Determinants of migration in Brazil: regional polarization and poverty traps

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Abstract

In the present study, we used the neoclassic human capital model as the theoretical foundation for the analyses of the determinants of migration in Brazil. In order to do so empirically, we applied a multiple regression macro model of migration based on the gravity model and on the Poisson distribution. In the empirical model, the number of migrants between Brazilian mesoregions was the response variable, and socioeconomic and criminal regional aspects, as well as geographical dummies were the explanatory ones. The influence of the distance in the migratory process was analyzed and also the power of regional polarization by urban centers. The determinants of migration when applied to migrants in different income strata showed the evidence of poverty traps in the Northeast Region in Brazil, the poorest area of the country.

Key words: migration, Brazil, human capital model, poverty traps.

Resumen

Determinantes de la migración en Brasil: polarización regional y trampas de pobreza

En el presente estudio, usamos el modelo neoclásico de capital humano como base teórica para los análisis de los determinantes de la migración en Brasil. Para esto empíricamente, aplicamos una regresión múltiple del macro modelo de migración, basados en el modelo gravitacional y en la distribución de Poisson. En el modelo empírico, el número de migrantes entre las meso-regiones brasileñas fue la variable de respuesta, y los aspectos socioeconómicos y criminalísticas regionales y los modelos geográficos fueron las variables explicativas. La influencia de la distancia en el proceso migratorio, así como el poder de la polarización regional fueron analizados por centro urbano. Los determinantes de la migración al aplicarse a migrantes de diferentes estratos de ingresos mostraron evidencia de la existencia de trampas de pobreza en la Región Noreste de Brasil, el área más pobre del país.

Palabras clave: migración, Brasil, modelo de capital humano, trampas de pobreza.

Introduction

In the last decades, Brazil, that was mainly a rural country in the beginning of the 20th century, became increasingly urban and, nowadays, most of its population lives in cities. Much has been discussed about the main features that promoted this process and, undoubtedly, one of the most important one was the rural exodus, when many migrants left the rural parts of the country and had as the most common destiny the main cities.

In the nineties, it was said that a new migratory dynamics was being developed with the reversion of this tendency of population concentration. It was discussed that the main urban centers were losing their power of population attraction in favor of medium size towns and other locations. Besides this, other phenomena, such as the increase in the power of population retention by the areas that historically lost population and the enhancement of the return migration due to life cycle aspects were influencing this new demographic pattern in Brazil. But these were caused, at least in part, by conjunctural aspects and not by structural ones (Golgher and Golgher 2000).

The data from the Brazilian Census of 2000 showed that many of the main urban centers in Brazil, such as São Paulo Metropolitan Region, continued to attract many migrants, but many others areas, including rural ones, were also absorbing a considerable number of internal immigrants.

These migratory movements can be associated to the evolution of many regional characteristics, such as regional inequalities in per capita income and population densities. Also related to these movements are some historical aspects of the spatial distribution of population in Brazil that might still influence migration patterns. Consequently, spatial heterogeneities may impact on migration, but the reverse causal relation is also true. Migratory movements can have a decisive impact on regional poverty due to the selectivity of the flows of migrants (Castiglioni, 1989; Frey, 1995).

The change of place of residence can also promote many modifications on the individual's life. Normally, the migrants search better opportunities in the labor market, pursue an enhancement of their education or an increase in their quality of life.

The effects of poverty on migration and the implications of migration in the well-being of low income individuals may have conflicting factors. On one hand, poverty can be an incentive for migration, as a strategy of diversification of income sources or as a means against destitution. On the other, the probability to migrate can be diminished due to the costs of changing place of residence (Waddington and Sabates-Wheeler 2003). Consequently, as will be described in the human capital model applied to migration in the following section, migration will occur only if the migrant can overcome the social and economic cost of migration. Due to these difficulties, for many individuals in the lower income strata of the population migration may not be feasible. Even those that can choose whether or not to change their place of residence might have as destiny options only places that do not require great sums of capital that, normally, are places close to the origin or in which the potential migrant have social ties (Kothari 2002). As a result, for the poor and extremely poor, there might exist poverty traps, when migration is not an option or when the destiny options are only those places that do not permit a reasonable possibility to increase income.

Many studies that analyzed migratory issues in Brazil quantified migration between regions, discussed the spatial allocation of population or characterized migrants (For two classical works see: Azzoni 1986 and Redwood 1984). This paper presents the migratory process in another perspective; as it analyzes the determinants of migration in Brazil with the use of macro models of migration. It has two main objectives. The fist one is to analyze de determinants in all regions in Brazil with the gravity model in order to discuss the influence of the distance, of regional socioeconomic variables and regional polarization. The second one, based in the same type of statistical analyses, but for migrants in different income strata, is to discuss the differences between income groups, which might show some evidence of poverty traps in the migratory phenomena.

In order to do this the paper contains seven sections. The first one is this introduction. The subsequent section discusses the theoretical foundations of the analysis, which is the human capital model, with a brief literature review, presenting works similar to this one. The next section briefly shows some aspects of the Brazilian regional diversity, with emphases in the inequality of the human development index (HDI). After that, we present quantitative data about the migratory process. After that, we discuss the methodology and the macro model of migration that was used in the empirical analysis. Finally, the main empirical results are shown, and the final discussions and conclusions are presented.

Human capital model

The neoclassic human capital model was used as the theoretical foundation for the empirical analyses of the determinants of migration in Brazil. In a micro perspective, the migration is an investment made by workers, or population in general, in order to improve their position in the labor market or to enhance their quality of life. The rational individual decides if he (she) will migrate when the expected gains at the destiny minus the gains at the origin are superior to the migration costs. The following equation clarifies this proposition:

(1) $G_{ij} = (V_{ij} - V_{ii}) - C_{ij} > 0$

Where G_{ij} are the net gains of migration, V_{ij} and V_{ii} are respectively the expected benefits in the destiny and in the origin analyzed until the end of the temporal horizon of analysis, and C_{ij} are the costs of migration. The migration will only occur if the net gains are positive (Congdon, 1991; see Massey *et al.,* (1998) for a similar model).

The expected gains both in the origin and in the destiny depend on many regional aspects that would contribute to the relative attractiveness of a place when compared to others (Stillwell and Congdon, 1991). Among them are: economic features (unemployment rates, rent prices, salaries, residential market, presence of industrial activities, etc); social characteristics (low criminality, urban amenities, good educational opportunities, ample range of leisure activities, etc); environmental aspects (low levels of pollution, weather, quality of the environment, quantity of sunshine, etc); and others. In most studies, the main factors considered important in explaining migration are the economic ones, but some authors also pointed out to the importance of non-economic regional disparities (Knapp *et al.*, 1989; Greenwood, 1985; Porrel 1982).

The equation above shows that the propensity to migrate will be increased if the individual utility in his origin is low. In this case, it is said that the push factors are decisive to the promotion of migration. Conversely, this enhancement in the propensity to migrate also occurs if the expected utility in the destiny is high, that is, the pull factors determine the change of place of residence. Normally, persons in the bottom of the social pyramid are more influenced by the push factors and individuals with higher earnings are particularly touched by the pull factors.

The costs are also decisive in the analysis if the migration will occur or not. If the costs are low, any small positive difference in the expected benefits between the destiny and the origin would promote the migration. On the contrary, if the costs are very high, the probability that the change of residence will take place is much smaller. The costs of migration can be related to many different aspects: material ones, costs of information search, psychic costs, opportunity costs, costs due to the adaptation process, etc. It is believed that the distance is well correlated to costs.

Many hypotheses concerning the migratory process can be made based on the human capital model and they are cited below. These can be empirically analyzed with the use of gravity models. Some empirical works that applied these theoretical and empirical strategies are also cited below. Individuals will preferentially migrate from regions with lower per capita income to places with higher wages and better opportunities in the labor market. Poorer persons will give particular importance to the economic conditions in the origin, while richer ones will be relatively more influenced by the destiny's characteristics and by non-economic aspects. Migration between close regions is more numerous due to the lower costs associated to the migratory process. Persons with higher income can handle the costs of migration more effectively and this enables them to migrate to further places. The previous migration of individuals from a specific place to another can be decisive in the present formation of the flow of migrants between these same places, especially for the poorer population, because strong social nets may exist and this can decrease the costs of migration. Young people show a greater propensity to migrate due to the larger time horizon they have in order to benefit from migration. Urban dwellers might have a decrease in the migratory costs if they are migrating to other urban centers because they may have lower costs for information search and smaller psychic costs related to the adaptation process at the destiny. Workers with specific human capital that cannot be applied in many other places might have a lower probability to migrate. More risk averse persons might show a lower propensity to migrate.

Many authors based their empirical analysis of the determinants of migration upon the theoretical foundations of the human capital model or similar frameworks. Among then can be cited: Todaro (1980), Porrel (1982), Gabriel and Justman (1987), Flowerdew and Lovett (1988). Some of their results are summarized below.

Todaro (1980) reviewed many studies about the determinants of migration in developing countries that applied gravity models. In this work, he pointed out that most of the migrants originated from regions with low average incomes and had as destiny areas with higher mean income, as expected by the human capital model.

Porrel (1982) studied the determinants of migration in the USA. The pull factors were much more important than the push ones that were mostly non-significant. He found out that the migrants were driven to regions not only with better economic conditions but also with better climate and that had a more favorable group of urban amenities.

Gabriel and Justman (1987) analyzed the proportion of migrants in various regions in Israel. They verified the importance of the gravity model variables and also observed the importance of regional income differentials in the promotion of migration. One important finding of these authors was that risk aversion did have an impact in the migratory process, as was discussed above in the hypotheses associated to the human capital model.

Flowerdew and Lovett (1988) observed the importance of geographical variables for data from Great Britain also applying gravity models. They analyzed the importance of the contiguity of the units of analysis in enhancing the expected number of migrants and they also described the power of attraction of naval bases.

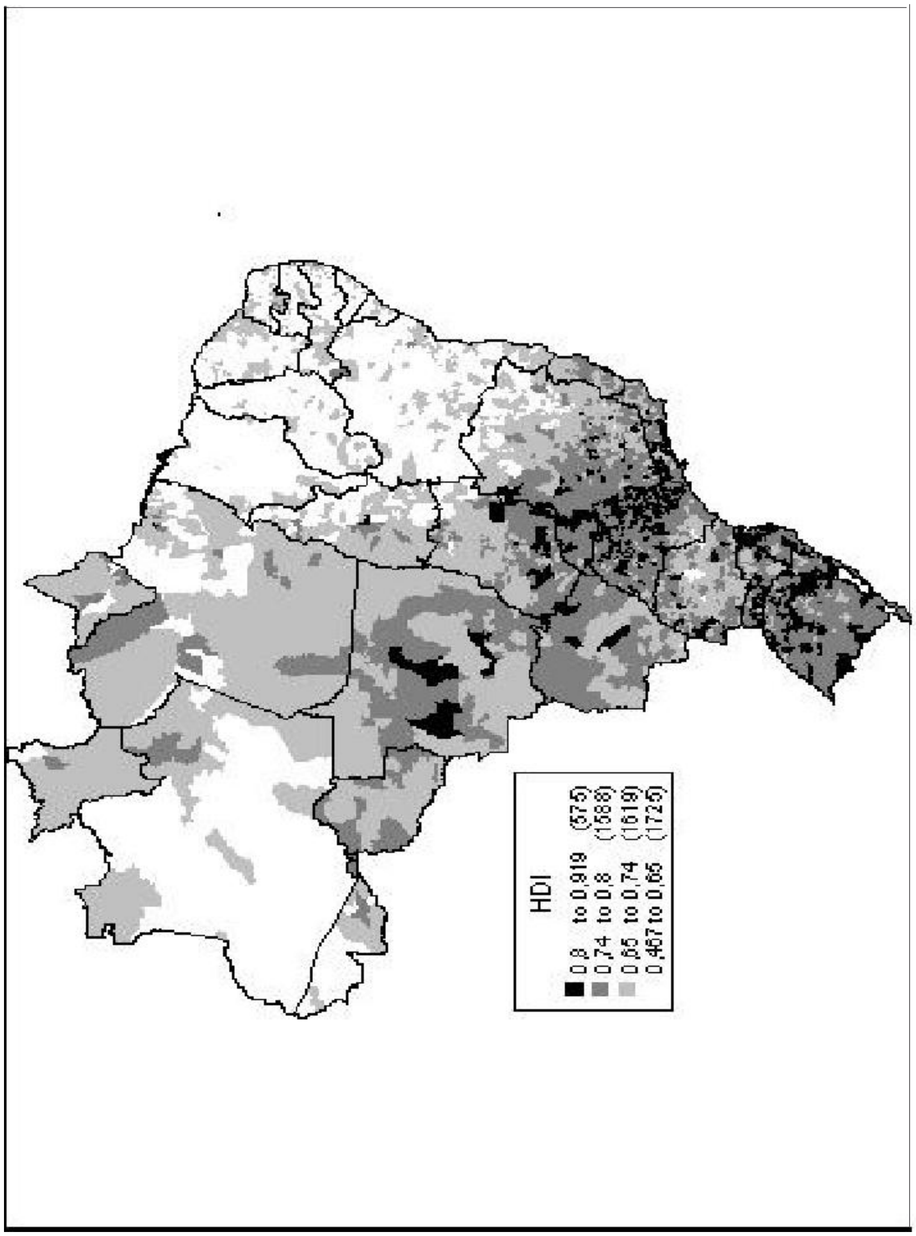
Regional diversity in Brazil

Brazil is one of the biggest countries in the world with more than 8 millions square kilometers, roughly the size of continental United States of America. It is divided in five macroregions (North, Northeast, Southeast, South Region and Center-West).

Brazil is one of the most unequal countries in income distribution and, also because of this, the poverty headcount is higher than in countries with similar per capita income. Barros *et al.* (2000) observed that the proportion of poor people was around 40 per cent from 1977 to 1994, before the Real Plan, and around 34 per cent after this plan untill 1999. Inequality was approximately stable between 1977 and 1999, with a Gini coefficient of approximately 0.60. In recent studies, it was noticed that both poverty and inequalities rates have fallen slightly in Brazil after 2000 (IBRE/FGV, 2005).

As was discussed by Hoffmann (2000), the data for the proportion of poor people shows a great geographical variability in Brazil. The Northeast Region, for instance, the region with the higher proportions of poor people, had only 29 per cent of the Brazilian population, but 53.2 per cent of the deprived in 1997. The North Region had the second highest relative numbers of poor people. Ferreira et al (2000) observed similar trends.

The map 1 shows for municipalities in Brazil in 2000 some features of this diversity that are directly related to the migratory process and the evidence of poverty traps, that is human development index (HDI) (www.undp.com for details). Areas with low values for this variable present lower socioeconomic levels. As can be easily seen, Brazil could be roughly divided in some regions according to this index.


HDI
0,8 to 0,919 (575)
0,74 to 0,8 (1588)
0,65 to 0,74 (1619)
0,467 to 0,65 (1725)

Two areas with an HDI lower than 0.65: one is composed mainly of the Northeast Region; and another area located in the west parts of the states of Amazonas and Acre. The first one of these is a highly populated area, while the second shows a much smaller population. On the one hand, some other regions had a better index, such as: one that counted with the state of São Paulo and parts of the southeast and Center-West Regions; another one in the two states located in the most southern part of Brazil; and an area in the center-north of Mato Grosso state.

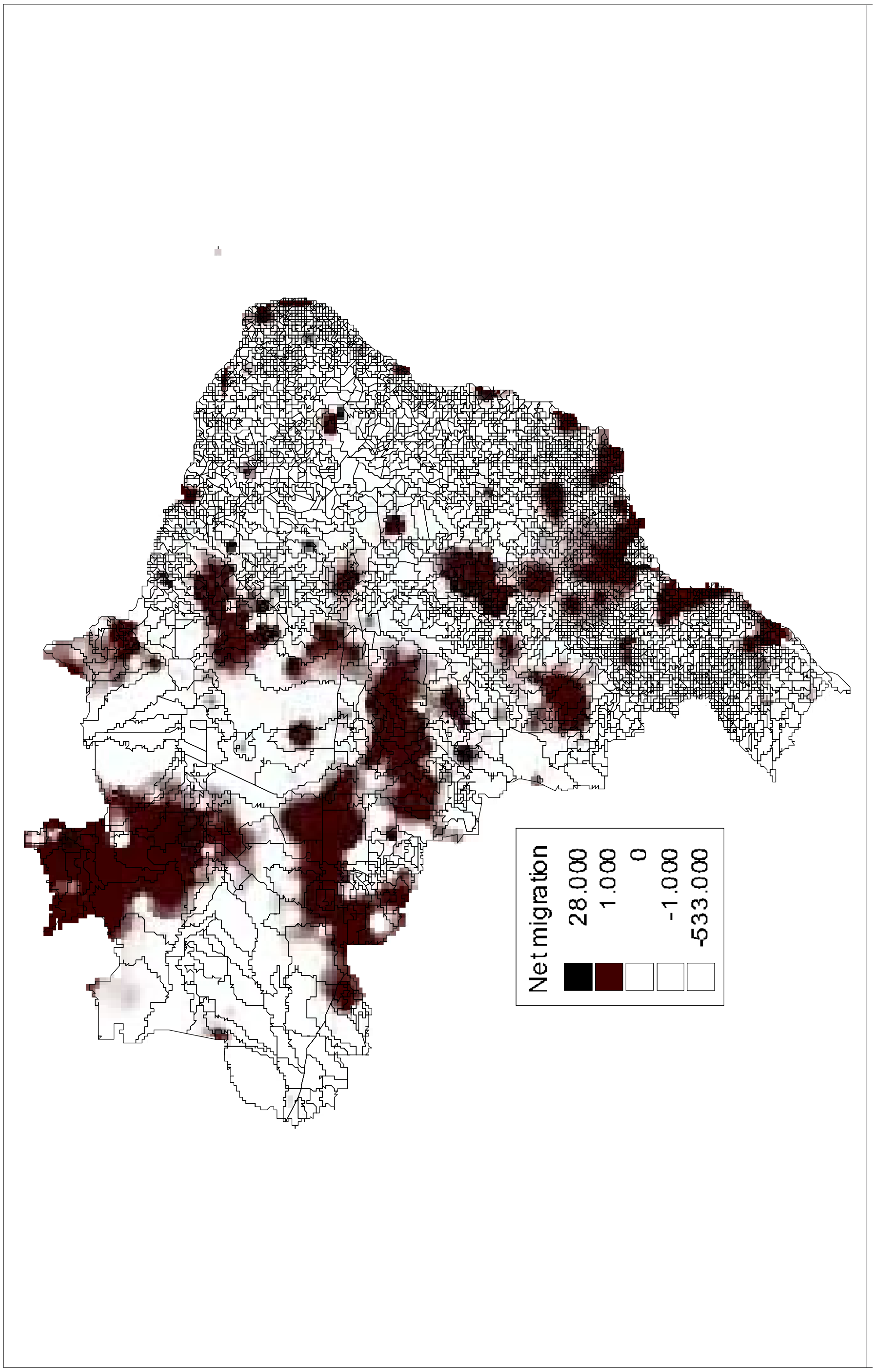
Migratory data

This section discusses some quantitative data about the internal migratory process in Brazil in 2000 for municipalities presented in the Demographic Census of this cited year. All the flows between the Brazilian municipalities were estimated with the use of the following question: "In which municipality did you live five years ago?". The data does not include international migration.

The number of migrants in Brazil in the 1995/2000 period, as specified above, was 15 315 242. The majority of these migrants, 70.4 per cent of the total, migrated between urban areas. The other types of migration rural to urban (13.3 per cent), urban to rural (8.8 per cent) and rural to rural (7.6 per cent) were less numerous (Golgher, 2006a).

As was discussed above, the costs of migration are extremely important both qualitatively and quantitatively in the migratory process. The closer the origin and the destiny, the more numerous is the flow and, normally, the higher is the proportion of low income migrants. In Brazil, 66 per cent of the internal migrants are intrastate, while only 34 per cent are interstate (Golgher, 2006b). Among these last ones, most migrated from a neighbor state, also in a relatively short migration. Numerous distant flows were also noticed between the poorest region in Brazil, the Northeast Region, and the most populous urban center, São Paulo Metropolitan Area.

Some states presented a negative internal net migration, especially in the Northeast of Brazil in states, such as: Bahia (-267 465), Maranhão (-173 653) and Pernambuco (-115 419). Most of the states in the South, Southeast and Center-West regions had positive figures for net migration. The three states with the greatest numbers were São Paulo (339 926), Goiás (202 802) and Santa Catarina (59 986) (Golgher, 2006b).


Net migration
28.000
1.000
0
-1.000
-533.000

The internal net migration for each municipality for this same period is presented in map 2. The dark areas are the regions with positive internal net migration. There are many of these areas, many quite extensive, and some of them are cited below. One is located in the northern part of the country. It can be seen that this is a quite big region composed by the area around Manaus and the state of Roraima up north. A little more south from this region there is another one located in the southwest of the Amazon Forest region. A third large area of population attraction is seen a little more south and east from this last one in the Mato Grosso state. From this last region in the north direction, it can be seen some others smaller areas of population attraction. These areas were the main regions of population attraction in the north of Brazil.

Other areas also showed a positive net migration in other regions in Brazil, most of them around states capitals or around medium and large urban centers. Among these it can be seen three extensive areas: one of them in Santa Catarina and Paraná states in the South Region, which includes both state capitals; another one is observed around the municipality of São Paulo, part of this area is the outskirts of the Metropolitan Region of São Paulo;[1] and the other one is located a little north, in the center of Brazil, with the urban centers of Brasilia and Goiânia (Golgher, 2006c).

Methodology

We applied multiple regression macro models of migration based on the gravity model and Poisson distribution in the empirical analyses, which can be described as similar to a multi-stream migration model (Gordon, 1991).

This section discusses the employed methodology and was divided in two parts: the first one presents the empirical model; and the second one specifies some of the features about the data.

The empirical model

Macro models of migration are normally used in studies that analyze the relationship between regional characteristics of the origin and the destiny of the migrant and the existence of flows of migrants. The general idea of this kind of model can be expressed by the equation below:

[1] The nucleus of the Metropolitan Region shows a negative net migration mainly due to the intraurban migration with the outskirts of this area.

$M_{ij} = Af(i)g(j)h(d_{ij})$

Where M_{ij} is the dependent variable related to the migratory process; A is a scale constant; f(i) is a function of the characteristics of the migrant's origin, which includes the population and socioeconomic variables; g(j) is a similar function for the destiny's characteristics; the costs of migration are represented by $h(d_{ij})$ that is a function of the distance between the origin and destiny of the migrant (Stillwell and Congdon, 1991). The functions f(i) and g(j) indicate the power of attraction/repulsion/retention of population respectively for the origin and for the destiny.

In this work, the model above has the specific following basic structure:

$$Mij = \exp(b_0 + b_1 lnPi + b_2 lnPj + b_3 lndij + SbiXi + SbjXj) + ei$$

Where Mij is the number of migrants between the origin, i, and the destiny, j; bs are the parameters obtained by the multiple regression analysis; Pi and Pj are the populations of i and j; dij is the distance between i and j; and Xi and Xj are respectively the other independent variables, which include socioeconomic and criminal aspects of i and j.[2]

Normally, models based in the Poisson distribution are much superior to the ones based on the normal distribution when used in studies similar to this one. However, the process of migration shows some features that are not well explained by this first distribution. Some of them are cited below. An individual does not always migrate as an independent entity. When a member of a family migrates to a specific destiny, the probability that another member will do the same is increased. Persons from the same place have a tendency to migrate to similar localities due to the existence of social networks. Besides this, different individuals can show different propensities to migrate. These and other phenomena cause an over dispersion of the data used as the response variable. In order to overcome this difficulty, an alternative is the use of models that are still based on the Poisson distribution, but that also counts with an extra specification for the error fixing the *deviance* as equal to the number of degrees of freedom (Flowerdew 1991; Congdom 1991). This proposed model was the one used here in the empirical analysis.

[2] Other independent variables were also included in some of the empirical models; many of them related to specific flows of migrants and to geographical/historical characteristics of Brazilian spatial distribution of population and economic activity. These variables were not directly linked to origins and destinies.

The data

Most of the variables used in the empirical analysis were obtained from the microdata of the Brazilian Demographic Census of 2000 (FIBGE, 2000b). In 2000, Brazil had 5507 municipalities and these were grouped in nearly a thousand microregions. Instead of using any one of these as a geographical unit of analysis, it was chosen to use the data more aggregated by mesoregion. There were 137 of these in Brazil in 2000. The response variable in the model is the number of migrants between two mesoregions in Brazil. This dependent variable was obtained from the following question from the 2000 Census: "In which municipality did you live five years ago?" The use of smaller geographical unit of analyses would present many null flows.

Another point to be emphasized is that the use of more aggregated data by mesoregion excludes from the analyses most short migrations, although some, as migrations from the Federal District to the vicinities in Goiás state, are still among them (Golgher, 2006c). This fact changes qualitative the type of migration being studied as the main reason to migrate depends fundamentally on the distance associated to the process (Gordon, 1991). Aspects related to residential features are the main motivation for short distance migration, mostly up to 20 km. Medium range ones, approximately from 20 to 100 km, have as their main reason environmental features. Longer migrations are mostly influenced by labor market characteristics. Hence, it can be inferred that most migrations in this study are motivated mainly by labor market features. Therefore, the empirical models include independent variables that are related to these aspects.

It must also be emphasized that the use of flows of migrants between two areas is one among many possible choices. For instance, Todaro (1980), in a review about macromodels of migration, cited the following dependent variables: flows of migrants between two places; flows of migrants divided by origins' population; flows of migrants divided by the populations of the origin and of the destiny; and other similar variables. In this paper, we chose to use the first one of these variables using a classical gravity model, as applied by Flowerdew and Lovett (1988). By doing so, we did not assume that the flows are proportional to populations of the origin or of the destiny, but simple an increasing linear function of both. However, this is a choice among many other possibilities, and this must be highlighted. Other possibilities, that are also much used, such as the probability to migrate from one region to another, could also have being used.

We applied different empirical models using the dependent variable and they could be divided in two groups. The first group of analysis was done with flows for all migrants and had as the main objective to determine the socioeconomic, demographic, criminal and geographical characteristics that influenced the formation of them. A second group of regressions were made with two specific groups of migrants in different income strata: the ones that had a household per capita income below 0.5 Brazilian minimum wages (MW) and others that had the same income above five MW. The main purpose of this last group of analysis was to investigate the differences in the determinants of migration for different income strata in order to, possibly, differentiate the impact of the push and pull factors on migration, and of the regional polarization effect.

The independent variables could approximately be divided in three groups. The first one is composed by the gravity model variables, as applied here with the flows of migrants between two places as the dependent variable. These are the logarithms of the origin's population, the same for the destiny and the logarithm of the distance between these two places. As pointed out above, the magnitude of flows of migrants tend to be an increasing function of the origin's and of the destiny's population and these independent variables are particularly important in gravity models (Aroca, 2004). It must be mentioned that the variable do have some limitations as they were used here. First, migrant flows have an impact on the population size and composition. We used population in the end of the period and this may be correlated with the size of the flows, although this is especially true for net migration. Moreover, flows are continuously made. We analyzed migration in the last five years and roughly the mean time since migration is two years. The best choice would be to include the instantaneous population or a approximated distribution of it during the last five years instead of final population, a simpler option. Besides that, as described above, we analyzed three groups in the population, all migrants, and the ones with household per capita income below and above specific thresholds. We do not have any information of income before migration. Therefore, we can not rely on information of population size by income prior to migration in order to include in the models. Finally, given these limitations, the gravitational model should be seen as a basis for comparisons with the more sophisticated ones presented in the text. Also in the models are the distances between two mesoregions. These were defined by road (or boat in a few cases) distance between the main municipality of the mesoregion. These variables are used as a parallel to the classical gravity force problem. The expected is that the number of migrants (force) is proportional to the populations (masses) and to the inverse of the distance (Gauss law in R^2). In this group of variables, it was also included a geographical dummy related to the contiguity between mesoregions. This variable tries to overcome some of the difficulties that arise with the use of a specific geographical unit of analysis instead of smaller units, such as municipal districts. Municipal districts that are neighbors but that are located in different mesoregions are normally much closer than is specified in the models, which use, approximately, the mean distance between mesoregions, or better defined, the road (or boat in a few cases) distance between the main municipality of the mesoregions.

The second group tries to determine the relative attractiveness of different places, as was discussed while presenting the human capital model and the hypotheses associated to this model. It is composed by socioeconomic variables that were also obtained from the Census, such as: urbanization degree (%), unemployment rate (%), average income (in MW), population schooling (years of formal education), proportion of workers in the different sectors of the economy (%), etc. This group of variables also counts with data for the mean number per year of homicides in the period of 1991-1993 that was obtained from the external causes of the mortality system information from SUS.

The third group includes many geographical dummies. One important aspect in the migratory process is that many urban centers in Brazil have a particular strong effect of regional polarization. This influences decisively the exchange of products, services and population between the urban center and the polarized area, lowering the costs associated to them, and, hence, as proposed by the human capital model, enhancing the probability of migration. In order to deal with these phenomena, geographical dummies were included in the model, one for each mesoregion that included a urban centers that had a national, regional or microregional polarization effect[3] (FIBGE, 2000a). The dummies indicate if the flows of migrants were between the mesoregion containing the specific urban center and its area of influence.

Based on the Central Place Theory and on the idea that urban centers exchange goods and services in a hierarchical manner, FIBGE (2000a) analyzed over 1000 municipalities in Brazil regarding many types and areas of interactions (Moura, 2001). Founded on these results, they classified the urban centers in eight categories, depending on the level of polarization, and also determined the areas of influence.

[3] Aracaju, Belém, Belo Horizonte, Brasília, Campinas, Campo Grande, Cuiabá, Curitiba, Fortaleza, Goiânia, João Pessoa, Maceió, Manaus, Natal, Porto Alegre, Porto Velho, Recife, Ribeirão Preto, Rio Branco, Rio de Janeiro, Santos, São José do Rio Preto, São Luis, São Paulo and Teresina.

Besides that, for each urban center that polarized in a national scale, Rio de Janeiro and São Paulo, it was also included three other dummies. The dummies are: for all the flows with origin in one of these urban centers; the same for the destiny; and for the flows between the Northeast Region of Brazil and the cited urban centers. These last variables are justified by historical features of the Brazilian spatial population dynamics that promoted stronger interactions between this region and these two urban centers.

The analyses of the residuals prompted the establishment of other six dummies: three indicating if the migration was between São Paulo and the states of the Northeast Region of Bahia, Pernanbuco or Maranhão; and three other based on microregional migrations aspects in the states of Mato Grosso do Sul and Minas Gerais.

The interaction between the distance and the area of polarization was also included as the former surely influences the strength of the latter.

Main empirical results

In this section, we discuss the empirical results below for different types of econometric models, bridging them with the theoretical discussions regarding the human capital model. The presentation begins with a model that includes the gravity model variables, the contiguity dummy, and the socioeconomic and criminal variables. After this, two other models will be presented: the first one with the gravity model variables and the geographical ones; and finally, a more sophisticated model with all the variables of the previous ones.

Gravity model, contiguity, socioeconomic and criminal variables

This subsection shows models that include the variables of the gravity model with the contiguity variable, and also include the urbanization degree at the origin and at the destiny, the average labor regional income in these two regions, the proportion of workers in the primary sector and in the industry (due to dependence of the data, the proportion of workers in the tertiary sector was the omitted variable in the models), both for the origin and for the destiny, and also the homicide rate in both regions. The correlations between these variables and also between these variables and the dependent variables are shown in annex in two tables. Some commentaries are also included.

The results for the econometric models are showed in table 1. The variables that are significant in a five per cent basis are showed in boldface. Given the coefficients of the other variables in the model, the constant term adjust the estimated values to the empirical ones via the maximum likelihood method. Last equation in the previous section describes the mathematical relation between the magnitude of the flows and independent variables.

As expected, the larger the population in the origin and in the destiny the more numerous were the flows of migrants. The coefficients for all migrants were respectively 0.69 and 0.91. If the interchange of migrants were exactly proportional to the populations, the coefficients would be one, as already mentioned. As can be seen in the other tables, in most of the models, the coefficient were below 1 and above 0.60, even considering the Standard Wald 95 per cent confidence interval. These results indicate that flows did increase with population but less than proportionally, suggesting greater mobility between areas with smaller population.

The results for the distance showed that the numbers of migrants decreased when the distance between the origin and the destiny increased, as pointed out in the theoretical discussion. However, the coefficient, -0.43, was well below – 1, as firstly expected. This last finding can be partially explained by the non-linearity of the costs of migration in relation to the distance due to the differences between real and perceived distances (Cadwallader 1992; Bell *et al.*, 1990): short distances would be over dimensioned and the long ones would be underestimated. Other aspect that has an impact, increasing the distance coefficient, is the contiguity dummy, that presents some colinearity with the distance, that was significant and positive (2.24). This result shows that the flows between neighbor areas are more numerous than expected by the mean distance between contiguous mesoregions. This is explained by the fact that the real distances associated to migration with origin and destiny in mesoregions that are contiguous are, in average, much smaller than the distances between the most important municipal districts in the mesoregion, which were used to build the distance variable. Another point that might influence this result is the possibility of intraurban migration between different mesoregions in a few flows of migrants.

The last two columns in table 1 compare migrants in different strata of family per capita income. It can be seen that the distance coefficient is smaller for the higher per capita family income migrants than for the other group, that is, the Standard Wald 95 per cent confidence intervals do not overlap. Conversely, the contiguity dummy has a higher value for the lower income one, indicating that low distance migration is proportionally more important for this stratum than for the higher income one. These two coefficients together indicated that a similar overall effect of deterrence due to the distance for both income strata existed (analyses without the contiguity dummy showed a similar coefficient for both income groups). As was discussed above in the human capital model, this was not expected: normally the lower income strata have a smaller (greater modulus) coefficient.

The urbanization degree coefficient in the origin was negative for all the models. This result would indicate that less urbanized areas had larger flows that more urbanized one. But note that these coefficient signs can be at least partially explained by the negative coefficient observed for the proportion of workers in the primary sector in the origin. These two variables are normally positively correlated. For the destiny, the urbanization degree coefficient was negative for all the migrants and the variable for the proportion of workers in the primary sector in the destiny was not significant. This result suggests, as was show in the section of migratory data, that many areas of population attraction do not show a high degree of urbanization. When migrants from different income strata are compared, it can be seen for the higher income strata that the urbanization degree in the destiny coefficient was positive, showing that for this type of migrant the preferential migration are highly urbanized areas, while the contrary was observed for the lower income group.

The coefficients related to income were positive for the origin for the three groups of migrants. As was discussed in the human capital model, this was not expected in a first and preliminary analysis. Some explanations can be given to address this finding. One possibility is the existence of multiple stage migration due to the continental size of Brazil. Migrants would make many changes of place of residence between their first origin and their final destiny. An example of a two step migration: the first one from one urban center to another; the second one from this last urban center with high average income to areas with lower average income in a short distance step. Other aspect that can also influence the average income in the origin coefficient could be the possibility of the return of migrants to their place of origin at the end of the productive cycle or by reasons of poor evaluation of the destiny and high turnover. These flows have as their main origin larger urban centers with high average income, as São Paulo Metropolitan Region. One last point is that a proportion of the intraurban migration in Brazil is done between mesoregions, normally from a richer more urbanized central urban center to less urbanized ones. All these phenomena were observed empirically in quantitative studies (Golgher, 2006a, 2006b, 2006c). All the coefficients for the destiny were positive and significant, as expected by the human capital model.

The coefficients for the proportion of workers in the primary sector were negative for the origin. These might be caused, at least partially, as already noticed, by the negative coefficient for the urbanization degree in the origin. Also, as is expected by the human capital model, normally workers in the primary sector show less mobility than others because they are linked to the earth plot where they work, and this may have an impact on the coefficient as flows tend to be less numerous than otherwise.[4] For the lower income strata migrants, the coefficient was also negative and significant in the destiny. For the other type of migrants, the coefficient was not significant. This negative coefficient suggests that these migrants have as preferential destiny regions that are not highly urbanized, as suggested by the negative coefficient for the urbanization in the destiny, but have a more developed service sector with a greater proportion of workers in this economic sector.

All the coefficients for proportion of workers in the industrial sector were negative and significant. One possible explanation for this is that, as proposed by the human capital model, individuals that work in the industrial sector may have specific human capital that cannot be used effectively in many other places. Hence, they may show a smaller probability to migrate than workers in the services sector, what would have a diminishing impact on the size of the flows.

The coefficients for the homicide rate in the origin where negative and significant. This means that, when the other variables are considered, a higher rate of homicides promotes less numerous flows of migrants, what is counter intuitive. Any explanation regarding this result requires further investigation than at hand presented in this paper. Moreover, this result may be spurious due to other correlated variables, as the coefficients were non-significant in the last model discussed in this study. For the destiny, all the coefficients were non-significant showing that, at least for the migration between mesoregions, they do not impact in the promotion of migration.

[4] However, these results as discussed here should be analyzed with some precautions. The models are applied to macro data, and the decision whether to migrate or not is done in a micro basis. It is inferred that individuals with lower probability of migration, as discussed in the human capital model, will promote less numerous flows of migrants if all the other variables are held constant, as observed in the empirical gravity models.

TABLE 1
THE DETERMINANTS OF MIGRATION: GRAVITY MODEL, CONTIGUITY DUMMY AND SOCIOECONOMIC VARIABLES– 1995-2000

Variable	All migrants	Lower household per capita income migrants	Higher household per capita income migrants
Intercept	-11.1	-11.6	-14.2
Origins population	0.69	0.71	0.63
Destiny's population	0.91	0.92	0.87
Distance	-0.43	-0.43	-0.46
Contiguity dummy	2.24	2.30	1.91
Urbanization degree in origin	-0.005	-0.007	-0.006
Urbanization degree in destiny	-0.010	-0.014	0.015
Average income in origin	0.291	0.219	0.369
Average income in destiny	0.211	0.173	0.336
Proportion of workers in the primary sector in the origin	-0.0174	-0.0192	-0.0294
Proportion of workers in the primary sector in the destiny	-0.0031	-0.0077	0.0032
Proportion of workers in the secondary sector in the origin	-0.0253	-0.0311	-0.0333
Proportion of workers in the secondary sector in the destiny	-0.0637	-0.0648	-0.0467
Homicide rate in the origin	-0.0017	-0.0016	-0.0038
Homicide rate in the destiny	-0.0005	-0.0002	-0.0003

Source: FIBGE, 2000.
Note 1: the significant variables are boldface.
Note 2: the number of observations is 18632.
Note 3: The Poisson model has no natural counterpart to the R^2 in a linear regression model. However, there are many alternatives suggested. We used the R_p (Greene, 2003), where we used as a default of comparison in the denominator the gravitational model with the variables of population and distance.

R_p^2: 0.565 (all migrants), 0.581 (lower income) and 0.536 (higher income).

Gravity model, contiguity and geographical variables

Two different models will be discussed in this subsection. They include the gravity model variables and the contiguity dummy, but do not include the other variables presented in table 1.

Model 1

As showed in table 2, geographical dummies were included in the model; one for each of the urban centers that had a national, regional or microregional polarization effect (FIBGE, 2000a). It was also included in the model six other dummies, three for the mesoregion of the city of São Paulo and the same three for the mesoregion of the city of Rio de Janeiro.

One important feature of the models presented in table 2 is that nearly all the regional polarization dummies were statistically significant and positive. For the model with all migrants, only three exceptions were noticed that were not significant in a five per cent basis. These urban centers all located near the Metropolitan Region of São Paulo with a greater polarization effect that might be disturbing the much weaker polarization effect of these smaller urban centers. These positive coefficients for the urban centers dummies suggest that the costs of migration are lowered by the past interchange of products, services and population. The existence of social networks and better channels of information change between the hinterland of urban influence and the urban center seems to be decisive in the promotion of migration.

For the lower and higher income strata migrants the coefficients were also mostly positive and significant. For the first group, there were the same three exceptions cited above. In the other income group, there were four exceptions one from this same state, Santos, and three other from the Northeast Region. Two of these urban centers are located in states that are among the less socially developed ones in Brazil, Maranhão and Alagoas. This indicates that these urban centers do not have a significant polarization effect upon the higher income strata. The other urban center that showed a non-significant coefficient was Aracaju, which is a medium size urban center located between two other larger urban centers, Salvador and Recife with greater polarization effect, which might be disturbing the much weaker polarization effect of this urban center. This lack of statistical significance noticed for the polarization effect of these urban centers in the Northeast Brazil for the higher income group, contrary to the observed for the lower income group, indicate that only for his last group that the polarization effect of these medium size urban centers are effective.

Another point that must be emphasized here is the differences between the distinct income strata, as indicated by the confident intervals, in the magnitude of these coefficients. For most of the urban centers located in the North or Northeast of Brazil, the coefficient for the lower income strata group was larger than for the other group showing a greater power of attraction of these cities for this kind of migrant. The contrary was observed for the urban centers in South, Southeast and Center-West Regions of Brazil, including Porto Velho and Rio Branco, which are located in the North Region, but are close to this last region. Some exceptions were noticed, such as for Rio de Janeiro and for Belo Horizonte that showed a similar coefficient for both groups of migrants. This, and the results discussed above for the statistical significance of the coefficients, show that Brazil could be divided in two areas of preferential polarization: the North and Northeast Regions for the low-income strata and the South, Southeast and Center-West for the other group. These two first regions present a much lower regional income than the other three. Consequently, many of the low income migrants are trapped in regions were incomes are smaller, diminishing the power of the migratory process as an individual or familiar strategy against poverty.

The dummy São Paulo-Northeast was positive and significant for all types of migrants. This indicates that the flows between these two regions are larger than expected by the other variables in the model. Notice that this region is already included in the area of polarization of São Paulo. For Rio de Janeiro, this same variable was smaller and significant only for the migrants in general and for the lower income group. This suggests that this center, although it continues to be a focal point of attraction for migrants from/to the Northeast of Brazil, is not as powerful as São Paulo, especially for the population with higher income. The dummies for the origin showed a negative sigh for these two urban centers indicating that, even after considering all the other variables in the model, these two urban centers have a strong power of population retention. For the destiny, only the variable for São Paulo showed a positive and significant coefficient indicating an extra power of attraction for all regions in Brazil.

TABLE 2
THE DETERMINANTS OF MIGRATION: GRAVITY MODEL, CONTIGUITY DUMMY AND GEOGRAPHICAL DUMMIES 1995-2000

Variable	All migrants	Lower household per capita income migrants	Higher household per capita income migrants
Intercept	-11.48	-11.49	-19.93
Origins population	0.79	0.74	0.96
Destiny's population	0.63	0.61	0.92
Distance	-0.41	-0.39	-0.42
Contiguity dummy	1.83	1.95	1.44
São Paulo city dummy	0.24	0.14	0.79
Rio de Janeiro city dummy	1.21	1.17	1.18
Belo Horizonte dummy	0.77	0.68	0.67
Porto Alegre dummy	1.37	1.12	1.57
Curitiba dummy	1.76	1.61	1.96
Campo Grande dummy	2.28	2.14	2.78
Cuiabá dummy	2.06	1.95	2.64
Goiânia dummy	1.80	1.69	1.77
Brasília dummy	2.24	2.13	2.24
Porto Velho dummy	2.44	2.38	2.85
Rio Branco dummy	2.37	2.18	2.45
Manaus dummy	1.86	1.90	1.59
Belém dummy	2.14	2.26	1.83
São Luis dummy	0.75	0.91	0.28
Teresina dummy	0.71	0.84	0.37
Fortaleza dummy	1.95	2.07	1.34
Natal dummy	1.94	1.98	1.76
João Pessoa dummy	1.26	1.31	1.16
Recife dummy	0.76	0.92	0.56
Maceio dummy	0.49	0.68	0.40
Aracaju dummy	0.40	0.38	-0.36
Ribeirão Preto dummy	0.25	0.09	0.47
Campinas dummy	0.39	0.36	0.60
Santos dummy	-0.12	-0.21	0.28
São José do Rio Preto dummy	-0.05	-0.11	0.32
São Paulo - Northeast dummy	2.65	2.82	0.91
São Paulo origin	-0.17	-0.14	-0.14
São Paulo destiny	1.16	1.30	0.36
Rio de Janeiro - Northeast dummy	1.05	1.15	0.02
Rio de Janeiro origin	-0.50	-0.51	-0.30
Rio de Janeiro destiny	0.03	-0.03	0.38

Source: FIBGE, 2000.
Note 1: the significant variables are boldface. Note 2: the number of observations is 18632.

Note 3: R_p^2: 0.620 (all migrants), 0.636 (lower income) and 0.516 (higher income).

TABLE 2
THE DETERMINANTS OF MIGRATION: GRAVITY MODEL, CONTIGUITY DUMMY AND GEOGRAPHICAL DUMMIES 1995-2000

Variable	All migrants	Lower household per capita income migrants	Higher household per capita income migrants
Intercept	-11.48	-11.49	-19.93
Origins population	0.79	0.74	0.96
Destiny's population	0.63	0.61	0.92
Distance	-0.41	-0.39	-0.42
Contiguity dummy	1.83	1.95	1.44
São Paulo city dummy	0.24	0.14	0.79
Rio de Janeiro city dummy	1.21	1.17	1.18
Belo Horizonte dummy	0.77	0.68	0.67
Porto Alegre dummy	1.37	1.12	1.57
Curitiba dummy	1.76	1.61	1.96
Campo Grande dummy	2.28	2.14	2.78
Cuiabá dummy	2.06	1.95	2.64
Goiânia dummy	1.80	1.69	1.77
Brasília dummy	2.24	2.13	2.24
Porto Velho dummy	2.44	2.38	2.85
Rio Branco dummy	2.37	2.18	2.45
Manaus dummy	1.86	1.90	1.59
Belém dummy	2.14	2.26	1.83
São Luis dummy	0.75	0.91	0.28
Teresina dummy	0.71	0.84	0.37
Fortaleza dummy	1.95	2.07	1.34
Natal dummy	1.94	1.98	1.76
João Pessoa dummy	1.26	1.31	1.16
Recife dummy	0.76	0.92	0.56
Maceio dummy	0.49	0.68	0.40
Aracaju dummy	0.40	0.38	-0.36
Ribeirão Preto dummy	0.25	0.09	0.47
Campinas dummy	0.39	0.36	0.60
Santos dummy	-0.12	-0.21	0.28
São José do Rio Preto dummy	-0.05	-0.11	0.32
São Paulo - Northeast dummy	2.65	2.82	0.91
São Paulo origin	-0.17	-0.14	-0.14
São Paulo destiny	1.16	1.30	0.36
Rio de Janeiro - Northeast dummy	1.05	1.15	0.02
Rio de Janeiro origin	-0.50	-0.51	-0.30
Rio de Janeiro destiny	0.03	-0.03	0.38

Source: FIBGE, 2000.
Note 1: the significant variables are boldface. Note 2: the number of observations is 18632.

Note 3: R_p^2: 0.620 (all migrants), 0.636 (lower income) and 0.516 (higher income).

Model 2

The next model considers all the variables cited above and the interaction between the distance and the regional dummies. The results are shown in table 3.

Most of the geographical dummies continued to be positive, as was noticed in the previous model, although the values were a little higher, showing, one more time, the effect of regional polarization in lowering the costs of migration. Only two urban centers with a small area of polarization showed negative signs. For most urban centers the interaction coefficient was negative. This suggests that the polarization effect is relatively more powerful when the distance between the regions is small. The only exceptions were the two urban centers that showed a negative sigh in the geographical dummy and another one that showed a positive coefficient for both variables.

Some differences were noticed when migrants from different income strata were compared. The most important result was that the interaction variables were positive for the higher income strata for Rio de Janeiro, Brasilia, Belém and Ribeirão Preto, indicating a relative stronger effect of long distance polarization for this type of migrant.

Gravity model, contiguity, socioeconomic, criminal and geographical variables

The last three models discussed include all the variables that were discussed in all the previous models, as presented in table 4. Most of the variables presented in the model have the same sigh and approximately the same values as the ones presented above. The main differences observed are discussed below.

It is verified that the coefficient for urbanization degree in the origin and in the destiny that were negative in table 1 for all migrants and for the lower income strata became positive, when the geographical dummies and the interactions were included in the model. This suggests that the preferential origin and destiny, when the effects of regional polarization are included, are the more urbanized areas instead of the more rural ones. This may have been also caused due to the correlation between the urbanization degree and the proportion of workers in the primary sector that showed a non-significant coefficient for the origin and a positive coefficient for the destiny in the complete model, instead of negative signs for both observed before.

TABLE 3
THE DETERMINANTS OF MIGRATION: GRAVITY MODEL, CONTIGUITY DUMMY AND GEOGRAPHICAL DUMMIES 1995-2000

Variable	All migrants	Lower household per capita income migrants	Higher household per capita income migrants
Intercept	-10.89	-10.89	-19.81
Origins population	0.79	0.74	0.96
Destiny's population	0.61	0.58	0.92
Distance	-0.44	-0.43	-0.44
Contiguity dummy	1.99	2.10	1.53
São Paulo - Northeast dummy	2.37	2.48	0.88
São Paulo origin	-0.24	-0.21	-0.19
São Paulo destiny	1.17	1.29	0.36
Rio de Janeiro - Northeast dummy	1.04	1.12	0.08
Rio de Janeiro origin	-0.41	-0.40	-0.29
Rio de Janeiro destiny	0.18	0.13	0.41
São Paulo city dummy	2.38	2.43	1.59
Rio de Janeiro city dummy	2.33	2.55	0.46
Belo Horizonte dummy	5.91	6.50	1.73
Porto Alegre dummy	16.83	17.82	10.02
Curitiba dummy	10.05	10.14	8.20
Campo Grande dummy	-58.99	-67.03	-41.05
Cuiabá dummy	1.63	1.22	2.50
Goiânia dummy	6.53	6.64	3.88
Brasília dummy	2.78	3.12	0.77
Porto Velho dummy	9.89	9.45	14.91
Rio Branco dummy	2.21	2.03	2.37
Manaus dummy	6.13	6.21	1.69
Belém dummy	2.36	2.80	1.59
São Luis dummy	6.68	7.91	2.26
Teresina dummy	1.54	1.05	4.74
Fortaleza dummy	6.39	6.70	7.32
Natal dummy	5.04	4.65	9.36
João Pessoa dummy	11.34	11.50	9.25
Recife dummy	2.88	3.00	2.71

TABLE 3
THE DETERMINANTS OF MIGRATION: GRAVITY MODEL, CONTIGUITY DUMMY AND GEOGRAPHICAL DUMMIES 1995-2000

Variable	All migrants	Lower household per capita income migrants	Higher household per capita income migrants
Recife dummy	2.88	3.00	2.71
Maceio dummy	11.47	12.36	12.05
Aracaju dummy	-19.32	-20.01	-19.96
Ribeirão Preto dummy	1.20	0.15	-1.40
Campinas dummy	1.05	0.68	0.90
Santos dummy	-0.26	-0.34	0.19
São José do Rio Preto dummy	-0.15	-0.19	0.26
São Paulo city interaction	-11.48	-12.19	-4.46
Rio de Janeiro city interaction	-7.00	-8.49	3.59
Belo Horizonte interaction	-29.32	-33.07	-6.36
Porto Alegre interaction	-84.17	-90.95	-45.93
Curitiba interaction	-45.20	-46.36	-34.32
Campo Grande interaction	365.68	412.88	261.90
Cuiabá interaction	2.52	4.39	0.87
Goiânia interaction	-27.84	-29.06	-12.55
Brasília interaction	-3.44	-5.68	7.01
Porto Velho interaction	-43.00	-40.67	-69.95
Rio Branco interaction	0.00	0.00	0.00
Manaus interaction	-30.05	-30.34	-0.85
Belém interaction	-1.89	-3.73	1.06
São Luis interaction	-35.79	-42.10	-12.21
Teresina interaction	-4.98	-1.79	-22.87
Fortaleza interaction	-23.80	-24.75	-32.43
Natal interaction	-15.96	-13.81	-38.90
João Pessoa interaction	-50.97	-51.42	-40.93
Recife interaction	-9.83	-9.74	-9.89
Maceio interaction	-50.63	-54.09	-55.42
Aracaju interaction	97.99	101.56	98.85
Ribeirão Preto interaction	-6.18	-0.94	10.28
Campinas interaction	-3.10	-1.53	-1.34
Santos interaction	0.00	0.00	0.00
São José do Rio Preto interaction	0.00	0.00	0.00
São Paulo - Bahia	0.84	0.91	0.32
São Paulo - Pernambuco	0.73	0.82	0.28
São Paulo - Maranhão	-0.60	-0.54	-0.53
Mato Grosso do Sul 1	-0.60	-0.71	-0.16
Mato Grosso do Sul 2	-0.64	-0.65	-0.60
South of Minas Gerais	-1.51	-1.69	-0.87

Source: FIBGE, 2000.
Note 1: the significant variables are boldface. Note 2: the number of observations is 18 632.

Note 3: R_p^2 : 0.631 (all migrants), 0.644 (lower income) and 0.528 (higher income).

TABLE 4
THE DETERMINANTS OF MIGRATION: ALL VARIABLES INCLUDED
1995-2000

Variable	All migrants	Lower household per capita income migrants	Higher household per capita income migrants
Intercept	-12.70	-12.73	-17.26
Origins population	0.64	0.64	0.68
Destiny's population	0.76	0.75	0.76
Distance	-0.45	-0.45	-0.41
Urbanization degree in origin	0.006	0.006	0.005
Urbanization degree in destiny	0.012	0.011	0.031
Average income in origin	0.318	0.226	0.434
Average income in destiny	0.217	0.159	0.370
Proportion of workers in the primary sector in the origin	0.002	0.000	-0.012
Proportion of workers in the primary sector in the destiny	0.021	0.018	0.019
Proportion of workers in the secondary sector in the origin	-0.018	-0.026	-0.031
Proportion of workers in the secondary sector in the destiny	-0.051	-0.053	-0.040
Homicide rate in the origin	0.002	0.001	0.000
Homicide rate in the destiny	0.002	0.002	0.000
Contiguity dummy	2.07	2.15	1.69
São Paulo - Northeast dummy	2.40	2.46	1.27
São Paulo origin	-0.23	-0.13	-0.26
São Paulo destiny	0.94	1.09	0.26
Rio de Janeiro - Northeast dummy	1.14	1.14	0.49
Rio de Janeiro origin	-0.76	-0.73	-0.60
Rio de Janeiro destiny	-0.48	-0.50	-0.10
São Paulo city dummy	2.09	2.06	0.90
Rio de Janeiro city dummy	2.01	2.07	1.40
Belo Horizonte dummy	5.51	5.83	3.06
Porto Alegre dummy	13.96	14.29	8.60
Curitiba dummy	8.82	8.81	7.17
Campo Grande dummy	-44.54	-49.25	-27.23

TABLE 4
THE DETERMINANTS OF MIGRATION: ALL VARIABLES INCLUDED
1995-2000

Variable	All migrants	Lower household per capita income migrants	Higher household per capita income migrants
Cuiabá dummy	1.02	1.05	2.49
Goiânia dummy	6.90	6.90	5.28
Brasília dummy	1.32	1.77	0.00
Porto Velho dummy	8.84	8.55	14.15
Rio Branco dummy	2.18	1.96	2.28
Manaus dummy	7.08	7.19	3.30
Belém dummy	3.03	3.36	4.39
São Luis dummy	7.00	8.05	3.45
Teresina dummy	2.38	1.91	5.37
Fortaleza dummy	6.18	6.39	6.87
Natal dummy	6.56	6.17	9.62
João Pessoa dummy	12.38	12.17	12.17
Recife dummy	2.75	2.77	2.91
Maceio dummy	11.62	12.33	14.42
Aracaju dummy	-18.30	-18.57	-21.65
Ribeirão Preto dummy	0.39	-0.83	-0.05
Campinas dummy	0.31	0.09	0.58
Santos dummy	-0.02	0.00	-0.12
São José do Rio Preto dummy	-0.23	-0.30	0.02
São Paulo city interaction	-11.14	-10.95	-1.87
Rio de Janeiro city interaction	-5.08	-5.63	-1.88
Belo Horizonte interaction	-26.72	-29.00	-12.98
Porto Alegre interaction	-69.12	-71.57	-39.05
Curitiba interaction	-38.31	-38.21	-30.32
Campo Grande interaction	275.97	303.83	171.98
Cuiabá interaction	4.35	4.16	-3.09
Goiânia interaction	-30.62	-31.02	-22.23
Brasília interaction	-0.44	-2.80	3.61
Porto Velho interaction	-39.41	-37.84	-67.06
Rio Branco interaction	0.00	0.00	0.00

TABLE 4
THE DETERMINANTS OF MIGRATION: ALL VARIABLES INCLUDED
1995-2000

Variable	All migrants	Lower household per capita income migrants	Higher household per capita income migrants
Manaus interaction	-36.33	-37.22	-9.57
Belém interaction	-4.58	-6.42	-12.40
São Luis interaction	-38.57	-44.78	-13.93
Teresina interaction	-9.21	-6.89	-22.68
Fortaleza interaction	-20.63	-21.66	-25.70
Natal interaction	-22.40	-20.68	-38.65
João Pessoa interaction	-56.16	-55.19	-55.80
Recife interaction	-9.31	-9.42	-9.46
Maceio interaction	-52.53	-55.96	-64.36
Aracaju interaction	93.07	94.11	108.84
Ribeirão Preto interaction	-2.23	4.74	0.15
Campinas interaction	1.05	2.57	-0.20
Santos interaction	0.00	0.00	0.00
São José do Rio Preto interaction	0.00	0.00	0.00
São Paulo - Bahia	0.85	0.87	0.63
São Paulo - Pernambuco	0.74	0.80	0.40
São Paulo - Maranhão	-0.81	-0.77	-0.35
Mato Grosso do Sul 1	-0.74	-0.84	-0.56
Mato Grosso do Sul 2	-0.80	-0.80	-0.87
South of Minas Gerais	-1.60	-1.75	-0.64

Source: FIBGE, 2000.
Note 1: the significant variables are boldface. Note 2: the number of observations is 18 632.

Note 3: R_p^2: 0.694 (all migrants), 0.699 (lower income) and 0.663 (higher income).

The homicide rate coefficients were all non-significant showing that, at least in this analysis, that they do not have a significant impact upon migration.

Very few differences were noticed in the geographical variables when the socioeconomic and criminal variables were included in the model. The main observed difference was for the Rio de Janeiro destiny dummy that was non-significant became negative. This suggest that, when all the variables are included in the model, that the city of Rio de Janeiro does not have a strong power of population attraction as it seemed to have had in the recent past.

Final discussions and conclusions

In the human capital model, regional characteristics interact with individual aspects and all these variables have a decisive influence on the determinants of migration. When the migrant change its place of residence he pursue a better position in the labor market; looks for places with a higher quality of life and better educational opportunities, etc. It can be said that migration has a significant impact on the person's life. However, migration also changes regional characteristics. The migratory process, besides the impact on the rates of population growth, has also an effect on population composition. Normally, regions that attract a great number of migrants have a higher proportion of young adults than other regions and this might have an impact on birth rates and on the demand for schooling and houses. On the other hand, areas that have a negative net migration, commonly, show a greater proportion of older population with a direct influence on the health system and on the social services related to retired persons. Castiglione (1989) shows some of these features for the Espírito Santo state in Brazil.

The social and economic characteristics of a region depend on the population composition and also on other factors, such as human and physical capital distribution. It is believed that the migratory process benefit some regions, while others may lose in the process. Some authors believe that the main point that defines if the migratory process brings benefits or not to a region is the type of persons it attracts/loses. Some places might absorb qualified persons, while other may receive manual works. The areas that attract this first type would benefit from the process, while other regions that lose them or that attract only population with low schooling would be harmed by migration.

Brazil was one of the main destinies for international migrants in the World between 1890 and 1910 (Koerner, 1990) and during the greater part of last century, this country continued to absorb more immigrants than it lost emigrants. However, in the last decades of the twentieth century this changed. For instance, between 1991 and 2000, the net balance of migration in Brazil just for young persons with an age between 24 and 33 years was minus 1.3 million (Prefeitura do Município de São Paulo, 2002). The main reasons cited in this publication to explain this phenomenon were the poor conditions in the labor market and the increasing violence. This population and brain drains will have a strong impact in many socioeconomic characteristics of Brazil in the near future.

As fertility rates approximate and fall below the replacement level in Brazil, internal migration will became crucial in the analysis of the spatial distribution of population. To better understand the determinants of migration will help the comprehension of how the Brazilian population will be distributed in the near future, and this will have direct impact upon regional characteristics and the effectiveness of social public policies.

The models used in the empirical analysis showed very robust results and may help to bring new insights on the determinants of migration in Brazil and related topics, as presented here in the evidence of poverty traps. Many of the low income migrants in Northeast Brazil seen to be unable to overcome the difficulties of migrating to higher income areas, because of the high costs involved in the process, and migrate from one low income area to another. Similar results were obtained also for Brazilian data by Golgher (2007), although with a different methodology.

Due to the continental size of this country and its regional heterogeneity, there are also many different types of migrants and regions that can be analyzed in more focused studies, such as local migrants, intraurban migrants, return migrants, low income migrants, elderly migrants, etc. Each type of migrant might influence the regional characteristics in different ways. Migration may also have a very different impact on the individuals' earnings depending on the type of migrants and on the characteristics of the migratory process. For the lower income population, strategies that include short distance migration in the North or Northeast of Brazil, the only feasible for many, may not be very effective as a means of income augmentation.

The determinants of migration can also be related to other specific topics, such as: migration and deforestation in the Amazon Forest; migration and droughts in Northeast Region; migration and urban crime; migration and rural poverty, etc. These last topics may use similar models as the ones presented here.

Annex

We show here two tables with coefficients of correlation between variables. Table A1 shows the correlation between the magnitude of flows of migrants and other variables. The magnitudes of the flows are highly correlated between themselves, with coefficients between 0.78 and 0.99. The correlations between the magnitude of the flows and the other variables were weaker but all of them were statistically significant. Table A2 shows the correlations between some independent variables. Given some of the socioeconomic aspects in Brazil, all of them show the expected sigh.

TABLE A1
CORRELATION BETWEEN FLOWS OF MIGRANTS AND SOME INDEPENDENT VARIABLES

Variable	All migrants	Variable Lower household per capita income migrants	Higher household per capita income migrants
Lower household per capita income migrants	0.83	-	-
Higher household per capita income migrants	0.99	0.78	-
Origins population	0.19	0.16	0.18
Destiny's population	0.18	0.20	0.18
Distance	-0.21	-0.18	-0.21
Urbanization degree in origin	0.13	0.13	0.11
Urbanization degree in destiny	0.07	0.13	0.06
Proportion of workers in the primary sector in the origin	-0.13	-0.14	-0.12
Proportion of workers in the primary sector in the destiny	0.09	0.10	0.08
Proportion of workers in the secondary sector in the origin	0.12	0.12	0.11
Proportion of workers in the secondary sector in the destiny	-0.07	-0.13	-0.07
Proportion of workers in the primary sector in the origin	0.04	0.09	0.03
Proportion of workers in the primary sector in the destiny	0.08	0.13	0.07
Average income in origin	0.15	0.16	0.13
Average income in destiny	0.10	0.17	0.09
Homicide rate in the origin	0.10	0.09	0.09
Homicide rate in the destiny	0.08	0.13	0.08

Source: FIBGE, 2000.

	Logarithm of the population	Urbanization degree	Average income	Proportion of workers in the primary sector	Proportion of workers in the secondary	Proportion of workers in the tertiary sector
Urbanization degree	0.46					
Average income	0.39	0.86				
Proportion of workers in the primary sector	-0.45	-0.96	-0.87			
Proportion of workers in the secondary	0.35	0.66	0.67	-0.70		
Proportion of workers in the tertiary sector	0.40	0.89	0.77	-0.93	0.39	
Homicide rate	0.22	0.48	0.48	-0.51	0.13	0.59

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