Economic sector, demographic composition, educational attainment, and earnings in Brazil

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Abstract
Brazil experienced population ageing and improvement in educational attainment between 1980–2010. Proportion of workers in the formal economic sector increased between 2000–2010. Earnings decreased from 1980 to 1991 and increased in 2000. However, earnings in the formal economic sector decreased again in 2010. We estimate associations of individual- and area-level variables with individual earnings of male workers living in urban areas in Brazil. Ordinary least squares regressions estimate variations on earnings of male workers, using the 1980–2010 Demographic Censuses. Individual independent variables include age, education, economic sector, race/color, marital status, religion, and region of residence. Contextual independent variables consider demographic, educational, and economic sector compositions by areas of residence. Considering individual-level variables, older and better educated workers have higher earnings. Workers in the formal economic sector have higher earnings than in the informal sector. For area-level variables, higher proportions of people working in the formal economic sector have positive associations with earnings. Proportions of people in age-education groups have negative associations with earnings mostly among older workers. For models by economic sector, proportions in age-education groups have higher positive coefficients in the informal sector, compared to the formal sector. Transitions in demographic, educational, and economic sector compositions are correlated with earnings. These effects generate greater economic inequality in the informal sector than in the formal sector. Our main contribution is the estimation of models about associations of individual earnings with individual and area-level variables, which can be replicated for other countries.

Keywords
Age-education transition; Informal economic sector; Formal economic sector; Earnings; Labor market; Brazil

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1. Introduction

The objective of this paper is to estimate the association of changes in economic sector and variations in demographic and educational compositions with earnings of male workers in Brazil. Previous studies estimated that higher proportions of older and better educated workers have negative correlations with earnings, but these effects have been decreasing over time (Amaral, 2012; Amaral et al., 2012; Amaral et al., 2013a; Amaral et al., 2013b; Amaral et al., 2015; Amaral et al., 2016). Workers with primary education have not experienced improvements on earnings even with their decreasing share in the population. Individuals with secondary education already experience lower earnings than those with university education and, additionally, have earnings that are most affected by changes in demographic and educational compositions. The Brazilian labor market seems to be assimilating and demanding workers with university education. The main contribution of the current study in relation to these previous analyzes is the estimation of models that evaluate the association of workers' earnings with variables related to informal and formal economic sectors. The paper also contributes to the discussion of informal and formal labor markets in a developing economy. Formal and informal sector in Brazil are characterized by the working contract and labor law coverage. In the informal sector, labor legislation is non-existent. We are able to identify the sector of employment by the workers response on having or not a "employment card". There is an important discussion about the segmentation of the labor market in Brazil and we argue that our analysis shed some light on this discussion. We estimate the association of regional composition of the workforce by economic sector, age, and education with individual earnings of workers.

Brazil is passing through a rapid process of demographic and educational changes with large regional and social inequalities (Barro and Lee, 2001; Lam and Marteleto, 2005; 2008; Marcílio, 2001; 2005; Potter et al., 2002; Potter et al., 2010; Riani, 2005; Gong and Van Soest, 2002; Lustig et al., 2013; Rios-Neto and Guimarães, 2010). There have been also significant decreases in rates of jobs in the informal economic sector in the country (Barbosa Filho and Moura, 2015; Mello and Santos, 2009; Ramos, 2002; G. Ulyssea, 2005; G Ulyssea, 2018). Our analysis considers demographic, educational, and economic regional variations over time. This paper is part of a broader discussion of regional differences in income and economic growth. We provide estimations that analyze simultaneously associations of three main factors (educational changes, demographic transition, and variations in economic sector) with male earnings.

The next section gives an overview of previous studies related to demographic and educational changes, as well as economic sector characteristics in developing countries. The following section presents our data and different methodological strategies. We estimate a series of ordinary least squares regressions to understand variations in earnings, based on a series of individual-level and area-level independent variables. This analysis is performed using Brazilian Demographic Censuses microdata from 1980 to 2010. We include further explanations about how we estimated models to evaluate how earnings at the individual level are associated with age, educational, and economic sector compositions of the workforce. We then present results from our analysis, which indicate that demographic, educational, and economic sector changes are correlated with earnings. Age-educational cohort effects on earnings were stronger in negative terms for workers in the formal economic sector, as compared to those in the informal economic sector. However, these negative relationships have been dropping over time. We

conclude with some final considerations that summarize our findings and contributions to this scientific field.

2. Background

The study of wage differentials in developing countries is an important subject to explore, since these countries are marked by larger economic differentials than developed countries. This section briefly summarizes studies dealing with the effects of geographical concentration of well-educated workers and cohort size on earnings. We further discuss factors that stimulate the emergence of informal economic sectors, emphasizing the particular case of Brazil.

2.1 Variations in earnings due to demographic and educational changes

The geographical concentration of well-educated people benefits everyone else in the population, as well as generates greater knowledge and economic dynamism. In the United States, the concentration of skilled people in some regions has a positive effect on productive gains, which further increases the concentration of qualified people in these areas (Berry and Glaeser, 2005). The greatest concentration of skilled people in specific locations occurred in the 1980s and 1990s, leading to an increase in the wages of all workers (Moretti, 2004a; b; c; 2011). The larger proportion of people with higher educational attainment benefits the population as a whole, as the result of a spillover effect (Moretti, 2011; Hout, 2012). Thus, there is a positive effect of population concentration on individual incomes (Moretti, 2004a; b; c). Other studies indicate that there are positive effects on the economic dynamism of American cities resulting from the concentration of skilled workers (Black, 1998; Rauch, 1993).

There are numerous studies evaluating wage differentials and income concentration in several developing countries. However, there are few comparative studies of the dynamics that have recently been affecting local labor markets. Studies analyzed the concentration of human capital in Brazil (Queiroz and Golgher, 2008), but they did not investigate the reasons or the implications of this concentration. Other studies emphasized positive effects of the concentration of skilled workers in the Brazilian labor market (Queiroz and Calazans, 2010). However, variations in cohort size across municipalities in Brazil led to associations with workers' earnings (Amaral, 2012; Amaral et al., 2012; Amaral et al., 2013a; Amaral et al., 2013b; Amaral et al., 2015; Amaral et al., 2016). More specifically, higher proportions of the population in age-education groups are negatively associated with income of these groups. These effects are larger for groups with higher educational attainment, but with declining effects over time. Thus, the concentration of skilled workers in specific locations can generate benefits for some groups but it can produce negative results for other groups.

Improvements in educational structure has significant benefits to the employment structure and wage distribution of a country (Jaume, 2017). Brazil experienced educational expansion between 1995 and 2014, but the occupation structure of employment remained fixed. This context allows for the analysis of its association with several aspects of the economy, such as wage levels, poverty, inequality indicators. Results suggest that formal businesses are more likely to hire workers with university education than informal businesses. This is an indication that educational improvements have significant effects on earnings. Workers with all types of educational qualifications (primary, secondary, university) were getting employed in lower paying jobs, relative to their skills. Earnings of workers with primary education increased and

earnings of workers with better education decreased in the period. This process resulted in a decline of inequality and poverty indicators in the country. Based on different policy experiments, this study investigated scenarios in which secondary and university education increased separately and simultaneously. Main results indicate that educational expansion predicts several changes in the Brazilian labor market, including improvements in earnings and reduction in poverty and inequality indicators.

2.2. Informal economic sector in developing countries

Jobs in the informal economic sector tend to be widespread in low-income and middle-income countries (Gasparini and Tornarolli, 2009). Informal sectors have been noted to represent a gross domestic product (GDP) of around 10 and 15 percent in most high-income nations, as compared to a GDP of between 25 and 80 percent in most low-income and middle-income countries (Binelli, 2016). In developing nations, informal labor markets facilitate economic growth by minimizing effects of regulation (Meghir et al., 2015). The informal labor market is generally perceived to operate outside the regulatory framework by failing to pay taxes or make contributions to social security. Consequently, informal labor markets reduce social protection of workers, as well as fail to comply with protection regulation for employees and minimum wage policies. This aspect generates an optimal engine for economic growth, because it allows organizations to operate in an environment characterized by low regulatory and wage costs (G. Ulyssea, 2010; Charlot et al., 2015).

The development of an informal economic sector is correlated with poorly functioning institutions, labor rigidness, high taxation levels, and elevated corruption levels (Binelli, 2016).

The growth and establishment of informal sectors happens in the same context as low aggregate welfare. An important aspect that relates to our study is that countries with high prevalence of informal markets tend to have higher levels of wage inequality and lower levels of economic development (Binelli, 2016). In Mexico, wage inequality within informal workers accounted for more than 60 percent of the overall wage inequality between 1987 and 2002 (Binelli, 2016). The 1995 Mexican financial crisis increased the share of informal workers and wage inequality, which affected the national economy and resulted in significant unemployment among formal employees. This crisis represented a macroeconomic shock that can be used as an instrumental variable to investigate variations in earnings. The association of informal economic sector and wage inequality can be also understood by decomposing changes in inequality by economic sector. Increases in wage inequality are related to differences in inequality within formal and informal workers, relative to inequality between formal and informal workers. Results from instrumental variable regressions and decomposition exercises suggest increases in wage inequality with the rise in informal economic sector (Binelli, 2016).

Workers in the informal economic sector usually do not remit taxes of their businesses and do not contribute towards social security (Bosch and Esteban-Pretel, 2015). All these factors make it difficult to authenticate their particular employment conditions, making it challenging for them to receive unemployment benefits. This trend is worrisome, since informal workers are more likely to lose their jobs in the labor market. Around 50 percent of the flow of workers into unemployment is generated from informal jobs in Brazil and Mexico. Furthermore, over 70 percent of workers in the world do not have any form of income support when they are unemployed (Bosch and Esteban-Pretel, 2015). The lack of income while unemployed is due to

the absence of employment benefits systems in most developing countries, especially in Latin America. Nevertheless, these countries tend to introduce such systems as their economies grow. Unemployment benefit systems might introduce challenges as people become reluctant to search for new jobs once they are discharged from their work places. In middle-income countries, the existence of informal economic sectors is also associated with low unemployment benefit coverage. Middle-income countries also tend to impose high costs upon the dismissal of formal workers, as a strategy to secure jobs and protect wages of unemployed workers. These statements bring up questions about how unemployment benefits could affect jobs in the informal and formal economic sectors, especially in countries with high incidence of informal labor markets. In the case of Mexico, the introduction of unemployment benefit systems was associated with increases in formal jobs in the labor market, as well as with small increases in unemployment. Overall, when these unemployment benefits are the only policy being implemented, they have lower effects in the reduction of informal jobs and higher impacts on the increase of unemployment. The combination of these benefits with the reduction of costs to have formal workers (e.g., lower employment taxes and firing costs) might have long-term positive effects on increasing formal jobs and decreasing unemployment rates (Bosch and Esteban-Pretel, 2015).

The choice on whether to select self-employment over wage employment depends on a variety of factors that independently affect an individual. A model simulated the decision of people choosing to be self-employed or working on a traditional wage-earning job, following the implementation of a hypothetical mandatory universal unemployment insurance (Pardo and Ruiz-Tagle, 2017). This model combines effects played by preferences and human capital in influencing workers choice. Based on panel data from Chile, results suggest an increase in the

number of workers selecting self-employment. Policy simulations of a mandatory unemployment benefit indicate that the fraction of self-employed workers would increase by around 1.6 percentage points. Experience and level of education had no significant impact on the individual's income, but they played an important role in the choice of the type of employment. More specifically, 46 percent of people with no education and no experience were likely to opt for self-employment, instead of wage-earning jobs. On the other hand, formal workers preferred benefits associated with their employment, such as health insurance and retirement benefits. Therefore, sector-specific experience plays a huge role in influencing an individual's decision on which type of employment to choose because of the risk-averse nature of their area of specialization. Although this model provides an idea of increasing self-employment with the implementation of a mandatory unemployment insurance, it does not incorporate effects of bargaining power of workers within the firm, taxes, health insurance, and pension benefits.

Labor markets in developing countries have continually being analyzed to understand how labor legislations might influence jobs in the formal and informal economic sectors. These legislations and regulations are usually pointed as a strategy to increase formal jobs. Based on data from Argentina, estimations from quasi-experiments in respect to minimum wage variations indicate that informal workers experienced significant increases in income, while formal workers did not experience similar increases (Khamis, 2013). This finding indicates that effects of minimum wage legislations on earnings of informal jobs were positively stronger than on earnings of formal jobs. This process happened despite informal workers not complying with other labor legislations and not contributing to the social security system, which means they will not have a steady source of income after retirement or termination of their employment. Noncompliance

with a single labor law (e.g., social security contribution policy) does not necessarily mean noncompliance with other laws (e.g., minimum wage). These findings are the case for many developing countries (Bargain and Kwenda, 2014). In Brazil, studies generally find that minimum wage compressed the earnings distribution in the formal and informal labor markets (Khamis, 2013). There are two views regarding this issue in Brazil. On the one hand, some studies suggest the existence of segmentation of the labor market, marked by large wage differentials between formal and informal sectors (Botelho and Ponczek, 2011). These differentials are larger at the bottom of the wage distribution, but these analyzes also find evidence of selection bias. On the other hand, other studies suggest evidence that the Brazilian labor market is competitive and individuals might find a position in the informal sector to be more attractive than in the formal sector (Bargain and Kwenda, 2014; Carneiro and Henley, 2001). These studies also indicate selection bias of workers in the economic sectors.

2.3. Informal economic sector in Brazil

In this context of high levels of informality in the economic sector in developing countries, it is important to analyze trends of jobs in the Brazilian labor market. The social protection system has undergone several changes and expanded its reach, especially after the 1988 Constitution. However, the country still experiences high rates of jobs in the informal economic sector, which present a major challenge to the country's economy (G. Ulyssea, 2005; Ramos, 2002; Mello and Santos, 2009; Barbosa Filho and Moura, 2015; Botelho and Ponczek, 2011; Carneiro and Henley, 2001). Economic informality is a structural problem of the Brazilian labor market and not a cyclical aspect. Between 1990 and 2000, significant increases in the proportion of jobs in the informal economic sector were a result of the increased number of self-employed and those

without a formal contract. Between 2000 and 2009, there was steady decline of jobs in the informal economic sector, accompanied by significant economic growth. More specifically, there was a significant drop in informality after 2001, increasing from 54.3 percent in 1992 to 56.2 percent in 1999, and dropping to 48.7 percent in 2009 (Neto and Zylberstajn, 1999; Mourão et al., 2013). This reduction in informality is related not only to changes in the composition of employed labor, but mainly to improvements in educational distribution (Mello and Santos, 2009). Even with this recent decline, the high level of jobs in the informal economic sector (around 32.5 percent in 2012) is still a concern to the country's economy (Barbosa Filho and Moura, 2015). Some studies suggest that over 40 percent of the Brazilian workforce is employed in the informal economic sector in 2015 (Meghir et al., 2015)

Most of self-employed workers in Brazil have low education, evade tax, and are unlikely to employ other people or expand their businesses (Narita, 2013; Botelho and Ponczek, 2011; Bargain and Kwenda, 2014). According to data from 2002 to 2007, older people depended more on self-employment than younger people, because of lower levels of educational attainment (Narita, 2013). At the same time, earnings were proportional to the increase in age, indicating that older and more experienced workers achieved greater success compared to younger individuals. Simulations indicate that increasing costs of informality have small effects on employment composition and informality, reduce lowest wages (i.e. increase wage inequality), and improve welfare of formal firms and all workers.

In relation to determining factors of informality in Brazil, a study estimated equilibrium models based on data about more than 48,000 small businesses in the country (Paula and Scheinkman,

2007). Since small informal firms tend to do not pay taxes, this results in relatively higher profits, which attract more entrepreneurs into the informal sector. Main results indicate that informal firms are small and less productive businesses with low per capita income. These small businesses account for a small percentage of workers since they are less likely to create jobs for many unemployed young workers in developing countries. Furthermore, informality of a business is associate with informality of other businesses throughout the production chain. Thus, existence of informal firms in one production stage increases informality and tax avoidance of suppliers and purchasers in other stages.

In order to understand the effects of high level of economic informality in Brazil, models were estimated in which workers search randomly for jobs, using data from two Brazilian municipalities (São Paulo and Salvador) (Meghir et al., 2015). Considering strategies by the government to enforce formal jobs and regulatory costs of formal jobs (e.g., taxes and minimum wages), results indicate that a firm can make similar profits in the formal and informal sectors. This suggests that incidence of informality is associated with institutional requirements for formal firms and with penalties of informality. Informal firms do pay more than formal firms when controlling for the level of productivity. However, informal firms are on average less productive than formal businesses, thus earnings in the formal sector are on average higher than those in the informal sector. A labor market with high levels of informal jobs reduces competition for workers and makes it harder for workers to get higher productivity jobs. Simulations indicate that policies aiming to reduce informality affect disproportionately larger informal firms, do not increase unemployment, improve allocation of workers to better firms in the formal sector, increase wages, and increase overall access to welfare.

With the increase of trade liberalization in developing countries, there have been reports on the increase of informal employment, especially in the manufacturing sector (Paz, 2014). This study investigated the impact of trade liberalization on informal labor markets of developing countries where tariffs influence the organizations' decisions on tax compliance. Manufacturing industries dominate the majority of the informal sector in Brazil and Columbia. Between 1989 and 2001, 85 percent of the Brazilian manufacturing industries dealt in trade liberalization. Firms' decisions to comply with payroll taxes depend on the expected return on investments since the evasion of taxes is subject to fines. Results suggest that a decrease in tariffs imposed on incomes increases average wages of formal workers. Therefore, for developing countries with high rates of jobs in the informal sector, trade liberation is a critical constraint to the growth of their economy. Furthermore, a decrease of trade liberalizations reduces informal employment and raises formal wage of workers.

The analysis about whether lowering taxes reduces the informal economic sector was performed in Brazil, after the implementation of the Individual Micro-Entrepreneur Program by the federal government in 2009 (Rocha et al., 2018). This program aims to foster entrepreneurship, create new formal businesses, increase tax registration, intensify compliance of small informal firms, and increase contributions to the social security system. Findings indicated that reducing entry costs had no significant effects on informality. However, the reduction of tax obligation increased formalization. Results also suggested that the major inhibiting factor to formalization is the cost of staying formal, not registration costs. For these reasons, governments that seek to

promote their formal economy should implement tax friendly laws on formal firms rather than only regulating the cost of entry.

Different studies were conducted to investigate effects of the tax simplification program (SIMPLES) on formalization rates. This program was implemented by the federal government in 1996 as a strategy to simplify tax systems for small businesses and micro firms. The program combined six social contributions and federal taxes into a single corporate income tax rate, which is paid on a monthly basis. An analysis indicated that this program improved rates of formalization, increased the number of workers in businesses in the formal sector, and generated higher levels of revenue, profits, and capital for newly created firms (Fajnzylber et al., 2011). By lowering costs to contract labor, this program incentivizes businesses to have permanent locations and have more paid workers. Another study also indicated an increase in formal firms created after the implementation of SIMPLES in eligible sectors, but had no effect on construction, transportation, services, and manufacturing jobs (Monteiro and Assunção, 2012). A more recent study suggest that this tax program did not affect formalization rates (Piza, 2018). This analysis suggests that previous models found positive effects of SIMPLES on formalization rates, because they were influenced by measurement errors and did not control for seasonal shocks. These new empirical strategies indicate that the program lacks short-term effects on formalization rates of small businesses (Piza, 2018).

Despite extensive literature regarding economic sectors in Brazil, there is no consensus about the existence, direction, and magnitude of wage variations due to segmentation of the labor market in formal and informal activities.

An important question related to high levels of informal jobs in the Brazilian labor market is whether workers with similar levels of productivity have higher wages in the formal economic sector, compared to the informal economic sector (Barros and Ulyssea, 2010). Previous analyzes have mixed results about whether workers in formal jobs receive higher wages than workers in informal jobs, controlling for their productivity. An important related question is whether wage variations alone of equally skilled workers could be utilized as an indication of a segmented labor market. Based on different research models, this analysis suggests that it is difficult to determine the existence of segmentation in the labor market by only analyzing wage differentials (Barros and Ulyssea, 2010). As a way to deal with these analytical challenges, our models investigate individual earnings differentials by considering both individual and contextual associated factors.

In terms of the association between unemployment benefits and jobs in the informal sector, a study analyzed Brazilian household surveys between 1999 and 2009 (Mourão et al., 2013). Results suggest that after receiving unemployment benefits, the incidence of formal employment among workers decreases by 42 percent. The analysis of interactive terms indicates that increases in the real values of the benefits, held since 1999, have not significantly improve the occurrence of formal employment among workers.

3. Data and methods

We investigate the associations of informality, demographic, and educational changes with earnings of urban areas in the Brazilian labor market. We analyze the correlations of the composition of the workforce of urban areas by informality status, age, and education with

individual earnings of workers. This analysis uses local-level data to construct age-education cells and follows their changes over time. We use microdata from the Brazilian Demographic Censuses to estimate how informality, population, and educational compositions at the local level are correlated with individual earnings of male workers over time. More specifically, we analyzed 1980, 1991, 2000, and 2010 Brazilian Demographic Censuses, which were obtained from the Brazilian Institute of Geography and Statistics (IBGE).

In terms of our methodological strategies, let the prospective worker have three choices: S, self-employment; I, informal employment; and F, formal employment. In Sectors S and I the person receives no social insurance benefits, in particular, no unemployment benefit coverage and no health insurance coverage. Assume that the worker chooses a sector by finding: $U^*=\text{argmax}[U(W^S), U(W^I), U(W^F)]$, where W indicates the wage in the sector. Let A be the worker's age, and assume that each W^S is a function of age. Assume too that workers' demand for social insurance peaks during their prime-age years because of family responsibilities, i.e., more dependents. Then W^F will be the utility-maximizing choice especially in prime-age years, because the benefits of having social insurance are greatest in the prime-age years. Moreover, that will be especially true for married men compared to unmarried men, with, if anything, the difference by marital status being reversed for women.

Beyond this, of course, the choice depends on relative wages in the three sectors. Those are endogenous with respect to choices in the entire labor market, as well as having issues of individual self-selection. As an instrument for opportunities in the sectors, we can write: $W^I=G_I(N^i)$, $G_I'<0$, and $W^F=G_F(N^i)$, $G_F'<0$, where N^i is the fraction of workers in the i'th person's

labor market who are in his/her demographic (age-education) group. We have shown that this fraction affects wage rates (Amaral et al., 2013b), so we know that it is at least a candidate to be an instrument for wages in the context of sector choice. We can reasonably argue that the returns to self-employment do not depend on the demographic density of worker i's group in his/her labor market. Thus, we should expect that, where N^i is larger, the prosperity to choose self-employment will be greater, other things equal, since the individual's wage rate is depressed by this greater density. Regarding the functions G_I and G_F, the question is whether we can argue that $G_F' < G_I' < 0$, i.e., that demographic density depresses relative wages more in the formal than in the informal sector.

At this point, we perform the analysis only for men. We categorized information on age into four groups: youths (15–24 years-of-age); young adults (25–34 years-of-age); experienced adults (35–49 years-of-age); and older adults (50–64 years-of-age). The level of education was classified into four groups using information on completed years of schooling and considering the specificities of the school system in Brazil. We utilize a standardized variable, which allows for international comparisons and focus on complete educational levels. The four education groups are: (a) less than primary education; (b) complete primary education and incomplete secondary; (c) complete secondary education and incomplete university; and (d) complete university education. Finally, we categorized workers only by formal and informal job. We did not generate a self-employed category. Formal workers are the following: workers employed with labor identification card; workers employed without labor identification card, but who contributed to the social security system; and workers in the public sector and government companies. All other individuals were classified as informal workers. Questions about formality in the labor market

changed over time. In the 1980 and 1991 Censuses, these questions are related to the activity during the previous twelve months. In the 2000 and 2010 Censuses, these questions are related to the activity during the previous week. These categories generated 32 age-education-formality-group indicators, which are utilized throughout our analysis.

We aggregated Census microdata by year, area, and age-education-informality group. In relation to the geographical areas considered for this study, we are using 502 comparable areas through time, which have similar boundaries as the ones created by IBGE for the 1991 Demographic Census. These comparable areas though censuses were first proposed by Potter et al. (2002, 2010) and we updated this information with the 2010 Demographic Census. For this study, we are analyzing only residents in urban areas with the hypothesis that there is a unique pattern of employment in these areas. We are not seeking the comparison to rural areas at this moment.

Our main independent variable comes from this collapsed database with information on male working population distributed by year, area, and age-education-informality group. Because Brazil was divided into 518 comparable microregions, 32 age-education-informality groups, and four censuses, the maximum possible number of observations in this aggregated database is 66,304. This database used census weights to estimate proportional distributions of males by age-education-informality group, time, and area. To measure the effect of aggregated informality, demographic, and educational transitions on individual earnings, we merge this aggregated data back to the individual-level data. The dependent variable is the natural logarithm of each individual male workers. In Brazil, information on earnings is based on primary occupation.

In Equation (1), $log(Y_i)$ is the logarithm of individual earnings (i). A total of 16 indicators of age-education groups (G) are included in the model estimated for each time (θ). The first age-education group is the reference category. This procedure originates a vector of 15 parameters (β_1) for each year. Not only age and education have a significant association with earnings, but also informality, demographic, and educational changes generate variation in cohort size and, thus, influence various aspects of the labor market. As a strategy to estimate the correlations of cohort size with earnings, the distribution of the male population in our 16 age-education groups (X) can be introduced as a set of variables from our aggregated database for each time (θ). This procedure originates a vector of 16 parameters (β_2) for each year. This exercise is similar to a study that estimated the effects of immigration on the U.S. labor market (Borjas, 2003). In our case, instead of including the immigration supply in the estimations, we include information on the male population distributed into age-education groups (g) by area (a) and time (θ), in order to verify its associations with individual earnings. At last, a binary variable for formal worker (β_3) is included, leaving the informal worker as reference. Other variables are included as controls.

$$log(Y_i) = \beta_0 + \beta_1 G_i + \beta_2 X_{ga} + \beta_3 Formal_i + \varepsilon_i. \quad (1)$$

Equation (2) substitutes the binary variable for formal workers for a variable which indicates the proportion of formal workers (P) by area (a). This exercise allows us to understand how the formal workers' cohort size of each microregion influences the individual earnings.

$$log(Y_i) = \beta_0 + \beta_1 G_i + \beta_2 X_{ga} + \beta_3 P_a + \varepsilon_i. \quad (2)$$

The third equation includes a series of interaction parameters (*I*) combining the binary variable of formal workers with the age-education groups (*G*). This inclusion enables us to test whether the coefficients are the same for formal and informal workers.

$$log(Y_i) = \beta_0 + \beta_1 G_i + \beta_2 X_{ga} + \beta_3 Formal_i + \beta_4 I_i + \varepsilon_i. \quad (3)$$

Finally, we estimated two models, one with a formal worker sample (*f*), and the other one with an informal worker sample (*if*), represented by the equations 4 and 5. These models are used in order to verify whether the magnitude and the direction of all the other variables are the same for both formal and informal models.

$$log(Y_i^f) = \beta_0^f + \beta_1^f G_i^f + \beta_2^f X_{ga}^f + \varepsilon_i^f \quad (4)$$

$$log(Y_i^{if}) = \beta_0^{if} + \beta_1^{if} G_i^{if} + \beta_2^{if} X_{ga}^{if} + \varepsilon_i^{if} \quad (5)$$

4. Results

We now present the results originated from our analysis. The estimation of an income equation is central to assess the association of individual earnings with an aging population, educational improvements, and decreases of workers in the informal economic sector. This study seeks to establish whether changes in age, educational, and economic sector structures influenced earnings of male workers in Brazil. Before estimating the models, it is important to evaluate the distribution of the male population by year, economic sector, and other independent variables (Table 1). We utilized a sample of male workers living in urban areas, classified by their economic sector (informal or formal). In general, the proportion of these men with less than primary completed decreased between 1980 and 2010. For example, the proportion of males between 15–24 years of age with less than primary completed and with formal jobs fell

considerably from 16.62 percent in 1980 to 3.29 percent in 2010 (Table 1). This trend is also observed for the other age groups with less than primary completed. In addition, the proportion of those with secondary completed and university completed increased during the period in all age groups. This is an expected outcome, since Brazil experienced an expansion of its educational system in the 1990's.

>>> Table 1 <<<

Table 1 also highlights that percentage of non-white males in the formal economic sector increased from 34.35 percent in 1980 to 46.10 percent in 2010, while percentage of white males decreased from 65.65 percent in 1980 to 53.90 percent in 2010. This result could be driven by an increase on the overall percentage of the non-white population in the country, but the 3.77 percentage point increase of this group in the informal economic sector was much less pronounced (from 52.19 percent in 1980 to 55.96 percent in 2010) than the 11.75 percent in the formal economic sector. Due to decreases in marriage rates in the country, percentages of non-married workers increased in the informal and formal economic sectors over time. The percentage of protestants increased between 1980 and 2000, going from 5.23 percent in the informal sector and 6.03 percent in the formal sector to 19.54 and 20.48 percent, respectively. The majority of the male population in urban areas continues to be concentrated in the Southeast. However, the share of these males in the informal economic sector decreased from 44.27 percent 1980 to 39.55 percent in 2010. The same happened in the formal economic sector, which indicates a slight decentralization of the population from the Southeast to other regions.

Finally, as previously discussed, Brazil has high levels of jobs in the informal economic sector, but they have been decreasing in recent years. The percentage of men in urban areas working in

the informal economic sector increased from 22.65 percent in 1980 to 40.91 percent in 2000, but decreased to 33.78 percent in 2010.

According to Table 2, differentials in average earnings between informal and formal economic sectors have been decreasing over time. Overall earnings in the informal sector were only 47 percent of earnings in the formal sector in 1980 (749.18/1,590.31), increased to 48 percent in 1991, 50 percent in 2000, and 59 percent in 2010. These results also indicate higher earnings for older, better educated, white, married, and non-protestant men, as well as those living in the Southeast and Center-West regions.

>>> Table 2 <<<

Results from the model in Equation (1) are presented in Table 3. This model indicates a positive association between individual earnings and formal economic sector across all years. These coefficients oscillated through time, but they have been increasing since 1991 until 2010, which highlights higher earnings for male workers in the formal economic sector. Moreover, coefficients for age-education indicators suggest that earnings are higher for those people with more schooling within each age category. We also verify that within each education group, earnings are higher for older men. These estimates are consistent with what we know about the association of age and education with earnings (Mincer, 1974; Hamermesh, 1993).

>>> Table 3 <<<

In relation to the distribution of males in age-education groups, among 15–24-year-old males, higher proportions of males with primary education completed generate stronger negative effects on earnings (except in 1991), compared to those with less than primary completed (Table 3). In other words, cohort size of the 15–24-year-old men with primary completed has a stronger

negative association with their individual earnings, in relation to the reference category. For men with 25–34 and 35–49 years, group proportions have positive correlations with earnings over time. For 50–64-year-old men, negative correlations are observed in most education groups through time. These estimates suggest that the Brazilian labor market does not require as many low educated men in recent years, as it did in previous decades. Local labor markets seem to be absorbing higher proportions of men in groups with secondary and university completed in recent years, without negative correlations with their earnings. Table 3 also indicates higher earnings for white, married, non-protestant male workers, living in the South and Center-West regions, when controlling for all other independent variables.

The model in Table 4 includes the proportion of male workers in the formal economic sector as a control variable (Equation (2)), instead of the binary variable for economic sector. This model reinforces results illustrated in Table 3 by estimating positive associations between individual earnings and proportion of workers in the formal economic sector. On other words, increasing proportions of workers in the formal economic sector between 2000 and 2010 (Table 1) did not generate negative correlations with earnings (Table 4). This is a sign that the Brazilian labor market is absorbing the increasing share of workers in the formal sector.

>>> Table 4 <<<

The model with interactions of age-education indicators and economic sector in Table 5 is based on Equation (3). Positive associations of workers in the formal economic sector with earnings remain positive across the decades, compared to those in the informal sector. Comparing Table 3 to Table 5, this binary variable for economic sector resulted in similar coefficients in 1980 (0.328 vs. 0.329), weaker coefficients in 1991 (0.219 vs. 0.174), and stronger coefficients in 2000

(0.265 vs. 0.316) and 2010 (0.273 vs. 0.445). In Table 5, coefficients for interactions between age-education groups and formal economic sector tend to indicate positive associations with earnings for younger groups (15–24) and negative associations for older groups (25–34 and 35–49) in 1980. These interactions oscillate through time and become negative for all age-education groups in 2010. These negative coefficients have bigger magnitudes for interactions among workers in the 25–34 and 35–49 age groups. These findings might be an indication that workers in prime working-age groups (from 25 to 49 years of age) are not profiting as much for having a job in the formal economic sector compared to younger and older workers.

>>> Table 5 <<<

Finally, we estimated models from Equations (4) and (5), which are reported on Tables 6 and 7. In 2010, coefficients related to the proportions of workers in age-education groups tend to have higher positive values for those in the informal economic sector (Table 7), compared to those in the formal sector (Table 6). First of all, these results suggest that a bigger proportion of workers competing for jobs in the formal economic sector in 2010 (Table 1) did not negatively affect their earnings in recent years. Furthermore, these coefficients have to be analyzed as differentials in earnings within each economic sector, compared to the reference category (15–24 years and less than primary completed). Thus, among workers in the informal economic sector (Table 7), stronger positive differentials of coefficients from age-group proportions are an indication of higher economic inequality within the informal economic sector, compared to workers in the formal economic sector.

>>> Table 6 <<<

>>> Table 7 <<<

5. Final considerations

Our study estimates variations in individual male earnings living in Brazilian urban locations, based on a series of individual-level and area-level characteristics. In terms of contextual information, we advance beyond the preceding literature by considering not only the influence of demographic and educational changes (proportion of males in age-education groups), but also changes in the composition of the economic sector (formal and informal jobs). In relation to individual-level variables, older and better educated workers have higher earnings. White, married, non-protestant men have higher earnings than other groups, as well as those living in the South and Center-West regions. Moreover, workers in the formal economic sector tend to have higher earnings than those in the informal sector.

Considering area-level variables, estimations suggest that changes in the composition of the workforce are associated with levels of earnings. Proportions of people in age-education groups tend to have negative associations with individual earnings mostly among older workers. These results for proportions of workers in age-education groups are consistent with previous studies, which indicate that age-education groups are not perfect substitutes, generating negative associations of cohort size with workers' income. We also know that there are higher proportions of men in groups with secondary completed than in university completed. These results are an indicative that labor markets are requiring workers with higher qualifications (university) than with mid-level qualifications (secondary). These models capture two sets of disadvantages for workers with secondary completed: (a) they already have lower levels of earnings than those with university completed, as it is indicated by age-education indicators (individual-level variables); and (b) they compete with a bigger cohort in the labor markets, which depreciates

even further their earnings, as it is suggested by the effects of proportions in age-education groups (area-level variables). There has been an increase in the demand for high-educated workers in Brazil during recent decades, which decreases the negative effects of the supply of workers with secondary or university completed over time.

When we consider separated models by economic sector, proportions in age-education groups have stronger positive correlations with earnings among workers in the informal sector, compared to those in the formal sector. This is an important result, because we could expect that the increase in proportion of workers in the formal economic sector in the last decades could generate competition for jobs and negatively affect earnings of workers in this economic sector. However, this expectation has not happened according to our models. Moreover, the stronger positive coefficients in the informal sector are an indication of higher levels of economic inequality among their workers, compared to workers in the formal sector. Our results suggest that the Brazilian labor market is relatively integrated, instead of presenting two segmented sectors. However, as observed by other studies, workers in the informal and formal sectors have specific characteristics in terms of age and education. There is a higher concentration of younger and less educated workers in the informal sector, compared to the formal sector.

Table 1. Male population distributed into categories of independent variables and economic sector (informal or formal), as percentage shares, Brazil, 1980–2010

Independent variables	1980		1991		2000		2010	
	Informal sector	Formal sector	Informal sector	Formal sector	Informal sector	Formal sector	Informal sector	Formal sector
Age-education indicators								
15-24 years; Less than primary completed	34.13	16.62	26.74	12.49	16.56	6.73	8.68	3.29
15-24 years; Primary completed	4.93	6.64	4.62	5.90	7.30	6.20	7.68	5.24
15-24 years; Secondary completed	1.62	3.84	1.92	4.07	3.93	6.76	5.83	8.61
15-24 years; University completed	0.15	0.24	0.15	0.35	0.20	0.38	0.28	0.62
25-34 years; Less than primary completed	18.61	20.01	20.63	14.99	17.21	11.73	11.23	6.67
25-34 years; Primary completed	1.63	4.66	3.90	6.50	4.83	6.54	5.37	5.76
25-34 years; Secondary completed	1.24	5.37	2.81	8.26	4.45	10.00	7.61	14.37
25-34 years; University completed	0.46	2.47	0.53	2.94	0.78	2.88	1.50	4.21
35-49 years; Less than primary completed	21.33	20.92	21.97	18.79	20.84	15.26	19.18	11.60
35-49 years; Primary completed	0.98	2.87	1.91	4.25	4.59	6.32	5.95	6.32
35-49 years; Secondary completed	0.74	2.89	1.46	5.54	4.30	9.78	6.53	12.03
35-49 years; University completed	0.36	2.20	0.52	4.12	1.06	5.24	1.48	5.07
50-64 years; Less than primary completed	13.00	8.75	11.72	8.67	10.86	7.16	12.00	6.94
50-64 years; Primary completed	0.37	0.90	0.47	0.94	1.20	1.34	2.64	2.48
50-64 years; Secondary completed	0.25	0.83	0.39	1.09	1.18	1.80	2.93	3.99
50-64 years; University completed	0.19	0.79	0.27	1.10	0.71	1.88	1.12	2.80
Race/color								
Non-white	52.19	34.35	55.56	38.92	49.37	37.56	55.96	46.10
White	47.81	65.65	44.44	61.08	50.63	62.44	44.04	53.90
Married								
Non-married	57.51	39.59	40.08	30.34	58.97	46.28	64.22	53.42
Married	42.49	60.41	59.92	69.66	41.03	53.72	35.78	46.58
Religion								
Non-protestant	94.77	93.97	92.63	91.89	86.48	86.46	80.46	79.52
Protestant	5.23	6.03	7.37	8.11	13.52	13.54	19.54	20.48
Region								
North	5.30	2.50	7.84	3.24	8.22	4.34	9.45	5.25
Northeast	29.38	13.87	31.09	14.88	27.30	15.42	29.30	16.93
South	11.36	17.09	12.59	17.32	13.26	18.11	12.62	17.53
Southeast	44.27	61.20	38.02	58.51	42.01	54.91	39.55	52.18
Center-West	9.69	5.33	10.45	6.04	9.21	7.22	9.09	8.11
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Economic sector								
Population percentage	22.65	77.35	30.79	69.21	40.91	59.09	33.78	66.22
Population size	975,900	3,333,210	854,733	1,921,091	1,352,379	1,953,426	1,276,493	2,502,369
Total population size (N)	**4,309,110**		**2,775,824**		**3,305,805**		**3,708,484**	

Source: 1980, 1991, 2000, and 2010 Brazilian Demographic Censuses (Brazilian Institute of Geography and Statistics – IBGE).

Table 2. Average real income of male population by categories of independent variables and economic sector (informal or formal), Brazil, 1980–2010

Independent variables	1980		1991		2000		2010	
	Informal sector	Formal sector	Informal sector	Formal sector	Informal sector	Formal sector	Informal Sector	Formal sector
Age-education indicators								
15-24 years; Less than primary completed	416.80	639.49	355.16	493.23	420.72	579.71	467.15	694.84
15-24 years; Primary completed	573.38	813.47	565.46	671.01	527.71	679.18	528.55	725.51
15-24 years; Secondary completed	955.42	1,307.42	798.16	999.18	842.36	1,024.30	748.15	939.00
15-24 years; University completed	1,523.25	2,636.32	1,222.29	1,757.34	1,545.82	2,325.39	1,569.66	1,829.81
25-34 years; Less than primary completed	717.37	1,048.75	570.31	755.21	705.90	857.04	681.08	878.81
25-34 years; Primary completed	1,346.28	1,636.21	975.39	1,117.13	1,108.13	1,225.89	912.40	1,044.38
25-34 years; Secondary completed	1,960.23	2,425.66	1,430.37	1,705.39	1,563.82	1,855.62	1,234.28	1,411.19
25-34 years; University completed	3,229.54	4,771.23	2,660.41	3,316.43	2,936.76	4,169.23	2,846.49	3,315.17
35-49 years; Less than primary completed	815.55	1,319.97	664.84	1,018.63	840.87	1,176.60	819.64	1,066.03
35-49 years; Primary completed	2,132.00	2,525.90	1,258.76	1,660.46	1,367.20	1,809.59	1,198.81	1,411.59
35-49 years; Secondary completed	3,233.28	3,792.14	1,975.94	2,535.42	2,148.13	3,032.83	1,720.32	2,096.14
35-49 years; University completed	5,631.51	6,693.26	4,300.66	5,066.40	4,461.99	6,478.57	4,217.73	5,161.21
50-64 years; Less than primary completed	745.45	1,326.77	612.53	1,003.57	843.11	1,373.27	839.15	1,205.08
50-64 years; Primary completed	2,332.67	2,930.67	1,573.44	2,096.54	1,593.31	2,484.86	1,325.19	1,736.50
50-64 years; Secondary completed	3,972.71	4,328.56	2,527.99	3,271.40	2,473.39	4,017.80	1,987.10	2,759.65
50-64 years; University completed	6,017.05	7,061.40	4,919.62	6,003.43	5,679.71	8,311.60	4,796.99	6,675.99
Race/color								
Non-white	574.27	1,014.89	519.55	896.46	700.38	1,192.20	798.49	1,260.80
White	940.12	1,891.40	862.05	1,707.01	1,232.43	2,383.37	1,352.00	2,196.53
Married								
Non-married	545.43	1,036.82	465.30	887.06	735.76	1,340.03	847.97	1,349.11
Married	1,024.99	1,953.09	809.90	1,611.23	1,306.00	2,449.32	1,390.94	2,242.22
Religion								
Non-protestant	745.50	1,596.51	669.12	1,406.29	967.72	1,988.86	1,044.25	1,841.85
Protestant	815.91	1,493.61	705.09	1,224.54	982.83	1,598.30	1,033.95	1,467.11
Region								
North	899.15	1,428.38	760.42	1,343.60	873.32	1,651.34	924.92	1,603.83
Northeast	511.63	1,268.53	450.02	1,015.66	642.31	1,436.47	702.38	1,402.27
South	832.87	1,452.88	721.12	1,283.73	1,052.49	1,889.65	1,182.19	1,776.59
Southeast	842.61	1,700.88	791.73	1,511.10	1,150.33	2,095.81	1,224.66	1,858.04
Center-West	862.49	1,674.90	769.01	1,494.39	1,083.97	2,074.89	1,271.70	2,004.30
Total	**749.18**	**1,590.31**	**671.77**	**1,391.55**	**969.76**	**1,935.99**	**1,042.24**	**1,765.12**

Note: Income adjusted by the national consumer price index (INPC), developed by the Brazilian Institute of Geography and Statistics (IBGE) (http://drcalc.net/easycalc/correcao.asp).

Source: 1980, 1991, 2000, and 2010 Brazilian Demographic Censuses (Brazilian Institute of Geography and Statistics – IBGE).

Table 3. Coefficients and standard errors estimated with ordinary least squares regression from Equation (1) for the logarithm of individual earnings as the dependent variable, Brazil, 1980–2010

Independent variables	1980	1991	2000	2010
Economic sector				
Informal economic sector	ref.	ref.	ref.	ref.
Formal economic sector	0.328***	0.219***	0.265***	0.273***
	(0.001)	(0.001)	(0.001)	(0.001)
Age-education indicators				
15-24 years; Less than primary completed	ref.	ref.	ref.	ref.
15-24 years; Primary completed	0.165***	0.211***	0.078***	0.055***
	(0.001)	(0.002)	(0.002)	(0.002)
15-24 years; Secondary completed	0.591***	0.561***	0.412***	0.288***
	(0.002)	(0.003)	(0.002)	(0.002)
15-24 years; University completed	1.154***	0.919***	1.043***	0.783***
	(0.008)	(0.011)	(0.008)	(0.006)
25-34 years; Less than primary completed	0.291***	0.210***	0.295***	0.238***
	(0.001)	(0.002)	(0.001)	(0.002)
25-34 years; Primary completed	0.686***	0.553***	0.548***	0.368***
	(0.002)	(0.002)	(0.002)	(0.002)
25-34 years; Secondary completed	1.062***	0.936***	0.851***	0.571***
	(0.002)	(0.002)	(0.002)	(0.002)
25-34 years; University completed	1.686***	1.525***	1.549***	1.242***
	(0.002)	(0.004)	(0.003)	(0.003)
35-49 years; Less than primary completed	0.368***	0.320***	0.376***	0.302***
	(0.001)	(0.002)	(0.002)	(0.002)
35-49 years; Primary completed	0.978***	0.789***	0.730***	0.521***
	(0.002)	(0.003)	(0.002)	(0.002)
35-49 years; Secondary completed	1.395***	1.219***	1.165***	0.807***
	(0.002)	(0.003)	(0.002)	(0.002)
35-49 years; University completed	1.968***	1.879***	1.897***	1.574***
	(0.003)	(0.003)	(0.003)	(0.003)
50-64 years; Less than primary completed	0.264***	0.199***	0.312***	0.273***
	(0.001)	(0.002)	(0.002)	(0.002)
50-64 years; Primary completed	1.014***	0.878***	0.818***	0.583***
	(0.005)	(0.007)	(0.005)	(0.003)
50-64 years; Secondary completed	1.423***	1.312***	1.277***	0.949***
	(0.005)	(0.007)	(0.005)	(0.003)
50-64 years; University completed	1.941***	1.948***	2.046***	1.760***
	(0.005)	(0.007)	(0.005)	(0.004)

(continue)

Independent variables	1980	1991	2000	2010
Proportions in age-education groups				
15-24 years; Less than primary completed	ref.	ref.	ref.	ref.
15-24 years; Primary completed	-1.512***	5.773***	-1.595***	-0.518***
	(0.045)	(0.103)	(0.067)	(0.086)
15-24 years; Secondary completed	1.205***	0.190	3.065***	1.924***
	(0.092)	(0.176)	(0.100)	(0.077)
15-24 years; University completed	17.129***	52.434***	-0.947	1.337***
	(0.781)	(0.843)	(0.847)	(0.466)
25-34 years; Less than primary completed	5.205***	3.673***	2.785***	4.882***
	(0.038)	(0.069)	(0.066)	(0.104)
25-34 years; Primary completed	10.158***	-3.958***	1.698***	8.416***
	(0.131)	(0.134)	(0.124)	(0.118)
25-34 years; Secondary completed	0.269**	1.234***	3.633***	2.944***
	(0.134)	(0.150)	(0.126)	(0.089)
25-34 years; University completed	10.380***	24.835***	14.436***	7.533***
	(0.191)	(0.260)	(0.298)	(0.174)
35-49 years; Less than primary completed	2.615***	3.899***	2.251***	2.649***
	(0.042)	(0.066)	(0.058)	(0.068)
35-49 years; Primary completed	4.581***	17.015***	2.111***	4.301***
	(0.222)	(0.211)	(0.139)	(0.117)
35-49 years; Secondary completed	3.779***	-0.628***	-2.513***	4.381***
	(0.219)	(0.190)	(0.112)	(0.101)
35-49 years; University completed	-0.104	-4.417***	8.310***	2.006***
	(0.229)	(0.240)	(0.208)	(0.200)
50-64 years; Less than primary completed	-0.375***	-2.522***	-3.433***	-0.247***
	(0.041)	(0.050)	(0.047)	(0.062)
50-64 years; Primary completed	-11.622***	-15.846***	11.828***	2.930***
	(0.336)	(0.432)	(0.288)	(0.169)
50-64 years; Secondary completed	22.545***	0.203	1.637***	-1.268***
	(0.352)	(0.413)	(0.266)	(0.132)
50-64 years; University completed	-15.710***	-6.072***	-17.277***	2.341***
	(0.449)	(0.437)	(0.301)	(0.177)

(continue)

Independent variables	1980	1991	2000	2010
Race/color				
Non-white	ref.	ref.	ref.	ref.
White	0.184***	0.201***	0.192***	0.155***
	(0.001)	(0.001)	(0.001)	(0.001)
Marital status				
Non-married	ref.	ref.	ref.	ref.
Married	0.300***	0.326***	0.256***	0.202***
	(0.001)	(0.001)	(0.001)	(0.001)
Religion				
Non-protestant	ref.	ref.	ref.	ref.
Protestant	-0.035***	-0.020***	-0.038***	-0.050***
	(0.001)	(0.002)	(0.001)	(0.001)
Region				
North	0.070***	0.234***	-0.031***	-0.033***
	(0.002)	(0.004)	(0.003)	(0.003)
Northeast	-0.098***	-0.089***	-0.226***	-0.222***
	(0.002)	(0.003)	(0.003)	(0.002)
South	-0.112***	-0.173***	-0.066***	0.026***
	(0.001)	(0.002)	(0.001)	(0.001)
Southeast	ref.	ref.	ref.	ref.
Center-West	-0.010***	0.117***	-0.002	0.052***
	(0.002)	(0.003)	(0.002)	(0.002)
Constant	6.202***	8.328***	4.133***	3.606***
	(0.018)	(0.029)	(0.024)	(0.045)
R^2	0.495	0.461	0.482	0.433
Sample size	4,309,104	2,775,824	3,305,805	3,778,862

Note: Robust standard errors are reported in parentheses. * Significant at p<0.1, ** Significant at p<0.05, *** Significant at p<0.01.
Source: 1980, 1991, 2000, and 2010 Brazilian Demographic Censuses (Brazilian Institute of Geography and Statistics – IBGE).

Table 4. Coefficients and standard errors estimated with ordinary least squares regression from Equation (2) for the logarithm of individual earnings as the dependent variable, Brazil, 1980–2010

Independent variables	1980	1991	2000	2010
Economic sector				
Proportion of people working in the formal sector	0.618***	1.146***	0.704***	1.112***
	(0.007)	(0.010)	(0.012)	(0.010)
Age-education indicators				
15-24 years; Less than primary completed	ref.	ref.	ref.	ref.
15-24 years; Primary completed	0.214***	0.249***	0.116***	0.087***
	(0.001)	(0.002)	(0.002)	(0.002)
15-24 years; Secondary completed	0.659***	0.617***	0.488***	0.362***
	(0.002)	(0.003)	(0.002)	(0.002)
15-24 years; University completed	1.200***	0.970***	1.122***	0.872***
	(0.008)	(0.011)	(0.008)	(0.006)
25-34 years; Less than primary completed	0.322***	0.223***	0.318***	0.263***
	(0.001)	(0.002)	(0.002)	(0.002)
25-34 years; Primary completed	0.744***	0.594***	0.605***	0.421***
	(0.002)	(0.002)	(0.002)	(0.002)
25-34 years; Secondary completed	1.130***	0.995***	0.934***	0.651***
	(0.002)	(0.002)	(0.002)	(0.002)
25-34 years; University completed	1.749***	1.589***	1.646***	1.333***
	(0.002)	(0.004)	(0.003)	(0.003)
35-49 years; Less than primary completed	0.393***	0.339***	0.396***	0.321***
	(0.001)	(0.002)	(0.002)	(0.002)
35-49 years; Primary completed	1.028***	0.834***	0.780***	0.567***
	(0.002)	(0.003)	(0.002)	(0.002)
35-49 years; Secondary completed	1.450***	1.278***	1.242***	0.880***
	(0.002)	(0.003)	(0.002)	(0.002)
35-49 years; University completed	2.025***	1.944***	1.997***	1.664***
	(0.003)	(0.003)	(0.003)	(0.003)
50-64 years; Less than primary completed	0.269***	0.216***	0.324***	0.284***
	(0.001)	(0.002)	(0.002)	(0.002)
50-64 years; Primary completed	1.056***	0.919***	0.854***	0.617***
	(0.005)	(0.007)	(0.005)	(0.003)
50-64 years; Secondary completed	1.469***	1.360***	1.330***	1.005***
	(0.005)	(0.007)	(0.005)	(0.003)
50-64 years; University completed	1.989***	2.002***	2.122***	1.838***
	(0.005)	(0.007)	(0.005)	(0.004)

(continue)

Independent variables	1980	1991	2000	2010
Proportions in age-education groups				
15-24 years; Less than primary completed	ref.	ref.	ref.	ref.
15-24 years; Primary completed	-1.798***	3.863***	-1.484***	0.333***
	(0.046)	(0.106)	(0.068)	(0.088)
15-24 years; Secondary completed	0.518***	-1.083***	2.190***	-0.295***
	(0.094)	(0.178)	(0.104)	(0.081)
15-24 years; University completed	19.591***	44.962***	0.247	3.330***
	(0.801)	(0.850)	(0.861)	(0.473)
25-34 years; Less than primary completed	3.994***	0.627***	2.288***	2.406***
	(0.047)	(0.077)	(0.068)	(0.109)
25-34 years; Primary completed	9.263***	-6.738***	0.548***	4.797***
	(0.135)	(0.138)	(0.130)	(0.127)
25-34 years; Secondary completed	-0.073	0.320**	3.692***	0.486***
	(0.137)	(0.150)	(0.128)	(0.094)
25-34 years; University completed	8.067***	20.777***	12.397***	3.972***
	(0.198)	(0.264)	(0.305)	(0.182)
35-49 years; Less than primary completed	2.434***	2.903***	1.321***	1.171***
	(0.043)	(0.068)	(0.065)	(0.071)
35-49 years; Primary completed	4.587***	14.697***	1.061***	-0.274**
	(0.228)	(0.213)	(0.144)	(0.128)
35-49 years; Secondary completed	2.419***	-3.379***	-3.783***	1.868***
	(0.228)	(0.193)	(0.117)	(0.106)
35-49 years; University completed	-0.866***	-6.613***	6.924***	2.023***
	(0.233)	(0.241)	(0.214)	(0.203)
50-64 years; Less than primary completed	-0.732***	-3.596***	-3.580***	-1.812***
	(0.043)	(0.052)	(0.048)	(0.065)
50-64 years; Primary completed	-10.345***	-9.622***	13.584***	3.624***
	(0.344)	(0.439)	(0.294)	(0.171)
50-64 years; Secondary completed	20.430***	-3.578***	1.360***	-0.693***
	(0.360)	(0.417)	(0.270)	(0.134)
50-64 years; University completed	-13.107***	-5.202***	-16.553***	-0.622***
	(0.459)	(0.438)	(0.305)	(0.181)

(continue)

Independent variables	1980	1991	2000	2010
Race/color				
Non-white	ref.	ref.	ref.	ref.
White	0.193***	0.201***	0.191***	0.151***
	(0.001)	(0.001)	(0.001)	(0.001)
Marital status				
Non-married	ref.	ref.	ref.	ref.
Married	0.338***	0.342***	0.281***	0.224***
	(0.001)	(0.001)	(0.001)	(0.001)
Religion				
Non-protestant	ref.	ref.	ref.	ref.
Protestant	-0.035***	-0.019***	-0.043***	-0.052***
	(0.001)	(0.002)	(0.001)	(0.001)
Region				
North	0.101***	0.342***	-0.016***	0.032***
	(0.003)	(0.004)	(0.003)	(0.003)
Northeast	-0.072***	-0.027***	-0.207***	-0.140***
	(0.002)	(0.003)	(0.003)	(0.002)
South	-0.126***	-0.169***	-0.081***	-0.017***
	(0.001)	(0.002)	(0.001)	(0.001)
Southeast	ref.	ref.	ref.	ref.
Center-West	0.002	0.189***	-0.000	0.063***
	(0.002)	(0.003)	(0.002)	(0.002)
Constant	6.448***	9.194***	4.416***	4.745***
	(0.019)	(0.030)	(0.026)	(0.048)
R^2	0.477	0.456	0.467	0.416
Sample size	4,309,104	2,775,824	3,305,805	3,778,862

Note: Robust standard errors are reported in parentheses. * Significant at p<0.1, ** Significant at p<0.05, *** Significant at p<0.01.
Source: 1980, 1991, 2000, and 2010 Brazilian Demographic Censuses (Brazilian Institute of Geography and Statistics – IBGE).

Table 5. Coefficients and standard errors estimated with ordinary least squares regression from Equation (3) for the logarithm of individual earnings as the dependent variable, Brazil, 1980–2010

Independent variables	1980	1991	2000	2010
Economic sector				
Informal economic sector	ref.	ref.	ref.	ref.
Formal economic sector	0.329***	0.174***	0.316***	0.445***
	(0.001)	(0.002)	(0.002)	(0.003)
Age-education indicators				
15-24 years; Less than primary completed	ref.	ref.	ref.	ref.
15-24 years; Primary completed	0.129***	0.244***	0.094***	0.080***
	(0.004)	(0.005)	(0.003)	(0.004)
15-24 years; Secondary completed	0.532***	0.520***	0.451***	0.370***
	(0.007)	(0.008)	(0.004)	(0.004)
15-24 years; University completed	0.808***	0.689***	0.931***	0.885***
	(0.024)	(0.030)	(0.017)	(0.018)
25-34 years; Less than primary completed	0.356***	0.224***	0.362***	0.316***
	(0.002)	(0.003)	(0.002)	(0.003)
25-34 years; Primary completed	0.832***	0.621***	0.670***	0.525***
	(0.006)	(0.005)	(0.004)	(0.004)
25-34 years; Secondary completed	1.152***	0.939***	0.929***	0.724***
	(0.007)	(0.007)	(0.004)	(0.004)
25-34 years; University completed	1.545***	1.446***	1.490***	1.352***
	(0.013)	(0.016)	(0.009)	(0.009)
35-49 years; Less than primary completed	0.347***	0.255***	0.395***	0.386***
	(0.002)	(0.003)	(0.002)	(0.003)
35-49 years; Primary completed	1.139***	0.738***	0.767***	0.675***
	(0.008)	(0.008)	(0.004)	(0.004)
35-49 years; Secondary completed	1.570***	1.121***	1.130***	0.933***
	(0.009)	(0.010)	(0.004)	(0.004)
35-49 years; University completed	2.102***	1.816***	1.789***	1.626***
	(0.013)	(0.017)	(0.009)	(0.010)
50-64 years; Less than primary completed	0.183***	0.101***	0.278***	0.311***
	(0.003)	(0.003)	(0.003)	(0.003)
50-64 years; Primary completed	1.028***	0.780***	0.772***	0.664***
	(0.016)	(0.018)	(0.008)	(0.006)
50-64 years; Secondary completed	1.445***	1.150***	1.169***	0.975***
	(0.021)	(0.021)	(0.008)	(0.006)
50-64 years; University completed	1.959***	1.801***	1.922***	1.696***
	(0.022)	(0.026)	(0.011)	(0.011)

(continue)

Independent variables	1980	1991	2000	2010
Interactions of age-education indicators and economic sector				
15-24 years; Less than primary completed x Formal economic sector	ref.	ref.	ref.	ref.
15-24 years; Primary completed x Formal economic sector	0.044***	-0.029***	-0.045***	-0.083***
	(0.004)	(0.005)	(0.003)	(0.004)
15-24 years; Secondary completed x Formal economic sector	0.066***	0.066***	-0.078***	-0.176***
	(0.007)	(0.008)	(0.004)	(0.004)
15-24 years; University completed x Formal economic sector	0.407***	0.288***	0.124***	-0.201***
	(0.025)	(0.032)	(0.020)	(0.019)
25-34 years; Less than primary completed x Formal economic sector	-0.084***	-0.016***	-0.143***	-0.173***
	(0.002)	(0.003)	(0.003)	(0.004)
25-34 years; Primary completed x Formal economic sector	-0.162***	-0.068***	-0.203***	-0.284***
	(0.006)	(0.006)	(0.004)	(0.004)
25-34 years; Secondary completed x Formal economic sector	-0.096***	0.015**	-0.126***	-0.265***
	(0.007)	(0.007)	(0.004)	(0.004)
25-34 years; University completed x Formal economic sector	0.148***	0.105***	0.040***	-0.208***
	(0.013)	(0.016)	(0.010)	(0.009)
35-49 years; Less than primary completed x Formal economic sector	0.027***	0.106***	-0.051***	-0.182***
	(0.002)	(0.003)	(0.003)	(0.004)
35-49 years; Primary completed x Formal economic sector	-0.177***	0.077***	-0.078***	-0.279***
	(0.009)	(0.009)	(0.005)	(0.005)
35-49 years; Secondary completed x Formal economic sector	-0.189***	0.127***	0.018***	-0.231***
	(0.010)	(0.010)	(0.005)	(0.005)
35-49 years; University completed x Formal economic sector	-0.142***	0.086***	0.094***	-0.142***
	(0.013)	(0.017)	(0.009)	(0.010)
50-64 years; Less than primary completed x Formal economic sector	0.115***	0.161***	0.054***	-0.101***
	(0.003)	(0.004)	(0.004)	(0.004)
50-64 years; Primary completed x Formal economic sector	-0.015	0.135***	0.051***	-0.177***
	(0.017)	(0.019)	(0.010)	(0.007)
50-64 years; Secondary completed x Formal economic sector	-0.025	0.204***	0.129***	-0.107***
	(0.021)	(0.022)	(0.010)	(0.007)
50-64 years; University completed x Formal economic sector	-0.020	0.182***	0.126***	-0.005
	(0.023)	(0.027)	(0.012)	(0.012)

(continue)

Independent variables	1980	1991	2000	2010
Proportions in age-education groups				
15-24 years; Less than primary completed	ref.	ref.	ref.	ref.
15-24 years; Primary completed	-1.537***	5.763***	-1.608***	-0.528***
	(0.045)	(0.103)	(0.067)	(0.086)
15-24 years; Secondary completed	1.198***	0.188	3.080***	1.871***
	(0.092)	(0.176)	(0.100)	(0.076)
15-24 years; University completed	17.133***	52.575***	-0.915	1.313***
	(0.780)	(0.842)	(0.846)	(0.465)
25-34 years; Less than primary completed	5.198***	3.667***	2.785***	4.875***
	(0.038)	(0.069)	(0.066)	(0.104)
25-34 years; Primary completed	10.196***	-3.977***	1.736***	8.321***
	(0.131)	(0.134)	(0.124)	(0.118)
25-34 years; Secondary completed	0.292**	1.224***	3.637***	2.953***
	(0.134)	(0.150)	(0.126)	(0.089)
25-34 years; University completed	10.397***	24.929***	14.482***	7.483***
	(0.191)	(0.260)	(0.298)	(0.174)
35-49 years; Less than primary completed	2.617***	3.934***	2.270***	2.626***
	(0.042)	(0.066)	(0.058)	(0.068)
35-49 years; Primary completed	4.604***	17.077***	2.146***	4.292***
	(0.222)	(0.211)	(0.139)	(0.116)
35-49 years; Secondary completed	3.727***	-0.640***	-2.525***	4.375***
	(0.219)	(0.190)	(0.112)	(0.100)
35-49 years; University completed	-0.102	-4.434***	8.313***	2.072***
	(0.229)	(0.240)	(0.208)	(0.199)
50-64 years; Less than primary completed	-0.370***	-2.540***	-3.454***	-0.254***
	(0.041)	(0.050)	(0.047)	(0.062)
50-64 years; Primary completed	-11.747***	-15.866***	11.856***	2.971***
	(0.336)	(0.432)	(0.288)	(0.168)
50-64 years; Secondary completed	22.492***	0.149	1.619***	-1.317***
	(0.352)	(0.413)	(0.265)	(0.132)
50-64 years; University completed	-15.677***	-6.023***	-17.311***	2.264***
	(0.449)	(0.437)	(0.301)	(0.177)

(continue)

Independent variables	1980	1991	2000	2010
Race/color				
Non-white	ref.	ref.	ref.	ref.
White	0.184***	0.200***	0.191***	0.155***
	(0.001)	(0.001)	(0.001)	(0.001)
Marital status				
Non-married	ref.	ref.	ref.	ref.
Married	0.301***	0.326***	0.257***	0.203***
	(0.001)	(0.001)	(0.001)	(0.001)
Religion				
Non-protestant	ref.	ref.	ref.	ref.
Protestant	-0.035***	-0.020***	-0.037***	-0.050***
	(0.001)	(0.002)	(0.001)	(0.001)
Region				
North	0.067***	0.235***	-0.032***	-0.034***
	(0.002)	(0.004)	(0.003)	(0.003)
Northeast	-0.098***	-0.087***	-0.225***	-0.221***
	(0.002)	(0.003)	(0.003)	(0.002)
South	-0.112***	-0.173***	-0.066***	0.026***
	(0.001)	(0.002)	(0.001)	(0.001)
Southeast	ref.	ref.	ref.	ref.
Center-West	-0.012***	0.117***	-0.003	0.051***
	(0.002)	(0.003)	(0.002)	(0.002)
Constant	6.204***	8.348***	4.109***	3.543***
	(0.018)	(0.029)	(0.024)	(0.045)
R^2	0.496	0.462	0.483	0.434
Sample size	4,309,104	2,775,824	3,305,805	3,778,862

Note: Robust standard errors are reported in parentheses. * Significant at p<0.1, ** Significant at p<0.05, *** Significant at p<0.01.
Source: 1980, 1991, 2000, and 2010 Brazilian Demographic Censuses (Brazilian Institute of Geography and Statistics – IBGE).

Table 6. Coefficients and standard errors estimated with ordinary least squares regression from Equation (4) for the logarithm of individual earnings as the dependent variable, only for workers in the formal economic sector, Brazil, 1980–2010

Independent variables	1980	1991	2000	2010
Age-education indicators				
15-24 years; Less than primary completed	ref.	ref.	ref.	ref.
15-24 years; Primary completed	0.173***	0.214***	0.051***	0.003*
	(0.001)	(0.003)	(0.002)	(0.002)
15-24 years; Secondary completed	0.597***	0.586***	0.373***	0.198***
	(0.002)	(0.003)	(0.002)	(0.002)
15-24 years; University completed	1.213***	0.976***	1.056***	0.692***
	(0.008)	(0.012)	(0.009)	(0.006)
25-34 years; Less than primary completed	0.274***	0.213***	0.224***	0.143***
	(0.001)	(0.002)	(0.002)	(0.002)
25-34 years; Primary completed	0.672***	0.558***	0.475***	0.247***
	(0.002)	(0.003)	(0.002)	(0.002)
25-34 years; Secondary completed	1.056***	0.959***	0.808***	0.463***
	(0.002)	(0.003)	(0.002)	(0.002)
25-34 years; University completed	1.693***	1.553***	1.537***	1.151***
	(0.002)	(0.004)	(0.004)	(0.003)
35-49 years; Less than primary completed	0.374***	0.366***	0.353***	0.209***
	(0.001)	(0.002)	(0.002)	(0.002)
35-49 years; Primary completed	0.964***	0.822***	0.700***	0.406***
	(0.003)	(0.003)	(0.003)	(0.002)
35-49 years; Secondary completed	1.382***	1.255***	1.158***	0.709***
	(0.003)	(0.003)	(0.002)	(0.002)
35-49 years; University completed	1.961***	1.907***	1.893***	1.493***
	(0.003)	(0.004)	(0.003)	(0.003)
50-64 years; Less than primary completed	0.297***	0.266***	0.340***	0.218***
	(0.002)	(0.003)	(0.003)	(0.002)
50-64 years; Primary completed	1.015***	0.923***	0.835***	0.499***
	(0.005)	(0.008)	(0.006)	(0.004)
50-64 years; Secondary completed	1.422***	1.361***	1.309***	0.880***
	(0.005)	(0.007)	(0.005)	(0.003)
50-64 years; University completed	1.940***	1.988***	2.060***	1.702***
	(0.005)	(0.007)	(0.005)	(0.004)

(continue)

Independent variables	1980	1991	2000	2010
Proportions in age-education groups				
15-24 years; Less than primary completed	ref.	ref.	ref.	ref.
15-24 years; Primary completed	-1.977***	6.648***	-1.276***	0.288***
	(0.050)	(0.133)	(0.087)	(0.103)
15-24 years; Secondary completed	0.592***	0.018	2.538***	0.756***
	(0.107)	(0.225)	(0.125)	(0.089)
15-24 years; University completed	17.237***	50.036***	-5.843***	-3.780***
	(0.919)	(1.021)	(1.053)	(0.530)
25-34 years; Less than primary completed	4.722***	4.156***	1.426***	4.499***
	(0.046)	(0.093)	(0.091)	(0.124)
25-34 years; Primary completed	10.550***	-5.364***	0.528***	6.135***
	(0.153)	(0.168)	(0.159)	(0.136)
25-34 years; Secondary completed	-0.075	1.177***	3.854***	2.994***
	(0.163)	(0.194)	(0.160)	(0.103)
25-34 years; University completed	11.267***	26.230***	14.573***	6.892***
	(0.221)	(0.319)	(0.368)	(0.200)
35-49 years; Less than primary completed	2.135***	4.683***	1.494***	1.894***
	(0.052)	(0.087)	(0.076)	(0.081)
35-49 years; Primary completed	6.601***	19.156***	1.014***	1.710***
	(0.266)	(0.263)	(0.176)	(0.134)
35-49 years; Secondary completed	1.771***	0.702***	-3.368***	3.787***
	(0.266)	(0.243)	(0.142)	(0.117)
35-49 years; University completed	0.476*	-4.315***	7.957***	4.705***
	(0.266)	(0.296)	(0.260)	(0.228)
50-64 years; Less than primary completed	0.009	-2.277***	-3.269***	0.104
	(0.051)	(0.064)	(0.061)	(0.073)
50-64 years; Primary completed	-17.248***	-16.632***	14.421***	4.458***
	(0.400)	(0.546)	(0.357)	(0.195)
50-64 years; Secondary completed	23.355***	-1.512***	-1.156***	-2.156***
	(0.409)	(0.515)	(0.332)	(0.152)
50-64 years; University completed	-15.609***	-5.551***	-18.699***	-0.010
	(0.517)	(0.530)	(0.369)	(0.199)

(continue)

Independent variables	1980	1991	2000	2010
Race/color				
Non-white	ref.	ref.	ref.	ref.
White	0.200***	0.213***	0.198***	0.160***
	(0.001)	(0.001)	(0.001)	(0.001)
Marital status				
Non-married	ref.	ref.	ref.	ref.
Married	0.297***	0.317***	0.241***	0.192***
	(0.001)	(0.002)	(0.001)	(0.001)
Religion				
Non-protestant	ref.	ref.	ref.	ref.
Protestant	-0.041***	-0.030***	-0.055***	-0.067***
	(0.001)	(0.002)	(0.001)	(0.001)
Region				
North	-0.016***	0.235***	-0.053***	-0.028***
	(0.003)	(0.005)	(0.004)	(0.003)
Northeast	-0.084***	-0.061***	-0.199***	-0.159***
	(0.002)	(0.004)	(0.003)	(0.002)
South	-0.111***	-0.170***	-0.060***	0.028***
	(0.001)	(0.002)	(0.002)	(0.002)
Southeast	ref.	ref.	ref.	ref.
Center-West	-0.053***	0.110***	-0.008***	0.034***
	(0.002)	(0.004)	(0.003)	(0.002)
Constant	6.737***	8.182***	4.896***	4.368***
	(0.021)	(0.037)	(0.034)	(0.055)
R^2	0.460	0.439	0.477	0.415
Sample size	3,333,208	1,921,091	1,953,426	2,502,369

Note: Robust standard errors are reported in parentheses. * Significant at p<0.1, ** Significant at p<0.05, *** Significant at p<0.01.
Source: 1980, 1991, 2000, and 2010 Brazilian Demographic Censuses (Brazilian Institute of Geography and Statistics – IBGE).

Table 7. Coefficients and standard errors estimated with ordinary least squares regression from Equation (5) for the logarithm of individual earnings as the dependent variable, only for workers in the informal economic sector, Brazil, 1980–2010

Independent variables	1980	1991	2000	2010
Age-education indicators				
15-24 years; Less than primary completed	ref.	ref.	ref.	ref.
15-24 years; Primary completed	0.120***	0.246***	0.090***	0.064***
	(0.004)	(0.005)	(0.003)	(0.003)
15-24 years; Secondary completed	0.521***	0.521***	0.446***	0.353***
	(0.007)	(0.008)	(0.004)	(0.004)
15-24 years; University completed	0.798***	0.686***	0.921***	0.852***
	(0.024)	(0.030)	(0.017)	(0.018)
25-34 years; Less than primary completed	0.351***	0.217***	0.353***	0.314***
	(0.002)	(0.003)	(0.002)	(0.003)
25-34 years; Primary completed	0.810***	0.610***	0.655***	0.504***
	(0.006)	(0.005)	(0.004)	(0.004)
25-34 years; Secondary completed	1.131***	0.931***	0.917***	0.702***
	(0.007)	(0.007)	(0.004)	(0.004)
25-34 years; University completed	1.529***	1.444***	1.475***	1.312***
	(0.013)	(0.016)	(0.009)	(0.009)
35-49 years; Less than primary completed	0.342***	0.245***	0.381***	0.371***
	(0.002)	(0.003)	(0.002)	(0.003)
35-49 years; Primary completed	1.110***	0.723***	0.746***	0.641***
	(0.008)	(0.008)	(0.004)	(0.004)
35-49 years; Secondary completed	1.537***	1.106***	1.111***	0.899***
	(0.009)	(0.010)	(0.004)	(0.004)
35-49 years; University completed	2.073***	1.807***	1.766***	1.577***
	(0.013)	(0.017)	(0.009)	(0.010)
50-64 years; Less than primary completed	0.183***	0.093***	0.263***	0.286***
	(0.003)	(0.004)	(0.003)	(0.003)
50-64 years; Primary completed	1.004***	0.762***	0.749***	0.622***
	(0.016)	(0.018)	(0.008)	(0.006)
50-64 years; Secondary completed	1.425***	1.134***	1.145***	0.937***
	(0.021)	(0.021)	(0.008)	(0.006)
50-64 years; University completed	1.939***	1.788***	1.895***	1.644***
	(0.022)	(0.026)	(0.011)	(0.011)

(continue)

Independent variables	1980	1991	2000	2010
Proportions in age-education groups				
15-24 years; Less than primary completed	ref.	ref.	ref.	ref.
15-24 years; Primary completed	-1.239***	4.170***	-2.288***	-1.630***
	(0.101)	(0.165)	(0.106)	(0.145)
15-24 years; Secondary completed	2.515***	0.077	3.339***	3.506***
	(0.180)	(0.283)	(0.164)	(0.139)
15-24 years; University completed	8.284***	55.753***	4.879***	3.288***
	(1.501)	(1.509)	(1.403)	(0.912)
25-34 years; Less than primary completed	5.616***	2.432***	3.561***	5.702***
	(0.071)	(0.105)	(0.095)	(0.177)
25-34 years; Primary completed	9.499***	-1.939***	2.938***	10.428***
	(0.259)	(0.224)	(0.195)	(0.218)
25-34 years; Secondary completed	2.558***	1.658***	2.639***	2.043***
	(0.237)	(0.235)	(0.203)	(0.164)
25-34 years; University completed	5.965***	21.064***	14.759***	9.256***
	(0.380)	(0.463)	(0.502)	(0.336)
35-49 years; Less than primary completed	3.492***	2.343***	2.532***	2.191***
	(0.074)	(0.103)	(0.089)	(0.115)
35-49 years; Primary completed	2.437***	11.185***	2.813***	8.845***
	(0.410)	(0.362)	(0.226)	(0.220)
35-49 years; Secondary completed	4.228***	-3.216***	-2.169***	3.879***
	(0.401)	(0.311)	(0.182)	(0.184)
35-49 years; University completed	1.493***	-5.305***	8.121***	-0.795**
	(0.466)	(0.415)	(0.344)	(0.387)
50-64 years; Less than primary completed	-0.557***	-3.121***	-3.839***	-0.668***
	(0.073)	(0.083)	(0.072)	(0.111)
50-64 years; Primary completed	-3.323***	-11.267***	8.702***	-0.121
	(0.638)	(0.722)	(0.477)	(0.325)
50-64 years; Secondary completed	23.339***	3.173***	4.443***	-0.580**
	(0.724)	(0.705)	(0.437)	(0.254)
50-64 years; University completed	-10.435***	-2.723***	-16.025***	4.008***
	(0.935)	(0.790)	(0.515)	(0.362)

(continue)

Independent variables	1980	1991	2000	2010
Race/color				
Non-white	ref.	ref.	ref.	ref.
White	0.129***	0.168***	0.182***	0.144***
	(0.002)	(0.002)	(0.002)	(0.002)
Marital status				
Non-married	ref.	ref.	ref.	ref.
Married	0.314***	0.345***	0.282***	0.228***
	(0.002)	(0.002)	(0.002)	(0.002)
Religion				
Non-protestant	ref.	ref.	ref.	ref.
Protestant	-0.019***	0.011***	-0.012***	-0.016***
	(0.003)	(0.004)	(0.002)	(0.002)
Region				
North	0.211***	0.222***	-0.037***	-0.073***
	(0.004)	(0.005)	(0.005)	(0.005)
Northeast	-0.120***	-0.140***	-0.269***	-0.314***
	(0.003)	(0.004)	(0.004)	(0.004)
South	-0.098***	-0.169***	-0.081***	0.025***
	(0.003)	(0.003)	(0.002)	(0.003)
Southeast	ref.	ref.	ref.	ref.
Center-West	0.065***	0.134***	-0.012***	0.061***
	(0.003)	(0.004)	(0.003)	(0.003)
Constant	5.871***	9.138***	3.996***	3.433***
	(0.035)	(0.045)	(0.035)	(0.076)
R^2	0.326	0.312	0.344	0.323
Sample size	975,896	854,733	1,352,379	1,276,493

Note: Robust standard errors are reported in parentheses. * Significant at p<0.1, ** Significant at p<0.05, *** Significant at p<0.01.
Source: 1980, 1991, 2000, and 2010 Brazilian Demographic Censuses (Brazilian Institute of Geography and Statistics – IBGE).

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