**Do Public Income Transfer to the Poorest affect Internal Inter-Regional Migration? Evidence for the Case of Brazilian *Bolsa Família* Program**

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**Resumo**
O trabalho utiliza o suplemento dos micros dados da PNAD de 2004 e a estrutura da metodologia de avaliação de políticas públicas para fornecer evidências a respeito do impacto das transferências de renda do programa Bolsa Família (BF) sobre a migração interna inter-regional brasileira. Os resultados, obtidos a partir de *matching* via *propensity score* entre beneficiários e não beneficiários do BF baseado em estimativas de um modelo *probit* bivariado para a probabilidade dos indivíduos serem beneficiários e migrantes, indicam que o programa BF afeta negativamente o fluxo migratório interno brasileiro, embora o programa não pareça afetar a migração de retorno. Em outras palavras, as transferências de renda parecem atuar no sentido de reduzir a emigração de indivíduos das regiões mais pobres para as mais ricas, mas não o retorno dos já emigrados.
**Palavras-chave:** migração interna, Bolsa Família, desigualdade regional.

**Abstrac**
The study uses supplementary micro data from 2004 PNAD and the evaluation framework of public policy, the study provides evidence of the impact of the Brazilian *Bolsa Família* income transfer program on recent internal migration and return migration in Brazil. The results, obtained using propensity score matching based on estimative from a bivariate probit model of the propensity of being a *Bolsa Família* beneficiary and, simultaneously, a migrant, indicate that, although it do not affect the flow of return migration, the *Bolsa Família* program does affect negatively the flow of Brazilian internal migration. In others words, our results indicates that the regional impact of *Bolsa Família* resources acts to reduce emigration of individuals from the poorest regions of Brazil.
**Key-words:** Internal migration, *Bolsa Família*, regional inequality.

**Área 9 - Economia Regional e Urbana**

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## 1. Introduction

It is a well known fact that Brazilian internal migration is mainly explained by regional economic and social disparities historically existent in the country (Sahota, 1968; Yap, 1976; Hollanda-Filho, 1989; Justo, 2006), typically, with individuals leaving the poorest regions and migrating to the richest ones. Using recent PNAD micro data, for example, it is possible to observe that in 2006 more than 55% of internal migrants were born in Brazilian Northeast region, the poorest one. Nevertheless, as is shown in following section, a more recent Brazilian flux of internal migration presents some important changes, with much less people leaving the poorest regions and an unprecedent stronger presence of return migration to these regions.

These new spatial movements of people in Brazil coincide with an important regional inequality income reduction among Brazilian states in the period 1995-2005 as shown by Silveira Neto & Azzoni (2008). Interestingly, these authors have shown that non-spatial policies like transference income programs and minimum-salary did have an important role in the process, explaining approximately 40% of regional income inequality reduction. This has happened because the social programs, although a non-spatial policy, are biased to poorest Brazilian regions (because of the high numbers of poor). For example, more than 50% of *Bolsa Família* resources went to Northeast region in 2005, although this region had no more than 28% of Brazilian population.

In fact, the recent Brazilian *Bolsa Família* social program has been analyzed by researches and the conclusions are that it does have important favorable social impacts. For example, Cardoso e Souza (2004) have shown that the program impact positively on scholar frequency of the child, a similar result to the one more recently obtained by Duarte and Silveira Neto (2008) for family farmers children of Brazilian Northeast. But the regional or spatial impact of this program has been much less analyzed. Apart from the above referred work by Silveira Neto & Azzoni (2008), few more references can be found.

In this work we try to fill in part of this gap by exploring the potential and suggestive impact of Brazilian *Bolsa Família* (BF) program on internal migration More precisely, making use of a framework of public policy evaluation, using the special supplement of PNAD micro data of the year of 2004, we intend to provide evidence about the impact of BF resources both on Brazilian internal migration and on Brazilian internal return migration. To quickly sum up, our results point out that, although it does not affect return migration, BF program does have a decreasing and significant impact on the flux of Brazilian internal migration.

The article presents the following structure. In the next section, we present some evidence of historical and recent patterns of internal migration in Brazil and highlight the difference of economic importance of BF resources among Brazilian regions. In section three, we present a simple theoretical framework for understanding the potential impact of BF program on individual location choice. The empirical results of the work are presented in section four and the conclusions are presented in the final and fifth section.

## 2. Internal migration and different regional economic opportunities in Brazil

In this section we take a brief look at historical and recent patterns of inter-regional migration in Brazil and at the recent changes in regional difference of economic opportunities. It will be made clear that there is strong suggestive evidence that the new observed inter-regional migration patterns are related to the recent changes in Brazilian regional disparities of economic opportunities.

From the numbers of table 1, it is possible to get a historical perspective of the the Brazilian inter-regional migration. From the numbers, we see that Northeast and South regions have been net migrant emissaries and Southeast, Mid-West and North regions have been net migrant receptors. Nevertheless, only two regions are responsible for approximately half of migrant inter-regional movement in Brazil: the richest region of Southeast and the poorest region of Northeast are the most important migrant receptor and migrant emissary, respectively.

**Table 1 – Internal migration in Brazil: historical patterns of macro regions (%) - 2006**

| | Distribution of population | Distribution of migrants by regions of destination | Distribution of migrants by regions of origin | Net migration / population | Main region of origin |
|---|---|---|---|---|---|
| **North** | 8.1 | 9.8 | 3.9 | 11.6 | Northeast, 59.2 |
| **Northeast** | 27.6 | 16.5 | 56.0 | -16.3 | Southeast, 69.7 |
| **Southeast** | 42.6 | 47.0 | 21.3 | 6.7 | Northeast, 75.6 |
| **South** | 14,6 | 12,3 | 13,7 | -2,8 | Southeast, 66.0 |
| **Mid-West** | 7,1 | 14,3 | 5,1 | 23,0 | Northeast, 41.1 |

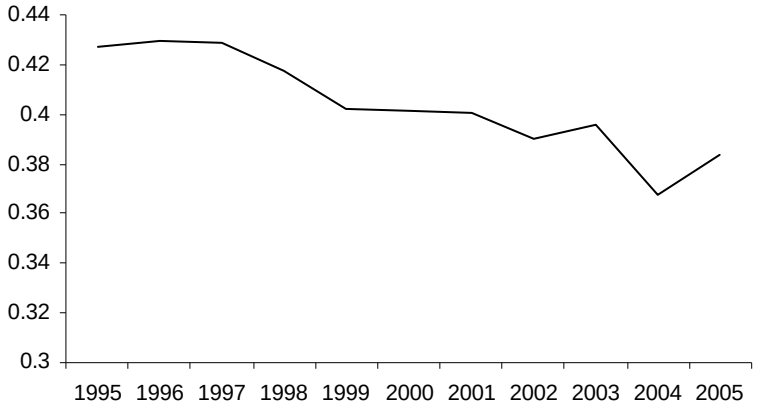
Source: author calculus using PNAD-IBGE micro data.

The above numbers have recently been discussed in detail by Justos (2006) and are consistent with the idea that internal inter-regional migration in Brazil is mainly explained by the Brazilian known regional disparities of economic and social conditions.

However, Silveira Neto and Azzoni (2008) have recently shown an important regional income inequality reduction from 1995 to 2005 in Brazil. This can be noted by looking at the following figure 1,that shows the evolution of standard-deviation of logarithm of *per capita* income for the distribution of the Brazilian 27 units (26 states and the federal district) from 1995 to 2005[1].

[1] As also shown by Silveira Neto and Azzoni (2007), the dynamic of regional *per capita* income reduction presented by figure 1 using log. of standard-deviation, known as sigma-convergence, is robust to the utilization of any other traditional inequality measure.

**Figure 1 - Evolution of Brazilian regional inequality of *per capita* income - Standard-deviation of logaritm**




Source: author calculus using PNAD micro data.

Interestingly, these authors have also shown that both labor market dynamic and public non-spatial policies, like income transference programs, do have a role to play in explaining the regional income reduction in Brazil from 1995 to 2005. More specifically, Silveira Neto & Azzoni (2008) have shown that approximately 40% of this regional income inequality reduction can be attributed to non-spatial policies like public income transference programs and minimum-salary growth, with almost half of this contribution being attributed to first factor.

To get a brief idea about the potential role of *Bolsa Família* Program on the above dynamic, in table 2 we present the regional distribution of these resources among regions and in table 3, we show how, relatively to regional mean *per capita* income, these resources are much more significant to the poorest regions of Northeast and North.

**Table 2 – Regional distribution of *Bolsa Família* resources (%)**

| | **Distribution of Brazilian population in 2004** | **Distribution of *Bolsa Família* Program resources** | | |
|---|---|---|---|---|
| | | **2003** | **2004** | **2005** |
| **North** | 8.0 | 8.2 | 8.6 | 8.6 |
| **Northeast** | 27.9 | 59.8 | 57.3 | 52.4 |
| **Southeast** | 42.1 | 19.7 | 21.7 | 24.9 |
| **South** | 14.8 | 8.8 | 8.9 | 9.8 |
| **Mid-West** | 7.2 | 3.4 | 3.5 | 4.2 |

Source: Ministério do Desenvolvimento Social e Combate à Fome.

**Table 3 – Different regional dimension of *Bolsa Família* resources: relation between *per* family program resources and mean family *per capita* income (%)**

| | **2003** | **2004** | **2005** |
|---|---|---|---|
| **North** | 5.1 | 18.3 | 20.1 |
| **Northeast** | 6.1 | 23.2 | 23.6 |
| **Southeast** | 2.6 | 7.9 | 9.4 |
| **South** | 2.4 | 7.8 | 8.9 |
| **Mid-West** | 3.1 | 7.9 | 9.0 |

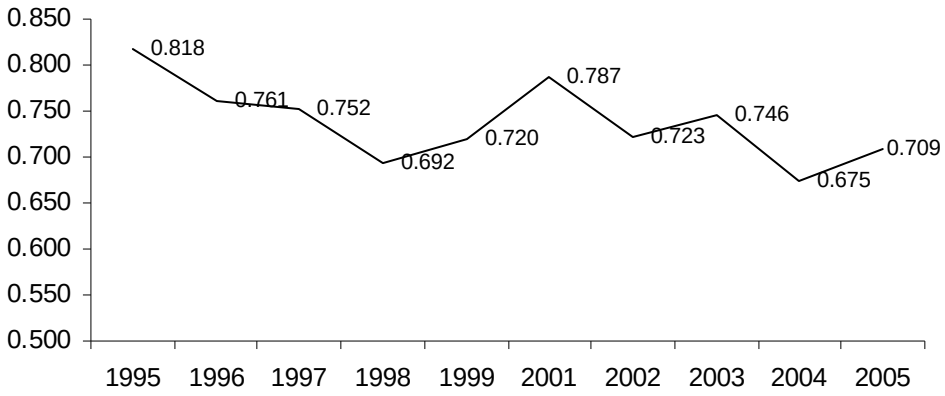
Source: author calculus using PNAD-IBGE micro data.

From table 2 we see that more than 50% of the resources of *Bolsa Família* went annually to Northeast region, the poorest one. Furthermore, as can be noted in table 3. measured *per* family. these resources were equivalent to more than 23% of the mean of family *per capita* income in the years of 2004 and 2005. In other words, not only more resources of *Bolsa Família* income transference program go to the poorest regions, but these resources are relatively more important in these regions

Given the Brazilian historical of internal migration, whose main rule has been emigration from less developed region, this recent scenario of less unfavorable economic and social conditions in the poorest regions of the country presumably brings changes to patterns of location choice of individuals. And there is suggestive evidence about it.

To begin with, we present in figure 2 the evolution of the ratio of the number of recent (no more than a year in destination region) inter-regional migrants to entire population of the country form 1995 to 2005.

**Figure 2 - Evolution of the ratio recent migrants/população (%)**



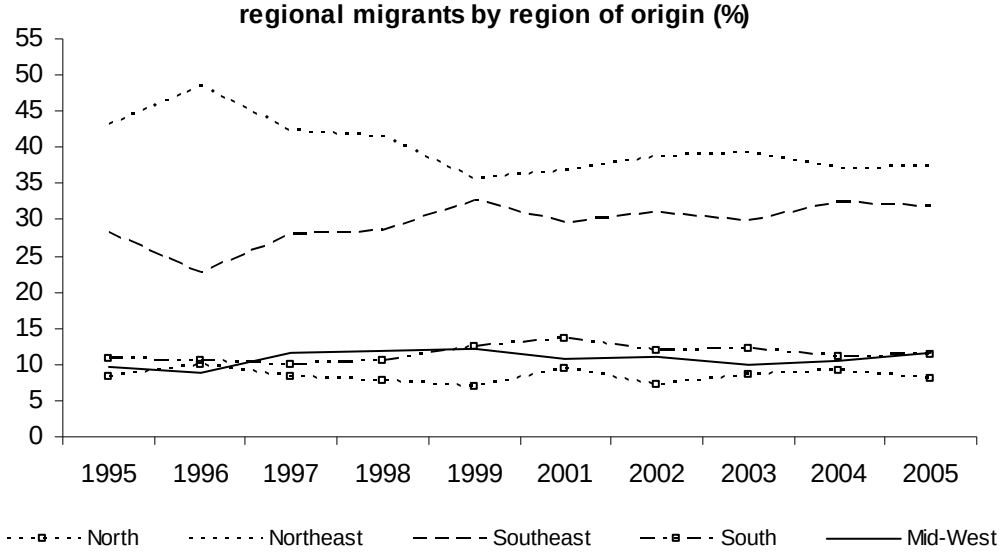

Source: author calculus using PNAD micro data.

Although there was some disturbance during the period 1998 to 2001, the patterns we can observe from the above figure is one of reduction in the proportion of recent migrants. More specifically, in the more recent years the proportion recent migrants is approximately 0.7%, inferior to the proportion 0.81% at the beginning of second half of the nineties 1990,s. Since internal inter-regional migration in Brazil is mainly motivated by regional disparities, this picture is consistent with the regional income inequality reduction we noted in the same period.

This reduction in the proportion of inter-regional migrants occurs with simultaneous important changes in the patterns of internal migration in Brazil that make this suggestive link even more expected.

First, as we can observe from the following figure 3, not only the participation of Northeast Brazilian region as the source of recent migrants decreases, as rises the participation of Southeast Brazilian region as the source of these migrants.

**Figure 3 - Evolution of the distribution of recent Brazilian inter-regional migrants by region of origin (%)**



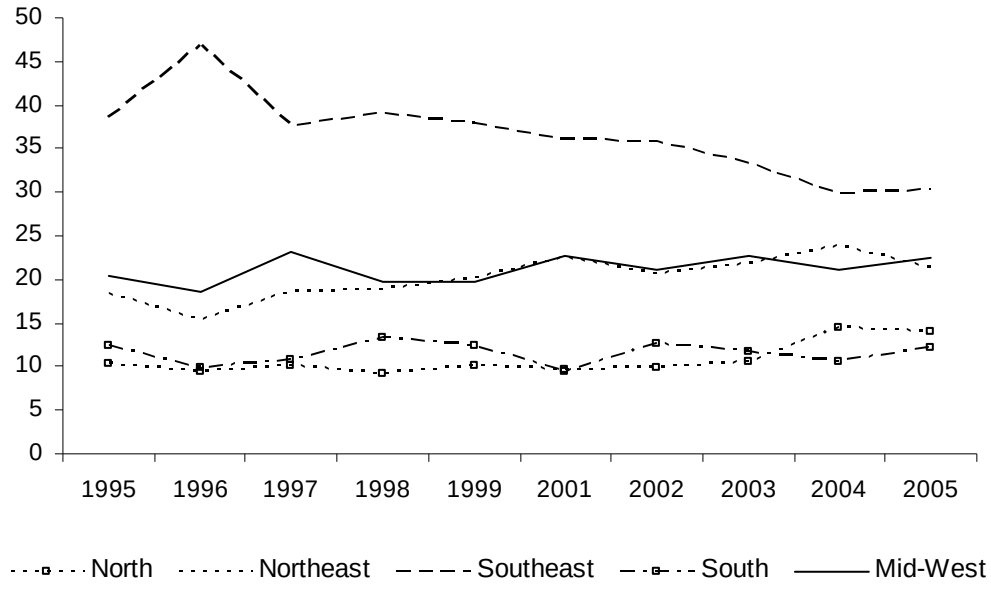

Source: author calculus using PNAD micro data.

More specifically, if in 1995 43.1% and 28.3% of inter-regional migrants left, respectively, the Northeast and Southeast regions, in 2005 these proportions were, in same order, 37.3% and 31.9%. As can immediately be noted through a quick look at the above figure, these important movements were accompanied, on one hand, by a small increase in the participation of South and Mid-West regions and by the small fall in North region participation, on the other.

Second, not only the Northeast region has presented a reduction in its participation as source of migrant from 1995 to 2005, as it has presented a consistent increase in its participation as destination of recent migrants. And exactly the opposite has happened in the Southeast region. More precisely, from the following figure 4, we note that Northeast region participation as destination of inter-regional migration in Brazil has increased from less 18% to more than 21% of total inter-regional migrants. Note that a similar movement is visible in the Mid-West region. On the other hand, there is a consistent decrease in the Southeast region's participation as a destination of inter-regional Brazilian migrants: from 38.5% to 30.5% of the total.

A third, and related to the others, important evidence consistent with a link between the reduction of regional income inequality favored by public income transference programs like *Bolsa Família* and changes in the patterns of migration observed above is the increasing importance of return migration, in other words, the migration back to native region.

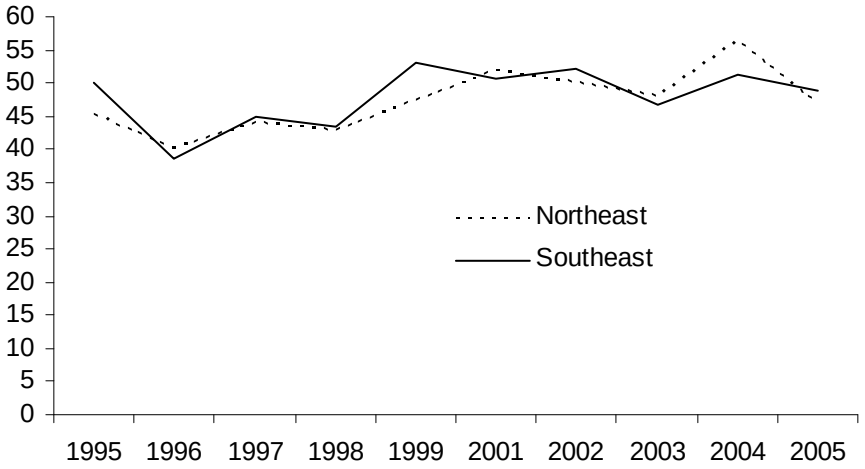
**Figure 4 - Evolution of the distribution of Brazilian inter-regional migrants by region of destination (%)**




Source: author calculus using PNAD micro data.

Focusing again on the universe of the recent migrant (no more than a year in destination region), the importance of inter-regional return migration in total inter-regional migration has been increasing almost continuously from 16.4 % of total in 1995 to 19.1% of total in 2005. But perhaps even more informative about this change is the evidence of the dynamic of the richest region as origin region and the poorest region as destination region for return inter-regional migrants. Both dynamics are simultaneously shown by the following figure 5.

**Figure 5 - Returning migration: participation of Northeast region as destination and Southeast region as origin (%)**




Source: author calculus using PNAD micro data.

From the above figure we noted that not only both regions have consistently increased their correspondent importance as destination (Northeast) and as origin (Southeast) of total inter-regional return migration in Brazil, as it appears that these movements are linked. This, of course, is at least partially explained by the numbers presented in table 1, from which we have noted that the most important Brazilian historical inert-regional migration route is from Northeast to Southeast. But notice, once more, that it appears more than suggestive that these now return migration movements are occurring during a period of consistent regional income inequality reduction.

## 3. Public income transfer programs and the decision to migrate: a simple theoretical framework

The above set of evidence suggests that an improvement in economic perspectives in a less developed region, through raising relative salary or public income transference, can reduce the incentives for individuals from the poorest region to migrate to more developed regions and raises the incentives for former migrants to return to the less developed regions. In order to characterize the individual migration decision and to highlight the potential role of public income transference to the poorest, we consider a very simple model of choice of the location of residence.

As we want to analyze the potential role of *Bolsa Família* program on internal migration, to make things as clear as possible and, at same time, to reflect empirical trends in Brazilian internal migration, we only take the situation of the individuals that were born in the poorest regions of the country. Specifically, we use the model to map different conditions characterizing both migration and return migration of a representative potential migrant that was born in a less developed region of Brazil.

Assuming no financial or credit market, we consider only three periods of analyses; apart from consumption decisions, in the first the individual decides to migrate or not, in the second he lives in region of origin (if he is a not migrant or if he is a return migrant) or in other region (if he is a migrant) and can also decide about return or not to origin region, and in the last third period the agent lives in the native or non-native region and does not migrate. Formally, we represent welfare conditions by the following very useful utility function (equation (1)) and the associated restrictions (equations (2), (3) and (4)):

$$\log(C_t) + \beta \log(C_{t+1}) + \beta^2 \log(C_{t+2}) \quad (1)$$

$$C_t = (1 - I_1) W_t^p + I_1 W_t^r + (1 - I_1) T_t - I_2 M_t \quad (2)$$

$$C_{t+1} = (1 - I_1) W_{t+1}^p + I_1 W_{t+1}^r + (1 - I_1) T_{t+1} - I_2 M_{t+1} \quad (3)$$

$$C_{t+2} = (1 - I_1) W_{t+2}^p + I_1 W_{t+2}^r + (1 - I_1) T_{t+2} \quad (4)$$

Where $C_i$ indicates consumption level at the period *i*, $\beta$ (< 1) is an inter-temporal discount rate, $W_i^p$ and $W_i^r$ denote the salaries, respectively, in the less developed and more developed regions at the period *i*, $T_i$ correspond to the public income transferences at the period *i*, $I_1$ is a binary indicator, being equal to zero or one, respectively, if the individual is, during the correspondent period, in his native region or not, $I_2$ is another

binary indicator, equal to zero in the case of no migration and equal to one in the case of migration, and, finally, $M_t$ and $M_{t+1}$ are the costs of migration at time $t$ and $t + 1$, respectively (assumed to be independent of the location ).

Although a little bit notational intensive, the above representation permits us to study both the case of migration and return migration (in the case of a non-planned potential return). We need just to compare the welfare conditions between regions based on optimum individual consumption choices in each region, a two stage optimization.

By comparing welfare conditions derived from first stage optimum choices of consumption, we can derive the optimum location choices (second stage optimization) and their migration implications. From the above conditions it is not difficult to show that now the conditions for an individual to be a migrant are:

$$\log\left(\frac{W_t^p + T_t}{W_t^p + T_t - M_t}\right) < \beta \log\left(\frac{W_{t+1}^r}{W_{t+1}^p + T_{t+1}}\right) + \beta^2 \log\left(\frac{W_{t+2}^r}{W_{t+2}^p + T_{t+2}}\right) \qquad (5)$$

*or*

$$\log\left(\frac{W_t^p + T_t}{W_t^p + T_t - M_t}\right) < \beta \log\left(\frac{W_{t+1}^r - M_{t+1}}{W_{t+1}^p + T_{t+1}}\right) \qquad (6)$$

In other words, it is necessary that the sum of $t + 1$ and $t + 2$ temporal adjusted income gains with migration compensate the initial investment in the migration, measured by the relative income loss of time $t$ (condition (5)), or, more strictly, that the income gain at time $t + 1$ net of migration cost compensates the initial investment in the migration, measured by the relative income loss of time $t$ (condition (6)). We see that a higher level of income transference and or a higher salary in the poorest region at times $t + 1$ and or $t + 2$ makes migration more difficult.

Since the above condition does not permit us to differentiate between return and non return migrants, we need to obtain the necessary conditions for an individual to be a return migrant. Focusing on this kind of migrant, the evaluation among different welfare conditions indicates that the necessary condition for a migrant to be a return migrant is given by:

$$\log\left(\frac{W_t^p + T_t}{W_t^p + T_t - M_t}\right) < \beta \log\left(\frac{W_{t+1}^r - M_{t+1}}{W_{t+1}^p + T_{t+1}}\right)$$

*and*

$$\log\left(\frac{W_{t+2}^p + T_{t+2}}{W_{t+2}^r}\right) \geq \beta \log\left(\frac{W_{t+1}^r}{W_{t+1}^r - M_{t+1}}\right) \qquad (7)$$

Where the first condition (the same of relation (6)) assures that migration is better than non migration and the second assures that return is better than non return. From this last relation we notice that a higher third period labor income and or income transference makes retuning more probable.

Notice that the above conditions assume that the individuals plan the potential return to native region. In fact this framework can not be used to understand entirely the

potential role of public income transference programs on internal migration because the majority of the migration flux took place before these programs were in place. But for using the above structure of analysis we can easily modify it to get the spatial arbitrage conditions of a migrant living in a non native region before the existence of such programs. In fact we need just to consider only two periods of analyses, a situation similar to the case of a non planned return.

Using a similar structure, but now with only two periods, we can show that for both the individual in his origin region at the initial period and for the case of being initially out of his native region, the total income gains, respectively, with migration and with return migration must compensate the investment involved in moving from one region to another. It is not difficult to show that the decisions to migrate and to return to the native region will be the optimum choices, respectively, if:

$$\log\left(\frac{W_t^p + T_t}{W_t^p + T_t - M_t}\right) < \beta \log\left(\frac{W_{t+1}^r}{W_{t+1}^p + T_{t+1}}\right) \quad (8)$$

*and*

$$\log\left(\frac{W_t^r}{W_t^r - M_t}\right) \leq \beta \log\left(\frac{W_{t+1}^p + T_{t+1}}{W_{t+1}^r}\right) \quad . \quad (9)$$

In other words, the migration will be the optimum decision if the time adjusted second period income gains more than compensate the initial investment involved in migrating (measured by he loss of income in the first period).

From equation (8), we note that a higher level of income transference and or a high growth of the poor region salary make this condition more difficult to be verified and, in this way, make migration less probable. On the other hand, for the case of the individual initially out of his native region, from equation (9), we observe that a higher level of income transference and or a high growth of the poor region salary make this condition easier to be verified, which means that return migration becomes more probable.

## 4. The influence of *Bolsa Família* income transfer program on internal migration in Brazil

To evaluate the impact of the *Bolsa Família* (BF) program on Brazilian internal migration we use the framework of public policy evaluation, comparing the levels of a target variable between groups of beneficiaries and non-beneficiaries. Under this perspective, we take as impact variables the proportions of migrants and return migrants and use matching of individuals based on propensity score estimative of being a beneficiary of BF program, taking into account account the incentives to be a migrant and a return migrant.

In the case of migration, the difficulties in using a traditional public policy evaluation framework are derived from the fact that both observable and non-observable factors can affect simultaneously the condition of being a BF beneficiary and the condition of being a migrant. For example, because of their more dynamic or active

behavior, migrant individuals can access more information about income transference public programs. At the same time, the migrant individuals are probably more dissatisfied with local economic conditions and would give more effective answers to economic incentives. Finally, living in a new region, recent migrant individuals can have more difficulties in accessing local government agencies to participate in social programs.

We recognize that it is very difficult to deal perfectly with all these potential sources of bias, but we intend to eliminate at least most of them by using a bivarite probit model for both the probability of being a BF beneficiary and the probability of being a migrant to obtain propensity score estimates. More specifically, when evaluating the impact of BF on Brazilian internal migration we will be matching individuals (BF beneficiaries and BF non beneficiaries) with similar probabilities of being simultaneously a BF beneficiary and a migrant, in other words, with similar bivarite predicted probabilities.

Formally, the bivariate probit model we consider presents the following specification both for propensity to be a BF beneficiary and for propensity to be a migrant:

$$BF_i^* = X_{ip}\beta_1 + X_{if}\beta_2 + X_{il}\beta_3 + \varepsilon_i$$

$$BF_i = \begin{matrix} 1 & if & \varepsilon_i \geq -X_{ip}\beta_1 - X_{if}\beta_2 - X_{il}\beta_3 \\ 0 & if & otherwise \end{matrix} \qquad (10)$$

and $$M_i^* = X_{ip}\alpha_1 + X_{if}\alpha_2 + X_{il}\alpha_3 + \mu_i$$

$$M_i = \begin{matrix} 1 & if & \mu_i \geq -X_{ip}\alpha_1 - X_{if}\alpha_2 - X_{il}\alpha_3 \\ 0 & if & otherwise \end{matrix} \qquad (11)$$

Where we assume that $BF_i^*$ represents an index of the propensity of individual *i* to be a BF beneficiary, $X_{ip}$ is a vector of personal variables, $X_{if}$ is a vector of household or family variables, $X_{il}$ is another vector of location variables, $M_i^*$ is an another index representing the propensity of individual $i$ to be a migrant, and $\varepsilon_i$ and $\mu_i$ are error terms that are potentially correlated. The variables in vectors *X* are those that presumably affect the propensity of being a BF beneficiary (equation (10)) and the propensity of being a migrant (equation (11)). The majority of them are presented in table 4, below.

The referred potential correlation between error terms can be tested though the estimation of the covariance between error terms, $\rho \equiv Cov(\varepsilon, \mu)$, and if we reject the null hypothesis of $\rho = 0$, using single probit estimation generates inappropriate estimative of the probability of being a *Bolsa Família* beneficiary or a migrant[2]. Note that, although from bivarite probit estimation we can obtain four different types of predicted probabilities, we are interested in the bivariated predicted probability of an individual simultaneously be a BF beneficiary *and* a migrant, in other words, in $P(BF_i = 1 \quad and \quad M_i = 1)$. The propensity score matching of beneficiary and non-

[2] See, for example, Greene (2003).

beneficiary of BF program is based on this predict probability (of course, if reject the null hypothesis of $\rho = 0$ ).

We emphasize that propensity score matching methodology assumes that, conditioned on covariates, there are not statistic difference of participation probabilities of being beneficiary of the program between treatment (beneficiary) and control group (non-beneficiary)) and that the results of impact variable, conditioned on the probabilities of participation, are independent of program participation (Rosembaum e Rubin, 1983). These hypothesis depend very much of our capacity to control for all influences on the participation in the program. We use nearest-neighbor criteria for matching beneficiary and non beneficiary of BF program based on predicted propensity score[3].

### 4.1 The data

To obtain an estimate of the impact of *Bolsa Família* program on inter-regional internal migration in Brazil, we use PNAD (Pesquisa Nacional por Amostra de Domicílio) micro data, a comprehensive house hold survey, of the year 2004. This is a PNAD special year because of its particular supplement bringing extensive information about government social programs. This supplement of PNAD is unique as it contains information identifying if the household is beneficiary of *Bolsa Família* (BF) income transference program and other social programs.

We consider as migrant the individual who has lived (return migrant) or was living out of his native region (non-return). Furthermore, as this BF program began in 2003, we consider the flux of migrants that last for less than three years. Additionally, in order to try to consider only economic arbitrage decisions, our universe is composed of individual that were 21 to 65 years old in 2004. Thus, the total numbers of individuals of our sample is 136,565. Table 4 presents information about three different sub-sets: migrants, return migrant and non-migrants.

[3] Estimative base on stratus or groups gave similar results and are available on request.

**Table 4 – Descriptive statistics: migrants, return migrants and non-migrants**

| | Migrants | Return migrants | Non-migrants |
|---|---|---|---|
| **Age (average)** | 36.5 | 36.7 | 40.1 |
| **Education by groups of years of studying (% of total)** | | | |
| **Less than 1** | 9.7 | 8.9 | 14.4 |
| **Between 1 and 4** | 11.0 | 15.4 | 13.2 |
| **Between 4 and 7** | 26.6 | 29.6 | 27.0 |
| **Between 8 and 10** | 15.2 | 13.4 | 15.1 |
| **Between 11 and 14** | 24.6 | 23.9 | 24.4 |
| **15 and more** | 12.9 | 8.8 | 5.9 |
| **Ethnic ( % of white)** | 47.7 | 46.1 | 48.0 |
| **Married (% of total)** | 64.2 | 62.7 | 62.6 |
| **With son ( % of total)** | 9.0 | 13.7 | 23.2 |
| **Age of sons (% of total)** | | | |
| **0 to 5** | 29.0 | 27.9 | 19.6 |
| **6 to 10** | 19.6 | 19.1 | 17.2 |
| **11 to 14** | 21.7 | 22.9 | 21.3 |
| **15 or more** | 29.7 | 30.1 | 42.0 |
| **Household number of people (average)** | 3.8 | 3.7 | 4.1 |
| **Household *per capita* income (R$. average)** | 584.90 | 435.81 | 438.61 |
| **Regional location (% of total)** | | | |
| **North** | 11.5 | 4.6 | 6.0 |
| **Northeast** | 20.0 | 40.7 | 28.9 |
| **Southeast** | 37.1 | 29.0 | 43.7 |
| **South** | 14.7 | 19.1 | 17.1 |
| **Mid-West** | 16.7 | 6.5 | 4.3 |
| **Receiving at most a minimum salary (% of total)** | 13.8 | 22.8 | 23.5 |
| **Receiving *Bolsa Família* (% of total)** | 2.4 | 4.0 | 4.4 |

Source: author calculus using PNAD micro data.

From table 4, we note first that the migrants are younger, an expected result, and relatively more educated than non-migrants. As for the family characteristics, for the both set of migrants we note a lower percentage of individuals with son. But we also note that, although it is not possible to note any important difference in the household number of people among the samples, the migrants present a higher level of average household *per capita* income than return migrant and non-migrants.

Looking at the regional distribution of individuals among the regions, consistent with the previous above evidence, we see that there are more migrants in Southeast region and more return migrants in Northeast region. Finally, the last line of table 4 shows us a lower percentage of migrants both receiving at most a minimum salary and resources from *Bolsa Família* program.

The above evidences are important once it conforms that migrants, but not necessarily return migrants, are a differentiated group in terms of observable characteristics (Santos Jr, Menezes-Filho e Ferreira, 2005). As previously argued, these characteristics are very useful for estimating the bivariated distribution of the probability of being a beneficiary and a migrant, and for estimating the bivariated distribution of the probability of being a beneficiary and a return migrant.

## 4.2 Estimating the influence of *Bolsa Família* income transfer program on internal migration in Brazil

As has been argued, we use propensity score matching for obtaining both the estimate of the impact of BF on internal migration and the estimate of the impact of the program on internal return migration in Brazil. For the first case, we use the estimated probabilities of being simultaneously a BF beneficiary and a migrant to compare the percentage of migrants from the groups of beneficiary and non-beneficiary of BF resources. Similarly, for the second case, by using only a sample of migrants, we consider the estimated probabilities of being simultaneously a BF beneficiary and a return migrant to compare the percentage of return migrants from the groups of beneficiary and non-beneficiary of BF resources.

*Migration*

To begin with, the following table 5 column (III) presents Maximum-Likehood estimate of the parameters on the equations (10) model, a bivarite probit model of the probability of being a BF beneficiary and a migrant.

The first important evidence to highlight is the value and statistical significance of error correlation coefficient,$\rho$, in the last line of the table. The negative and statistically significant value indicates that non-observable or non-measurable determinants of being a BF beneficiary are negatively associated to non-observable or non-measurable determinants of being a migrant. This implies that we must estimate a bivariated probit, instead of a single probit for the probability of being a migrant, in order to analyze the program participation decision of migrants and non-migrants. We notice that this negative correlation is also consistent with the evidence of a positive selection of productive skills of migrants found by Santos Jr et. al. (2005). Even with this result, we also present evidence from a simple probit model of the determinants of being a BF beneficiary (columns (I) and (II)).

**Table 5 – Probit and Bivariate Probit on migration indicator and *Bolsa Família* indicator - ML estimation.**

| | Probit | | Bivarite probit | |
|---|---|---|---|---|
| ***Bolsa Família*** | **Coefficient (I)** | **SE (II)** | **Coefficient (III)** | **SE (IV)** |
| Education: 1-4 | 0.037 | 0.028 | 0.037 | 0.028 |
| Education: 4-7 | -0.058* | 0.026 | -0.058* | 0.026 |
| Education: 8 -10 | -0.187** | 0.031 | -0.188** | 0.031 |
| Education: 11 on | -0.343** | 0.032 | -0.347** | 0.032 |
| Sex: man | -0.150** | 0.020 | -0.149** | 0.020 |
| Age | 0.001 | 0.006 | 0.001 | 0.006 |
| $Age^2$ | 0.0001 | 0.000 | 0.0001 | 0.000 |
| White | -0.081** | 0.019 | -0.081** | 0.019 |
| Head of the famly | 0.088** | 0.020 | 0.087** | 0.020 |
| Employed | 0.113** | 0.020 | 0.111** | 0.020 |
| Family *per capita* income | -0.004** | 0.000 | -0.004** | 0.000 |
| Married | -0.119* | 0.048 | -0.121** | 0.048 |
| Married with son | 0.306** | 0.047 | 0.308** | 0.047 |
| No. of people | 0.070** | 0.004 | 0.070** | 0.004 |
| No. of sons: 0-5 | 0.061** | 0.012 | 0.061** | 0.012 |
| No. of sons: 6-10 | 0.141** | 0.014 | 0.142** | 0.014 |
| No. of sons: 11-15 | 0.107** | 0.013 | 0.107** | 0.013 |
| North | -0.272** | 0.025 | -0.275** | 0.025 |
| Southeast | -0.328** | 0.023 | -0.328** | 0.023 |
| South | -0.242** | 0.030 | -0.242** | 0.030 |
| Midwest | -0.473** | 0.041 | -0.476** | 0.041 |
| Urban área | -0.111** | 0.022 | -0.112** | 0.022 |
| Metropolitan área | 0.030 | 0.019 | 0.029 | 0.019 |
| Constant | -1.217** | 0.106 | -1.228** | 0.106 |
| ***Migrant*** | | | | |
| Education: 1-4 | - | - | 0.089** | 0.033 |
| Education: 4-7 | - | - | 0.067* | 0.029 |
| Education: 8 -10 | - | - | 0.065* | 0.031 |
| Education: 11 on | - | - | 0.111** | 0.029 |
| Sex: man | - | - | 0.020 | 0.015 |
| Age | - | - | 0.005 | 0.004 |
| $Age^2$ | - | - | -0.0002** | 0.000 |
| White | - | - | 0.073** | 0.015 |
| Familly head | - | - | 0.145** | 0.016 |
| Employed | - | - | -0.167** | 0.016 |
| Married | - | - | 0.296** | 0.021 |
| Married with son | - | - | -0.293** | 0.023 |
| No. of sons: 0-5 | - | - | 0.099** | 0.012 |
| No. of sons: 6-10 | - | - | 0.018 | 0.014 |
| No. of sons: 11-15 | - | - | 0.024 | 0.014 |
| North | - | - | 0.338** | 0.022 |
| Southeast | - | - | -0.035 | 0.019 |
| South | - | - | -0.024 | 0.023 |
| Midwest | - | - | 0.720** | 0.021 |
| Urban área | - | - | 0.163** | 0.023 |
| Metropolitan área | - | - | -0.178** | 0.014 |
| Constant | - | - | -2.044** | 0.083 |
| N. of observations | 136,565 | - | 136,565 | - |
| $\rho$ | - | - | -0.120** | 0.023 |
| Chi(2) | - | - | 292.886 | - |

* Statistically significant at the 5% level.** Statistically significant at the 1% level.

As for estimated parameters of the bivariated probit, from columns (III) and (IV), we first note that, consistent with the program objective, higher family *per capita* income diminishes the probability of being a BF beneficiary.

For human capital variables, we notice that less formal education increases the probability of one being a BF beneficiary, the opposite occurring to the probability of being a migrant. Individual age has no effect on the probability of being a BF beneficiary, but reduces the probability of being a migrant.

For the other personal characteristics, we note that to be a white person and to be married diminishes the probability of being a BF beneficiary, although both conditions increase the probability of being a migrant. We also note that having children is a much more important condition in increasing the probability of being a BF beneficiary than for being a migrant. Consistent with the idea of following economic opportunities, being employed reduces the probability of being a migrant, but, somehow unexpected, increases the probability of being a BF beneficiary.

For location variables, what looks like a regional bias in the BF resource allocation, we note that not living in Northeast Brazil diminishes the probability of being a BF beneficiary, on the other hand, living in North or Mid-West instead of in Northeast region increases the probability of being a migrant. Finally, contrary to what occurs to the probability of being a migrant, living in a urban instead of in a rural area diminishes the probability of being a BF beneficiary.

By using the above estimated parameters, we calculate individual probability of being a BF beneficiary *and* of being a migrant. Using the nearest-neighbor matching based on these calculated probabilities for BF beneficiary and BF non-beneficiary, we arrive at results of table 6 last line, that shows the proportions of migrants for the group of beneficiary and non beneficiary of *Bolsa Família* program.

**Table 6 – Impact of *Bolsa Família* (BF) income transference on internal Brazilian migration (proportion of migrants) - 2004.**

| | **Proportion of migrants Beneficed by BF (I)** | **Proportion of migrants control group (II)** | **Impact of BF on migration (III)** |
|---|---|---|---|
| | 0.017 | 0.038 | -0.021** |
| **Mean difference** | (0.002) | (0.000) | (0.002) |
| **Matching via Propensity** | 0.017 | 0.034 | -0.017** |
| **Score, probit** | (0,131) | (0.182) | (0.004) |
| **Matching via Propensity** | 0.017 | 0.043 | -0.026** |
| **Score, bivariate probit** | (0.131) | (0.203) | (0.005) |

Source: author calculus base on micro data from PNAD 2004. Bootstrap standard-deviation in parenthesis.
* indicates statistical significance at 5%, ** indicates statistical significance at 1%.

As can be seen from the last line of table 6, by comparing individuals with similar probabilities of being BF beneficiary *and* migrant , we note that the beneficiaries of BF present an 2.6 percentage point less of migrants than non beneficiaries, a difference statically significant at 5% level. In other words, as expected from the model of the previous section, we find out that the program affect negatively Brazilian internal migration.

Interestingly, note that both simple mean difference estimate (table 6 first line) and conventional propensity score estimate (table 6 second line), although statistically

significant, under-estimate the impact of the BF on internal Brazilian migration. Given the known skills positive selection bias of migrant condition, one possible explanation for this important result is that by taking into account simultaneously the conditions that affect probability of being a BF beneficiary and a migrant we compare individuals not only of similar conditions of eligibility for BF program but also with similar skills and motivation for location arbitrage (probably more sensitive to regional income differential changes).

*Return migration*

Next, for evaluating the impact of the *Bolsa Família* program on return migration, we consider similar probit model for the probability of being a BF beneficiary and a similar bivarite estimate for the probability of being a BF beneficiary *and* a return migrant. An Important difference is that now we are dealing only with the universe of 5,161 migrants and ask if the BF resources affect the return decision.

For the same set of variables and the same specifications of table 6, in table 7 we present an estimate of the parameters of a probit model for the probability of being a BF beneficiary (column (I)) and of bivarite probit model for the probability of being a BF beneficiary and a return migrant (column (III)).

Different from the evidence of table 6, the non statically significant estimative of $\rho$ at the last two lines of table 7 indicates that there is not any evidence of correlation between non-observable or non-measurable determinants of being a BF beneficiary and non-observable or non-measurable determinants of being a return migrant. Thus, it is sufficient to estimate a single probit for the probability of being a BF beneficiary, which results we show in table 7 columns (I) and (II).

As can be noted from table 7 column (I) and (II), and as could be expected when dealing with observations of only migrants, we now obtain few statistically significant variable affecting the probability of being a BF beneficiary. First, only the individual condition of employment is statically significant. As for family or household variables we note that only family *per capita* income, the household number of people per household and the variable of number of children below 6 years old affect the probability of being a BF beneficiary.

Finally, by looking at the estimate for regional variables location, we can also note that, except for the case of Mid-West region, there is no bias favoring Northeast region in the allocation of BF resources. On the other hand, we can notice that now individuals living in Metropolitan areas, instead of in rural areas, present higher chances of being a BF beneficiary.

**Table 7 – Probit and Bivariate Probit on return migration indicator and *Bolsa Família* indicator - ML estimation.**

| | Probit | | Bivariate probit | |
|---|---|---|---|---|
| ***Bolsa Família*** | **Coefficient (I)** | **SE (II)** | **Coefficient (III)** | **SE (IV)** |
| Education: 1-4 | -0.026 | 0.219 | -0.025 | 0.219 |
| Education: 4-7 | 0.050 | 0.192 | 0.051 | 0.192 |
| Education: 8 -10 | -0.156 | 0.224 | -0.153 | 0.225 |
| Education: 11 on | -0.425 | 0.243 | -0.423 | 0.243 |
| Sex: man | -0.188 | 0.145 | -0.187 | 0.145 |
| Age | -0.005 | 0.043 | -0.005 | 0.043 |
| $Age^2$ | 0.000 | 0.001 | 0.000 | 0.001 |
| White | -0.029 | 0.123 | -0.030 | 0.123 |
| Head of the famly | 0.124 | 0.143 | 0.123 | 0.143 |
| Employed | 0.330* | 0.143 | 0.329* | 0.143 |
| Family *per capita* income | -0.003** | 0.001 | -0.003** | 0.001 |
| Married | 0.188 | 0.293 | 0.189 | 0.293 |
| Married with son | -0.008 | 0.275 | -0.008 | 0.275 |
| No. of people | 0.111** | 0.034 | 0.111** | 0.034 |
| No. of sons: 0-5 | 0.223** | 0.072 | 0.223** | 0.073 |
| No. of sons: 6-10 | 0.024 | 0.087 | 0.024 | 0.087 |
| No. of sons: 11-15 | 0.063 | 0.098 | 0.063 | 0.098 |
| North | -0.101 | 0.157 | -0.099 | 0.158 |
| Southeast | -0.171 | 0.163 | -0.167 | 0.164 |
| South | -0.154 | 0.217 | -0.155 | 0.217 |
| Midwest | -0.426* | 0.182 | -0.423* | 0.182 |
| Urban area | 0.214 | 0.176 | 0.215 | 0.176 |
| Metropolitan area | 0.264* | 0.130 | 0.264* | 0.130 |
| Constant | -2.390** | 0.795 | -2.400** | 0.797 |
| ***Migrant*** | | | | |
| Education: 1-4 | - | - | 0.221* | 0.106 |
| Education: 4-7 | - | - | 0.180 | 0.094 |
| Education: 8 -10 | - | - | 0.166 | 0.100 |
| Education: 11 on | - | - | 0.025 | 0.093 |
| Sex: man | - | - | -0.016 | 0.049 |
| Age | - | - | 0.011 | 0.014 |
| $Age^2$ | - | - | 0.000 | 0.000 |
| White | - | - | -0.124** | 0.044 |
| Familly head | - | - | 0.135** | 0.049 |
| Employed | - | - | 0.014 | 0.049 |
| Married | - | - | -0.109 | 0.062 |
| Married with son | - | - | 0.140* | 0.070 |
| No. of sons: 0-5 | - | - | -0.064 | 0.039 |
| No. of sons: 6-10 | - | - | -0.002 | 0.044 |
| No. of sons: 11-15 | - | - | -0.078 | 0.045 |
| North | - | - | -1.057** | 0.069 |
| Southeast | - | - | -0.519** | 0.058 |
| South | - | - | -0.176** | 0.065 |
| Midwest | - | - | -1.117** | 0.063 |
| Urban area | - | - | 0.031 | 0.072 |
| Metropolitan area | - | - | -0.154** | 0.046 |
| Constant | - | - | -0.494** | 0.264 |
| N. of observations | 5161 | - | 5161 | |
| $\rho$ | - | - | 0.016 | 0.084 |
| Chi(2) | - | - | 0.039 | |

* Statistically significant at the 5% level.** Statistically significant at the 1% level.

Similarly to what we have done for the case of migration, now for the case of return migration, we use the above estimated parameters to estimate individual probabilities of being a BF beneficiary. Using propensity score matching and the criteria of nearest-neighbor, the following table 8 presents an estimate of the impact of *Bolsa Família* on Brazilian internal return migration.

**Table 8 – Impact of *Bolsa Família* (BF) income transfer on return migration (proportion of migrants) - 2004.**

| | **Proportion of return migrants: Beneficed by BF (I)** | **Proportion of return migrants: control group (II)** | **Impact of BF on return migration (III)** |
|---|---|---|---|
| | 0.305 | 0.223 | 0.083 |
| **Mean difference** | (0.055) | (0.006) | (0.055) |
| **Matching via Propensity** | 0.306 | 0.167 | 0.139 |
| **Score, probit** | (0.464) | (0.375) | (0.085) |

Source: author calculus based on micro data from PNAD 2004. Bootstrap standard-deviation in parenthesis. * indicates statistical significance at 5%, ** indicates statistical significance at 1%.

As can immediately be noted from column (III) of the above table, for both simple mean difference and matching using propensity score estimate, we did not find any statistically significant evidence of the impact of BF resources on Brazilian internal return migration. In fact, although the beneficiaries of *Bolsa Família* present a higher proportion of return migrant than non beneficiaries of the program, the difference of proportions is not statically different from zero.

## 5. Conclusion

As pointed out by Silveira Neto and Azzoni (2007), non spatial policies can explain one important part of *per capita* income regional inequality reduction in Brazil from 1995 to 2005. We take this fact and the well documented evidence that Brazilian internal migration is mainly explained by regional economic disparities to investigate an absolutely unexplored question: the potential impact of *Bolsa Família* (BF) program, a very important non-spatial policy, on Brazilian internal migration.

To evaluate the impact of the referred program on Brazilian internal migration we had to deal both with the potential bias of selection related to the choice of BF beneficiary and with the bias of self-selection of migrants. So we estimated the difference in the proportion of migrants between BF beneficiaries and BF non-beneficiary from a proposed propensity score matching based on a bivariated probit model for the probability of being simultaneously a BF beneficiary and a migrant.

Our results indicate that, by improving relatively more the economic conditions of the poorest Brazilian regions, the *Bolsa Família* program does affect in a decreasing manner the Brazilian internal migration. On the other hand, we did not find any effect of the program on return migration. We do not have any well empirically demonstrated reason for this difference, but a possible reason could be the highest cost of retuning migration, not necessarily monetary, than of initial migration.

For future investigation, additional research work needs to be done to evaluate the influence of other non-spatial policies (ex. minimum-salary policy) on our results and to explore the impact of these other policies by themselves on Brazilian internal migration.

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