Fields of Study and the Earnings Gap by Race in Brazil

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Paper Prepared for the IARIW-IBGE Conference
on Income, Wealth and Well-Being in Latin America

Rio de Janeiro, Brazil, September 11-14, 2013

Session 4: Race and Ethnicity

Time: Thursday, September 12, 4:00-5:30

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Abstract

The labor earnings differential by race in Brazil is high even among individuals who completed at least a bachelor's degree. Decompositions of the earnings gap between white and black workers using the 2000 and 2010 Census data indicate that disparities in the distributions of racial groups across fields of study help explain 14% of the total mean earnings differential in 2000 and 24% in 2010. The estimated contribution of this factor seems to be larger at the median of the earnings distribution, accounting for one third of the gap between white and black workers in 2010.

JEL: J15, J31, I20.
Keywords: Field of study, race, labor earnings gap.

1 – Introduction

The earnings difference between white and black workers is noticeably high in Brazil, and disparities in the schooling level by race help to explain an important part of this earnings gap. The average educational level of black individuals improved over time, as well as the proportion of blacks who reached tertiary or higher educational level. In 2000, black workers represented 15% of the Brazilian labor force with a bachelor's or graduate degree, whereas in 2010 the participation of this racial group increased to 25%.[1] This educational improvement contributed to important earnings gains for many black individuals, who entered a select group that comprised 15% of the Brazilian labor force in 2010. Workers with at least a bachelor's degree in Brazil earn three times more than those with a lower level of schooling, on average.

Although the attainment of a bachelor's or graduate degree by a black worker usually provides important benefits at the individual level, it does not assure equal labor market outcomes compared to white workers with the same level of education. Empirical evidence shows that whites earned 39% more per hour than blacks among Brazilian workers with at least a bachelor's degree in 2000, while in 2010 the hourly labor earnings differential between whites and blacks increased to 41%.

An aspect that draws attention when comparing white and black individuals with tertiary education in Brazil is the unequal distribution across fields of study. Black workers are more concentrated in areas like education, arts, humanities and languages, and social care, while white individuals are more represented in engineering and health professions. Several studies present evidence for different countries indicating that university premium varies substantially by field of study.[2] The Brazilian labor market not only exhibits important earnings differences across fields of study, but also the participation of black individuals is much higher in fields of study with lower average earnings. In both 2000 and 2010, for example, the average labor earnings in engineering are three times higher than that in education. Thus, the distributions of white and black workers with tertiary education across fields of study may play a role in the labor earnings gap by race in Brazil. It should be mentioned that there are many other elements that may contribute to explaining this earnings differential by race in Brazil,

[1] According to Census data, only 3.6% of the black workers in Brazil had at least a bachelor's degree in 2000, while 8% reached this level of schooling in 2010. In the latter period, 22% of the white workers had a bachelor's or graduate degree.

[2] See Altonji (1993), Bundell et al. (2000), Finnie and Frenette (2003), among many others.

such as demographic characteristics, mismatch between field of education and occupation, proportion of workers with a graduate degree, as well as unobserved variables, like discrimination and quality of education.

The aim of this paper is to investigate the labor earnings differential between white and black workers with a bachelor's or graduate degree in Brazil, decomposing this gap into components accounted for by observable differences across individuals, and differences in the return on these characteristics. The empirical analysis uses data from the 2000 and 2010 Brazilian Census. This survey, conducted by the Brazilian Census Bureau (IBGE), has information about labor market and field of study for those who have tertiary education, in addition to demographic characteristics of the individuals. The empirical strategy is based on decompositions of the mean labor earnings difference between white and black workers using the traditional Oaxaca-Blinder methodology (Oaxaca, 1973 and Blinder, 1973), and decompositions for different quantiles of the earnings distribution, through the method proposed by Fortin, Lemieux and Firpo (2009). This way, not only the racial earnings gap could be attributed to differences in the distribution of observable characteristics, and in the returns on these characteristics, but also the former component can be decomposed into contributions associated with individual's distribution across fields of study, mismatch between education and occupation, attainment of a graduate degree and demographic variables. And this could be done for different percentiles of the earnings distribution.

According to estimates, 14% of the mean labor earnings gap between white and black workers with at least a bachelor's degree in 2000 seems to be associated with differences by race in the distribution of individuals across fields of study. In 2010, the estimated contribution of this component amounts to 24%, which represents 60% of the mean difference in earnings by race due to the characteristics of white and black individuals.

Earnings differential by race is larger at the top of the distribution, but quantile decompositions show that different characteristics of whites and blacks are associated with a more important share of the racial gap at lower percentiles of the earnings distribution. About the contribution of racial disparities in field of study composition, evidence indicates that it represents a larger share of the total earnings gap at the median of the distribution, accounting for 18% of all difference in 2000 and 33% in 2010.

This paper is structured as follows. Section 2 describes the dataset, and Section 3 shows the descriptive statistics. Section 4 presents the Oaxaca-Blinder and Fortin,

Lemieux and Firpo (2009) decomposition methods, whereas Section 5 reports and comments on the estimated results. Section 6 presents the main conclusions of the paper.

2 – Data

The analysis in this paper uses data from the 2000 and 2010 Census, conducted by IBGE (*Instituto Brasileiro de Geografia e Estatística*), the Brazilian Census Bureau. The 2000 Census has information about more than 50 million households in all Brazilian municipalities, while the 2010 Census covers almost 70 million households in the 5,565 Brazilian municipalities. For a selected sample of the households, the survey conducts a more detailed questionnaire.[3] This study uses information from that selected sample of households, which correspond to around 11% of the total in each of the two periods analyzed.

The detailed questionnaire of the Census provides individual information about education, age, gender, race, employment status, labor earnings and occupation in the main job, and place of residence, among many other variables. Based on the information about race, which is self-reported, the sample is divided into white and black workers, where individuals who reported themselves as black or colored are included in the latter group. Asian and indigenous are excluded. For individuals who completed tertiary education, the Census has information about their fields of study. However, the classification system in 2000 is not the same as that in 2010. The appendix describes how codes from different Census years are matched in this paper. As also shown in the appendix, the detailed categories for fields of study are aggregated into 10 broader groups, which are used in most of the analysis presented here. The Census questionnaire also allows identifying whether an individual has a graduate degree, although the 2000 survey does not distinguish between master's and doctoral degrees. In both periods, fields of study refer to the individuals' highest degrees.

Making use of the descriptions of occupations provided by the Brazilian Labor Ministry (Classificação Brasileira de Ocupações, MTE, 2010), each field of study is

[3] In each municipality, the proportion of households selected to answer the more detailed questionnaire depends negatively on its population. In 2000, it was applied for 10% of the households in municipalities with more than 15,000 inhabitants, and in 20% of the households in smaller municipalities. In 2010, municipalities were classified into five groups according to their population. For municipalities with less than 2,500 inhabitants, 50% of the households were selected, and for municipalities with more than 500,000 inhabitants, 5% of the households were selected to respond the more detailed questionnaire.

associated with one or more occupations, which are defined at the 4-digit level. Thus, individuals in the sample can work in occupations associated with their fields of study or in occupations unrelated to their degrees, whereas some of those in the latter group may work in occupations that do not require tertiary education.

The sample used in this paper is limited to individuals with at least a bachelor's degree, who are occupied in the week of reference of the survey, with positive labor earnings. Only those aged between 25 and 60 years, with information about field of study and occupation are included in the analysis. The sample comprises around 450,000 observations in 2000, and 650,000 in 2010.

3 – Descriptive analysis.

Table 1 reports the summary statistics regarding labor earnings, demographic characteristics and education separately for white and black workers with at least a bachelor's degree in 2000 and 2010. It is possible to notice that black individuals represented only 15% of the workers with tertiary education in Brazil in 2000, but 10 years later, the share of this group increased to one quarter. In spite of this great improvement, the attainment of tertiary education in 2010 is still very unequally distributed by race. Considering occupied workers in all educational levels, the 2010 Census data show that black individuals represent almost half of the total, and only 8% of the black workers have a bachelor's or graduate degree, while the percentage of white workers with this level of education is 22%.

Table 1 shows that mean hourly earnings among white workers with at least a bachelor's degree (R$ 27.4) was 38% higher than that of black workers (R$ 19.9) with the same educational level in 2000, and that this differential increased to 41% in 2010. Comparing mean monthly labor earnings, an even higher differential can be noticed between these two racial groups, amounting to 45% in 2000 and to 47% in 2010.

As also shown in Table 1, black workers are slightly younger than white ones and this age differential increased between 2000 and 2010. Women's participation among black workers with tertiary education was 54% in 2000, and augmented to 61% 10 years later. Among white workers with this level of education, the share of women increased from 52% to 56% between 2000 and 2010.

The attainment of a graduate degree is much more common among white individuals than among black ones, which may help to explain part of the racial

earnings gap, since workers with this level of education earn almost two times more than those with just a bachelor's degree, on average. Table 1 shows that 4.1% of the black workers in the sample had a master's or doctoral degree in 2000, and this percentage improved only 0.4 percentage point in 10 years. Among white individuals, 5.8% had a master's or doctoral degree in 2000, and this percentage increased to 6.9% in 2010.

Forty percent of the black individuals were in occupations associated with their fields of study in 2000, while among whites 45% were in this same situation. Between 2000 and 2010, the percentage of those in occupations considered related to the area of study improved 9 percentage points among black individuals and 7 percentage points among white ones. As also shown in Table 1, 36.5% of the black individuals in 2000 were working in occupations that require a lower level of education than a bachelor's degree,[4] which was 5 percentage points higher compared to white individuals in the same situation. This difference diminished 2 percentage points from 2000 to 2010. Some human capital accumulated during tertiary education is occupation-specific, and an individual may have an income penalty when his or her occupation does not match the field of study (Robst, 2007; and Nordin et al. 2010) or requires a lower level of schooling (Hartog, 2000). Thus, the descriptive statistics in Table 1 also suggest that part of the earnings gap by race may be due to a job-education mismatch.

Figure 1 presents the relationship between the participation of black workers in a given field of study and the mean hourly labor earnings for white and black workers in the same field. As can be seen, both periods reveal that the distribution of white and black workers is very different across fields of study. In 2000, the share of black individuals in each area of study ranges from 10.6% in engineering to 23% in social care. The three fields with higher proportions of black individuals (education and arts, languages and humanities, in addition to social care) are also those with lower mean hourly earnings among black and white individuals in 2000, whereas fields with lower percentages of blacks, such as engineering and health professions, have mean earnings more than two times higher than the former ones.

Between 2000 and 2010, the share of black individuals improved in all fields of study. In spite of this change, black workers in 2010 remained more concentrated in the

[4] That category includes individuals with tertiary education working in technical, sales, service and administrative support occupations, farming, forestry, and fishing occupations, as operators, manufacturers, and laborers, or in precision production, craft, and repair occupations.

same areas as 10 years before. In fact, the most remarkable changes in terms of percentage points occurred in fields with higher participation of black individuals in 2000. Another similarity between 2000 and 2010 data is the negative relationship between the proportion of black workers and mean hourly earnings. In 2010, black workers represented 38% of those who completed a program in education, but only 19% of those who completed a program in engineering. Mean hourly earnings were R$ 12.4 for the former group and R$ 29.8 for the latter.

In summary, the racial earnings gap is very high in Brazil even among workers with tertiary education, and the descriptive statistics suggest that a number of factors could be associated with this differential. For example, the proportion of workers with a graduate degree is lower among black than among white individuals, and the incidence of mismatch between field of study and occupation is greater for black workers, who are also more concentrated in fields of study that usually have lower labor earnings. The next section presents the methods used in this paper for decomposing the relative importance of each one of these factors on the earnings differential by race in 2000 and in 2010.

4 – Decomposing the earnings gap by race

4.1 – Oaxaca-Blinder decomposition

The Oaxaca-Blinder methodology (Oaxaca, 1973 and Blinder, 1973) offers a way to decompose differences in mean earnings between whites and blacks into characteristic and price components. Following this method, suppose that the log hourly labor earnings for individual *i* in racial group *r* (w_{ir}) can be written as:

(1) $w_{ir} = \beta_r X_{ir} + e_{ir}$,

where X_{ir} is a vector of characteristics (age, age squared, gender, state dummies, dummy variables for residence in metropolitan and urban areas, a dummy for those who concluded a master's or doctoral degree, dummies for field of study, an indicator for mismatch between area of study and occupation, and a dummy indicating that the

occupation does not require a bachelor's degree). The term e_{ir} represents unobserved factors, where it is assumed that $E(e_{ir} / X_{ir}) = 0$, and β_r is a vector of parameters.

Thus, differences in mean earnings between whites (W) and blacks (B) can be decomposed into two components:

$$(2)\ \overline{w_W} - \overline{w_B} = (\overline{X}_W - \overline{X}_B)\hat{\beta}_W + (\hat{\beta}_W - \hat{\beta}_B)\overline{X}_B$$

The first term on the right side of equation (2) is the amount of the earnings gap due to differences in characteristics, while the second term represents differences in the returns on similar characteristics between white and black workers. Although the Oaxaca-Blinder method offers a simple way to decompose earnings differences between two groups, it has important limitations (Fortin, Lemieux and Firpo, 2011). It should be mentioned, for example, that general equilibrium effects are not taken into account and the results depend on the order of the decomposition. Also, Oaxaca-Blinder method is useful only for decomposing mean differences. About this last point, decompositions for different quantiles of the earnings distribution are performed using the method described in the next subsection.

4.2 –RIF-regression decomposition.

This subsection presents a brief description of the RIF-regression decomposition method, following Fortin, Lemieux and Firpo (2009). This methodology allows performing an Oaxaca-Blinder-type decomposition for different quantiles of the earnings distribution. Thus, it is possible to investigate, for example, the role of differences in the distribution of white and black workers across fields of study in the earnings gap at the bottom as well as at the top of the earnings distribution.

A RIF-regression consists in estimating a regression similar to a standard one, where the dependent variable is replaced with the recentered influence function (RIF) for a quantile Q_τ or another statistic of interest (Firpo, Fortin and Lemieux, 2009). The influence function for a quantile Q_τ is defined as:

$$(3)\ \mathrm{IF}(Y; Q_\tau) = \frac{\tau - I(Y \leq Q_\tau)}{f_Y(Q_\tau)},$$

where f_Y is the density of the marginal distribution of Y, and I(.) is an indicator function. Thus, the $RIF\ (Y; Q_\tau)$, which is equal to $Q_\tau + IF(Y; Q_\tau)$, can be represented by:

(4) $RIF(Y; Q_\tau) = Q_\tau + \frac{\tau - I(Y \leq Q_\tau)}{f_Y(Q_\tau)} = c_{1,\tau} I(y > Q_\tau) + c_{2,\tau}$

where $c_{1,\tau} = \frac{1}{f_Y(Q_\tau)}$ and $c_{2,\tau} = Q_\tau - c_{1,\tau}(1 - \tau)$ are constants. Thus, the RIF for a quantile Q_τ is a function of the constants $c_{1,\tau}$ and $c_{2,\tau}$, and a variable $I(Y \leq Q_\tau)$ indicating whether labor earnings are smaller than or equal to the quantile Q_τ. Using equation (4) and computing the estimates $\hat{Q}_\tau$ and $\hat{f}_Y(\hat{Q}_\tau)$, it is possible to obtain an estimate of the RIF:

(5) $\widehat{RIF}(Y; Q_\tau) = \hat{Q}_\tau + \frac{\tau - I(Y \leq \hat{Q}_\tau)}{\hat{f}_Y(\hat{Q}_\tau)}$

Assuming that the conditional expectation of the RIF is a linear function of the covariates (*X*), that is, $E[RIF(Y; Q_\tau)|X] = X\gamma + e$, the vector of parameters γ can be estimated by ordinary least squares. The coefficients of the unconditional quantile regression (γ) for a given racial group *r* in each quantile τ can be estimated as follows:

(6) $\hat{\gamma}_{r,\tau} = (\sum_{i=R} X_i X_i^T)^{-1} \left(\sum_{i=R} \widehat{RIF}(Y_{ri}; Q_{r,\tau}) X_i\right)$.

Making use of the estimated coefficients in equation (6), it is possible to compute a decomposition of the labor earnings gap by race for any quantile:

(7) $\hat{\Delta}^\tau = (\bar{X}_W - \bar{X}_B)\hat{\gamma}_{B,\tau} + \bar{X}_W(\hat{\gamma}_{W,\tau} - \hat{\gamma}_{B,\tau})$,

where the first term represents the characteristic effects, while the second term represents the price differences. The former component can be represented as the sum of the contributions of each covariate *k*:

(8) $\hat{\Delta}_X^{\tau} = \sum_{k=1}^{K} (\bar{X}_{Wk} - \bar{X}_{Bk}) \hat{\gamma}_{Bk,\tau}$

Then, it is possible to compute the contribution of differences between whites and blacks regarding demographic characteristics, attainment of a graduate degree, education-job mismatch and distribution across fields of study towards the earnings differential between these two racial groups for each quantile of the earnings distribution.

5 – Results

5.1 – Evidence for Oaxaca-Blinder decomposition

Table 2 presents the results for decompositions of the mean log hourly labor earnings difference between white and black workers in 2000 into components due to characteristic and price effects. The estimated contribution of each variable or set of variables representing the individual's characteristics is also reported. Values in brackets in Table 2 display the share of the total difference between whites and blacks attributed to each factor.

According to column (1), almost one third of the earnings difference by race in 2000 seems to be due to disparities in observed characteristics between white and black workers. The estimated contribution of differences in fields of study corresponds to 15% of the total gap, which is half of the difference associated with characteristics. Regional distribution of white and black workers represents 12% of the earnings gap between these two groups, while differences regarding the attainment of a graduate degree, and composition by age and gender seem to play a minor or non-significant role.

Decomposition in column (2) considers the contribution of variables representing the mismatch between education and job. In this case, the share of the earnings differential due to characteristics increases from 32% to 37%. The estimated contributions of the terms reported in column (1) remain almost the same, including the one representing differences in field of study composition by race. Around 4% of the earnings difference between white and black workers is associated with education-job mismatch, according to estimates.

The results in column (3) are estimated using a more disaggregated classification with 35 fields of study. Because graduate degree is defined only for 9 aggregated areas in 2000 and fields of study refer to the individuals' highest degree, decomposition in column (3) is limited to those who have only a bachelor's degree. Individuals who concluded a program in one of the six fields in 2000 for whom a corresponding one in 2010 is not assigned, as shown in the appendix, are also excluded. Column (3) indicates that differences in the characteristics of white and black workers represent 39% of the earnings gap by race. About half of this differential is attributed to the distribution of each racial group across fields of study.

Table 3 reports the estimated results for 2010. As can be seen in column (1), the characteristic effects represent 34% of the difference in mean hourly labor earnings between whites and blacks. Differences in racial composition across fields of study contribute to one quarter of the total difference in mean earnings, which represents 70% of the share associated with the characteristic effects.

In column (2), the inclusion of education-job mismatch variables increases the contribution of the characteristic effects from 34% to 41%. Indeed, most of this change is related to effects associated with education-job mismatch. According to estimates in column (3), using a classification of areas of study with 35 categories, as in column (3) of Table 2, the characteristic effects represent 44% of the mean earnings differential between white and black workers in 2010. Most of this component seems to be due to differences in field of study composition by race, which contributes with one third of the total difference, and with 75% of the share associated with the characteristic effects. The estimated effects associated with differences in the other covariates are similar to those reported in the first two columns of Table 3.

According to estimates, the share of racial earnings difference attributed to disparities in the distribution of whites and blacks across fields of study is larger in 2010 than in 2000. Although the characteristic effects represent around one third of all differential in both years, disparities in fields of study composition account for half of this component in 2000, and 70% in 2010. In the former period, regional distribution contributes with 12% of the total racial earnings gap, but the effect associated with this term is close to zero in 2010. Comparisons between Tables 2 and 3 should be made with caution because the classification system is not the same in the 2000 and 2010 Census,

as described in the appendix. Nevertheless, this evidence is also verified for a number of different classifications of fields of study adopted.[5]

The results presented in this subsection are robust to other specifications, which include changing the reference group and using monthly instead of hourly earnings. In another robustness check, the analysis is carried out separately by gender, without changes in the main conclusions about the role of disparities in field of study composition in earnings differential by race.[6] Decompositions are also performed using the Juhn, Murphy and Pierce (1993) method, and the results, reported in appendix B, are very similar to those presented in Tables 2 and 3.

5.2 – Evidence for RIF-regression decomposition

Table 4 reports racial earnings gap decomposition of the 10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th} percentiles of the unconditioned distribution of hourly labor earnings for 2000. It can be noticed that the earnings differential is much larger at the top of the distribution than at the bottom. Also, the share of the racial difference attributed to individuals' characteristics seems to be more important at lower percentiles of the distribution. At the 10^{th} percentile, differences in observable characteristics of white and black workers represent almost two thirds of the hourly earnings gap between these two groups, while this component represents only one quarter of the racial earnings gap at the 90^{th} percentile.

Estimates indicate that the distribution of whites and blacks across areas of study accounts for 18% of the total difference in hourly earnings by race at the median of the distribution. At the 10^{th} and 90^{th} percentiles, the estimated contributions of this factor represent 13% and 12% of the total. About the other characteristic effects, racial differences in regional distribution and education-job mismatch, in particular the proportion of workers with at least a bachelor's degree who work in occupations that do not require this level of education, seem to represent an important share of the earnings

[5] In addition, decompositions of the racial hourly earnings gap in 2010 using the aggregated classification provided by the 2010 Census with 8 groups, instead of the one adopted in the estimates reported in Table 3, show that differences regarding fields of study contribute with 23% of the total gap. This value is very similar to the estimated effects in columns (1) and (2) of Table 3.

[6] These results are available upon request.

gap by race at the 10th percentile, but the effects associated with these factors become less important at the top of the distribution.

Table 5 reports the results of quantile decompositions of the earnings distribution in 2010. Hourly earnings differential between white and black workers is also higher at the top of the distribution, while the contribution of characteristic effects is higher at the lower part of the distribution. These patterns are similar to the ones reported in Table 4 for 2000. Disparities in the distribution of whites and blacks across fields of study represent about one quarter of the earnings gap by race at the 10th, 25th and 90th percentiles, and 19% at the 75th percentile.

The relative importance of differences in fields of study reaches its highest value at the 50th percentile, corresponding to 34% of the total difference. Therefore, decompositions using RIF-regressions also suggest that the share of the earnings differential by race attributed to disparities in the distributions of whites and blacks across fields of study is larger for 2010 compared to 2000. At the top half of the earnings distribution in 2010, it can be noticed that almost all of the racial earnings gap due to characteristic effects is represented by differences in field of study composition. In 2000, the contribution of this term at the 75th and 90th percentiles corresponded to half of the estimated characteristic effects.

Also according to Table 5, regional composition by race represents an important share of the earnings gap at the bottom of the distribution, whereas differences regarding age and the attainment of a master's or doctoral degree are more important at the top of the distribution than at lower percentiles.

6 - Conclusions

The labor earnings differential between white and black workers is very high in Brazil, even restricting the comparison to individuals who completed at least a bachelor's degree. This paper analyzes whether racial differences in the distribution of workers across fields of study contribute to this earnings gap, using Brazilian Census data from 2000 and 2010.

Estimates indicate that 14% of the difference in mean earnings by race in 2000 seems to be due to the fact that black individuals were much more concentrated in fields of study with lower mean earnings. Between 2000 and 2010, the percentage of black workers who completed at least a bachelor's degree increased from 3.6% to 8%, which

is still much lower compared to whites with this same educational level (22%). In addition, 10 years later, black individuals remained concentrated in fields of study where labor earnings are usually lower. In 2010, racial disparities in fields of study composition represent 33% of the mean earnings gap, according to estimates.

Evidence also shows that earnings difference by race is greater at the top of the distribution than at the bottom. Quantile decompositions of the earnings distribution indicate that field of study composition by race seems to be more important in explaining total earnings difference at the median of the distribution, representing 18% of the gap in 2000 and 32% in 2010.

Thus, the results suggest that black individuals are underrepresented not only in the group of workers with a bachelor's or graduate degree, but also in fields of study where labor earnings are usually higher, which helps to explain part of the elevated earnings differential by race among highly educated individuals in Brazil. Also, it seems that the improvement over time in the proportion of black workers with tertiary education has been mainly driven by fields with low mean earnings, contributing to increasing the role of racial composition of fields of study in earnings differential.

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Table 1: Descriptive statistics

	2000		2010	
	Blacks	Whites	Blacks	Whites
Mean hourly earnings (R$)	19.91	27.39	18.06	25.41
Monthly earnings (R$)	3,152.83	4,564.49	2,514.36	3,696.52
Age	39.29	39.52	38.43	39.10
Women (%)	54.19	51.67	60.73	56.32
Master's or Doctoral degree (%)	4.05	5.82	4.51	6.92
Individuals in occupations related to their fields of study (%)	39.77	45.06	48.71	52.35
Individuals in occupations that do not require a bachelor's degree (%)	36.51	31.41	32.14	29.02
Population share (weighted)	0.15	0.85	0.26	0.74
Observations	66,431	364,221	179,897	487,882

Source: the 2000 and 2010 Brazilian Census.

Note: The sample includes individuals with at least a bachelor's degree, aged 25-60 years, who are occupied.

Table 2: Oaxaca-Blinder decomposition of racial earnings gap (2000)

	(1)	(2)	(3)
Log hourly labor earnings difference:	0.312		0.305
Difference attributed to:			
i) Observable characteristics	0.100**	0.115**	0.120**
	[31.92%]	[36.77%]	[38.20%]
i.i) Fields of study	0.047**	0.043**	0.060**
	[15.15%]	[13.91%]	[19.34%]
i.ii) Master's or doctoral degree	0.007**	0.006**	
	[2.08%]	[1.78%]	
i.iii) Age	0.002*	0.001	-0.0005
	[0.52%]	[-]	[-]
i.iv) Gender	0.007**	0.007**	0.007**
	[2.32%]	[2.25%]	[2.14%]
i.v) Place of residence	0.037**	0.039**	0.034**
	[11.85%]	[12.56%]	[10.99%]
i.vi) Education-job mismatch		0.018**	0.006**
		[5.86%]	[2.02%]
ii) Unexplained component	0.213**	0.198**	0.186**
	[68.08%]	[63.23%]	[59.48%]

Source: the 2000 Brazilian Census.

Note: place of residence is represented by 26 state dummies, and dummy variables for metropolitan and urban areas. Education-job mismatch is represented by a dummy for individuals in occupations unrelated to their degrees and a dummy for those in occupations that do not require a bachelor's degree. In columns (1) and (2), fields of study are represented by 10 groups, while column (3) considers 35 groups. Decomposition in column (3) excludes individuals with a graduate degree. Values in brackets show the share of the total difference attributed to each factor.

* significant at the level of 5%, ** significant at the level of 1%.

Table 3: Oaxaca-Blinder decomposition of racial earnings gap (2010)

	(1)	(2)	(3)
Log hourly labor earnings difference:	0.292		0.278
Difference attributed to:			
i) Observable characteristics	0.099**	0.112**	0.122**
	[33.83%]	[41.06%]	[43.67%]
i.i) Fields of study	0.069**	0.073**	0.091**
	[23.58%]	[25.00%]	[32.80%]
i.ii) Master's or doctoral degree	0.011**	0.010**	-
	[3.86%]	[3.29%]	
i.iii) Age	0.011**	0.010**	0.008**
	[3.66%]	[3.55%]	[3.01%]
i.iv) Gender	0.011**	0.011**	0.009**
	[3.65%]	[3.70%]	[3.20%]
i.v) Place of residence	-0.003*	0.002	0.0021
	[-0.91%]	[-]	[-]
i.vi) Education-job mismatch		0.014**	0.011**
		[4.76%]	[3.90%]
ii) Unexplained component	0.193**	0.172**	0.157**
	[66.17%]	[58.94%]	[56.33%]

Source: the 2010 Brazilian Census.

Note: place of residence is represented by 26 state dummies, and dummy variables for metropolitan and urban areas. Education-job mismatch is represented by a dummy for individuals in occupations unrelated to their degrees and a dummy for those in occupations that do not require a bachelor's degree. In columns (1) and (2), fields of study are represented by 10 groups, while column (3) considers 35 groups. Decomposition in column (3) excludes individuals with a graduate degree. Values in brackets show the share of the total difference attributed to each factor.

* significant at the level of 5%, ** significant at the level of 1%.

Table 4: Quantile decomposition of racial earnings gap (2000)

	(1)	(2)	(3)	(4)	(5)
			Percentile:		
	10th	25th	50th	75th	90th
Log hourly labor earnings difference:	0.242	0.287	0.281	0.309	0.333
Difference attributed to:					
i) Observable characteristics	0.153**	0.128**	0.103**	0.095**	0.079**
	[63.10%]	[44.58%]	[36.51%]	[30.70%]	[23.76%]
i.i) Fields of study	0.031**	0.042**	0.051**	0.049**	0.038**
	[12.94%]	[14.51%]	[18.01%]	[15.75%]	[11.51%]
i.ii) Master's or doctoral degree	0.002**	0.003**	0.006**	0.008**	0.007**
	[0.80%]	[1.09%]	[2.02%]	[2.67%]	[2.09%]
i.iii) Age	-0.002**	-0.001	0.001	0.003**	0.006**
	[-0.91%]	[-]	[-]	[1.02%]	[1.78%]
i.iv) Gender	0.005**	0.005**	0.007**	0.008**	0.008**
	[1.92%]	[1.80%]	[2.55%]	[2.66%]	[2.25%]
i.v) Place of residence	0.090**	0.060**	0.023**	0.013**	0.009**
	[37.05%]	[20.78%]	[8.29%]	[4.25%]	[2.58%]
i.vi) Education-job mismatch	0.027**	0.019**	0.015**	0.014**	0.012**
	[11.30%]	[6.74%]	[5.35%]	[4.36%]	[3.55%]
ii) Unexplained component	0.089**	0.159**	0.179**	0.214**	0.254**
	[36.91]	[55.42%]	[63.49%]	[69.30%]	[76.24%]

Source: the 2000 Brazilian Census.
Note: place of residence is represented by 26 state dummies, and dummy variables for metropolitan and urban areas. Education-job mismatch is represented by a dummy for individuals in occupations unrelated to their degrees and a dummy for those in occupations that do not require a bachelor's degree. Values in brackets show the share of the total difference attributed to each factor.
* significant at the level of 5%, ** significant at the level of 1%.

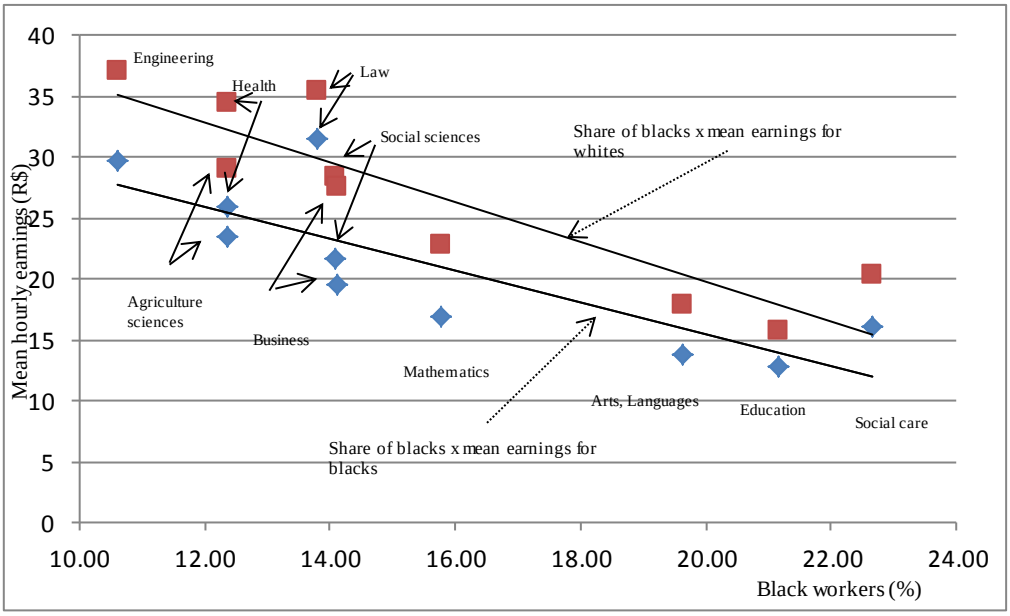
Table 5: Quantile decomposition of racial earnings gap (2010)

	(1)	(2)	(3)	(4)	(5)
			Percentile:		
	10th	25th	50th	75th	90th
Log hourly labor earnings difference:	0.217	0.274	0.306	0.429	0.327
Difference attributed to:					
i) Observable characteristics	0.140**	0.143**	0.142**	0.096**	0.098**
	[64.31%]	[65.99%]	[65.34%]	[44.42%]	[45.35%]
i.i) Fields of study	0.053**	0.070**	0.100**	0.081**	0.088**
	[24.60%]	[25.44%]	[32.54%]	[18.78%]	[26.82%]
i.ii) Master's or doctoral degree	0.002**	0.005**	0.001**	0.012**	0.013**
	[1.07%]	[1.81%]	[3.17%]	[2.88%]	[4.00%]
i.iii) Age	0.003**	0.005**	0.009**	0.010**	0.016**
	[1.13%]	[1.86%]	[2.86%]	[2.26%]	[4.73%]
i.iv) Gender	0.010**	0.011**	0.014**	0.013**	0.016**
	[4.55%]	[4.00%]	[4.64%]	[3.04%]	[4.81%]
i.v) Place of residence	0.066**	0.048**	0.005**	-0.023**	-0.037**
	[30.19%]	[17.36%]	[1.71%]	[-5.29%]	[-11.40%]
i.vi) Education-job mismatch	0.006**	0.005**	0.004**	0.003**	0.004**
	[2.76%]	[1.73%]	[1.37%]	[0.79%]	[1.12%]
ii) Unexplained component	0.077**	0.131**	0.165**	0.333**	0.229**
	[35.69%]	[47.80%]	[53.71%]	[77.54%]	[69.93%]

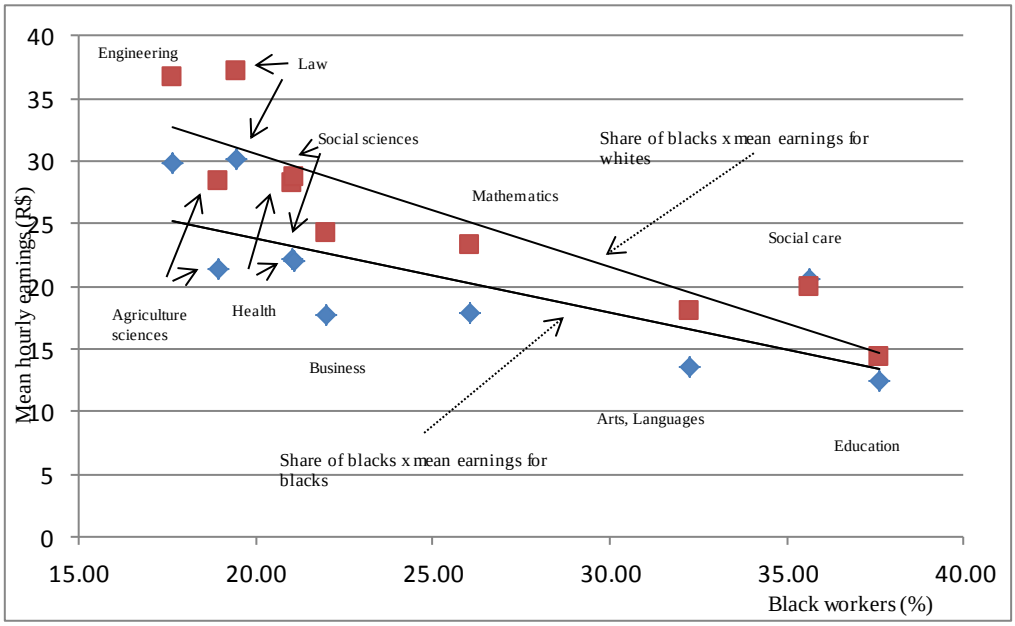
Source: the 2000 Brazilian Census.
Note: place of residence is represented by 26 state dummies, and dummy variables for metropolitan and urban areas. Education-job mismatch is represented by a dummy for individuals in occupations unrelated to their degrees and a dummy for those in occupations that do not require a bachelor's degree. Values in brackets show the share of the total difference attributed to each factor.
* significant at the level of 5%, ** significant at the level of 1%.

Figure 1: Share of black workers and mean hourly earnings by field of study

(a) 2000



(a) 2010



Source: the 2000 and 2010 Brazilian Census.

Note: The sample includes individuals with at least a bachelor's degree, aged 25-60 years, who are occupied.

Appendix A

The 2000 Brazilian Census classifies individuals with a bachelor's degree into 41 fields of study, and those with a graduate degree (master's or doctoral, without distinction between them) into 9 groups. In the 2010 Census, individuals with a bachelor's degree are classified into 89 areas of study, which are similar to the ones available to classify those with a master's or doctoral degree. In both periods, an individual's field of study is defined according to his or her highest educational degree.

The 2000 and 2010 codes for field of study are matched following the description reported in Table A1 (columns (1) and (2)). For many areas of study, mainly for those comprising an important share of the individuals with tertiary education in Brazil, such as medicine and law, the match is clear. As can be seen, there are fields in the 2000 classification system, such as business administration and arts, which refer to many narrower codes in the 2010 system. Also, a few codes in 2000 are not assigned to a code in 2010. This is done in situations where the program in the former system does not have an equivalent one in the latter (geography, physical education), or the match is not considered clear, as are the cases of science programs, other agriculture programs, other social science, and other arts and languages programs.

The 41 fields of study are aggregated into 10 groups, as reported in column (3) of Table A1, which may help to mitigate part of the problems due to missing or unclear correspondence. It can be noticed that a few programs related to sciences and social sciences are classified as education in the aggregated classification. This is done because comparisons between data from 2000 and 2010 show a remarkable reduction in the participation of these groups over time, which could be due to the fact that the 2010 system has a more detailed classification for programs in education. The estimated results are robust to other criteria used to classify these areas of study.

It should be also mentioned that the 2000 census classification system aggregates the 41 groups defined for those with a bachelor's degree into 9 graduate categories. This restriction causes a problem when a graduate group includes programs assigned to different areas in the aggregated classification, as is the case, for example, of some programs in humanities and social science.

Table A.1: Fields of study in the 2000 and 2010 Brazilian census

Fields of study in the 2000 Census	Fields of study in the 2010 Census	Aggregated classification (10 groups)
Agronomy	General agriculture and agronomy, Agriculture production, plant science, and Forestry	8 - Agricultural sciences
Veterinary science	Veterinary science	8 - Agricultural sciences
Other agricultural science	-	8 - Agricultural sciences
Agricultural science (graduate degree)	General agriculture and agronomy, Agriculture production, Plant science, Forestry, and Veterinary science.	8 - Agricultural sciences
Biology	General biology, biology, biochemical sciences, and environmental science.	6 - Mathematics, computers and sciences
Physical education	-	1 - Education
Nursing	Nursing	9 - Health professions
Pharmacology	Pharmacology	9 - Health professions
Medicine	Medicine	9 - Health professions
Dentistry	Dentistry	9 - Health professions
Miscellaneous Biology and health professions	Medical technologies technicians, treatment therapy professions, and general health services	9 - Health professions
Medicine (graduate degree)	Medicine (graduate degree)	9 - Health professions
Biology and health profession (graduate degree) - except medicine.	Biology, nursing, pharmacology, dentistry, medical technologies technicians, treatment therapy professions, and general health services (graduate degree)	9 - Health professions
Architectural engineering	Architectural engineering	7 - Engineering and architecture
Sciences	-	1 - Education
Computer science	Computer science, computer programming, and information sciences.	6 - Mathematics, computers and sciences
Civil engineering	Civil engineering	7 - Engineering and architecture
Electrical and electronic Engineering	Electrical and electronic Engineering	7 - Engineering and architecture
Mechanical Engineering	Mechanical and metallurgical Engineering	7 - Engineering and architecture
Chemical and Industrial Engineering	Chemical, Industrial, and materials Engineering	7 - Engineering and architecture
Miscellaneous Engineering	Mining and mineral engineering, marine engineering, and miscellaneous engineering.	7 - Engineering and architecture
Engineering (graduate degree)	Engineering (graduate degree)	7 - Engineering and architecture
Statistics	Statistics	6 - Mathematics, computers and sciences
Physics	Physics	6 - Mathematics, computers and sciences
Geology	Geology and earth science	6 - Mathematics, computers and sciences
Mathematics	Mathematics	6 - Mathematics, computers and sciences
Chemistry	Chemistry	6 - Mathematics, computers and sciences
Miscellaneous mathematics, computers and sciences.	General physical sciences	6 - Mathematics, computers and sciences
Miscellaneous mathematics, computers and sciences (graduate degree).	Computer and information sciences, statistics, geology, mathematics, chemistry, and physical sciences (graduate degree).	6 - Mathematics, computers and sciences
Business administration	Business management and administration, commerce, human resources and personeel management, finance and business economics.	4 - Business
Library science	Library science	3 - Social sciences
Accounting and Actuarial Science	Accounting and Actuarial Science	4 - Business
Economics	Economics	3 - Social sciences
Social science	Sociology, and social and political sciences	3 - Social sciences
Journalism and communication	Journalism and communication	3 - Social sciences
Law	Law	5 - Law
Philosophy	Philosophy	2 - Arts, languages and humanities
Teacher education: specific matters	Teacher education: specialization in specific matters and voccational programs.	1 - Education
Geography	-	1 - Education
History	History and archeology	1 - Education

Table A.1 (continued)

Fields of study in the 2000 Census	Fields of study in the 2010 Census	Aggregated classification (10 groups)
Teacher education	Elementary, secondary and early childhood education, miscellaneous education.	1 - Education
Advertising and marketing	Advertising and marketing	4 - Business
Psychology	Psychology	3 - Social sciences
Social work	Social work	10 - Social care
Theology	Theology	2 - Arts, languages and humanities
Miscellaneous Social Sciences and humanities	-	3 - Social sciences
Business administration (graduate degree)	Business management and administration, and advertising and marketing (graduate degree).	4 - Business
Economics and accounting (graduate degree)	Economics and accounting (graduate degree)	3 - Social sciences
Law (graduate degree)	Law (graduate degree)	5 - Law
Teacher education (graduate degree)	Elementary, secondary and early childhood education, voccational programs teacher education, teacher with specialization in specific matters, and miscellaneous education (graduate degree).	1 - Education
Miscellaneous Social Sciences and humanities (graduate degree).	Psychology, Sociology, and social and political sciences, Journalism and communication (graduate degree).	3 - Social sciences
Languages And Literature	Foreign languagues, portuguese language, literature and miscellaneous languages and humanities.	2 - Arts, languages and humanities
Arts	Fine arts, drama and theater arts, music, visual and performing arts, commercial art and graphic design.	2 - Arts, languages and humanities
Miscellaneous Arts, languages and literature	-	2 - Arts, languages and humanities
Miscellaneous Arts, languages and literature (graduate degree).	Foreign languagues, portuguese language, literature and miscellaneous languages and humanities, fine arts, drama and theater arts, music, visual and performing arts, commercial art and graphic design (graduate degree).	2 - Arts, languages and humanities

Table B1: Juhn, Murphy and Pierce decomposition of racial earnings gap

	2000		2010	
Log hourly labor earnings difference:	0.312		0.292	
	(1)	(2)	(3)	(4)
Difference attributed to:				
i) Observable characteristics	0.100	0.115	0.099	0.120
	[31.87%]	[36.73%]	[33.81%]	[41.03%]
i.i) Fields of study	0.047	0.043	0.069	0.073
	[15.11%]	[13.87%]	[23.55%]	[24.98%]
i.ii) Master's or doctoral degree	0.006	0.006	0.011	0.010
	[2.08%]	[1.78%]	[3.86%]	[3.29%]
i.iii) Age	0.002	0.001	0.011	0.010
	[0.52%]	[0.40%]	[3.66%]	[3.55%]
i.iv) Gender	0.007	0.007	0.011	0.011
	[2.32%]	[2.25%]	[3.65%]	[3.70%]
i.v) Place of residence	0.037	0.039	-0.003	0.002
	[11.85%]	[12.56%]	[-0.91%]	[0.75%]
i.vi) Education-job mismatch	-	0.018	-	0.014
		[5.86%]		[4.76%]
ii) Observable prices	0.213	0.198	0.193	0.172
	[68.08%]	[63.23%]	[66.17%]	[58.94%]
iii) Unobservable prices	0.000	0.000	0.000	0.000
	[0.04%]	[0.04%]	[0.02%]	[0.02%]

Source: the 2000 and 2010 Brazilian Census.

Note: place of residence is represented by 26 state dummies, and dummy variables for metropolitan and urban areas. Education-job mismatch is represented by a dummy for individuals in occupations unrelated to their degrees and a dummy for those in occupations that do not require a bachelor's degree. Fields of study are represented by 10 groups. Values in brackets show the share of the total difference attributed to each factor.