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Article

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Composition and determinants of the skilled out-migration in the Brazilian formal labor market: A panel data analysis from 1995 to 2006[☆]

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Abstract

This paper aims to examine the composition and identify determinant factors of interstate the skilled labor loss in the Brazilian formal labor market between 1995 and 2006, with emphasis on the role of individual motivations and regional factors. In order to estimate such determinants, we use a fixed-effect logit in a wide panel with data from Ministry of Labor and Employment (RAIS-Migra – annual report on social information) and IBGE (the Brazilian Statistics Bureau). The estimated results confirm the importance of wage differentials in determining such mobility. Furthermore, an increased skilled out-migration probability is explained by skilled workers heading to states showing economic prosperity, higher dynamism in the labor market, as well as higher population density.

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Resumo

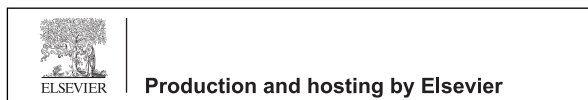
O objetivo deste artigo é analisar a composição e identificar os fatores determinantes da mobilidade interestadual de trabalhadores formais no Brasil entre 1995 e 2006, com destaque para o papel das motivações individuais e dos fatores regionais. A partir de dados da RAIS-Migra (MTE) e do IBGE, estimaram-se os determinantes da mobilidade de trabalhadores por meio de um modelo logit com efeitos fixos. Os resultados obtidos confirmam a importância do diferencial salarial como determinante da saída de trabalhadores qualificados. Além disso, o aumento da probabilidade de ocorrência da saída de trabalhadores qualificados está

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condicionado à procura por estados de destino com maior prosperidade econômica, maior dinamismo no mercado de trabalho e densidade populacional mais elevada.

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Palavras-chaves: Migração qualificada; mobilidade do trabalho; efeitos fixos; Brasil

1. Introduction

Human capital comprises the knowledge, ability and experience a person is able to acquire and so is understood as an investment by which an individual seeks to increase his/her labor productivity (Jauhainen, 2008). In addition to direct effects on the worker's ability, there are two other indirect ways through which production is affected by human capital: firstly, through the externalities it brings about that mitigate decreasing capital yields; secondly, by means of generation, adoption and diffusion of new technologies. Therefore, human capital has been taken as one of the major factors of economic development and growth, which is accountable for much of the productivity differential among countries and regions (Mankiw et al., 1992).

In this context, a phenomenon related to resource transfer by way of human capital from one region to another – sometimes called brain drain in the literature – is particularly worth mentioning. Such a phenomenon consists in skilled labor force out-migration that – since being involved with human capital flows – may be seen as an alternative to poverty reduction, regional growth and reduction of spatial inequalities.

Therefore, due to the significance of resource transference by means of human capital for the economy, an important question arises: what are the factors influencing a skilled individual's choice to remain or leave a given region? Despite their relevance, factors determining the exit of skilled labor from a given region have been scarcely treated, mainly as far as the individual's decision is concerned. Most studies have focused on the effect of international brain-drain on macroeconomic aspects of less-developed countries, as well as on the determinants of brain drain among countries. However, studying this phenomenon in the context of internal migration is highly relevant, since the movement of skilled people occurs between regions in a country and involves a much more intense migration flow. And this occurs because there are no barriers to migration, such as legal hindrances, cultural and language differences. The Brazilian case is an example.

Being a continent-sized and highly economically and socially diversified country, internal migration in Brazil has proved to be a highly significant phenomenon. Fiess and Verner (2003) pointed out that Brazil is a country of immigrants, since more than 40% of its population has migrated in a given point in time. Pereira (2000) showed that almost a third of the Brazilian population live in a different municipality than that of origin.

Furthermore, Brazil has presented a remarkable growth in the education of skilled labor force in the last years. According to the *Censo do Ensino Superior* (the higher learning census from INEP – the Brazilian Institute of Studies and Educational Research Anísio Teixeira of the Brazilian Ministry of Education), the number of students concluding tertiary education grew from 245,887 in 1995 to 717,858 in 2005, and the number of higher learning institutions increased from 894 to 2499 in the same period. A significant expansion of skilled workers could be detected in the Brazilian formal labor market, ranging from approximately 3% in 1995 to 9% in 2005 – RAIS – *Relação Anual de Informações Sociais* (annual report on social information of the Ministry of Labor and Employment). However, even in face of skilled labor growth, there still exists a significant concentration of more qualified people mainly in the Southeast and South regions of the country.

In this sense, resource transference through human capital among Brazilian regions is an important factor in the country's economic growth and development. Therefore, analyzing the determinants of skilled labor force migration is relevant for Brazil, since a better understanding of such determinants may become useful for economic policy intended to reduce spatial inequalities, as well as for determining strategies viewing the Brazilian economic growth.

This paper is thus mainly intended to analyze and identify the determinants of interstate redistribution of skilled labor force in the formal Brazilian labor market with the use of a fixed-effect logit model covering the period 1995–2006.

Particularly, the paper attempts to show skilled labor mobility among Brazilian states, its size and characteristics, as well as to identify its determinants within the individual decision context.¹

For this, the paper takes resort to a comprehensive data panel based on the *Relação Anual de Informações Sociais – Migração* (RAIS-MIGRA) – annual report on social information with the primarily purpose of analysing migration. These data are made available by the Ministry of Labor and Employment for the period 1995–2006, which allow determining the loss and/or gain of skilled workers in the formal Brazilian labor market resulting from labor mobility among Brazilian states. Such database allows following up longitudinally the workers' trajectory in the Brazilian labor market by controlling their individual characteristics, as education degree for example. Additionally, data on place of origin and destination of individuals were also included in the panel, by using data from the *Instituto Brasileiro de Geografia e Estatística* (IBGE – the Brazilian official institution for census and socioeconomic data) as main data source.

Major results found confirm the relevance of positive wage differential as a determinant of skilled labor mobility. Additionally, these workers' increased propensity to move is mainly conditioned to their seeking states of destination showing lower unemployment rates, higher economic prosperity and population agglomeration, as well as lower homicide rates and traffic victims as compared to their places of origin.

In addition to this introduction, this paper comprises four other sections. Section 2 presents migration determinants or skilled labor mobility as shown in the theoretical and empirical literature. The methodology used here is described in section 3. Section 4 shows the composition, features and mobility determinants of the Brazilian skilled labor force in the period 1995–2006. The conclusions can be found in the last section of the study.

2. Skilled labor mobility: causes and effects

Migration and labor force mobility are phenomena that play an important role in the spatial redistribution of human capital. Migration involves changing place of residence by which an individual moves from one geographic space to another intended to remain in the place of destination for some time. However, mobility does not necessarily involve moving from the place of residence, as it may only refer to changing the place of employment (Nas et al., 2001; Gravensen and Friis-Jensen, 2001).

However, economic effects are what migration and mobility have in common as for skilled persons or workers. Such effects can be identified in the theoretical and empirical literature as follows: interregional and interfirm diffusion of technological knowledge (Mukkala, 2005; Gravensen and Friis-jensen, 2001; Audretsch and Keilbach, 2005); and increase and/or decrease of skilled labor stock with positive or negative backwash effect on economic productivity, capacity of introducing innovation and regional and urban growth (Lucas, 1988; Bartel and Lichtenberg, 1987; Ciccone and Hall, 1996; Myrdal, 1957).

A local loss of skilled persons is a phenomenon treated as brain drain in the literature, constituting one of the several ways by which migration happens. According to Kwok and Leland (1982), the term brain drain refers to skilled professionals who move from their place of origin seeking for more promising job opportunities elsewhere. For Beine et al. (2008), this terminology means resource transference as for human capital and is mainly applied to migration of individuals with relative qualification moving from developing countries toward developed countries.

Through years, such studies have placed greater emphasis on the effects of brain drain or brain effect mainly for countries of migrant origin, especially as far as developing countries were concerned. However, several motivations behind brain drain have been suggested in all types of studies. The first authors dealing with the subject have initially argued that major motivations were related with political or social matters. In the 1960s and 1970s, on the other side, main motivations had to do with labor market shortage and insufficient jobs for skilled people. As for the 1980s decade, the main brain drain motivation was linked to higher productivity and income of skilled workers in developed countries. And since the 1990s, chief motivations have been linked to individual reasons.

¹ The term skilled labor loss is preferably used in this paper instead of “brain drain”, as the latter phenomenon requires, by definition, identifying the individual's previous place of schooling, which is not available in this database. Therefore, mobility of more educated individuals cannot be closely associated with the concept of “brain drain”. In this respect, see the works of Kwok and Leland (1982) and Beine, Docquier and Rapoport (2008).

Theoretical studies have presented different motivations for brain draining. [Portes \(1976\)](#) offered one of the most important studies of brain drain determinants. According to this author, three sets of factors may explain brain draining. The primary determinants are related to regional inequalities between the migrant's origin and destination places, especially as far as pay differentials, social and research conditions are concerned. As for the secondary reasons, determinants refer to labor market differentials – skilled labor demand and supply – in the worker's place of origin. The tertiary determinants, on the other hand, have to do with differences among individuals. The latter are linked to differences ranging from training quality to the individual's social environment. According to [Grubel and Scott \(1976\)](#), the behavior of highly qualified workers is basically determined by the same type of market motivations and forces as those of less skilled ones. However, these authors argue that factors, such as market organization, personality and educational features of those more skilled workers, tend to influence the relative importance of the various aspects affecting their choices.

In contrast with the traditional wage differential reason, [Kwok and Leland \(1982\)](#) proposed asymmetric information in the labor market as the reason of brain draining, by showing that wage differentials among countries is only a consequence and not cause of this phenomenon. On the other hand, [Miyagiwa \(1991\)](#) emphasized the importance of scale economy in education in attracting skilled workers of places with significant concentration of qualified labor force. According to this author, the scale effect in education improves productivity, and hence skilled people income in a region showing significant skilled labor agglomeration. This fact, as he put it, explained wage differentials among regions.

As for empirical evidence concerning brain draining in the international context, [Cheng and Yang \(1998\)](#) argued that differences in job opportunities and living conditions between the country of origin and the USA were important migration determinants of skilled professionals living in this country. [Kazlauskienė and Rinkevičius \(2006\)](#) listed professional attraction, socioeconomic situation, academic system and macroeconomic context as the main factors of brain draining for Lithuania. [Dumont et al. \(2007\)](#) stated that poorer countries are more affected by female brain draining. Additionally, population variables and the English language as well have proved to be determinants of female brain draining as well.

[Docquier et al. \(2007\)](#) showed that brain draining is significant in poor countries where average level of schooling is low. As for job opportunities in destination countries in Africa, [Marfouk \(2007\)](#) found that wage differential and geographic distance were the major reasons for skilled people out-migration. [Beine et al. \(2008\)](#) presented squared GDP per capita for the origin country, geographic distance and country size as brain drain factors. According to [Ritsilä and Haapanen \(2003\)](#), highly educated individuals had moved to densely populated urban centers with better job opportunities and personal prospects in Finland. A similar result could be found for The Netherlands where highly educated individuals had chosen to move primarily to areas with higher job opportunities and secondarily because of regional differences in the cost of living ([Venhroost, Van Dijk, & Van Wissen, 2011](#)). Other factors, such as urban amenities ([Gleaser and Gottlieb, 2006](#)) and natural amenities ([Patridge, 2010](#)), have also been reported to attract skilled people in the United States.

As far as the Brazilian literature is concerned, [Bezerra and Silveira Neto \(2008\)](#), based on the demographic censuses as of 1991 and 2000, stated that Rio de Janeiro and Rio Grande do Sul had been the states presenting the highest brain draining toward the state of São Paulo. The authors also referred to states in the North and Center-West regions as losing brains, although in smaller proportion. Finally, for these authors, the Northeast region did not show brain draining because of relative shortage of skilled people in that macroregion, which enhanced the economic incentives for skilled labor to remain in their places of origin. [Justo and Silveira Neto \(2009\)](#), based on the 2000 census data, amplified the evidence presented in the Brazilian case beyond those found in the 1980 and 1991 censuses. After comparing migration periods, they found that a regional deconcentration of migrants' destination had occurred between 1980 and 2000, in addition to an increased homogeneity in migrants' schooling. Other information revealed that migrants tended to be white and young males in average. Additionally, these migrants had attributed more weight to unfavorable and social conditions in their federation states of origin than to their status as household chiefs or having children in their decision to migrate. However, being married has proved to become a negative impact and not positive in the decision to migrate.

[Mata et al. \(2007\)](#) found that labor market dynamism and smaller social inequality were conditional on the choice of the skilled migrants' places of destination. [Faria \(2008\)](#) established that the number of scholarships offered and the historic migration flows had been determinants of brain draining. [Sabbadini and Azzoni \(2006\)](#), who also used the idea of brain draining, concluded that income, quality of living and the number of existing graduate programs were also important as determinants of such a phenomenon. As far as researchers' shifting is concerned, [Guimarães \(2002\)](#) found

Authors	Coverage	Dependent variable	Type of estimation	Type of data	Period	Major results
Cheng and Yang (1998)	International (from China to EUA)	Total of skilled immigrants	Cross-section – Ordinary least squares	Database on admission of immigrants	1988	Differences in living conditions and job opportunities
Guimarães (2002)	Domestic (Brazil)	Total of skilled immigrants	-----	Electronic survey	1990's	Professional activity, search for better work and salary conditions
Ritsilä and Haapanen (2003)	Domestic (Finland)	Choice of destination	Ordered probability model	Census	1994-1995	Densely populated urban municipalities, better job and improvement opportunities
Kazlauskien and Rinkevicius (2006)	International (Lithuania)	Total of skilled immigrants	-----	Electronic survey	2004-2005	Professional attraction, socioeconomic status, academic system, macroeconomic situation of the country
Doquier et al. (2007)	International	Rate of skilled labor out-migration	Ordinary least squares and Instrumental variables	Doquier and Marfouk (2006)	1990-2000	Significant brain draining in poor countries with low average schooling
Dumont et al. (2007)	International	Out-migration rates by schooling and gender	Cross-section – Ordinary least squares	OECD and United Nations data	2000	Poor countries are more affected by female brain draining
Mata et al. (2007)	Domestic (Brazil)	Skilled people migration	Cross-section – spatial lag model	Census	2000	Labor market dynamism – the smallest social inequality
Marfouk (2007)	International (Africa)	Out-migration rate of skilled labor force	Cross-section – Tobit	Doquier and Marfouk (2006)	1990-2000	Racial, ethnolinguistic and salary differences, job opportunities, salary differentials and distance
Venhorst et al. (2010)	International (The Netherlands)	Graduated people mobility	Multinomial logit	Individual microdata	1997-2008	Existing large labor market as the main factor for graduated people retention
Sabbadini and Azzoni (2008)	Domestic (Brazil)	Net migration rate of skilled labor force	Gravity model and first difference	Censuses	1991 and 2000	Variables of income, quality of living and graduate programs
Faria (2008)	International	Out-migration rate of skilled workers	Ordinary least squares	Doquier and Marfouk (2006)	1990–2000	Number of scholarships and historic migration flows
Bezerra and Silveira Neto (2008)	Domestic (Brazil)	Skilled workers' migration	-----	Censuses	1990–2000	Brain draining in the states of Rio de Janeiro and Rio Grande Sul toward São Paulo
Justo and Silveira Neto (2009)	Domestic (Brazil)	Probability to migrate	Multinomial logit	Censuses	1980–2000	More educated, younger and mainly male migrant, mostly from states showing relatively precarious social condition

Chart 1. A comparative view of empirical studies related to skilled labor mobility and brain draining.

Table 1
Database structure constructed based on RAIS-Migra (1995–2005).

Year	Skilled workers	Migrants		Non-migrants	Total (migrants + non-migrants)
		Skilled	Others		
1995	55,607	427	1556	392,202	394,185
1996	57,553	487	1352	392,346	394,185
1997	60,775	655	1757	391,773	394,185
1998	63,643	456	1201	392,528	394,185
1999	65,672	684	1679	391,822	394,185
2000	67,563	597	1385	392,203	394,185
2001	69,520	583	1238	392,364	394,185
2002	71,685	464	1100	392,621	394,185
2003	77,356	549	1110	392,526	394,185
2004	81,453	530	1136	392,519	394,185
2005	85,063	629	1231	392,325	394,185
Total	755,890	6061	14,745	4,315,229	4,336,035

Source: RAIS-Migra (1995–2006) – MTE.

that the most important reason for their decision to migrate had been to complete their academic training. Furthermore, Brazilian researchers generally migrate for better pay and working conditions, although quality of living in places of destination was also taken into account.

As shown in [Chart 1](#), most studies concerning international and domestic brain draining have been carried out by assessing the brain-drain rate in the aggregate, mainly by including locational features in the origin and destination places. Brazilian studies follow the international literature both on domestic and international spheres.

Therefore, it is worth mentioning that variables used in such analyses show aggregate features and do not take into account individual characteristics. In this way, they neglect significant variables of brain-drain determinants. Additionally, this kind of analysis is carried out based on stock variables as its databases are predominantly dependent on demographic census data. Due to such a circumstance, following-up these individuals through years and the respective pattern changes cannot be accomplished. It should also be noted that an interstate redistribution analysis of skilled workers in Brazil in the individual decision context has not been carried out yet. In this sense, the present study appears to be important as it attempts to contribute toward the literature in attempting to understand the causes of such a phenomenon in the individual context.

3. Methodology

3.1. Database

The annual social information report on migration – RAIS-Migra – was used for composing the broad data panel on the subject. Such data on the 1995–2006 are made available by the Brazilian Ministry of Labor and Employment (MTE), which were designed to carry out a longitudinal follow-up of workers formally employed and receiving social benefits, as well as to monitor the formal labor market.

The RAIS coverage is very broad as it longitudinally follows-up approximately 70 million workers in the formal labor market every year. It comprises geographic, sectoral and income information in addition to personal features, such as age, gender and schooling, together with those data related to employers, such as activity sector and establishment size.

RAIS can be considered as a census of the Brazilian formal labor market due to its amplitude. In view of its main characteristic, this database has made it possible to identify those skilled individuals among all workers who had left the state in which they were working in 1995–2006, since data on interstate mobility and individual qualification are

Variables	Description
Dependent Variable	
Mobility	Binary variable(1,0) – indicating mobility
Individual variables	
Wage difference	Expected difference between real wage log in destination and origin states
Gender	Binary variable (1,0) when female
Age	
15-24	(1,0) people aged 15-24
35-39	(1,0) people aged 35-39
40-64	(1,0) people aged 40-64
65 and more	(1,0) people aged 65 and more
Experience	Time in the same formal employment (number of months)
Employment variables	
Small company	(1,0) with up to 99 employees
Medium-size company	(1,0) with 100 to 499 employees
Big company	(1,0) with 500 or more employees
Sector A	(1,0) agricultural, cattle-raising, silvicultural and forest activities
Sector B	(1,0) fishing activities
Sector C	(1,0) extractive industries
Sector D	(1,0) manufacturing industries
Sector E	(1,0) energy, gas and water production and distribution
Sector F	(1,0) civil construction
Sector G	(1,0) commerce; motor vehicles repair, personal chattels
Sector H	(1,0) lodging and meals
Sector I	(1,0) transport, storage and communications
Sector J	(1,0) financial intermediation
Sector K	(1,0) real estate, rental activities and services rendered to business companies
Sector L	(1,0) public administration, social defense and security
Sector M	(1,0) education
Sector N	(1,0) health and social services
Sector O	(1,0) other collective, social and personal services
Sector P	(1,0) domestic services
Sector Q	(1,0) international organizations and other extraterritorial institutions
Locational variables	
Growth rate of GDP <i>per capita</i>	Expected difference between GDP <i>per capita</i> growth rate logs for the destination and origin states in the year previous to mobility (market values in R\$[thousand]).
Population	Expected difference between the population logs of destination and origin states.
Unemployment rate	Expected difference between the unemployment rate logs of destination and origin states (in %).
Average schooling	Expected difference between the average schooling logs of destination and origin states.
Metropolitan area	(1,0) in case a metropolitan area is the destination.
Traffic accident victims	Expected difference between logs for traffic accident victims in destination and origin states.
Homicides	Expected difference between logs for homicides in destination and origin states.

Chart 2. Description of variables.

Source: Compiled by the author.

made available. Therefore, loss of skilled labor was understood here as those cases in which individuals having higher learning were found in different states by comparing t with $t + 1$ years.²

Due to a great number of individual observations contained in the RAIS-Migra database, a 5% sample out of total number was determined. This sample was constructed including all transitions achieved among Brazilian states, by observing non-null salary values of individuals aged more than 15 years in 1995–2006.³ Therefore, the data panel was constructed in such a way as to follow-up the labor force path. This panel shows 4,218,343 observations and considered imbalanced, as the number of individuals varies each year.

Table 1 contains figures annually compiled in the database used in this study. Migrants and non-migrants reach a total of 4.3 million workers. Interstate migrants correspond to approximately 0.5% of total workers in the Brazilian formal labor market from 1995 to 2006, which in turn amounted to 0.8% of total skilled labor force. On the other

² It is worthy to note that due to the article's focus on the skilled worker's migration in the formal labor market it is possible the occurrence of a greater weight of the skilled worker migrants in the total workers in comparison with the total of migrant workers when samples including informal workers are considered. As stated in [Bezerra and Silveira Neto \(2008\)](#), among Northeast migrants who live in the state of São Paulo, there is an outstanding greater weight of the less skilled workers as one compares with the Northeast inhabitants. The authors gratefully acknowledge this point by the anonymous referee.

³ The sample has gone through adjustments due to measurement errors. Since RAIS-MIGRA is obtained by means of questionnaires, response problems may arise, such as an individual change of gender from one year to another. For this reason, such individuals were taken out of the sample (65,651 observations).

hand, 6061 skilled workers were reported to leave their places of origin in the period, which totaled 29% of interstate migrants. The number of cases representing loss of qualified people and the number of migrants reached 551 and 1340, respectively.

3.2. Explaining variables used

The explaining variables comprise three different groups (see [Chart 2](#)): (i) variables related to individual characteristics (ii) variables related to job characteristics and (iii) those referring to the federation units of origin and destination. Individual characteristics become important as far as decision to migrate is concerned as those people moving to different places do so because of a specific and common stimulus, such as age, gender and specialization ([Castiglione, 1989](#)). These factors have made the individual more inclined to migrate in any way. Such data were taken from the RAIS-Migra database. The individual variables are described as follows:

- Wage differential was taken from information on labor remuneration in December taking into account the value of national minimum wage deflated by the Broad Consumer Price Index (IPCA),⁴ by means of the difference between the salary in the state of destination and that in the state of origin. However, as the decision to migrate was made before the observed pay in the destination, what in fact was obtained was the individual's salary expectation in the destination state and this should be compared to the observed salary in the origin state. Therefore, the average salary received by individuals working in the destination state should be considered as salary expectation in the destination, in accordance with the workers' qualification in the year of the individuals' decision to out-migrate (*t*). Including this variable was aimed at capturing the decision to migrate as an attempt to maximize income, since the expected wage differential in some localities was seen as the most important economic variable to influence out-migration on skilled labor force ([Sahota, 1968](#)).
- Gender was taken in a binary way, in which value 1 represented females and 0, males. Including this variable was aimed at capturing the individuals' mobility propensity given their gender. [Dumont et al. \(2007\)](#) showed that poorer countries were more affected by female brain draining, which was an evidence of higher female propensity to migrate in such countries.
- Age at the origin was included by means of dummies indicating four age-group categories: 15 to 24; 25 to 39; 50 to 64; and 65 and more years of age. Individuals ageing from 15 to 65 and more were considered, as the database time interval has made it possible to qualify an individual as a skilled worker in one year within the 12-year period. According to [Lucas \(2001\)](#), the current value of a given income differential flow was higher for the younger due to their longer lifespan, resulting in an attraction to migrate, which decreased as age increased.
- Experience was continuous and represented seniority, i.e., the number of months of a worker's formal job in the origin state. This was an attempt to verify whether seniority was a factor enabling the worker to stay in the origin state or whether this factor had acted in reducing the out-migration risk of more skilled labor force. The squared experience variable was also to be tested so as to verify whether there had been a possible inverse propensity to migrate of those skilled workers which might be associated with greater experience.

Variables relating employment relationship of workers were also important factors in determining skilled labor loss. These might be able to stimulate workers from a given place to migrate or not as they revealed individual job conditions. Such data were all obtained from the RAIS-Migra database. The employment variables used here are listed as follows.

- Workplace size means workplace categories under which the individual was employed in the origin state. Three categories were constructed: i small company – that with up to 99 employees; ii medium-size company – that with

⁴ As IPCA is originally estimated by IBGE for nine Brazilian metropolitan areas, the values for these areas were extrapolated from those for their respective states when deflating them. As for the unconsidered states, the approximation criterion was used by means of the existing index for the nearest metropolitan area. Therefore, IPCA for Belém was extrapolated for the North region; the index for Fortaleza was extrapolated for Maranhão, Piauí and Rio Grande do Norte; that for Recife was extrapolated for Paraíba, Alagoas and Sergipe; the one for Rio de Janeiro was extrapolated for Espírito Santo; that for Paraná was extrapolated for Santa Catarina; and the index for Goiânia was extrapolated for Mato Grosso and Mato Grosso do Sul.

100 to 499 employees and; big company – that with 500 or more workers. This aimed at assessing the relevance of company size for the labor force exit probability.

- The economic activity sector in which the individual had worked in the origin state was included by means of dummies that have been determined in accordance with the *Classificação Nacional de Atividades Econômicas* – CNAE (a national roll of economic activities). This was intended to verify those sectors that were more liable to lose skilled labor force. Golgher (2001), for example, suggested that mobility would raise in a sector with higher geographic amplitude, in such a way that workers in secondary sectors would be in those with smaller geographic amplitude as compared to those in the service sector.

The idea that an individual decides to migrate in search of better economic conditions is a literature stylized fact. Therefore, locational variables should be considered as skilled labor mobility determinants as these features are also taken into account in such an individual decision-making. Then, these variables were included as differences between origin and destination of labor force so as to make it possible a comparison between states having such characteristics in the mobility choice process. However, as in the case of the wage difference variable, origin and destination variables represent expected values, since it is not possible to include an *ex-post* value in an *ex-ante* decision when estimating such determinants. Locational variables of destination thus showed a one-year gap in value, i.e., an individual takes destination data into account before accomplishing mobility, not afterward. Data were taken from the IBGE database and the variables used are described below.

- The expected difference between per capita Gross Domestic Product (GDP) in the year before the worker's mobility decision attempted to capture differences in the living standard and degree of economic prosperity between the states under study. According to Marfouk (2007), the expected differences in living standard between states determine the decision to migrate. Therefore, the better the living standard in a given state, the higher the immigration flow into that state.
- The unemployment rate represented the percentage of people who were seeking jobs but could not find any paid professional position among all those active occupations in the labor market – a group including people aged 10 years or more that were seeking jobs or working during the PNAD reference week. This variable was included as an attempt to capture the expected difference between destination and origin states as for labor market dynamism. Expected regional differences in unemployment rates encouraged migration, i.e., the higher the unemployment rate in the origin, the higher the propensity to migrate, since the probability to find jobs in the labor market in the origin state was low (Cheng and Yang, 1998).
- The state population was included so as to verify if population size influenced skilled labor mobility. This variable referred to resident population estimates obtained from reference data on July 1st of each year. The hypothesis to be tested is that larger states attract more qualified people as these states are liable to offer more job opportunities as well as qualification improvement opportunities (Beine et al., 2008).
- Average schooling represented the expected difference between states as for average years of completed schooling of individuals aged 25 years or more. Miyagiwa (1991) showed that the effect of education scale has increased productivity and hence skilled labor income in a region having significant skilled people agglomeration, which in turn has enhanced the attraction power of this region. Therefore, this paper intended to verify whether localities with more qualified people proved to have the power to attract brains or whether such individuals were more attracted by regions lacking skilled labor force where human capital return seemed to be higher.
- Variables such as deadly transit accidents and number of homicides attempted to capture how urban amenities influence mobility propensity in accordance with the international (Graves, 1980; Patridge, 2010; Glaeser and Gottlieb, 2006) and national literatures (Mata et al., 2007).

As costs are incurred in migration, data on distance were also included in the study. Therefore, mobility was more liable to occur in nearer states as compared to those more distant states. Furthermore, a dummy referring to metropolitan areas was also included with the aim to capture whether the most qualified people were more attracted by such areas.

4. Empirical model

As said before, skilled labor mobility could be verified by identifying individuals having higher learning education in t , whose federation unit in t was different from that in $t + 1$, i.e., skilled out-migrants. Therefore, two sets of comparison comprised in this phenomenon should be taken into account when estimating mobility determinants, as follows: the decision to migrate or remain in a given place and the skilled individual's decision to migrate as compared to the unskilled individual's choice.

A highly significant stylized fact in the literature refers to that migrants do not comprise a random sample of individuals (Borjas, 1999), as the decision to migrate makes them distinct from non-migrants. Self-selection becomes even more evident when studying skilled labor mobility as these workers had already shown significant personal characteristics in a positive selection related to skillfulness. As panel data were available, estimating labor force decision to migrate could be carried out by means of a fixed-effect logit model, an efficient mode of treating migrant selection bias. It is reasonable to assume that other non-observed personal characteristics might also have influenced the skilled worker's decision to migrate, such as individual preferences and abilities and education quality as well. Estimates could thus be inconsistent and biased in case non-observed variables were not included in the regression.

Therefore, in a first moment, the dependent binary variable ascribed value 1 to out-migrants and 0 to the remaining individuals. Additional variables – concerning features of individuals and their origin and destination states – were then aggregated to the decision to migrate as described in Eq. (1).

$$y_{it} = \alpha_i + X_{it}\beta + Z_{it}\lambda + R_{it}\tau + T_i\gamma + \varepsilon_{it} \quad (1)$$

where i represents the individual, t the calendar years, y represents the binary variable indicating out-migration, α_i the fixed-effect vector, X is the vector explaining variables of individual characteristics, Z represents the vector of variables related to employment, R is the vector of locational variables, ε_{it} relates to the error term, T_i represents the dummies for the calendar years and, β , λ , τ and γ are the parameters.

In a second moment, the skilled individual's decision to migrate was estimated. Therefore, only individuals who have out-migrated at any time were selected for the sample so as to make it possible to compare the skilled worker's decision to migrate with an individual's decision to migrate, no matter their qualification. As for the new estimation, which was also based on Eq. (1), the dependent variable showed value 1 to skilled out-migrants and 0 to the remaining out-migrants.

It should be emphasized that the specification presented previously for both comparison groups was estimated by means of a logit model using the method for both fixed effects and random effects, which took non-observed effects into account. Choosing between fixed-effects and random-effects methods was dependent on the Hausman test.



Chart 3. Skilled labor force out-migration in the period 1995–2005.

Source: RAIS-Migra (1995–2006) – Brazilian Ministry of Labor and Employment.

Table 2
Transition matrix of individuals among states – 1995 to 2006.

State	AC	AL	AM	AP	BA	CE	DF	ES	GO	MA	MG	MS	MT	PA	PB	PE	PI	PR	RJ	RN	RO	RR	RS	SC	SE	SP	TO	Out-migrants
AC	0	0	1	0	0	1	2	0	0	0	3	0	2	1	0	1	0	1	0	0	4	0	0	0	0	0	0	16
AL	0	0	1	1	2	3	8	0	0	0	0	0	1	1	4	13	0	0	5	1	0	0	0	0	4	2	0	46
AM	1	1	0	1	1	6	18	1	0	1	1	2	1	4	1	2	0	1	29	1	1	2	17	2	0	15	0	109
AP	0	0	0	0	1	0	2	0	0	1	0	0	1	11	0	1	0	0	0	0	0	0	0	0	0	1	0	18
BA	0	2	1	1	0	26	31	4	1	1	25	1	0	0	1	14	0	5	56	0	1	1	14	1	10	44	0	240
CE	1	3	9	1	19	0	30	1	0	8	2	0	0	3	4	18	16	1	10	13	1	0	2	2	1	17	0	162
DF	2	4	7	1	25	12	0	9	35	10	111	6	15	46	12	41	3	16	147	6	3	1	32	33	6	105	6	694
ES	0	0	0	0	0	0	18	0	1	0	21	1	1	0	0	0	0	0	37	0	0	0	9	2	0	19	0	109
GO	0	0	0	0	2	2	72	0	0	0	14	3	3	3	0	0	0	2	7	0	1	1	2	2	0	35	9	158
MA	0	0	2	0	2	4	14	0	1	0	3	0	0	3	1	3	7	0	9	1	0	0	0	1	0	4	3	58
MG	1	2	2	0	21	5	127	25	14	6	0	1	2	4	3	8	0	17	80	6	2	1	11	9	1	146	3	497
MS	1	0	0	0	2	1	13	0	7	0	6	0	25	0	1	0	0	7	17	2	2	0	3	1	0	15	1	104
MT	3	0	2	0	1	0	29	3	3	0	4	15	0	3	1	0	0	24	2	0	6	0	2	12	0	16	1	127
PA	1	1	9	15	0	3	58	0	1	3	5	1	1	0	4	3	0	4	31	2	1	1	2	3	0	12	0	161
PB	0	2	1	0	3	4	12	0	0	2	3	1	2	4	0	18	1	1	3	8	0	1	1	2	0	4	0	73
PE	0	15	4	1	23	14	48	3	0	4	10	0	1	4	17	0	0	2	26	17	0	1	4	1	3	42	0	240
PI	0	0	0	0	0	15	7	0	0	5	0	0	0	0	2	0	0	0	3	1	0	0	0	0	0	3	1	37
PR	0	1	2	0	6	2	48	1	3	1	16	14	8	6	0	4	0	0	56	1	3	0	28	61	0	152	0	413
RJ	1	5	21	0	51	13	198	46	31	7	80	16	2	22	3	23	2	57	0	14	1	0	56	14	2	280	0	945
RN	1	0	3	0	1	10	17	0	4	0	3	3	0	2	4	15	1	0	11	0	4	2	4	1	0	8	1	95
RO	4	0	2	1	4	2	9	1	3	0	1	2	4	1	0	1	1	4	4	3	0	0	4	0	0	5	0	56
RR	0	0	1	0	0	0	12	0	0	0	0	0	0	3	0	1	0	0	1	1	0	0	1	0	0	2	0	22
RS	0	1	2	0	8	20	52	14	2	2	7	2	2	2	0	5	0	34	58	3	2	1	0	50	0	89	3	359
SC	0	0	2	1	2	2	24	2	4	0	7	1	8	5	1	0	1	48	40	10	0	0	27	0	0	40	0	225
SE	0	1	0	0	12	1	5	0	0	0	0	0	0	0	1	3	0	1	1	0	0	0	0	0	0	5	1	31
SP	0	2	16	0	42	19	139	12	42	2	143	17	17	6	5	33	2	121	251	13	2	0	108	43	7	0	4	1046
TO	0	0	1	0	0	1	7	0	3	1	2	0	0	0	0	0	0	0	0	1	0	0	1	0	1	2	0	20
In-migrants	16	40	89	23	228	166	1000	122	155	54	467	86	96	134	65	207	34	346	884	104	34	12	328	240	35	1,063	33	6,061

Source: RAIS-Migra (1995–2006) – Brazilian Ministry of Labor and Employment.

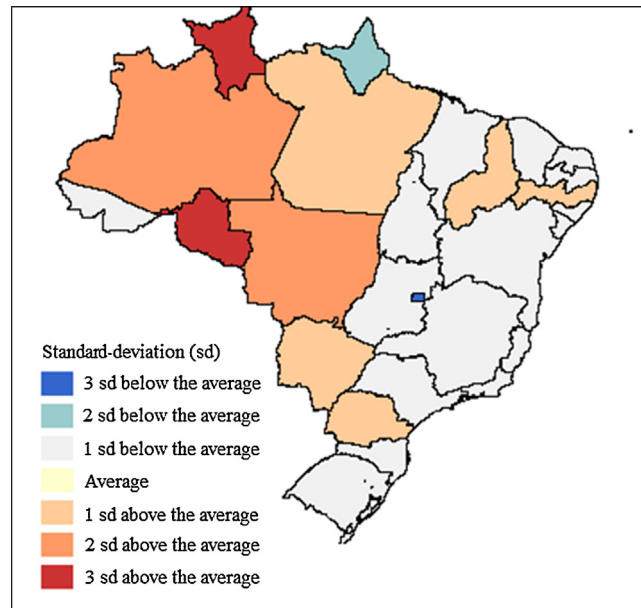


Fig. 1. Net labor force loss by states (1995–2006). *Note:* The net labor force loss means the percentage of net skilled workers loss (out-migrants minus in-migrants) by state divided by the total of skilled workers from the respective state. *Source:* RAIS-Migra (1995–2006) – Labor Ministry of Brazil.

Table 3
Average profile of workers according to RAIS-Migra (1995–2006).

	Migrants		Non-migrants
	Skilled	Others	
Wage (average)	6.148,10	1.767,55	1.762,74
Gender (male, %)	66,77	77,41	57,41
Age (average)	39,50	36,20	40,70
Experience (average)	135,15	119,07	157,36

Source: RAIS-Migra (1995–2006) – Labor Ministry of Brazil.

Note: Wage was taken from the value of national minimum wage and experience was continuous and represented seniority, i.e., the number of months of a worker's formal job in the origin state (see section 3.2 for additional details).

5. Results

5.1. Composition and characteristics of skilled labor mobility

Once mobility was confirmed, it was possible to show its interstate composition, as well as its profile for the period 1995–2005. [Chart 3](#) shows the number of out-migrant skilled workers for the period. The percentage of skilled labor loss has increased with time. Skilled emigrants represented 7.05% in 1995 of total skilled labor migration in the period. As for 2005, this percentage reached 10.40%, and overcame the percentage of skilled non-emigrants. However, there was no uniform growth trend for the period as a whole, whose peak reached 11.30% in 1999.

[Table 2](#) presents a matrix of brain transition by state for the whole period, i.e., entry and exit flows of skilled labor force. Results on the line represent out-migration and those in the columns, in-migration. Generally speaking, the loss of skilled workers was not uniformly distributed among Brazilian states. The states receiving the highest numbers of skilled labor force were São Paulo, Distrito Federal, Rio de Janeiro and Minas Gerais. These very states were those showing the highest loss.

Additionally, more than 60% of the states revealed net loss (out-migration minus in-migration of skilled people), being Paraná the state with the highest brain loss and Distrito Federal the one with the highest gain of migrant skilled

Table 4
Determinants of worker mobility in the Brazilian labor market (1995–2006).

Variable	Estimation (1)			Estimation (2)		
	Random effects	Fixed effects	Fixed effects Odds-ratio	Random effects	Fixed effects	Fixed effects Odds-ratio
<i>Individual characteristics</i>						
Wage difference	−0.830***	0.249***	1.283***	−1.027***	0.178***	1.194***
Gender	−0.511***	–	–	0.587***	–	–
15–24 years of age	0.802***	–	–	−0.608***	–	–
25–39	0.457***	–	–	0.000	–	–
40–64 ¹	–	–	–	–	–	–
More than 65	−1.602***	–	–	−0.239	–	–
Experience	−0.003***	0.007***	1.007***	−0.000	0.003***	1.003***
Squared experience	0.000	−0.000***	1.000***	0.000	−0.000	1.000
<i>Job characteristics</i>						
Small company	−0.320***	−0.295***	0.745***	−0.183***	−0.116*	0.891*
Medium-size company	0.274***	−0.039	0.961	−0.015	0.005	1.005
Large company ¹	–	–	–	–	–	–
<i>Location characteristics</i>						
Population	0.003	−0.109***	0.896***	0.230***	0.177***	1.194***
Unemployment rate	0.079	−0.287***	0.750***	0.158	−0.490***	0.613***
Average schooling	0.779***	0.117*	1.124*	0.224	−0.346	0.708
Metropolitan area	−0.218***	−0.215***	0.806***	−0.158***	−0.332***	0.718***
Growth rate of GDP <i>pc</i>	0.439***	0.106***	1.112***	0.387***	0.150***	1.161***
Homicides	−0.202***	−0.083***	0.920***	−0.246***	−0.137**	0.872**
Traffic accident victims	−0.472***	−0.004	0.996	−0.119*	−0.116*	0.890*
<i>Year dummies</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>State dummies</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Sector dummies</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Constant</i>	−7.355***	–	–	−3.253***	–	–
Number of observations	3,536,453	102,704	102,704	126,952	34,855	34,855

Source: RAIS-Migra (1995–2006) – Labor Ministry of Brazil.

Note: Estimation (1) is based on the full sample of workers; estimation (2) is restricted to the sample of out-migrants, i.e., individuals that experienced migration at least in one of the sample years. The odds-ratio means the probability of an occurrence in a particular group. The pseudo- R^2 is 0.042 in estimation (1), and 0.046 in estimation (2). Gender dummies, age dummies, and distance were dropped from the fixed effects regression due to null or small within variability.

Note: 1 Omitted dummies were chosen according to the high frequency criteria.

* Statistically significant at 10%.

** Statistically significant at 5%.

*** Statistically significant at 1%.

workers. Furthermore, it can be noted that the highest brain flow between federation units was that from Rio de Janeiro to São Paulo. Distrito Federal was the only unit having in-migrants coming from all states of the federation, as well as sending out-migrants to all states. Although using different databases, other studies have presented results for Brazil that were similar to the ones found for the present study. [Bezerra and Silveira Neto \(2008\)](#), for example, based on the 1991 and 2000 censuses, concluded that Rio de Janeiro and Rio Grande do Sul are the major states that send brains to São Paulo.

However, it is only possible to grasp the true importance of skilled labor loss in a state if the analysis takes the number of highly skilled workers in this every state into account. The net loss percentage in relation to the number of skilled labor force in such a state should be considered (the net loss rate of skilled workers). As for positive figures, the higher this rate, the higher the loss of skilled workers for the state in question as it will be losing more brains in relation to its skilled labor force. As for negative figures of the rate, the said state is to benefit from skilled labor mobility.

[Fig. 1](#) shows the net balance percentage distribution of skilled labor mobility between states through a standard deviation map, by dividing the states in accordance with the interval in which they appear in relation to the average.

The Brazilian northern states seem to be those states with the highest net loss rate of skilled labor, i.e., those states losing more in relation to the average, except for the state of Amapá. This confirmed the result found by [Bezerra and Silveira Neto \(2008\)](#), which indicated this region together with the Center-West as losers of skilled human resources to São Paulo. As a matter of fact, [Fig. 1](#) shows rates with standard deviation above the average for the northern states and some states in the Northeast region. Most rates for the Northeast states were below the average. By comparing this result with that found by [Bezerra and Silveira Neto \(2008\)](#), it can be noted that the Northeast states lacked qualified people, and hence this situation has created incentives for such individuals to stay in this Brazilian macroregion. In the same way, figures in some states in the Southeast and South regions were also below the average, except for Paraná. Specifically as for Rio Grande do Sul, the result found in this paper differs from that found by the above mentioned authors perhaps because of different used databases.

[Table 3](#) contains the major individual characteristics. As can be seen, among those cases of net skilled labor loss in all years of the period, males constituted the majority – 66.77% in average – of approximately 39 years of age. Additionally, skilled workers' wages were high – equal to R\$ 6.148,10 in average – whose observed experience amounted to 135 months obtained in the origin state.

When comparing wages of migrant skilled labor force with those of migrants having other qualification levels, it can be noted the latter – R\$ 1.767,55 in average – were quite lower than the former. Moreover, when comparing salaries of skilled migrants to those of non-migrant workers – R\$ 1.762,74 in average – the difference was still higher. Therefore, skilled migrant individuals were paid above the average.

As far as gender is concerned, as can be seen skilled males prevailed even among other migrants categories (77.41%). Therefore, one can observe that – whatever their qualification – migrant males prevailed. This was in line with international results which reveal a majority of males comprising labor migration. When comparing ages, it can be perceived that non-migrants showed a higher average age. As for the experience variable, skilled migrants proved to have more experience than other migrants, although the former were less experienced than non-migrant workers.

5.2. Determinants of skilled labor loss

[Table 4](#) shows the estimates relating the two comparison groups – out-migrants and skilled workers. As mentioned before, it is reasonable to assume that – in the context of skilled labor mobility – the presence of non-observable features. In case such features are not taken into account, estimates are subject to inconsistency and bias. Therefore, logit models were estimated for non-observed, random and fixed effects.⁵ Then, an attempt was made to certify whether such effects were innate, i.e., fixed in time. For this, the Hausman test was used in order to verify which model – fixed or random – was most adequate for the matter.

The Hausman test favored the fixed-effect model for the two estimated specifications and rejected random effects as this would be inconsistent. The fixed-effect logit model may thus be used to obtain coefficients whose values are free from the effects of non-observed variables that are constant in the course of time. In this way, the likelihood function to be maximized is restrained by the non-observed variables that are specific to each worker.

The estimation (1) provided results concerning the individual's decision to migrate or not based on the complete database. Therefore, it was intended to determine which factors were motivating or holding migrations back, whatever the individuals' schooling. Results pointed to that the coefficient of differences between salaries was statistically significant and positively correlated to migration. The higher the wage expectation in the destination state, the higher the probability of an individual to migrate, whose chance to move is 28% higher.

The experience variable proved to be significantly and positively related to migration probability showing that an increased experience in the origin enhanced the propensity to migrate. This proved that seniority in the origin state turned the individual more inclined to migrate, which made it possible the idea that the risk of an individual to become unsuccessful in the destination environment decreased with his/her seniority. The squared experience proved to be negative and significant, showing that – given to some restraints – seniority lessened the propensity to migrate.

It is important to highlight that the coefficients of both variables, wage differentials and experience, were negative and significant in the random effects estimation. The fixed effects estimation correctly promoted the coefficient' change,

⁵ [Table 4](#) shows figures concerning the coefficient and odds ratio for the fixed-effect model as the latter proved to be adequate by the Hausman test. The odds ratio means the probability of an event to occur in a given group.

whose signal is positive. This proved that both variables were correlated to the individual specific effects. Therefore, the higher the seniority in the source state, and the higher the wage in the destination state, the higher the probability of an individual to migrate.

As for the activity establishment variable, small businesses had significant coefficients and were inversely related to migration probability showing that such a propensity is decreased for individuals working in their states of origin as compared to that of big companies.

As far as locational variables were concerned, most of them proved to have statistical significance and expected sign. The coefficient of expected unemployment difference pointed that the higher the difference between destination and origin states, the smaller the migration probability. This outcome revealed the importance of labor market dynamism for the decision to migrate, which confirmed the literature hypothesis. Similarly, the evolution of the previous growth rate of GDP per capita in the destination state in relation to that of the origin state was positively related to mobility, which evidenced the importance of economic prosperity in the state that the worker had decided to move to.

As for the variable of expected difference related to average schooling showed that probability to migrate enhanced with an increased average difference of population schooling between destination and origin states. This proved that individuals are more inclined to migrate toward states having higher average level of education.

The population size difference between the destination and origin states was positively related to migration – the higher the population of the destination state, the higher the propensity to out-migrate. The dummy variable related to a metropolitan area indicated that migration propensity decreased in 19% if the destination was a metropolitan area. This outcome suggested that workers moving to other states sought job opportunities out of metropolitan areas.

Urban amenities showed expected results in terms of sign and significance, except for traffic victims, which was not significant. Differences among murders were negatively related to mobility suggesting that workers sought states having smaller violence indices.

Considering that the previous estimation (1) allowed determining reasons for the migration phenomenon both for more qualified and less qualified individuals, then it was possible to analyze the skilled labor migration determinant.

Table 5
Determinants of skilled workers mobility in a restrict sample.

	Fixed effects Coeff.	Fixed effects Odds-ratio
<i>Individual characteristics</i>		
Wage difference	0.348***	1.416***
Experience	0.005***	1.005***
Squared experience	−0.000**	1.000**
<i>Job characteristics</i>		
Small company	−0.122*	0.885*
Medium-size company	0.019	1.02
Large company	–	–
<i>Location characteristics</i>		
Population	−0.162*	0.850*
Unemployment rate	−0.498***	0.608***
Average schooling	0.208*	1.231*
Metropolitan area	−0.433***	0.648***
Growth rate of GDP <i>pc</i>	0.123***	1.131***
Homicides	−0.001	0.999
Traffic accident victims	0.018	1.018
<i>Year dummies</i>	Yes	Yes
<i>State dummies</i>	Yes	Yes
<i>Sector dummies</i>	Yes	Yes
Number of observations	28,019	28,019

Source: RAIS-Migra (1995–2005) – Labor Ministry of Brazil.

Note: See Table 4. This estimation is based on a restricted sample that includes only skilled workers, i.e., workers who had the tertiary level of education. The pseudo- R^2 is 0,041 in the estimation.

The results can be seen in the estimation column (2) in [Table 4](#). The fixed-effect control results showed a statistically relevant positive relation between the expected wage difference and the decision to migrate of those more skilled workers, as well as that of migrants in general. This shows that labor force migrate in search of better wages, a fact that confirms national and international literature on motivations behind this kind of mobility.

As far as individual characteristics are concerned, greater experience was positively and significantly associated with decision to migrate. Conversely, the squared experience variable proved to be negative in the same way as it did in the decision to migrate of workers in general.

The establishment-size variable in turn showed a negative and significant coefficient only for small business in relation to the reference dummy (big company). Therefore, migration probability is decreased if individuals are employed in a small business in the origin state.

The difference between GDP per capita growth rates previous to decision to migrate was positively related to skilled workers' migration, showing that a qualified individual also moved to states with better living conditions.

The difference between the destination state population and that of origin state was an evidence that skilled people seek states showing higher population agglomerations, in accordance with the literature that affirms that major states attract more qualified people. On one hand, more opportunities can be found in such states, mainly as far as job opportunities are concerned, according to [Beine et al. \(2008\)](#). On the other hand, there is no significant evidences on the migration of qualified workers toward to states whose population have less education than the average.

The unemployment rate difference proved to be significant, bearing an expected negative sign, which indicated that skilled workers migrate seeking better job opportunities as is the case of labor mobility in general. These results were quite in line with those found in the Brazilian literature, although differences occur as for time period, econometric method and database used (see [Chart 1](#)). These studies generally show that probability to migrate increase when individuals find unfavorable social conditions in their origin states or when these federation units are less prosperous than those of destination. This is the case when analyzing propensity to migrate in the North, Northeast and Southeast regions ([Justo and Silveira Neto, 2009](#)).

As is the case of labor force in general, skilled labor mobility was influenced by urban amenities. Higher indices of violence in the workers' destination made propensity to migrate decrease as compared to their origin. This result is similar to the study of [Mata et al. \(2007\)](#) to the Brazilian cities.

The dummy variable related to metropolitan area indicated that propensity to migrate decreased in 18% when the destination was metropolitan areas, showing that there occurred spatial deconcentration of skilled labor force in Brazil.

A method of testing the robustness of estimated coefficients can be carried out by comparing – among skilled workers only – migrant skilled individuals with non-migrant skilled individuals. Therefore, a restrict sample was chosen that considered only those workers with complete higher learning in all years of the period. And this was because identification problems could arise if workers with only some years of higher education were considered. Therefore, the dependent variable was a dummy which took on value 1 for out-migrants and 0 for non-migrants. [Table 5](#) provides results for the fixed-effect estimation, considered as the best method when verified through the Hausman test.

Such results generally confirm the behavior of skilled labor migration (estimation 2, [Table 4](#)). As can be seen, wage difference remained as an important exit determinant of skilled workers in view of its positive sign. The remaining individual and locational variables presented the same sign and statistical significance, except for the inverted signal of the population per capita and the average level of education, and for the not significant coefficients from the variables of urban amenities. In particular, the positive signal from the average level of education is quite in line with those found by [Mata et al. \(2007\)](#) to Brazilian cities.

6. Conclusion

This paper aimed to analyze and identify determinants of skilled labor mobility in the Brazilian formal labor market for the period 1995–2006 within the individual decision context. When analyzing the determinants of skilled labor exit, the results found here have confirmed the relevance of wage differences, which were in line with results found in the literature on the subject. As for individual characteristics, seniority in the state of origin was confirmed as a factor that made an individual more inclined to migrate. Therefore, the argument that risks of failure in the state of destination can be lessened with experience is acceptable. On the other hand, it was observed that small businesses tend to represent a

retaining factor of labor force in their origin, as compared to big companies. And this was observed both in the skilled labor sample and in that of workers in general.

As for locational variables, it was demonstrated that the propensity to migrate of skilled workers was directly associated with the following: search of states having higher economic prosperity as compared to those of origin; higher dynamism in the labor market; larger population agglomeration and; existing urban amenities. Such results confirmed the idea that workers sought better living conditions and skilled job opportunities.

Finally, the analysis of composition and features of skilled labor exit has evidenced the importance of this phenomenon in the interstate context. States in the North and Center-West (MT and MS) regions were the biggest losers of skilled labor force as for skilled labor stock; this was true especially for Roraima and Rondonia. São Paulo was the federation unit that received the largest number of skilled labor force. Furthermore, the analysis of individual profiles suggested that skilled migrants are mostly men who are paid higher average wages as compared to those of workers bearing other qualifications, whatever migrants or not.

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