the 27 states in Brazil, only two, Roraima and Amapá, did not present values over 50% of the total for intrastate migrants, both for immigrants and for emigrants.

Table 2 – Proportion of intrastate migrants on the total for Brazilian states in the 1995/2000 period

Proportions		Proportion of intrastate immigrants		
		Less than 50%	Between 50 and 70%	Above 70%
Proportion of intrastate emigrants	Less than 50%	Amapá and Roraima	Paraíba and Piauí	-
	Between 50 and 70%	-	Acre, Amazonas, Espírito Santo, Goiás, Mato Grosso, Mato Grosso do Sul, Pará, Rio de Janeiro, Rondônia, Sergipe and Tocantins	Alagoas, Bahia, Maranhão, Pernambuco and Paraná
	Above 70%	-	Rio Grande do Norte, Santa Catarina and São Paulo	Minas Gerais and Rio Grande do Sul

Source: FIBGE, 2000.

The quantitative importance of the distance can also be verified in table 3 with the proportion of migrants classified by macroregion of destiny for the three analyzed distances: intrastate, interstate between states that are neighbors and interstate between states that are non-neighbors. As discussed above, the majority of the migrants in Brazil were intrastate ones, 68% of the total, or more than 10 million. Roughly, half of the other 32% that were interstate migrants were between neighbors and the other half between non-neighbors. Thus, the great majority of migrants in Brazil are intrastate or interstate between neighbor migrants. Only a minority, although significant, migrate between states that are not neighbors.

The Center-West Region had the highest values for both types of interstate migration, and the North Region had also a high number for both, reflecting the absorption of population from other regions relatively more effectively than the other regions. Note that the Northeast and Southeast are the ones with the number of migrants between non-neighbors greater than for neighbors, indicating that both regions have strong ties and numerous flows between them. The South presents the higher values for intrastate migration, also due to geographical localization.

Table 3 –Migrants by distance of migration for macroregions of destiny

Type of migration	Macroregion - destiny					Brazil	
	North	Northeast	Southeast	South	Center-West	Proportion (%)	Number of migrants
Intrastate	59.7	69.5	69.2	75.8	52.2	67.8	10060571
Interstate between neighbors	23.1	11.5	14.2	15.1	26.2	15.8	2339839
Interstate between non-neighbors	17.2	18.9	16.6	9.1	21.5	16.4	2439551

Source: FIBGE, 2000.

Next table discusses the flows of migrants for different types, urban/urban, rural/urban, urban/rural and rural/rural, also for the period between 1995/2000. There were over 15 millions internal migrants in Brazil in this period. It is observed that the majority of them were urban/urban, more than 10 millions, or approximately 70% of the total. Following this type of migration, with much smaller numbers, appeared the rural/urban migration with a little over 2 millions, then the urban/rural one and, lastly, the rural/rural migration. These last two with values between 1 and 1.5 million.

As can also be seen in the table, the urban/urban migration was the most numerous for all the macroregions in Brazil. However, in the North and Northeast regions, the relative values were smaller, because these last two regions had greater proportions of urban/rural and rural/rural migrations.

Table 4 –Migrants by type of migration for macroregions

Type of migration	Macroregion - destiny					Brazil	
	North	Northeast	Southeast	South	Center-West	Proportion (%)	Number of migrants
Urban/urban	59.3	61.5	78.0	69.4	70.8	70.4	10775021
Rural/urban	15.3	16.0	11.2	14.1	12.1	13.3	2032908
Urban/rural	13.6	11.6	6.3	8.0	9.7	8.8	1345422
Rural/rural	11.7	10.9	4.5	8.4	7.4	7.6	1161891
Total	1369035	3473122	6276944	2539714	1656427	100	15315242

Source: FIBGE, 2000.

Table 5 presents each type of migration for each kind of distance. Note that the majority of migrants for all types of migration are intrastate ones. For rural/rural migration they are roughly 80%, while for the urban/urban migration they represent 66% of the total. Note that the rural/urban and urban/rural flows are very similar. Moreover, it is

observed that less than 10% of the rural/rural migrants are long distance ones, for the urban/urban migration this number is much higher, 17.9%.

Table 5 –Migrants by type of migration and distance

Type of migration	Distance		
	Intrastate	Interstate between neighbors	Interstate between non-neighbors
Urban/urban	65.6	16.5	17.9
Rural/urban	70.5	14.5	15.0
Urban/rural	71.4	14.3	14.3
Rural/rural	79.2	12.6	8.2

Source: FIBGE, 2000.

This section discussed four types of migration – urban/urban, rural/urban, urban/rural and rural/rural – for three distances – intrastate, interstate between neighbors and interstate between non-neighbors. Based on these categories, all the non-zero flows were analyzed by cluster analyses, as presented in the next section.

#### 4. CLUSTER ANALYSES OF THE FLOWS OF MIGRANTS

This section discusses the similarities and differences of 1098 flows of migrants between states in Brazil with the use of cluster analyses. These flows were obtained by the following methodology. For all states in Brazil as destiny, the four types of flows described above were analyzed. Moreover, the flows were divided in intrastate, interstate between neighbors for each one of the neighbors and interstate between non-neighbors for each macroregion of origin. Because of its' population and dimension of the flows, for São Paulo state as origin or destiny all the flows were discussed separately with all the states.

The cluster technique attempts to identify relatively homogeneous groups of cases based on selected characteristics. Due to the amount of information of all the 1098 flows, the results are presented in five similar subsections, one for each macroregion of destiny, always with six clusters. The flows were characterized with the following variables: proportion of children (0 to 14 years), proportion of adults (15 to 64 years), proportion of elderly (65 years and above), sex ratio, proportion of married, proportion of singles, mean schooling level (years of formal education), mean age and mean per capita income. A ranking with each one of these variables was obtained.



The clusters were obtained with these rankings. The final center of each cluster for each one of the macroregions is shown separately in annex 1. Low values, that is, much lower than 1098 indicate that for the specific variable the cluster had a high value of it. Conversely, if the cluster final center has a value near 1098, the variable has a low value for the variable. The cluster membership for each flow is shown separately for each macroregion of destiny in annex 2.

#### **4.1 North Region**

All the flows with destiny in the North Region are analyzed in this subsection. Table A1, in annex 1, show the rankings values for each one of the variables, which were obtained with data of all the flows in Brazil and not only with the ones with destiny in the North Region, for each one of the clusters final centers. Each cluster is discussed separately in an order that was considered the best one to understanding.

The number 5 cluster showed higher schooling and income levels than the other five with destiny in the North Region. This can be seen by the low values for the cluster final centers for these variables, respectively 226 and 248 in table A1, lower than any other cluster in this table. Notice that many clusters in the A2 to A5 tables have lower values than these, indicating that the flows that were categorized in this cluster are among the ones with higher levels of these two variables for the flows with destiny in the North Region, but not nationally. The proportions of adults and married people were also high, as is shown correspondingly by the values of 110 and 302 for the cluster final center obtained for these variables. The cluster had also low proportions of children, elderly and singles, as is indicated by the high values of the rankings for these variables, respectively 1041, 963 and 870. The other variables, sex ratio and mean age had values around the national mean, as indicated by the values approximately 550. Table 6 shows a summary of the characteristics of the cluster: young married adults with high levels of schooling and income.

Table 6 – Cluster characteristic and main flows – North Region

Cluster	Summary of the characteristics	Main flows
1	Young single female adults with relatively high income and schooling levels	Mostly urban/urban intrastate and between neighbors, and also urban/rural migration between non-neighbors
2	Single adults with income and schooling levels relatively low	Interstate flows with origin or/and destiny in rural areas.
3	Families with high income and schooling levels	Long distance flows, mostly urban with destiny in Rondônia and Pará
4	Families with many children with low levels of schooling and income	Intrastate flows in Rondônia and between non-neighbors with origin or/and destiny in rural areas.
5	Young married adults with high levels of schooling and income	Long distance flows, mostly with urban destiny, with few flows to Rondônia or to Pará
6	Families with many children and single adults with low income and formal education	Intrastate and between neighbors flows with origin or/and destiny in rural areas. Between non-neighbors flows with rural destiny.

Source: FIBGE, 2000.

Table B1 in annex 2 shows the classification of all flows with destiny in the North Region. The objective of this type of analyses is to present a general profile of the flows and not to discuss a particular flow, although this can be also done. A special attention is given to intrastate ones, due to their dimensions, as was shown in table 2. Notice that the flows are between regions, indicated by the symbol  $\Leftrightarrow$ , or from one region to another, the flows with  $\Rightarrow$  symbol.

The flows that are characterized by the number five cluster have a particular peculiarity: all of them are long distance step of migration, mostly with urban destiny, but all the four types of flows are represented. The most numerous are the urban/urban flows, the majority from the Southeast, South and Center-West regions. The destiny was all over the North Region, with the exception of Pará and of Rondônia. The flows with rural destiny were less numerous. Table 6 presents the main features of these flows.

As is show in table A1, the number 3 cluster had schooling and income levels slightly below the cluster above, but still above all the others with destiny in the North Region. The cluster final centers for these variables were respectively 290 and 269. The clusters number five and three show socioeconomic levels well above all the other with destiny in the North Region. Other features that make these two cluster similar is the mean age, that was relatively high, the proportion of married and the proportion of singles that were respectively superior and inferior than the other clusters. The most remarkable difference between clusters 3 and 5 is the proportion of children and elderly,

much higher in cluster 3, indicating the greater presence in cluster 3 of nuclear and extended families than in cluster five, which showed a larger proportion of couples.

For cluster 3, similarly to cluster 5, most flows were long distance steps of migration with urban destiny. However, the states of Rondônia and of Pará, contrary to the observed for cluster 5, are preferential destinies, and also Tocantins, suggesting that demographic differences did exist for distinct destinies. Moreover, some between neighbors flows were classified in cluster 3, dissimilar to the observed for cluster 5.

Cluster 1 had schooling and income levels below these first two, but higher than the other three. The characteristics of this cluster are: a low mean age, large proportions of singles and women, and low proportion of married people. Hence, the relatively high levels of education and income are a common feature for all these three first clusters discussed so far. However, the first cluster, number 5, characterized young couples, the second, number 3, families, and the third, number 1, young single women.

This last cluster characterized all the intrastate and most urban/urban flows between neighbors. That is, contrary to the long distance flows that showed a larger presence of families and couples, the short distance urban/urban flows had a greater proportion of women and singles. Also note that nearly all urban/urban flows were characterized by one of the three cited clusters, indicating the higher socioeconomic levels of these flows when compared to the other types.

The other three clusters, numbers 2, 4 and 6, had educational and income levels much inferior than the three above. That is, there were a clear distinction between urban/urban flows and some of the long distance ones, and the other flows.

Cluster 6 was the one with the lowest levels of education and income among all the ones with destiny in the North Region. Besides this, other main characteristics were the high proportion of children and singles, very low proportion of adults and married people and very young flows.

Firstly, no urban/urban flow had these characteristics, that is, all flows had origin and/or destiny in rural areas. Most importantly, the cluster characterized most of the intrastate flows in the North Region that were not urban/urban, with the exception of Rondônia state as destiny. Many flows between neighbors, that is, mostly between states in the North Region, were also classified by cluster 6.

Clusters 6 and 4 are very similar in most aspects. The main difference is that the first had relatively more singles, while the latter had more married migrants, indicating the dichotomy between single individuals and family migration. Both of these clusters categorized many intrastate flows with origin or/and destiny in rural areas, but with one difference, while the number 6 classified most of the flows in the North Region, number 4 categorized the flows to Rondônia, indicating a rather different profile for civil status in the flows.

Cluster 2 showed a high proportion of single adults with income and schooling levels above the last two clusters. The proportions of children or elderly are very low. The flows were all interstate ones with origin and/or destiny in rural areas, mostly long distance flows.

After this brief explanation about the cluster details, some final commentaries are given. Firstly, the clusters can be roughly divided in two groups. One with numbers one, three and five, with higher income and schooling levels, which characterized nearly all urban/urban flows, most long distance steps of migration and very few rural/rural flows. They differed mainly in demographic aspects. Number one was composed especially of singles, but also of families, number 3, of married couples and families, and number 5, consisted mainly of couples.

The other group of clusters, the one with numbers 2, 4 and 6, had much lower socioeconomic levels and also differed among themselves due to demographic features, number 2 with single adults, number 4 with high fertility families, and number 6 with very young flows, mostly singles. They typically characterized short step migration with rural origin and/or destiny.

## **4.2 Northeast Region**

The same type of discussion that was done above for the North Region will be presented separately for each one of the other four macroregions of Brazil, firstly for the flows with destiny in the Northeast Region.

As is shown in table A2, the values of income and formal education for the flows with destiny in the Northeast Region, the one with the lowest socioeconomic levels in Brazil, as expected, were much lower than the national mean for five out of six clusters:

three of them had rankings above 900, and the other two over 750 for educational and schooling levels. However, one of them, the number 6, had much higher values for both variables, with rankings respectively of 244 and 243 for the cluster final center. That is, these flows differed in a great extent in comparison to the others in the region because of these two variables. All other characteristics of cluster 6 were closer to the national median values, with slightly low values for the proportions of children, men and singles. Table B2 show that this profile characterized over 100 flows, the great majority of the urban/urban type, what clear indicate that the flows between urban centers in the Northeast Region are not preferentially composed of poor people. Besides that, some long distance flows, especially with urban origin or destiny were classified in this cluster. The table below summarizes all the information., as was done above for the North Region.

All the others cluster had very low levels of income and schooling and they mainly differed because of demographic features. Custer 5 characterized very young flows with great proportions of children and singles, and low proportions of adults, elderly and married. The flows were mainly long distance ones, but also between neighbors, mostly with rural origin and/or destiny. This cluster characterized none of the intrastate flow. Moreover, nearly all urban/urban flows that did not follow the features of cluster 6 were classified in this cluster, half with destiny in Maranhão.

Cluster 1 had many of the same characteristics of cluster 5, such as low levels of income and schooling, high proportions of children and singles, low proportions of adults and married. One point differed the two clusters. The number 1 presents high proportion of elderly, what implicate in a higher mean age. This suggests that the flows are made of low income high fertility families, singles and also of elderly people. This was the profile of most intrastate flows in the Northeast Region, except the urban/urban that were mostly categorized by cluster 6. This cluster was also the outline of many relatively short distance flows between neighbors. These two facts indicate that most or at least a great proportion of flows of migrants with origin and/or destiny in rural areas in the Northeast Region presents the characteristics pointed out by this cluster.

Cluster 4 had also great proportions of elderly, especially women, with very low income and schooling levels, but with low proportions of children and high mean age.

That is, the main difference from the cluster above and this one is the predominance of the female sex and the low proportion of young people. Four intrastate urban/rural flows had these characteristics, and also many others longer distance urban/rural, indicating the return of migrants after retirement or due to life cycle aspects for women.

Cluster 3 was very similar in many aspects to cluster 1. The socioeconomic levels were extremely similar, that is, very low, as was the proportion of adults. The proportions of married and of children were high. To be exact, the flows were represented mostly by low-income high fertility families. The flows with these characteristics were mostly long distance with origin or/and destiny in rural areas.

The last cluster to be discussed is the number 2, which had socioeconomic levels below the national mean, but that showed higher levels of income and schooling than all the clusters with the flows with destiny in the Northeast Region, but the number 6. Cluster 2 had a remarkable property: great proportion of adults of the male sex. Nearly all the flows were long distance ones, mostly rural/urban.

Contrary to the observed in the North Region, nearly all urban/urban flows in the Northeast Region were characterized by the cluster with much higher socioeconomic levels, indicating that these flows, disregarding the distance, are very similar.

Notice in Annex 1 that only three clusters had values above 900 for the rankings of income and schooling among the 30 clusters discussed for all macroregions in Brazil. All of them had destiny the Northeast. Other two clusters, one with destiny in the Northeast and another with destiny in the North Region had values above 840 for these same rankings. That is, where were the flows of migrants with the greater proportions of poor people in Brazil? Mostly in the flows characterized by these four clusters with destiny in the Northeast Region. Among these, some had great proportions of elderly women, number four; others were extremely young flows, as the ones in cluster five; others, characterized by cluster 3, were composed mainly of high fertility families; and lastly, cluster 1, with flows with large proportion of children and elderly, indicating extended families and complex flows.

Table 7 – Cluster characteristic and main flows – Northeast Region

Cluster	Summary of the characteristics	Main flows
1	Very low income and schooling levels, large proportions of young and old people.	Intrastate and short distance flows with origin or/and destiny in rural areas
2	Adults with predominance of the male sex with medium to low income and schooling levels	Flows between non-neighbors, mostly rural/urban
3	Families with low income and schooling levels	Long distance flows with origin or/and destiny in rural areas
4	Elderly women with very low income and schooling levels	Short distance urban/rural flows
5	Very young flows with low income and schooling levels	Interstate flows with Maranhão as destiny
6	High income people	Urban/urban flows

Source: FIBGE, 2000.

### 4.3 Southeast Region

This subsection discusses the data for flows with destiny in the Southeast Region similarly as was done for the above regions. As is shown in table A3, and as expected, these flows presented higher socioeconomic levels than the ones discussed above, the highest ranking was 741 for schooling in cluster 3 and the lowest, 192, also for schooling in cluster 6.

The presentation will begin with this last cluster, the one with the highest levels of income and schooling in the Southeast Region, respectively with ranking values of 208 and 192 for the cluster final center, and second in Brazil, losing only to cluster 4 in the South Region. The other main characteristics are the low proportion of children, of singles and men, and high proportions of adults. In other words: low fertility high-income families and women with high income and schooling. These were the characteristics of most urban/urban flows, including the intrastate ones. Cluster 6 categorized very few of the flows of this type, especially from the Northeast and North regions. Some other flows, all with urban origin or destiny were also classified in cluster 6.

Cluster 5 had socioeconomic levels slightly lower than the above cluster and had also low proportion of children. The main difference between these two clusters was the much higher proportion of men and adults in cluster 5. Rather differently than the cluster above, all the flows had rural origin and/or destiny, mostly long distance flows, indicating the relative higher attraction of rural areas on men.

These two clusters, numbers 6 and 5, had much higher socioeconomic levels than the others, well above the national mean. All the other clusters had values around

the Brazilian median. Besides this characteristics, Cluster 1 presented low proportions of children, of elderly, of men and of married people, and high proportion of adults and singles. The flows were also very young. That is, mainly young female adults with medium levels of income and schooling. All the urban/urban flows that were not classified in cluster 6 were categorized by cluster 1. Notice that most of them from the North or Northeast regions. Moreover, flows from these two regions, but with rural origin and/or destiny also were members of this cluster. Rio de Janeiro or São Paulo is the main destiny, indicating the power of population attraction of these areas on the young females of the North or Northeast of Brazil.

Cluster 2 had as its' main characteristics the high proportion of elderly, the lowest ranking among all the 30 clusters in Brazil, females and low proportions of adults and singles. Cluster 4 had the same socioeconomic level as cluster 2, but with higher proportion of men, adults and married people. That is, in this first cluster old women predominated and in the last low fertility families. Neither of them categorized urban/urban flows. Notice also that nearly all intrastate with rural origin and/or destiny were categorized in one of these cluster. Which one is the main difference? Cluster 2 shows a greater proportion of urban/rural flows, probably many return migrants, including the two most rural state of the region Minas Gerais and Espírito Santo. Cluster 4 had more flows of the rural/urban and rural/rural types, especially intrastate and short distance ones

Cluster 3 had the lowest socioeconomic level in the Southeast Region, but still the ranking values were around the national mean. The flows presented as main features a very low mean age, with great proportions of children and low proportions of adults and elderly. The flows were mainly long distance ones with rural origin and/or destiny, as was observed in cluster 5. The main differences between these clusters were the origin of the flows. In cluster 3, the origin is mainly Northeast, North and Center-West with high fertility low/medium income families, while in cluster 5 the origin was mostly the South Region with high-income people, with lower levels of fertility.



Table 8 – Cluster characteristic and main flows – Southeast Region

Cluster	Summary of the characteristics	Main flows
1	Young females with mean levels of income and schooling	Flows with origin in the Northeast and destiny in São Paulo or in Rio de Janeiro
2	Elderly females with mean levels of income and schooling	Flows with origin and/or destiny in rural areas, mostly urban/rural
3	Young adults with mean/low levels of income and schooling	Interstate flows with origin and/or destiny in rural areas and origin in the Northeast Region
4	Families with mean levels of income and schooling and slight predominance of men	Flows with origin and/or destiny in rural areas, mostly rural/rural or rural/urban
5	Male adults with high levels of income and schooling	Long distance flows origin and/or destiny in rural areas
6	High income low fertility families and women with high income and schooling levels	Urban/urban flows

Source: FIBGE, 2000.

#### 4.4 South Region

The flows with destiny in the South Region, as was observed for the Southeast Region but in a greater extent, had income and schooling levels above the national mean, as presented in table A4. Besides that, the proportions of singles were smaller and the proportions of married were higher than the Brazilian mean, indicating differences in age and civil status.

Two clusters characterized all the urban/urban flows, the numbers 2 and 4, mostly this last one, the one with the highest levels of income and schooling in Brazil. Moreover, Cluster 4 had as its main characteristics the low proportion of children and of singles and the high mean age. That is, they were mainly high-income low fertility families. Although the flows were mostly urban/urban ones, some long distance rural/urban and a few urban/rural flows were also observed. Cluster 2 had a socioeconomic level that was slightly lower than cluster 4 and also had other differences. The main ones were the greater proportion of children, of women and of singles, with lower mean age. That is, the families had higher levels of fertility and single young females were more present in the flows. The flows that had these characteristics: were urban/urban with Paraná as destiny, and rural/urban and urban/rural, mainly with Rio Grande do Sul as destiny.

Two clusters characterized nearly all of the intrastate flows with rural origin and/or destiny: numbers 5 and 3. Both had income and schooling level around the national mean, levels much lower than the clusters above. Both had also very low proportion of

singles and very high proportion of married people. Cluster 5 had relatively low proportion of children and high of elderly, while the contrary occurred with number 3. That is, cluster 5 was composed mostly of couples with high mean age, and cluster 3 of families with children. All the flows in both cluster had rural origin and/or destiny. The main difference was the origin: for cluster 5, from the North and Northeast regions, and for cluster 3, from the other regions in Brazil.

The two last clusters characterized mainly long distance flows with origin and/or destiny in rural areas with similar origins and destinies. Both had mean values for income and schooling, low mean age and low proportion of elderly people. The main differences were that cluster 1 had predominance of women and greater proportion of married adults. Cluster 6 showed predominance of men and greater proportion of singles and children. That is, the first one was composed preferentially of young medium income low fertility families with female predominance and the second, young adults with male prevalence.

Table 9 – Cluster characteristic and main flows – South Region

Cluster	Summary of the characteristics	Main flows
1	Medium income low fertility families	Long distance flows with rural origin and/or destiny
2	High income families and single female	Urban/urban flows with origin in the Center-West or Northeast, or rural/urban and urban/rural flows with Rio Grande do Sul as destiny.
3	Medium income families	Intrastate flows, or between non-neighbors, mostly with origin in the Southeast or Center-West regions and destiny in Paraná, all with rural origin and/or destiny
4	High income low fertility families	Urban/urban flows
5	Medium income couples	Intrastate flows, or between non-neighbors, mostly with origin in the Northeast or North regions and destiny in Paraná, all with rural origin and/or destiny
6	Young adults with male predominance	Long distance flows with rural origin and/or destiny

Source: FIBGE, 2000.

#### 4.5 Center-West Region

Tables A5, B5 and 10 show the results for the Center-West Region in Brazil. As can be seen in the first one of these, three clusters had income and schooling levels

above the national mean, numbers 1, 2 and 5, and just one had values below this mean, that was cluster 4. Table B5 presents a general picture less clear than the observed in other regions.

What are the main differences between clusters 1, 2 and 5, which had similar socioeconomic levels? Cluster 1 had as its main feature the very high proportion of children, very low proportions of adults and elderly people and very low mean age. Cluster 2 had low proportions of children and singles and high proportion of married people. Cluster 5 presented all variables around the mean. Concluding: the relative high-income flows with destiny in the Center-West Region were divided in three groups: high fertility families, couples and families. All these clusters categorized very few rural/rural flows, that is, most had urban origin and/or destiny. This last cluster characterized most short distance urban/urban flows and also longer distance rural/urban ones. The flows of cluster 1 had as destiny Mato Grosso and Mato Grosso do Sul, areas, especially the first of these states, of recent significant absorption of immigrants. On the other hand, many flows with cluster 2 characteristics had Goiás as destiny

Two clusters 3 and 6 had medium levels for income and schooling. They also showed small proportions of children and of elderly and high proportions of adults. Cluster 6 was the “oldest” in Brazil, although the proportion of elderly was not so high. This indicates that the adults are not young, even though they are not yet considered aged. They differed mainly in civil status attributes. Cluster 6 had large proportion of married people, with predominance of men, and the contrary was observed for cluster 3. In a few words: married couples relatively aged with slight prevalence of males for cluster 6; and young single adults with predominance of females for cluster 3, all with medium income and schooling levels. Very few flows were characterized by cluster 6, all interstate, mostly rural/rural long distance from the South or Southeast regions, signaling the return of migrants. Cluster 3 also categorized only interstate flows, as well mostly long distance ones, but especially with urban origin and/or destiny with origin in the North or Northeast regions.

The last cluster to be analyzed is the number 4, with much lower levels of income and education. The other main feature was male predominance. The flows with these

characteristics were short distance with rural origin or destiny, or short and long distance of the rural/rural type.

Table 10 – Cluster characteristic and main flows –Center-West Region

Cluster	Summary of the characteristics	Main flows
1	Medium/high income high fertility families	Interstate flows with destiny in Mato Grosso or Mato Grosso do Sul
2	Medium/high income relatively old couples	Flows with urban origin and/or destiny with origin in the South, Southeast or Center-West regions
3	Medium income young single females	Interstate flows with urban origin and/or destiny with origin in the North or Northeast regions
4	Low/medium income males	Flows with rural origin and/or destiny with origin in the North or Northeast regions
5	Medium/high income individuals with slight female predominance	Short distance urban/urban flows
6	Married couples relatively aged with slight prevalence of males	Long distance rural/rural flows with origin in the South or Southeast regions

Source: FIBGE, 2000.

## 5. FINAL DISCUSSION AND CONCLUTIONS

The discussion above presented some of the characteristics of the intrastate and interstate flows of migrants in Brazil. In order to analyze the main similarities and differences, the multivariate technique of cluster analyses was used. Some tendencies were clearly observed such as: the higher socioeconomic levels of the urban/urban flows; and the lower income and schooling levels of the rural/rural ones. Long distance flows tend to present higher values for these variables than short ones. Females tend to predominate in flows with urban origin and/or destiny and males are the majority in many rural/rural flows. Married people predominate in many long distance flows, while singles dominate short step migrations.

Although some general trends could be noticed, it was observed that the characteristics of the flows are highly context dependent, and the heterogeneity is quite large. However, it was noticed that the poor migrants concentrate in rural/rural, rural/urban and urban/rural flows with destiny in the North and Northeast regions, especially this last one, including long distance flows.

Despite the many aspects of migration, income and poverty, as proposed by Ghobadi et al (2005), migration appear to be mainly an ex-ante strategy, and, hence, migration from rural areas is a response to employment and other types of opportunities

in rural areas. De Haan (1999) observed that most studies that analyzed rural and agricultural regional development did not give the appropriate importance to migration. Human mobility is much more common than normally assumed by the notion that population is essentially sedentary. Therefore, given the importance of migration for the rural population, policies that promote mobility or, that increase the positive effects of migration, should be encouraged. Policies that diminish the costs of migration would have a positive impact on the range of possibilities for the low-income population strata. For instance, policies that: improve channels for information exchange; facilitate the absorption of the migrant in the destiny; minimize environmental damages; increase the effectiveness of the use of remittances for local development, etc are some of them.

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## ANNEX 1

Table – A1

Clusters final centers for flows with destiny in the North Region

Variables	Cluster final centers					
	1	2	3	4	5	6
Proportion of children	459	1015	680	271	1041	244
Proportion of adults	656	131	546	892	110	936
Proportion of elderly	752	959	491	703	963	588
Sex ratio	830	470	462	367	563	436
Proportion of married	912	991	246	356	302	990
Proportion of singles	267	191	949	748	870	195
Mean schooling	389	641	290	817	226	915
Mean age	923	530	360	704	381	856
Mean per capita income	439	748	269	740	248	841

Table – A2

Clusters final centers for flows with destiny in the Northeast Region

Variables	Cluster final centers					
	1	2	3	4	5	6
Proportion of children	268	843	208	891	207	766
Proportion of adults	992	340	990	500	914	446
Proportion of elderly	240	649	570	299	896	500
Sex ratio	672	252	512	998	532	767
Proportion of married	903	604	273	799	914	526
Proportion of singles	290	568	853	437	254	706
Mean schooling	995	780	984	911	885	243
Mean age	651	411	629	315	1000	420
Mean per capita income	972	786	972	955	899	244

Table – A3

Clusters final centers for flows with destiny in the Southeast Region

Variables	Cluster final centers					
	1	2	3	4	5	6
Proportion of children	929	510	263	738	1041	875
Proportion of adults	219	867	878	518	133	339
Proportion of elderly	787	189	794	405	878	506
Sex ratio	870	859	497	366	246	889
Proportion of married	881	416	602	284	715	416
Proportion of singles	286	829	566	941	507	873
Mean schooling	523	626	741	633	295	192
Mean age	959	409	962	402	621	402
Mean per capita income	583	613	685	613	324	208

Table – A4

Clusters final centers for flows with destiny in the South Region

Variables	Cluster final centers					
	1	2	3	4	5	6
Proportion of children	783	469	348	868	764	625
Proportion of adults	318	741	848	337	606	479
Proportion of elderly	904	525	478	474	234	851
Sex ratio	755	966	514	670	628	290
Proportion of married	248	588	194	411	211	615
Proportion of singles	884	744	1025	917	1037	524
Mean schooling	431	207	642	142	581	436
Mean age	773	502	468	281	228	712
Mean per capita income	599	347	640	179	598	483

Table – A5

Clusters final centers for flows with destiny in the Center-West Region

Variables	Cluster final centers					
	1	2	3	4	5	6
Proportion of children	176	891	915	416	656	1042
Proportion of adults	938	415	234	770	504	101
Proportion of elderly	1019	346	777	583	608	1057
Sex ratio	466	446	742	393	761	362
Proportion of married	495	286	921	479	552	290
Proportion of singles	789	967	276	677	689	973
Mean schooling	371	376	513	828	318	525
Mean age	847	222	805	605	550	180
Mean per capita income	300	285	620	733	302	609

## ANNEX – 2

### B1 - FLOWS CATEGORIZATION IN CLUSTERS – NORTH REGION

Type of flow		CLUSTER					
		1	2	3	4	5	6
Urban/urban	Intrastate	ALL STATES	-	-	-	-	-
	Interstate between neighbors	RO ⇔ AM; RO ⇔ AC; AC ⇔ AM; AM ⇔ RR; AM ⇔ PA; PA ⇔ AP; PA ⇔ TO; RR ⇒ PA; MA ⇒ PA, TO; MT ⇒ RO, PA, TO	-	BA, GO ⇒ TO	-	-	-
	Interstate between non-neighbors	NOR ⇒ RO, AM, RR, AP; NOD ⇒ RO, AM, PA, AP	-	SUD, SUL, COE ⇒ RO; NOD, MG/ES/MG ⇒ AC; SP, COE ⇒ AM; SP ⇒ RR; NOR, SUD, SUL COE ⇒ PA; MG/ES/RJ, SUL, COE ⇒ AP; SP, NOD, SUL ⇒ TO	NOD ⇒ TO	SP, NOR, SUL, COE ⇒ AC; NOD, MG/ES/RJ, SUL ⇒ AM; MG/ES/RJ, SUL, COE ⇒ RR; SP ⇒ AP; MG/ES/RJ, COE ⇒ TO	-
	Intrastate	-	-	-	RO, TO	-	AC, AM, RR, AP
Rural/urban	Interstate between neighbors	MT ⇒ PA; PA ⇒ AP	AM ⇒ AC; RR ⇒ AM, PA; PA ⇒ AM	MT ⇒ RO; GO ⇒ TO	MT, BA ⇒ TO	-	RO ⇔ AM; RO ⇔ AC; AC ⇒ AM; AM ⇒ RR, PA; PA ⇒ TO; AP ⇒ PA; MA ⇒ PA, TO
	Interstate between non-neighbors	NOR ⇒ AC, RR; SUL ⇒ PA	SUL ⇒ AC; NOD ⇒ AM; COE ⇒ AM, RR, TO; NOR, NOD, SUD, SUL ⇒ AP; MG/ES/RJ ⇒ TO	SP, COE ⇒ RO; MG/ES/RJ, COE ⇒ AC; SP ⇒ AM; SUL ⇒ RR; NOR, MG/ES/RJ, COE ⇒ PA; NOR ⇒ TO	NOR, NOD, MG/ES/RJ, SUL ⇒ RO; SP, NOD ⇒ AC; SP ⇒ RR; NOD ⇒ PA; NOD ⇒ TO	NOR, MG/ES/RJ, SUL ⇒ AM; MG/ES/RJ ⇒ RR; SP ⇒ PA; COE ⇒ AP; SP, SUL ⇒ TO	NOD ⇒ RR
	Intrastate	RR	-	-	RO	-	AC, AM, PA, AP, TO
Urban/rural	Interstate between neighbors	AP ⇒ PA; GO ⇒ TO	RO ⇒ AM; BA ⇒ TO	RR ⇒ AM	RR ⇒ AP; MT ⇒ TO RO	-	RO ⇔ AC; AC ⇔ AM; AM ⇒ RO, RR; AM ⇔ PA; PA ⇔ TO; PA ⇒ RR; MA, MT ⇒ PA, TO;
	Interstate between non-neighbors	SP ⇒ TO; NOR ⇒ AC; NOD ⇒ RO; MG/ES/RJ ⇒ AC, PA; COE ⇒ AM	SP, SUL ⇒ AC; NOD, SUL ⇒ AM; NOR, SUD ⇒ RR; COE ⇒ TO	SP ⇒ AM, PA; NOR ⇒ AP; NOD ⇒ AC; SUL ⇒ RO, RR, PA	SUD ⇒ RO; NOD, COE ⇒ RR; MG/ES/RJ, COE ⇒ AP; NOD, MG/ES/RJ, SUL ⇒ TO	SP ⇒ AP; NOR ⇒ AM, PA, TO; COE ⇒ RO	NOR ⇒ RO; NOD ⇒ PA, AP; MG/ES/RJ ⇒ AM; SUL ⇒ AP; COE ⇒ AC, PA.
	Intrastate	-	-	-	RO	-	AC, AM, RR, PA, AP, TO
Rural/rural	Interstate between neighbors	-	RO ⇒ AC; AM ⇒ RO; RR ⇒ AM; AP ⇒ PA	-	RO ⇒ AM; AM ⇒ PA; TO ⇒ PA; MT, MS ⇒ TO; MT ⇒ RO	-	AC ⇒ RO; AC ⇔ AM; AM ⇒ RR; RR ⇒ PA; PA ⇒ AM, AP, TO; MA ⇒ PA, TO; BA ⇒ TO
	Interstate between non-neighbors	-	MG/ES/RJ, SUL ⇒ AC; NOD, SP ⇒ AM; COE ⇒ RR; SP, MT, NOR ⇒ PA; NOD ⇒ AP; SP, NOR ⇒ TO	NOR ⇒ RO; SUL ⇒ TO	NOD, SUD, SUL, COE ⇒ RO; NOD, MG/ES/RJ, SUL ⇒ AM; NOD ⇒ RR; NOD, SUL ⇒ PA; NOD, MG/ES/RJ ⇒ TO	SP, NOR ⇒ AC; SUL ⇒ AP; COE ⇒ AM, PA, TO	NOR ⇒ RR; NOD ⇒ AC; MG/ES/RJ ⇒ RR, PA; SUL ⇒ RR; COE ⇒ AC



## B2 - FLOWS CATEGORIZATION IN CLUSTERS – NORTHEAST REGION

Type of flow		CLUSTER					
		1	2	3	4	5	6
Urban/urban	Intrastate	MA	-	-	AL	-	PI, CE, RN, PB, PE, SE, BA
	Interstate between neighbors	-	-	-	-	PA, TO $\Rightarrow$ MA; MA $\Rightarrow$ PI; AL $\Rightarrow$ SE; ES $\Rightarrow$ BA	PI $\Rightarrow$ MA; CE, PE, BA $\Leftrightarrow$ PB, RN, PE $\Leftrightarrow$ CE; PB $\Leftrightarrow$ RN; PE $\Leftrightarrow$ PB; AL, BA $\Leftrightarrow$ PE; BA $\Leftrightarrow$ AL; SE $\Rightarrow$ AL; S $\Leftrightarrow$ BA; TO, MG, GO $\Rightarrow$ BA
	Interstate between non-neighbors	-	SP $\Rightarrow$ PI	-	-	NOR $\Rightarrow$ MA	RJ $\Rightarrow$ NOD; SP $\Rightarrow$ NOD (PI); MG/ES $\Rightarrow$ MA, CE, PE, RN, PE, AL, SE; SUL MG/ES $\Rightarrow$ MA, CE, PB, RN, PE, AL, SE; NOR, NOD, SUL, COE $\Rightarrow$ NOD
Rural/urban	Intrastate	NOD	-	-	-	-	-
	Interstate between neighbors	MA, CE $\Rightarrow$ PI; RN $\Leftrightarrow$ PB; PB $\Rightarrow$ PE; SE $\Leftrightarrow$ BA; BA $\Rightarrow$ AL; AL $\Rightarrow$ SE; TO, MG $\Rightarrow$ BA	BA $\Rightarrow$ PI; PB, PE $\Rightarrow$ CE; PE, SE $\Rightarrow$ AL; PI, PE, AL $\Rightarrow$ BA	CE $\Rightarrow$ PB; PI, PB, BA $\Rightarrow$ PE; GO $\Rightarrow$ BA	PI $\Rightarrow$ MA; PE $\Rightarrow$ PI; CE $\Rightarrow$ RN, PE;	PA, TO $\Rightarrow$ MA; PI, RN $\Rightarrow$ CE; AL $\Rightarrow$ PE; ES $\Rightarrow$ BA	-
	Interstate between non-neighbors	NOR $\Rightarrow$ SE	NOR, NOD $\Rightarrow$ MA; RJ $\Rightarrow$ CE, PB; SP $\Rightarrow$ PI, CE, RN, SE, BA; NOR, MG/ES $\Rightarrow$ PB; NOD $\Rightarrow$ PI, PE, BA; MG/ES $\Rightarrow$ AL; SUL $\Rightarrow$ CE, SE; COE $\Rightarrow$ PI, CE, PB, PE, SE, BA	RJ, COE $\Rightarrow$ RN; SP $\Rightarrow$ PB, PE, AL; NOR, MG/ES $\Rightarrow$ CE; MG/ES, SUL $\Rightarrow$ PE; SUL, COE $\Rightarrow$ AL	RJ $\Rightarrow$ AL	SP $\Rightarrow$ MA; RJ $\Rightarrow$ PI, PE, SE; NOR $\Rightarrow$ PI, RN, PE, AL, BA; NOD $\Rightarrow$ CE, RN; ES/MG $\Rightarrow$ SE; SUL $\Rightarrow$ MA, PI, PB; COE $\Rightarrow$ MA	MG/ES, RJ $\Rightarrow$ MA; MG/ES, SUL $\Rightarrow$ RN; NOD $\Rightarrow$ AL, SE; RJ, SUL $\Rightarrow$ BA
Urban/rural	Intrastate	MA, CE, AL, SE, BA	-	-	PI, RN, PB, PE	-	-
	Interstate between neighbors	TO, PA $\Rightarrow$ MA; PE $\Rightarrow$ PI; BA $\Rightarrow$ PI, SE; MA $\Leftrightarrow$ PI; RN $\Rightarrow$ PB; PB $\Leftrightarrow$ PE; AL $\Rightarrow$ PE; PE, ES $\Rightarrow$ BA	-	CE $\Rightarrow$ RN, PE; GO $\Rightarrow$ BA	CE $\Rightarrow$ PI; RN, PE $\Rightarrow$ CE; PB $\Leftrightarrow$ CE; PB $\Rightarrow$ RN; PI, BA $\Rightarrow$ PE; PE $\Rightarrow$ AL; SE, MG $\Rightarrow$ BA	PI $\Rightarrow$ CE; SE, BA $\Leftrightarrow$ AL; TO $\Rightarrow$ BA	PI $\Rightarrow$ BA
	Interstate between non-neighbors	NOR $\Rightarrow$ PI, CE; NOD $\Rightarrow$ PB, SE; MG/ES $\Rightarrow$ PI, PE, AL; SUL $\Rightarrow$ PI, PE; COE $\Rightarrow$ PE	COE $\Rightarrow$ MA; RJ, SUL $\Rightarrow$ CE; SP $\Rightarrow$ RN; NOR $\Rightarrow$ PE, BA; NOD $\Rightarrow$ AL; SP, NOR, SUL $\Rightarrow$ SE;	RJ $\Rightarrow$ PB; SP $\Rightarrow$ PI, CE, AL; NOD $\Rightarrow$ MA, RN; MG/ES $\Rightarrow$ CE; SUL $\Rightarrow$ PB; COE $\Rightarrow$ CE, RN, PB, AL, BA	NOD $\Rightarrow$ PI, BA; NOR $\Rightarrow$ RN; SP $\Rightarrow$ PB; RJ $\Rightarrow$ PE; COE $\Rightarrow$ SE	RJ $\Rightarrow$ PI, AL, SE; SP $\Rightarrow$ MA, PE, BA; NOR $\Rightarrow$ MA, PB, AL; NOD $\Rightarrow$ CE, PE; MG/ES $\Rightarrow$ PB, SE; COE $\Rightarrow$ PI	RJ, SUL $\Rightarrow$ MA; RJ, ES/MG, SUL $\Rightarrow$ RN; SUL $\Rightarrow$ AL; RJ, SUL $\Rightarrow$ BA
Rural/rural	Intrastate	NOD (-RN)	-	RN	-	-	-
	Interstate between neighbors	MA $\Leftrightarrow$ PI; CE, PE $\Rightarrow$ PI; RN $\Leftrightarrow$ PB; PB $\Rightarrow$ PE; BA $\Rightarrow$ SE; GO $\Rightarrow$ BA	PB $\Rightarrow$ CE; PI $\Rightarrow$ BA	BA, CE $\Leftrightarrow$ PE; BA, $\Leftrightarrow$ AL; ES $\Rightarrow$ BA	PI $\Rightarrow$ PE; BA $\Rightarrow$ PI; TO, MG $\Rightarrow$ BA	PA, TO $\Rightarrow$ MA; PI $\Rightarrow$ CE; CE $\Leftrightarrow$ RN; CE, PE $\Rightarrow$ PB; PE, SE $\Leftrightarrow$ AL; SE $\Rightarrow$ BA	-
	Interstate between non-neighbors	RJ $\Rightarrow$ PB, BA; SP $\Rightarrow$ PE; NOR $\Rightarrow$ PI, MA, SE, BA; NOD $\Rightarrow$ MA; MG/ES $\Rightarrow$ CE, RN, AL; SUL $\Rightarrow$ AL	SP, SUL $\Rightarrow$ MA; SP, COE $\Rightarrow$ CE; NOR $\Rightarrow$ PE; COE $\Rightarrow$ AL, SE; SP $\Rightarrow$ BA	RJ $\Rightarrow$ PI, RN, AL; SP $\Rightarrow$ PI, RN, PB, AL, SE; NOR $\Rightarrow$ CE, RN, PB, AL; NOR $\Rightarrow$ RN, PB, PE, AL; MG/ES $\Rightarrow$ MA, PE; SUL $\Rightarrow$ PI, RN, PE; COE $\Rightarrow$ PE, BA	RJ $\Rightarrow$ CE, PE; MG/ES $\Rightarrow$ PB, SE; SUL $\Rightarrow$ SE	RJ $\Rightarrow$ SE; NOD $\Rightarrow$ PI, CE, SE, BA; SUL $\Rightarrow$ CE, PB; COE $\Rightarrow$ MA, PI, RN, PB	SUL $\Rightarrow$ BA

### B3 - FLOWS CATEGORIZATION IN CLUSTERS – SOUTHEAST REGION

Type of flow		CLUSTER					
		1	2	3	4	5	6
Urban/urban	Intrastate	-	-	-	-	-	MG, ES, RJ, SP
	Interstate between neighbors	BA ⇒ MG, ES	-	-	-	-	MG ⇔ ES, RJ, SP RJ ⇔ SP, ES; PR, MS ⇒ SP; MS, GO DF ⇒ MG
	Interstate between non-neighbors	NOD ⇒ RJ; NOD (-RN) ⇒ SP; RR, PA, AP, TO ⇒ SP	-	-	-	-	ES ⇔ SP; NOR, NOD, SUL, COE = MG, ES; NOR, SUL COE ⇒ RJ; RO, AC AM, RN, SUL, COE ⇒ SP
Rural/urban	Intrastate	-	ES	-	MG, SP	-	RJ
	Interstate between neighbors	-	GO, DF ⇒ MG; ES ⇒ RJ	BA ⇒ MG, ES	MG ⇔ ES; MG ⇔ RJ; SP, MS ⇒ MG; RJ ⇒ ES; PR, MS ⇒ SP	MG, RJ ⇒ SP	SP ⇒ RJ
	Interstate between non-neighbors	NOD, SUL ⇒ ES; NOR, MA, CE ⇒ RJ; AP, TO, MA, PI, PB, SC ⇒ SP	AL, BA, COE ⇒ RJ; RO, PE ⇒ SP	NOD, COE ⇒ MG; NOR, COE ⇒ ES; PB, PE ⇒ RJ; RR, RN, AL, SE, BA, ES, GO ⇒ SP.	NOR, SUL ⇒ MG; SP ⇒ ES; MT ⇒ SP	AL, SUL ⇒ RJ; AM, PA, RS ⇒ SP	PI, RN ⇒ RJ; AC, CE, DF ⇒ SP
Urban/rural	Intrastate	-	MG, ES	-	RJ, SP	-	-
	Interstate between neighbors	BA ⇒ MG; MG ⇒ SP;	SUD, COE ⇒ MG; RJ ⇒ ES; SP ⇒ RJ; MS ⇒ SP	BA ⇒ ES;	MG ⇒ ES, RJ; RJ, PR ⇒ SP	-	ES ⇒ RJ
	Interstate between non-neighbors	PI, MA, CE, SE, BA, NOR ⇒ RJ; PA, NOD ⇒ SP	NOR, COE ⇒ MG; SP, NOR, SUL ⇒ ES; RN ⇒ RJ; PE ⇒ SP	NOD ⇒ MG; COE ⇒ ES; PB, PE ⇒ RJ; RO, AM, DF ⇒ SP	SUL ⇒ MG; NOD ⇒ ES; MT ⇒ SP	SUL, COE ⇒ RJ; AC, ES, SC, RS, GO ⇒ SP	SE ⇒ RJ; RR, TO ⇒ SP
Rural/rural	Intrastate	-	RJ	-	MG, ES, SP	-	-
	Interstate between neighbors	-	ES ⇔ RJ;	ES ⇔ MG; BA, RJ ⇒ MG; RJ, MS ⇔ SP	SP ⇔ MG; MS, GO, DF ⇒ MG; MG, SP ⇒ RJ; PR ⇔ SP	-	-
	Interstate between non-neighbors	NOD ⇒ ES; PI, RN, PE ⇒ RJ; AC, AM, MA, CE, SE, AL, RS ⇒ SP	NOR ⇒ ES; CE ⇒ RJ; PA, RN; DF ⇒ SP	NOR, NOD ⇔ MG; SP, COE ⇒ ES; MA, PB, BA, NOR, SUL, COE ⇒ RJ; TO, PE, BA, GO ⇒ SP	SUL, COE ⇒ MG; AL ⇒ RJ; RO, PB, ES, MT ⇒ SP	SUL ⇒ ES; PI, SC ⇒ SP	-

B4 - FLOWS CATEGORIZATION IN CLUSTERS – SOUTH REGION

Type of flow		CLUSTER					
		1	2	3	4	5	6
Urban/urban	Intrastate	-	-	-	PR, SC, RS	-	-
	Interstate between neighbors	-	MS $\Rightarrow$ PR	-	PR $\Leftrightarrow$ SC; SC $\Leftrightarrow$ RS; SP $\Rightarrow$ PR	-	-
	Interstate between non-neighbors	-	NOR $\Rightarrow$ PR, SC; COE $\Rightarrow$ PR	-	NOD, SUD, SUL $\Rightarrow$ PR; NOD, SUD, SUL, COE $\Rightarrow$ SC; BRASIL $\Rightarrow$ RS	-	-
Rural/urban	Intrastate	-	-	PR	-	SC, RS	-
	Interstate between neighbors	MS $\Rightarrow$ PR	RS $\Rightarrow$ SC	SP, SC $\Rightarrow$ PR; SC $\Rightarrow$ RS	-	-	PR $\Rightarrow$ SC
	Interstate between non-neighbors	NOR $\Rightarrow$ SC; NOD, SUL $\Rightarrow$ RS	NOR, COE $\Rightarrow$ RS	SUL, COE $\Rightarrow$ PR	SUD $\Rightarrow$ RS; MG/ES/RJ, COE $\Rightarrow$ SC	NOR, NOD $\Rightarrow$ PR	NOD, SP $\Rightarrow$ SC; MG/ES/RJ $\Rightarrow$ PR
Urban/rural	Intrastate	-	-	-	RS	PR, SC	-
	Interstate between neighbors	PR $\Rightarrow$ SC; SC $\Rightarrow$ RS	-	SP, SC $\Rightarrow$ PR	RS $\Rightarrow$ SC	MS $\Rightarrow$ PR	-
	Interstate between non-neighbors	SUL $\Rightarrow$ RS; COE $\Rightarrow$ SC	MG/ES/RJ $\Rightarrow$ RS	NOR, COE $\Rightarrow$ PR	SP $\Rightarrow$ SC, RS; NOR $\Rightarrow$ SC	NOD, SUD, SUL $\Rightarrow$ PR	NOD, MG/ES/ES $\Rightarrow$ SC; NOR, NOD, COE $\Rightarrow$ RS
Rural/rural	Intrastate	-	-	PR, SC	-	RS	-
	Interstate between neighbors	-	-	MS, SP $\Rightarrow$ PR; PR $\Leftrightarrow$ SC; SC $\Leftrightarrow$ RS	-	-	-
	Interstate between non-neighbors	NOR, NOD $\Rightarrow$ SC; NOD $\Rightarrow$ RS	-	COE $\Rightarrow$ PR; SUD $\Rightarrow$ SC; SUL, COE $\Rightarrow$ RS	-	NOR, SUL $\Rightarrow$ PR; NOR $\Rightarrow$ RS	NOD, MG/ES/RJ $\Rightarrow$ PR; COE $\Rightarrow$ SC; MG/ES/RJ $\Rightarrow$ RS

B5 - FLOWS CATEGORIZATION IN CLUSTERS – CENTER-WEST REGION

Type of flow		CLUSTER					
		1	2	3	4	5	6
Urban/urban	Intrastate	-	-	-	-	MS, MT, GO	-
	Interstate between neighbors	PA, TO $\Rightarrow$ MT	MG, SP $\Rightarrow$ MS; AM $\Rightarrow$ MT	TO, BA $\Rightarrow$ GO	-	MS $\Leftrightarrow$ MT; MS $\Leftrightarrow$ GO; MT $\Leftrightarrow$ GO; PR $\Rightarrow$ MS; RO $\Rightarrow$ MT; MG $\Rightarrow$ GO; DF $\Leftrightarrow$ GO	-
	Interstate between non-neighbors	NOR $\Rightarrow$ MT	ES/RJ, SUL, DF $\Rightarrow$ MS; SP, SUL $\Rightarrow$ MT; ES/RJ, SP $\Rightarrow$ GO; SUD, SUL $\Rightarrow$ DF	NOR, NOD $\Rightarrow$ DF; NOD $\Rightarrow$ GO	-	NOR, NOD $\Rightarrow$ MS; DF $\Leftrightarrow$ MT; NOR $\Leftrightarrow$ GO	-
Rural/urban	Intrastate	-	GO	-	MS, MT	-	-
	Interstate between neighbors	MT $\Rightarrow$ MS	GO $\Rightarrow$ MS; TO $\Rightarrow$ MT; DF $\Rightarrow$ GO	MG $\Rightarrow$ MS; AM, PA $\Rightarrow$ MT; TO, MT $\Rightarrow$ GO;	PR $\Rightarrow$ MS; RO, MS, GO $\Rightarrow$ MT; BA $\Rightarrow$ GO	SP $\Rightarrow$ MS; MG, MS $\Rightarrow$ GO	-
	Interstate between non-neighbors	ES/RJ $\Rightarrow$ MS	NOD $\Rightarrow$ MS; SP, SUL $\Rightarrow$ MT; ES/RJ, SP $\Rightarrow$ GO	DF $\Rightarrow$ MS, MT; NOR $\Rightarrow$ MT; NOD $\Rightarrow$ GO; NOR, NOD, COE $\Rightarrow$ DF	NOR $\Rightarrow$ MS	NOR $\Rightarrow$ MS; ES/RJ $\Rightarrow$ DF;	SUL $\Rightarrow$ MS, DF
Urban/rural	Intrastate	-	GO	-	MS, MT	-	-
	Interstate between neighbors	DF $\Rightarrow$ MT, MS; TO $\Rightarrow$ MT	MG, SP, PR $\Rightarrow$ MS; AM, MS, GO $\Rightarrow$ MT;	TO, MG $\Rightarrow$ GO	MT $\Rightarrow$ MS; GO $\Leftrightarrow$ MS; RO, PA $\Leftrightarrow$ MT; BA, MT $\Leftrightarrow$ GO	DF $\Rightarrow$ GO	-
	Interstate between non-neighbors	NOR $\Rightarrow$ MT	SUL $\Rightarrow$ MS; SP, SUL $\Rightarrow$ MT; SUL $\Rightarrow$ DF	NOD, ES/RJ $\Rightarrow$ GO; ES/RJ, NOR, NOD, COE $\Rightarrow$ DF;	NOR, NOD $\Rightarrow$ MS; NOR $\Rightarrow$ GO	SP $\Rightarrow$ GO	ES/RJ $\Rightarrow$ MS
Rural/rural	Intrastate	-	-	-	MS, MT, GO	-	-
	Interstate between neighbors	DF $\Rightarrow$ MT	GO $\Rightarrow$ MS	AM $\Rightarrow$ MT	MT $\Leftrightarrow$ MS, SP, PR $\Rightarrow$ MS; RO, TO $\Rightarrow$ MT; GO; TO, BA, MG, MS, DF $\Rightarrow$ GO	-	MG $\Rightarrow$ MS; AM $\Rightarrow$ MT
	Interstate between non-neighbors	-	SUL $\Rightarrow$ MT; SP $\Rightarrow$ GO	NOR, NOD $\Rightarrow$ DF;	NOR, NOD $\Rightarrow$ MS; NOR $\Rightarrow$ MT; NOR, NOD $\Rightarrow$ GO; MS/MT $\Rightarrow$ DF	SUL $\Rightarrow$ MS	ES/RJ $\Rightarrow$ MS; SP $\Rightarrow$ MT; ES/RJ $\Rightarrow$ GO, DF; SUL $\Rightarrow$ DF