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WIDER Working Paper 2016/127

Patterns and trends of group-based inequality in Brazil

Pedro H. Leivas¹ and Anderson M.A. dos Santos²

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Abstract: In this paper, we analyse the patterns and trends of group-based inequalities in Brazil in the past 30 years. Using data from the last four demographic censuses (1980, 1991, 2000, and 2010), we estimate numerous measures to analyse inequalities between different ‘ethnic’ groups. Our results show that the trend toward greater equality in Brazil shown in other analyses of vertical inequality is also found in terms of horizontal inequalities along racial, gender, and regional lines between 1980 and 2010. Nevertheless, horizontal inequalities in terms of race and gender in particular remain pronounced; as shown using various measures, race is highly correlated with income and education. We show that municipalities with low ethnic diversity and low income and education inequality tend to be located in the South region. In regression analysis, we note that ethnic diversity negatively affects the institutional quality of Brazilian municipalities.

Keywords: Brazil, group-based inequality, ethnic diversity, institutional quality, spatial econometrics, vertical inequality

JEL classification: C21, D63, I24, O17

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1 Introduction

Historically, Brazil has been considered one of the most unequal countries in the world and inequality has been a major theme in the economic literature on the country. One of the key findings from recent work is that there has been a significant reduction in income inequality in Brazil since the late 2000s (Paes de Barros et al. 2006; Neri et al. 2013). The literature indicates that this trend is explained by changes in the non-labour income and labour income per worker (Paes de Barros et al. 2006). Sátyro and Soares (2009) show that the cash transfers, especially the Bolsa Família Program, is the principal cause of the reduction in inequality in the North and Northeast of Brazil; while in the South, Southeast and Midwest regions, labour income is primarily responsible for the reduction in inequality.

This paper investigates to what extent such findings are also evident with regard to horizontal inequality, with particular attention to race, region, religion, and gender. Some researchers suggest that racial and gender divisions, in particular, are notable in Brazil and have been highly significant to politics and society (Henriques 2001; Heringer 2002). Despite that, there is relatively little work that has mapped patterns and trends in horizontal inequalities along these lines. There are some exceptions (Pinheiro and Soares 2005; Pinheiro et al. 2006; Pinheiro et al. 2008; Instituto de Pesquisa Econômica Aplicada et al. 2011; Arretche 2015). However, these important initiatives do not measure appropriate indicators for analysing group-based inequality, limiting the analysis to utilization of descriptive statistics. Several Brazilian policy initiatives (Jaccoud and Beghin 2002; Theodoro 2008; Jaccoud 2009) to address such group-based inequalities further underscore the relevance of analysing trends in these areas. In order to focus on the period since the late 1980s, our analysis draws on data from the four latest available censuses—1980, 1991, 2000, and 2010.

We analyse the labour income and education inequalities of different ethnic groups. Education in Brazil has three educational systems, organized hierarchically, but each maintaining its autonomy. These educational systems are: the federal system; the state system and the federal district system; and the municipal system (UNESCO 2010). The 1988 Federal Constitution through Constitutional Amendment No. 14, 1996 and the National Guideline and Framework Law established by Law No. 9394 1996, are the main laws governing the Brazilian educational system at the federal level. The system is subdivided into: early childhood education—child care (0–3 years) and preschool (4–5 years); primary education (6–14 years); secondary education (15–17 years); higher education—graduation (18 or older) and post-graduation (18 or older) (UNESCO 2014).¹ Municipalities are responsible for early childhood education and primary education (compulsory). The states are also responsible for primary education, but especially for secondary education and vocational and technological education. The federal government is responsible for sequential courses, extension courses, and graduate and postgraduate courses.

Broadly, we find a trend toward greater equality in Brazil for vertical and horizontal inequalities along racial, gender, and home location (region, rural/urban, and capital/other) lines. Nevertheless, horizontal income inequalities, in terms of race in particular, remain pronounced. However, horizontal education inequalities had a significant and continuous decline between

¹ In ‘Education for All’ (UNESCO 2014: 9) it is noted that ‘education levels and steps can be permeated by teaching modalities, i.e. education formats that may be offered by the school depending on specific demands and needs, namely special education, professional education, distance education (EaD) and youth and adult education (EJA), indigenous school education and rural education. In addition, offers to specific ethnic-racial groups, such as the Quilombola school education should be mentioned’.

1980 and 2010, although there are still educational inequalities in the country. We also find that ethnic diversity and horizontal inequalities tend to be lower in the South region. Finally, we observe a negative effect of ethnic diversity on the institutional quality of Brazilian municipalities.

The next section of this paper presents the data source and methods. Section 3 presents the results and section 4 presents the study conclusions.

2 Data and methods

The data used to calculate the indicators presented in this study come from the last four demographic censuses—1980, 1991, 2000, and 2010 (IBGE 1980, 1991, 2000, 2010). In these censuses, a more comprehensive questionnaire was given to a sample of the population. This varied according to municipality size, apart from in the 1980 census when the questionnaire was given to 25 per cent of the population in all municipalities. In the 1991 census, in municipalities with more than 15,000 inhabitants, the questionnaire was given to 10 per cent of the population, while in municipalities with less than 15,000 inhabitants it was given to 20 per cent of the population. The sample of the population given the questionnaire in the 2000 census, was the same as that for the 1991 census. In the 2010 census, the questionnaires were given to five samples of the population, ranging from 50 per cent for municipalities with up to 2,500 inhabitants to 5 per cent for municipalities with more than 500,000 inhabitants.

The variables do not have the same categories in the four censuses. We need to harmonize the information to make a longitudinal analysis. Therefore, we use the census microdata extraction package available on the Data Zoom site² to build our database. Data Zoom is an initiative of the Department of Economics at the Pontifical Catholic University of Rio de Janeiro and aims to facilitate access to microdata from Brazilian Institute of Geography and Statistics (IBGE) household surveys.

We use race, gender, religion, region, urban/rural and capital as ‘ethnic’ characteristics. The race variable is divided into four groups: white, black, Asian and mixed race.³ Ethnic classification is based on self-identification, and there may be a measurement error.

Religion is divided into nine groups: non-religious, Catholic, traditional evangelical, Pentecostal evangelical, Kardecist, African-Brazilian spiritist, practitioners of oriental religions, Jewish/Israeli, and practitioners of other religions.

Labour income⁴ and education are considered as socioeconomic characteristics in the measurement of inequalities. Labour income and years of education are used as a continuous variable in the calculation of the Gini and Theil vertical inequality indicators as well as in the horizontal inequalities measures—Group-weighted coefficient of variation (GCOV), Group-weighted Gini coefficient (GGini), and Group-weighted Theil (GTheil). Whereas in the crosscuttingness (CC) and calculations, labour income was coded into quintiles in which the first

² See Data Zoom (n.d).

³ It is important to keep in mind that the group here labelled as being of mixed race is a merger of those with a mixed white, black, Asian, and indigenous (mixed-race) background and the indigenous group. In the 1980 census it is not possible to separate mixed race and indigenous, so to make a longitudinal analysis it is necessary to merge these two groups.

⁴ We imputed labour income for those who do not work using the Heckman procedure (Heckman 1979).

quintile is the lowest labour income and the fifth quintile is the highest labour income, education was coded into five categories: 0–3 years of education, 4–7, 8–10, 11–14, and 15 or more years of education.

There is no information in the censuses on years of education of individuals. For this variable, we calculate the average educational level in the range. In other words, the assumption is that within this range, people are distributed proportionally among the possible years of schooling. Moreover, we consider that those who are illiterate had no schooling.⁵

We analyse the correlation between income and education inequality indicators based on race and ethnic diversity measures. The indicators are calculated for Brazilian municipalities. We also analyse the relationship between ethnic diversity and the institutional quality of Brazilian municipalities using spatial econometric techniques (LeSage 2008) in order to mitigate potential endogeneity problems caused by spatial dependence (Anselin 1988).

In this analysis we control for other factors that can influence the institutional quality of the municipalities. We control for household per capita income, since it is expected that the higher the level of income of a municipality, the better its institutional quality. The same applies to education, since it is expected that municipalities with a population with a higher level of education are able to develop better institutions. Thus, we control for the illiteracy rate of Brazilian municipalities. In addition, we use the distance to the capital state as a geographic control and the population to control for the size of municipalities.

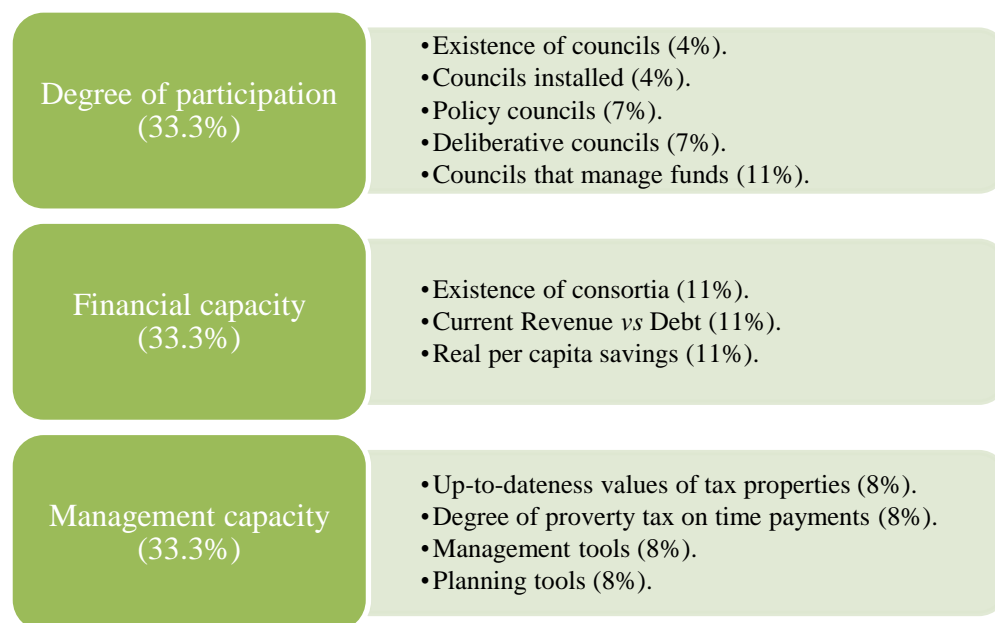
The proxy for institutions was the Municipality's Institutional Quality Indicator (MIQI), prepared by the Planning, Budget and Management Ministry for 5,507 Brazilian municipalities in 2000.⁶ The MIQI ranges from 1 to 6 and is the average of three sets of sub-indicators related to the degree of participation, financial capacity, and management capacity. As can be seen in Figure 1, each set of sub-indicators is composed of a varying number of micro-indices relevant to its characterization.

The first set of sub-indicators seeks to measure the degree of participation of the population in municipal administrations through the number of municipal councils and their characteristics. The second set of sub-indicators, consists of three micro-indices: the number of inter-municipal consortia, designed to meet the demands of the population; the relationship between debt and current revenues of the municipality, in order to capture the municipality's capability of payment; and real savings per capita. Finally, the third set of sub-indicators evaluates how up to date the data are for property tax collection purposes, the degree of default in relation to the same tax, and the number of management and planning tools used by the municipality.

⁵ We calculate the indicators using data from the 1992–2014 National Household Survey that has a continuous education variable and the results are very similar.

⁶ For more details of the MIQI, see MPOG (n.d.).

Figure 1: Municipality's Institutional Quality Indicator (MIQI)



Source: Author's calculations based on data from the Planning, Budget and Management Ministry (MPOG n.d.).

3 Results

3.1 Descriptive statistics

Table 1 shows the mean labour income, years of education, and proportions by cleavages in Brazil between 1980 and 2010. The white group makes up the majority of the population (49.7 per cent in 2010). However, this group is reducing in size. The mixed-race group has the second largest representation, followed by blacks, and Asians.

Due to Portuguese colonization, Brazil is a largely Catholic country. However, between 1980 and 2010, the Catholic group showed a significant relative reduction. The Pentecostal evangelical and non-religious groups have the second and third largest representation, respectively. The participation of the other religions group increases significantly between 1980 and 2010 (see Table 1).

Labour income and education have improved in Brazil. For example, the number of women's years of education increased from 3.75 in 1980 to 7.73 in 2010. However, women's labour income is much lower than men's labour income, while years of education are relatively similar for the two groups. In general, black and mixed-race individuals, individuals living in the rural, non-capital, North and Northeast areas and the Pentecostal evangelic group were the groups of socioeconomic disadvantage (income and education).

Table 1: Mean of the variables by year—Brazil

	Proportion				Mean of labour income				Mean of years of education			
	1980	1991	2000	2010	1980	1991	2000	2010	1980	1991	2000	2010
Gender												
Women	0.507	0.516	0.504	0.514	553	547	750	884	3.751	5.189	6.262	7.729
Men	0.493	0.484	0.496	0.486	1403	1149	1340	1377	4.111	5.313	6.159	7.373
Race												
White	0.576	0.544	0.571	0.497	1216	1071	1312	1435	4.901	6.277	7.152	8.527
Black	0.062	0.054	0.064	0.080	579	513	655	808	2.210	3.549	4.658	6.510
Asian	0.007	0.005	0.006	0.012	2151	2204	2481	1438	7.173	8.957	9.641	8.555
Mixed race	0.354	0.397	0.359	0.411	621	545	661	799	2.543	3.957	4.966	6.562
Religion												
Not religious	0.019	0.040	0.070	0.079	1561	740	1061	1177	5.408	4.664	6.113	7.576
Catholic	0.886	0.868	0.745	0.664	944	562	1040	1119	3.828	3.979	6.106	7.345
Traditional evangelic	0.036	0.022	0.043	0.041	1109	782	1144	1214	4.717	6.047	7.487	8.823
Pentecostal evangelic	0.029	0.048	0.100	0.125	721	490	769	850	2.710	3.698	5.426	6.963
Kardecist	0.009	0.008	0.018	0.025	1714	1538	2040	2110	7.067	9.435	10.56	11.35
Afro-Brazilian spiritist	0.007	0.002	0.004	0.004	1178	815	1169	1272	5.473	5.936	7.755	9.295
Oriental religions	0.003	0.001	0.003	0.003	1887	1462	1839	1910	6.325	8.783	9.133	10.45
Jewish/Israeli	0.001	0.000	0.001	0.001	4026	3039	5487	4545	10.91	11.81	13.06	12.91
Other religions	0.010	0.011	0.016	0.058	1201	696	1054	1112	4.830	5.715	7.158	8.370
Macro-Region												
North	0.042	0.058	0.064	0.073	831	722	790	902	3.131	4.354	5.398	6.990
Northeast	0.262	0.263	0.245	0.258	554	466	608	726	2.370	3.732	4.685	6.227
Southeast	0.471	0.456	0.462	0.444	1215	1055	1269	1307	4.760	6.059	7.016	8.258
South	0.165	0.159	0.159	0.151	970	836	1099	1245	4.264	5.512	6.553	7.880
Midwest	0.060	0.063	0.069	0.074	998	933	1167	1372	3.789	5.510	6.438	7.936
Area												
Rural	0.289	0.217	0.154	0.136	495	369	480	533	1.618	2.389	3.069	4.069
Urban	0.711	0.783	0.846	0.864	1166	969	1145	1216	4.866	6.032	6.842	8.141
Capital												
Others	0.733	0.742	0.736	0.745	800	686	881	965	3.145	4.468	5.519	6.953
Capital	0.267	0.258	0.264	0.255	1446	1279	1490	1592	6.083	7.461	8.250	9.391

Note: Labour income for those who do not work imputed using Heckman procedure (Heckman 1979).

Source: Authors' calculations based on data from the Brazilian Institute of Geography and Statistics (IBGE 1980, 1991, 2000, and 2010).

The labour income of the Jewish/Israeli group is much higher than the labour income of other groups. However, the Jewish/Israeli group has very low representation. The Kardecist group is the religious group with the second largest labour income.

3.2 Patterns and trends of group-based inequalities in Brazil

Vertical inequalities

Table 2 shows two vertical inequality indicators, the Gini and Theil indices, for Brazil. The indicators were measured for 1980, 1991, 2000, and 2010 for individuals older than 18 years of age (for labour income) and 25 years of age (for years of education).

We can observe that there was an important reduction in income inequality (for both Gini and Theil) between 2000 and 2010 in Brazil. An interesting pattern is that the reduction of the Theil

is greater than the decrease of the Gini. This result suggests that the poorest had a significant gain in income during the period. That is because the Theil is especially sensitive to the lower end of the distribution, being able to identify an increase (decrease) in inequality between the extremes of the income distribution. Unlike income, inequality of years of education showed a steady decline over the period 1980–2010.

Table 2: Vertical inequalities measures, Brazil

Year	Labour Income		Years of Education	
	Gini	Theil	Gini	Theil
1980	0.542	0.638	0.554	0.222
1991	0.564	0.718	0.488	0.191
2000	0.554	0.729	0.430	0.173
2010	0.496	0.586	0.376	0.153

Note: Labour income for those who do not work imputed using Heckman procedure (Heckman 1979).

Source: Authors' calculations based on data from the Brazilian Institute of Geography and Statistics (IBGE 1980, 1991, 2000, and 2010).

Paes de Barros et al. (2006) point out that the reduction in income inequality in Brazil has contributed to reducing poverty in the country and improving the standard of living of the poorest. However, despite the decrease in inequality observed in the 2000s, Brazil remains one of the most unequal countries in the world. The reduction in income inequality in Brazil can be attributed to increases in non-labour income and labour income per worker. An important example of a non-labour source is the *Bolsa Família* programme. This policy is a conditional cash transfer programme of the Federal Government established by the Lula government by Interim Measure 132 of 20 October 2003, brought into law on 9 January 2004, Federal Law n. 10,836. The programme is intended for families in poverty and extreme poverty so that they can overcome their situation of vulnerability and poverty. Currently, the programme benefits almost 14 million Brazilians.⁷

The increase in labour income per worker reflects a real increase in worker income and was made possible by the reduction of educational heterogeneity of the workforce and remuneration differences.

Sátyro and Soares (2009) show that cash transfers, especially the *Bolsa Família* programme, were the principal cause of the reduction in inequality in the North and Northeast regions in Brazil, while in the South, Southeast, and Midwest regions, labour income was primarily responsible for the reduction in inequality.

Educational inequalities show a significant decline since the 1980s. In Table 2 we can observe a decrease in both the Gini and Theil. The increase in educational supply, which practically universalized basic education in the country and mainly benefited the most disadvantaged people, can be seen as one of the most responsible factors for reducing educational inequalities in Brazil. In 1970, for example, there were 16 million enrolments in primary education, while in 1998 that number reached 35.5 million (Silva and Hasenbalg 2000), an increase of over 120 per cent, while the Brazilian population grew by around 80 per cent.

⁷ Information from the Government agency responsible for payment of the programme. For more details, see CAIXA (n.d.).

Ethnic diversity

Table 3 presents the fractionalization and polarization indices of Brazil between 1980 and 2010 for the different cleavages. The ethnolinguistic fractionalization index is the most commonly used measure of ethnic divisions. It is an adaptation of the Herfindahl-Hirschman index. Intuitively, it can be interpreted as the probability that two randomly chosen individuals will belong to different groups (Baldwin and Huber 2010; McDoom and Gisselquist 2015).

The ethnic fractionalization values in Brazil are greater than the global average value of 0.44 (Alesina et al. 2003) (Table 4). The table shows a relatively small increase in ethnic diversity in Brazil. However, the growth of religious diversity was much greater than the growth of ethnic diversity between 1980 and 2010 with a significant decrease in the number of people in the Catholic proportion of the population. Table 4 also shows a reduction in rural/urban fractionalization; in this case, there was an increase in the proportion of the population living in urban areas.

Regarding the polarization of a society, Montalvo and Reynal-Querol (2005) highlight that in highly homogeneous or highly heterogeneous societies there is less violence than in societies where a relatively large ethnic minority faces an ethnic majority. In this sense, the authors emphasize that the polarization index can capture the likelihood of conflict or even the intensity of potential conflict.

Table 3: Ethnic diversity (fractionalization, polarization), Brazil

	Year	Ethnicity	Religion	Region	Rural/urban	Capital/others
Frac.	1980	0.538	0.213	0.677	0.411	0.391
	1991	0.544	0.243	0.690	0.340	0.383
	2000	0.541	0.428	0.692	0.261	0.389
	2010	0.577	0.531	0.702	0.234	0.380
Polar.	1980	0.902	0.369	0.783	0.821	0.783
	1991	0.931	0.416	0.770	0.680	0.767
	2000	0.906	0.631	0.759	0.521	0.778
	2010	0.919	0.693	0.754	0.469	0.760

Source: Authors' calculations based on data from the Brazilian Institute of Geography and Statistics (IBGE 1980, 1991, 2000, and 2010).

Ethnic polarization in Brazil is higher than in other countries such as Philippines (Mindanao) and Sri Lanka (McDoom and Gisselquist 2015). As Table 3 suggests, religious polarization tends to be lower than ethnic polarization in Brazil (similar to the fractionalization index).

Horizontal inequalities

Horizontal inequalities, i.e. inequality between members of different ethnic groups, have been an increasing subject of research (Stewart et al. 2010). The evidence suggests that horizontal inequalities between ethnic groups may be related to civil wars (Cederman et al. 2011) and low provision of public goods (Baldwin and Huber 2010).

Numerous measures have been employed to analyse the inequality between ethnic groups. In this paper, we calculate three of them: GCOV, GGini, and GTheil.

The GCOV corresponds to the coefficient of variation (COV), i.e. the variance divided by the mean, weighted by the population size of each group (Stewart et al. 2010). With population weighting, changes in the position of small groups will have less effect than changes in the position of large groups.

A feature of the Group Gini is that it compares every group with every other (Stewart et al. 2010). Like the Gini, GGini ranges from 0 to 1 and has a very similar interpretation. Its minimum value of 0 is achieved when there is perfect equality between groups, i.e. when the average incomes of all groups in society are the same. Its maximum value of 1 is achieved when one infinitely small group controls all the income in society (Baldwin and Huber 2010).

The GTheil, like the GCOV, compares each group with the mean (in contrast to the GGini). Like the conventional Theil index, the GTheil is sensitive to the lower end of the distribution (Stewart et al. 2010).

Table 4 presents the results of GCOV, GGini, and GTheil for Brazil for the cleavages of race, gender, religion, region, rural/urban, and capital, considering income as socioeconomic variables. The results of the three group-based inequality measures for the race cleavage show a downward trend in race-based inequality between 2000 and 2010. Further, the reduction of the GTheil tends to be greater than the reduction of other indicators. That pattern may indicate a significant increase in the labour income of the poorest, since the GTheil, as well as conventional Theil, is more sensitive to the lower end of the distribution, giving greater weight to the extremes of income distribution.⁸

Table 4: Horizontal inequalities measures (labour income), Brazil

	Year	Ethnicity	Religion	Region	Gender	Rural/ Urban	Capital/ Others
GCOV	1980	0.321	0.172	0.281	0.437	0.313	0.294
	1991	0.335	0.187	0.290	0.359	0.295	0.310
	2000	0.325	0.194	0.264	0.283	0.230	0.257
	2010	0.282	0.186	0.229	0.219	0.208	0.243
GGini	1980	0.158	0.041	0.148	0.218	0.142	0.130
	1991	0.164	0.043	0.154	0.179	0.122	0.136
	2000	0.159	0.051	0.136	0.142	0.083	0.113
	2010	0.141	0.058	0.115	0.110	0.071	0.106
GTheil	1980	0.053	0.011	0.043	0.098	0.056	0.040
	1991	0.056	0.013	0.046	0.065	0.052	0.044
	2000	0.054	0.014	0.038	0.041	0.032	0.031
	2010	0.041	0.014	0.028	0.024	0.026	0.027

Note: Labour income for those who do not work imputed using Heckman procedure (Heckman 1979).

Source: Authors' calculations based on data from the Brazilian Institute of Geography and Statistics (IBGE 1980, 1991, 2000, and 2010).

The reduction in race-based inequality can be attributed to the improved living conditions of the poor, although the proportion of black and mixed-race groups among the poor remains high.

⁸ It is important to keep in mind, however, that the GTheil is quite small, being sensitive to small absolute changes that can translate into large percentage changes.

Moreover, the greater participation of black and mixed-race groups in the labour market and the reduction of wage differentials with whites may have contributed to reducing race-based inequalities. The Institute for Applied Economic Research (Neri et al. 2013) points out that one of the most striking aspects of Brazilian social changes since the early 1990s is the reduction in inequality between groups. During this period there has been significant growth in income mainly in the historically underprivileged groups, including blacks.

Just like race-based inequality, gender-based inequality also shows a downward trend between 2000 and 2010. However, the reduction in inequality between men and women is much higher than the decrease in inequality between different ethnic groups. Again, the percentage change of GTheil is significantly greater than the percentage change of GCOV and GGini.

The reduction trend in gender-based inequality can be attributed to the greater inclusion and achievement of better position of women in the labour market. The Institute for Applied Economic Research (IPEA) published four editions of *O Retrato das Desigualdades de Raça e Gênero no Brasil* (Pinheiro and Soares 2005; Pinheiro et al. 2006; Pinheiro et al. 2008; Instituto de Pesquisa Econômica Aplicada et al. 2011), which seek to analyse in more detail the inequality between blacks and whites and between men and women. In 2006, in the second edition of the study, it is noted that inequality between men and women and blacks and whites has been dropping since the mid-1990s, but there is still a high degree of inequality between these groups in Brazil.

Table 5: Horizontal inequalities measures (years of education), Brazil

	Year	Ethnicity	Religion	Region	Gender	Rural /Urban	Capital/ Others
GCOV	1980	0.310	0.145	0.256	0.046	0.375	0.331
	1991	0.231	0.163	0.186	0.012	0.285	0.250
	2000	0.183	0.121	0.157	0.008	0.226	0.191
	2010	0.131	0.102	0.113	0.024	0.189	0.139
GGini	1980	0.155	0.041	0.132	0.023	0.170	0.146
	1991	0.116	0.038	0.096	0.006	0.117	0.110
	2000	0.091	0.037	0.081	0.004	0.084	0.083
	2010	0.066	0.036	0.058	0.012	0.066	0.060
GTheil	1980	0.051	0.009	0.036	0.001	0.083	0.050
	1991	0.027	0.010	0.018	0.000	0.048	0.029
	2000	0.017	0.006	0.013	0.000	0.030	0.017
	2010	0.009	0.005	0.007	0.000	0.021	0.009

Source: Authors' calculations based on data from the Brazilian Institute of Geography and Statistics (IBGE 1980, 1991, 2000, and 2010).

Religion-based inequality is lower than that observed for the race and gender cleavages. At the same time, there is a small increase in religion-based inequality between 1980 and 2010.

We can observe that there was also a reduction in group-based inequality for the rural/urban, capital/non-capital, and region cleavages of Brazil; in others words, the poorer regions (North and Northeast, rural and non-capital) had higher growth in labour income.

Table 5 shows the trend of group-based inequality in Brazil for years of education as socioeconomic variable, between 1980 and 2010. The results indicate that unlike income, the

reduction in horizontal inequality for schooling was continuously stronger over the period from 1980–2010; this result can be observed for race, region, rural/urban, and capital and non-capital. Further, the gender-based inequality of schooling is very small. Thus, we can observe a stronger improvement in the education of people belonging to disadvantaged groups.

The reduction in educational inequality between different groups of the cleavages considered in the study is also related to the increase in education supply observed since the 1980s. As noted above, the increase in education supply especially benefited the most disadvantaged, i.e. black and mixed-race people, residents in the North and the Northeast regions, people living in the rural areas, and non-capital residents. Through a descriptive analysis, Arretche (2015) also shows a decrease in educational inequalities based on race.

Crosscuttingness

In this section, we also present other measure of group-based inequality, based on Selway’s (2011) refinement of the concept of ‘crosscuttingness’ (CC). CC is nothing more than a measure of statistical independence between two variables (cleavages). It enables us to check if the fact that an individual belonging to a group in a cleavage (e.g. ethnic) tells us something about what group this individual belongs to in another cleavage (e.g. religion) (McDoom and Gisselquist 2015; Selway 2011). If the fact that the individual belongs to a certain group in a cleavage does not infer anything about what group it belongs in another cleavage, then there is perfect crosscuttingness (Selway 2011). The CC ranges from 0 (perfect reinforcingness) to 1 (perfect crosscuttingness).

Table 6 shows the CC results for Brazil, with regard to the cleavages of race, gender, religion, region, rural/urban, and capital/non-capital crossing with labour income. As McDoom and Gisselquist (2015) highlight, until Selway’s (2011) work, there was a lack of quantitative studies using crosscuttingness measures, which meant that comparisons between countries were not possible.

Table 6: Crosscuttingness (CC)—labour Income, Brazil

	Year	Ethnicity	Religion	Region	Gender	Rural/ Urban	Capital/ Others
CC	1980	0.811	0.939	0.774	0.574	0.540	0.732
	1991	0.817	0.934	0.777	0.697	0.563	0.745
	2000	0.823	0.929	0.788	0.757	0.630	0.787
	2010	0.828	0.927	0.776	0.750	0.609	0.840

Note: Labour income for those who do not work imputed using Heckman procedure (Heckman 1979).

Source: Authors’ calculations based on data from the Brazilian Institute of Geography and Statistics (IBGE 1980, 1991, 2000, and 2010).

The cross-cutting between the cleavages of race, religion, region, and labour income in this study remained relatively stable between 1980 and 2010, while, the CC between gender, rural/urban, capital/non-capital, and labour income increased. These results are similar to the conclusions for GCOV, GGINI, and GTHEIL: a reduction of group-based inequality.

Selway’s (2011) cross-country analysis revealed a world average CC value of 0.876 between race and income cleavages; this value is slightly greater than Brazil’s CC. In this paper, we use labour income instead of income. Perhaps this is why our results for Brazil are lower than those of Selway (2011).

Table 7 shows the CC results for Brazil, with regard to the cleavages of race, gender, religion, region, rural/urban, and capital/non-capital crossing with education. We can observe greater

equality for race, region, rural/urban, capital in their crossing with education. These results confirm the findings in the previous section: schooling gains were greater for poorer people.

Table 7: Crosscuttingness (CC)—years of education, Brazil

	Year	Ethnicity	Religion	Region	Gender	Rural/ Urban	Capital/ Others
CC	1980	0.836	0.926	0.865	0.955	0.641	0.692
	1991	0.854	0.921	0.881	0.976	0.666	0.712
	2000	0.881	0.914	0.910	0.968	0.717	0.762
	2010	0.898	0.917	0.922	0.936	0.725	0.823

Source: Authors' calculations based on data from the Brazilian Institute of Geography and Statistics (IBGE 1980, 1991, 2000, and 2010).

3.3 Regional patterns and trends of ethnic diversity and group-based inequalities in Brazil

Table 8 shows the correlation between income inequality indicators based on race, educational inequality indicators based on race, and ethnic diversity of Brazilian municipalities. Indicators with the suffix 'I' were calculated using monthly household per capita income, while indicators with the suffix 'E' were calculated using years of education.

The correlation between income inequality indicators is quite high, as is the correlation between educational inequality indicators. However, the correlation between these two types of indicators is positive, although lower, suggesting that there is some relationship between the income inequality and educational inequality of Brazilian municipalities. At the same time, ethnic diversity has a positive, though lower, correlation with income and education inequality.

Table 8: Correlation matrix

	GCOV_I	GGINI_I	GTHEL_I	GCOV_E	GGINI_E	GTHEL_E	FRAC	POL
GCOV_I	1							
GGINI_I	0.892	1						
GTHEL_I	0.924	0.808	1					
GCOV_E	0.304	0.378	0.251	1				
GGINI_E	0.326	0.455	0.259	0.955	1			
GTHEL_E	0.272	0.332	0.235	0.961	0.909	1		
FRAC	0.192	0.398	0.13	0.32	0.498	0.245	1	
POL	0.163	0.365	0.104	0.33	0.499	0.246	0.955	1

Note: Indicators with 'I' were calculated using monthly household per capita income, and indicators with 'E' were calculated using years of education. FRAC is the ethnic fractionalization index calculated using race cleavage. POL is the polarization index, also calculated using race cleavage.

Source: Authors' calculations based on data from the Brazilian Institute of Geography and Statistics (IBGE 2000, 2010).

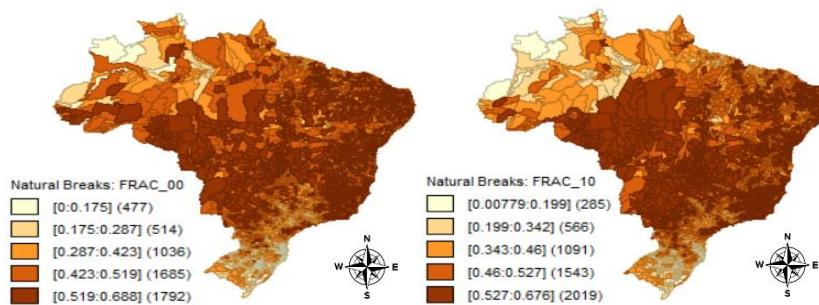
Ethnic diversity and horizontal inequality have a relatively clear regional pattern in Brazil. As can be seen, the South had, both in 2000 and in 2010, low ethnic diversity (Figure 2(a)) and low levels of horizontal inequality (Figures 2(b) and (c)). At the same time, the Midwest and Northeast tend to be municipalities with high levels of ethnic diversity. Another important pattern is that income inequality tends to be greater in the Midwest, while educational inequality tends to be higher in the Northeast.

Figure 2: Ethnic fractionalization and horizontal inequality distribution in Brazil—2000 and 2010

(a) Ethnic Fractionalization

2000

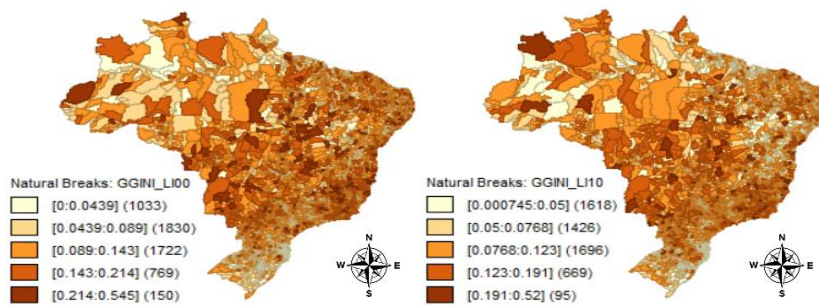
2010



(b) GGINI Income

2000

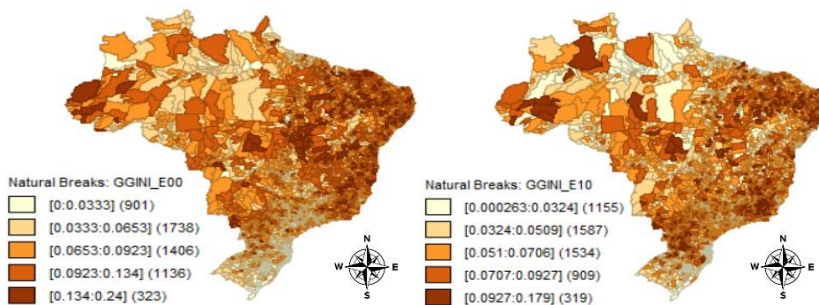
2010



(c) GGINI Education

2000

2010



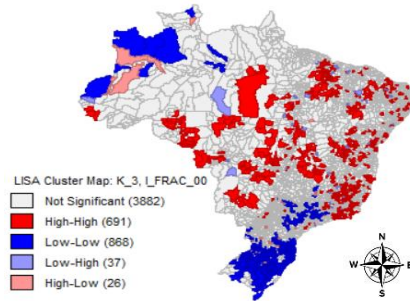
Source: Authors' calculations based on data from the Brazilian Institute of Geography and Statistics (IBGE 2000, 2010).

The suggested patterns in Figure 2 are supported by Figure 3. Figure 3 shows the Location Indicator of Spatial Association—LISA (Anselin 1995) for ethnic fragmentation, GGini income, and GGini education. As we can see, clusters of municipalities with low ethnic fractionalization tend to be located in the South, while clusters of municipalities with high ethnic fragmentation tend to be concentrated in the Midwest and Northeast. Similarly, clusters of municipalities with low income and educational horizontal inequality are located mostly in the South region. On the

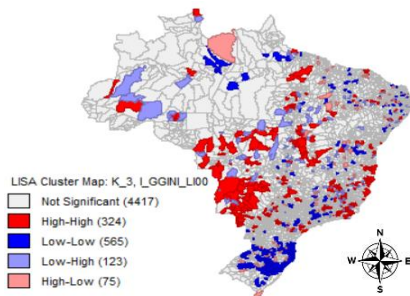
other hand, clusters with high income inequality are located mostly in the Midwest, while clusters with high education inequality are located mostly in the Northeast.

Figure 3: Local Indicator of Spatial Association of Horizontal Inequality and Ethnic Fractionalization—2000

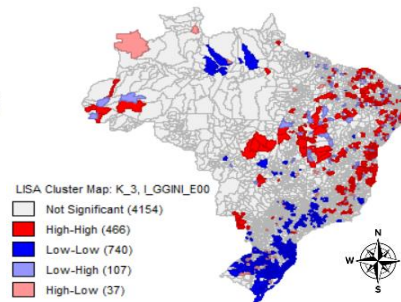
(a) Ethnic fractionalization



(b) GGINI Income



(c) GGINI Education



Source: Authors' calculations based on data from the Brazilian Institute of Geography and Statistics (IBGE 2000).

3.4 Regression analysis

Institutions and ethnic diversity

The relationship between ethnic diversity and factors that could influence economic growth has been investigated over time. Alesina et al. (1999) present a model that links heterogeneity of preferences across ethnic groups in a city to the amount and type of public good the city supplies. Empirical analysis shows an inverse relationship between productive public goods—education, roads, libraries, sewers, and trash collection—and ethnic fragmentation, even after controlling for other socioeconomic and demographic characteristics. Alesina et al.'s (1999) results, however, do not remain unchallenged. Gisselquist (2014) re-analyses Alesina et al.'s (1999) data and shows that ethnic diversity does not straightforwardly undermine public goods provision.

Easterly and Levine (1997) show that high levels of ethnic diversity in Sub-Saharan Africa are strongly related to high black-market premiums, poor financial development, low provision of infrastructure, and low levels of education. The study's findings are consistent with the view that ethnic diversity encourages the adoption of growth-retarding policies that foster rent-seeking behaviour and make it more difficult to form a consensus for growth-promoting public goods.

Miguel and Gugerty (2005) show that ethnic diversity in rural western Kenya is associated with lower primary school funding and poorer school facilities. Kimenyi (2006) evidences a relationship between ethnic heterogeneity and under-provision of non-excludable public goods.

Easterly et al. (2006) argue that social cohesion can determine the strength of the institutions and emphasize that social cohesion is essential for generating the confidence and patience needed to implement reforms. Our results also show that social cohesion determines institutional quality.

The results presented in Table 9 suggest that ethnic diversity is related to an important determinant of economic development in Brazil.⁹ The regressions presented in this table relate institutional quality to the ethnic fractionalization of Brazilian municipalities. The second column of the Table presents the ordinary least squares (OLS) regression of the institutional quality indicator on the fractionalization index without any other covariate. The fractionalization coefficient is negative and statistically significant, i.e. the higher the ethnic diversity of Brazilian municipalities, the lower their institutional quality. Even controlling for household per capita income, illiteracy rate, distance to the state capital, and population, the coefficient of the fractionalization index remains negative and statistically significant (third column of Table 9).

At the bottom of Table 9 we present some diagnostic tests for spatial dependence in the OLS regression. The Moran's I of regression errors show that they have a positive spatial autocorrelation that are statistically significant, so the OLS coefficients can be biased, thus requiring the specification of a spatial model. The Lagrange multiplier tests do not make clear which spatial model is the most appropriate, since the robust test is significant for both the error model and the lag model. In both models, however, the effect of the fractionalization index on the institutions is negative and statistically significant.

It is important to keep in mind, however, that the relationship between ethnic diversity and institutional quality observed in Brazil may reflect in some way, not just an effect of the lack of social cohesion but the result of the country's colonization process. Brazil experienced two episodes in the colonial period—the sugar cane and gold booms—that influenced the development of institutions in the country (Naritomi et al. 2012). The sugar cane boom arose from the effective colonization of Brazil from 1570 until 1760 and was characterized by an oligarchic society with the presence of slave labour. The gold boom occurred between 1695 and the end of the eighteenth century and was characterized by the heavily inefficient presence of the Portuguese state along with the presence of slave labour. Municipalities affected by these two episodes in Brazil's history are located in the Northeast and in the central region of the country—places with high ethnic fractionalization clusters (Figure 2(a)).

⁹ See Nakabashi et al. (2013).

Table 9: Effect of ethnic diversity on institutional quality

VARIABLES	OLS		SAR		SEM	
Fractionalization	-1.3807*** (0.0455)	-0.4076*** (0.0456)	-0.7236*** (0.0459)	-0.2519*** (0.0452)	-0.7999*** (0.0684)	-0.3050*** (0.0539)
Household per capita income		0.0009*** (0.0001)		0.0008*** (0.0001)		0.0008*** (0.0001)
Illiteracy rate		-0.0129*** (0.0009)		-0.0090*** (0.0008)		-0.0139*** (0.0009)
Distance to the state capital		0.0001** (0.0000)		0.0001** (0.0000)		0.0001* (0.0000)
Population		0.0000 (0.0000)		0.0000* (0.0000)		0.0000 (0.0000)
Constant	3.6155*** (0.0204)	3.1665*** (0.0417)	1.9360*** (0.0497)	2.2684*** (0.0625)	3.3750*** (0.0313)	3.1644*** (0.0436)
Rho			0.4634*** (0.0127)	0.2610*** (0.0145)		
Lambda					0.4654*** (0.0137)	0.2714*** (0.0153)
Observations	5,504	5,504	5,504	5,504	5,504	5,504
R-squared	0.1307	0.3811				
Diagnostic tests for spatial dependence in the OLS regression						
Moran's I	32.654***	18.444***				
Spatial error:						
Lagrange multiplier	1063.190***	336.988***				
Robust Lagrange multiplier	35.241***	8.104***				
Spatial lag:						
Lagrange multiplier	1234.287***	341.998***				
Robust Lagrange multiplier	206.338***	13.115***				

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Source: Authors' calculations based on data from the Brazilian Institute of Geography and Statistics (IBGE 2000).

4 Conclusion

This study, using information from the last four censuses (1980, 1991, 2010, and 2010) aims to analyse the patterns and trends of vertical and horizontal inequalities in Brazil, thereby contributing to the considerable effort of UNU-WIDER to provide evidence of group-based inequality in developing countries.

Although there are a significant number of studies that address the issue of inequality in Brazil, most of them focus on the analysis of vertical inequalities, whereas group-based inequalities are barely investigated. Despite providing insights about disparities between individuals of different groups (particularly ethnic groups), they lack appropriate indicators to analyse more thoroughly the horizontal inequalities. We, therefore, measure and analyse indicators of vertical and horizontal inequalities in Brazil. The measures used to analyse patterns and trends of vertical inequality are the Gini and Theil indices, while 'ethnic' diversity is analysed by the fractionalization (FRAC) and polarization (POL) indices. The group-based inequalities are analysed using four indicators: GCOV, GGini, GTheil, and CC. The cleavages considered in this study are race, gender, religion, and region (geographic region, rural/urban areas, and capital/non-capital).

Broadly, we find that between 1980 and 2010, there is a trend toward greater equality in Brazil for vertical and horizontal inequality along racial, gender, and regional lines. This trend is observed for both labour income and educational inequality. Nevertheless, the horizontal inequality of labour income in terms of race and gender in particular remain pronounced.

The reduction in race-based inequality can be attributed to improved living conditions of the poor, whereas the proportion of black and mixed-race groups among the poor is high. Moreover, the greater presence of black and mixed-race groups in the labour market and the reduction in wage differentials relative to whites may have contributed to reducing race-based inequalities in Brazil. The reduction trend in gender-based inequality can be attributed to the greater inclusion and achievement of better positions in the labour market by women.

We also find that race-based income inequality indicators are highly correlated, as are race-based education inequality indicators. At the same time, ethnic diversity and group-based inequality indicators present a positive, though small, correlation. In other words, municipalities with greater ethnic diversity tend to have higher levels of inequality between members of different ethnic groups.

Finally, we observe a negative effect of ethnic diversity on institutional quality of Brazilian municipalities, a result that remains even after controlling for other municipalities' characteristics and endogeneity caused by spatial dependence.

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