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Inequality in Brazil: A Regional Perspective

by Carlos Góes and Izabela Karpowicz

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I N T E R N A T I O N A L M O N E T A R Y F U N D

IMF Working Paper

Western Hemisphere Department

Inequality in Brazil: A Regional Perspective

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Authorized for distribution by Alfredo Cuevas

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Abstract

In this study, we document the decline in income inequality and a convergence in consumption patterns in Brazilian states in a new database constructed from micro data from the national households' survey. We adjust the state-Gini coefficients for spatial price differences using information on households' rental prices available in the survey. In a panel regression framework, we find that labor income growth, formalization, and schooling contributed to the decline in inequality during 2004–14, but redistributive policies, such as *Bolsa Família*, have also played a positive role. Going forward, it will be important to phase out untargeted subsidies, such as public spending on tertiary education, and contain growth of public sector wages, to improve budgetary efficiency and protect gains in equality.

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Keywords: income inequality, redistribution policies, Brazil.

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A. Overview

Over the past decade or so, Brazil—a still highly unequal country—has been the poster child for social mobility. According to the World Bank’s international poverty line, Brazil slashed poverty from 25 percent of the population in 2004 to 8.5 percent in 2014. Extreme poverty declined from 12 to 4 percent over the same period.² As millions were lifted out of poverty, the middle class was boosted. The most commonly used inequality measure – the Gini coefficient (the closer to 1, the more unequal) – declined from 0.60 in 1990 to 0.51 in 2014 according to World Bank’s data. Inequality reduction was achieved thanks to a decade-long period of economic growth and deliberate income and social inclusion policies, such as minimum wage increases and targeted social programs. Yet, inequality remains high: based on data from the 2014 *Pesquisa Nacional de Amostra de Domicílios* (PNAD), labor income of the population in the top decile of the income distribution corresponds to 40 percent of labor income of all Brazilian families, the top 1 per cent receives about 12 percent, and the top 0.1 per cent around 2.5 percent. Half percent of all labor income is concentrated in the top 0.01 percent.

The recession that started in 2014 is likely to have affected the pace of progress on the social dimension. Earnings from work continue to be the main source of income for the poorest, who are suffering disproportionately from job losses. Rising unemployment and compressed households’ disposable incomes are affecting their living standards and jeopardizing social mobility. Indeed, unemployment reached 13 percent in 2017, but has been higher for lower-skilled labor.³ But even after the recession, the government will face a long period of fiscal consolidation. To observe the cap on federal government non-interest expenditures, restraint will be necessary across all categories of spending in the medium term.

In this paper, we construct a new database in which we aggregate individual and households survey data from the annual PNAD and correct households’ incomes for spatial price differences across different regions in the country. We use this data to study the evolution and the drivers of income inequality in Brazil. To our knowledge, we are the first to apply the methodological techniques from the literature on global income inequality spearheaded by Milanović and his co- authors, and recently updated in Lakner and Milanović (2015), to gain insights on both within- and between-state inequality in Brazil. Another novelty of our paper is the use of a

² Households whose income is less than \$3.10 a day/less than \$1.90 for extreme poverty at constant 2011 PPP-adjusted U.S. dollars.

³ By early-2017, more than one in four young adults in Brazil were unemployed.

spatial price differences index that we construct from PNAD data to allow comparability of nominal incomes across states with unequal living standards. Because of the nature of the data employed, we focus mainly on inequality of outcomes, and do not study inequality of opportunities, such as access to education and health services, clear water and sanitation, and quality infrastructure.

We find that the decline in overall inequality in Brazil was driven by both falling inequality within states and income convergence across states. We look at the evolution of income and consumption patterns for specific income percentiles of the national income distribution over time and show that income convergence was more evident around the median of the state distributions. From our regressions we find that most of the change in Gini can be explained by income growth, higher schooling levels and labor formalization, but the targeted social program, *Bolsa Família*, also contributed to income convergence. Civil servants' wage growth has, in contrast, slowed gains in equality. The reforms necessary to ensure fiscal sustainability should incorporate the objective of improving spending efficiency while avoiding adverse effects on income distribution. As labor formalization and income growth are slowing down, going forward, better targeting of social benefits, rationalizing the tax system, and moderating civil servants' wages will be key for preserving gains in equality.

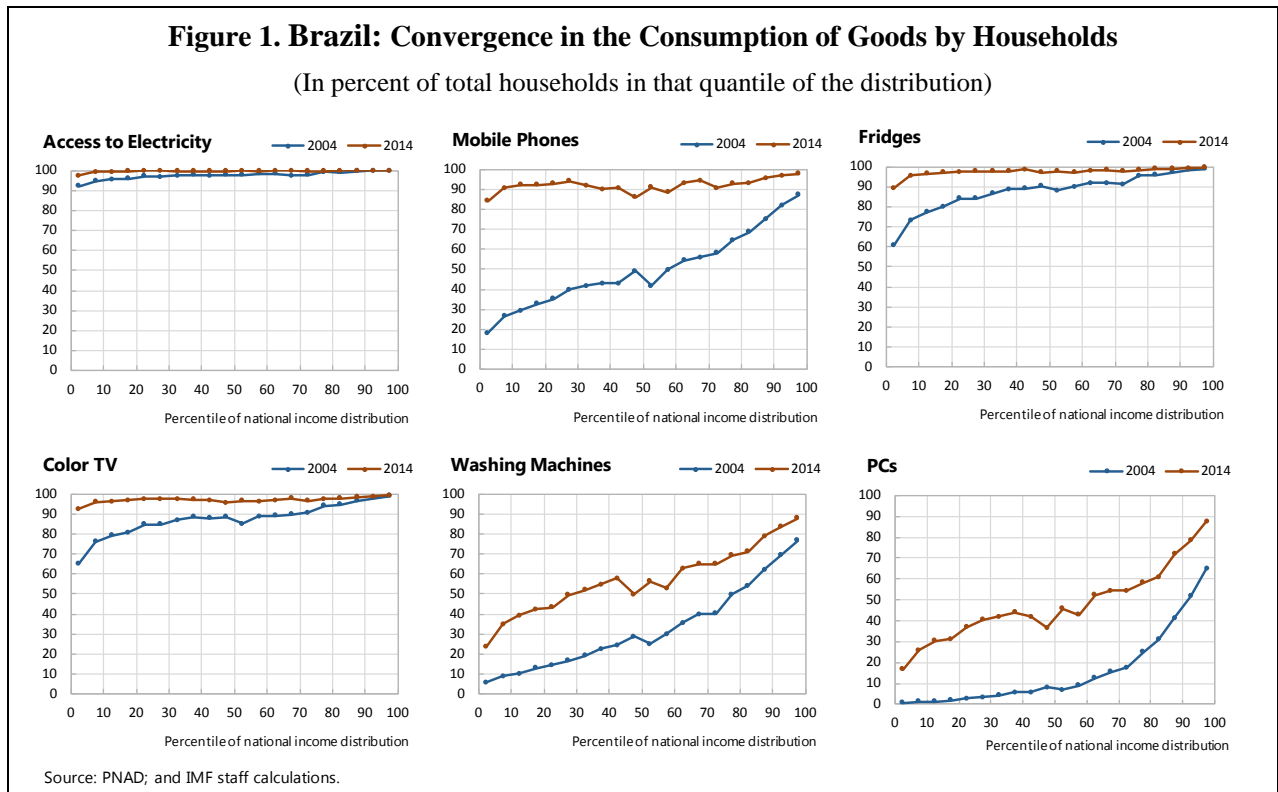
The paper is organized as follows: in Section B, we describe the evolution of inequality in Brazilian states and regions over the past decade using a novel data set; in Section C, we present a regression analysis to study the policy drivers of the decrease in inequality; and we conclude in Section D.

B. Historical Trends in Regional Inequality 2004–14

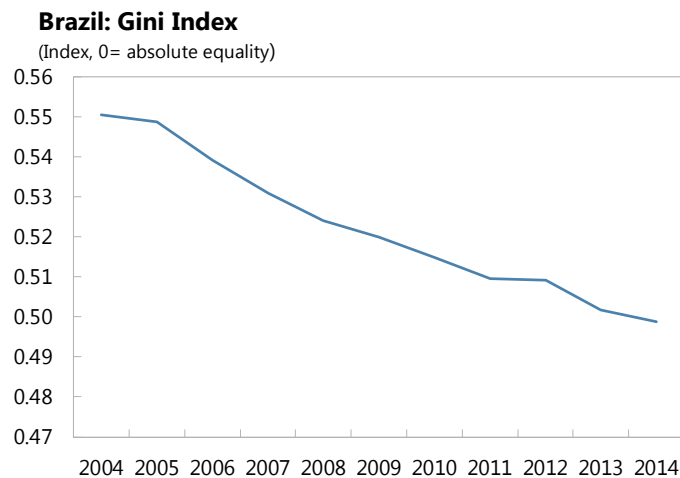
In this section, we analyze the historical trends in inequality in Brazil based on the new database constructed using micro-data from the Brazilian households' survey (PNAD) and adjusted for spatial price differences. Because of the nature of the data we are using, we focus mainly on inequality of outcomes, and do not study inequality of opportunities, such as access to health, clear water and sanitation, and quality infrastructure. We base our estimates of inequality on after-tax per capita income as reported in the PNAD, which includes data on labor income, retirement benefits, social security benefits, and income from financial and real assets.

Growth in incomes over the past decade has allowed the poorer segments of the population to increase their consumption of durable goods. With access to electricity being nearly universal across all income levels already in 2004, access to durable goods increased substantially for all

households over the following 10 years (Figure 1). But how have overall incomes behaved and what is the state of income inequality today?



Income inequality in Brazil has declined. The Gini coefficient for Brazil published by the Brazilian Institute of Statistics (IBGE) fell from 0.54 in 2004 to 0.49 in 2014, and other commonly used inequality measures also show declining trends. We construct a Gini coefficient based on the income reported by individuals and households in the annual survey (PNAD) administered by the IBGE, adjusting household incomes for spatial prices differences throughout the country (Box 1). Our “adjusted” Gini index has declined at the level of the country from 0.55 to 0.50 over the same period. The usefulness of this adjusted income measure is in facilitating comparisons across states.



Box 1. The Cost of Living Adjustment

Inequality measures must take into account differences in the cost of living across and also within countries to distinguish between nominal and real differences in incomes. Cross-country inequality studies, such as Lakner and Milanović (2015) or Dollar and others (2013) for instance, typically correct the between-country income statistics using PPP conversions, often based on national price indices. But adjusting for living standards is important also when studying inequality within large countries because, as highlighted by Deaton and Dupriez (2011), the Balassa-Samuelson effect may cause richer regions to show permanently higher price levels. Indeed, price levels are not homogeneous in Brazil. Góes and Matheson (2017) have documented large divergences of product-specific price dynamics, particularly for non-tradables, across different metropolitan areas. Almeida and Azzoni (2016) showed that overall price level differences in Brazilian metro areas can diverge with levels as low as -19 percent and as high as +14 percent from the national average.

Because micro-data for consumer-price level differences is not available in Brazil we use information on rental prices as a proxy. The consumer price indices are available only for the 12 metropolitan areas, insufficient to capture the potentially ample differences in living costs across Brazilian states. Using data on declared households' rent prices from the PNAD and other characteristics of the dwelling (such as the number of rooms or area in square meters) we adjust households' incomes for spatial price differences in a two-step procedure. The advantage of using rental price data for the adjustment is that most of the price dispersion generally comes from non-traded goods, and especially housing. Li and Gibson (2014), for instance, have used data on dwelling sales in urban China to develop spatially-disaggregated indices of house prices which they used as spatial deflators for both provinces and core urban districts.

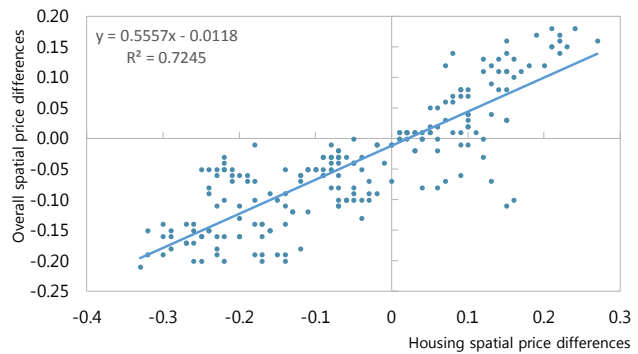
First, for each sub-region $k = [1, 2, \dots, 7]'$ of each state $s = [1, 2, \dots, 27]'$ and each year $t = [2004, \dots, 2015]'$, we construct a *rental spatial price difference index*, which measures the percent deviation of the per room average rental price from the national average:

$$r_{s,k,t} = \frac{m_{s,k,t}/n_{s,k,t}}{m_t^*/n_t^*} - 1$$

where m is the average monthly rent price for the cluster s,k , while n is the average number of rooms per household for the cluster, and the stars denotes national averages.

Given that overall spatial price differences can be well approximated by a linear function of housing spatial price differences, we use the parameter from Azzoni and Almeida (2016), assumed to be homogenous across regions, and our heterogeneous rental spatial-price difference index to fit an overall spatial price difference index $\hat{p}_{s,k,t} = \phi r_{s,k,t}$. Finally, we use $\hat{p}_{s,k,t}$ to obtain adjusted households incomes, which are then used in the analysis of income distributions and their trends.

Brazilian Metro-Areas: Correlation Between Overall and Housing Spatial Price Differences (In deviations from national averages)

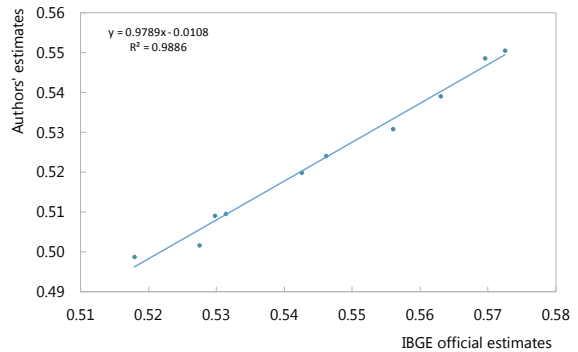


Sources: Almeida and Azzoni (2016); PNAD microdata; and IMF staff calculations.

Box 1. The Cost of Living Adjust (Concluded)

Our estimates of the overall Gini coefficients are nearly perfectly correlated with the official estimates of the IBGE. Higher households income per capita regions tend to face price levels above the national average, while lower income regions tend to face price levels below the national average. Thus, adjusting for spatial price differences compresses nominal differences in incomes and decreases the overall inequality indicator. The estimated coefficient shown in the figure (less than one) denotes the compression effect of the adjustment.

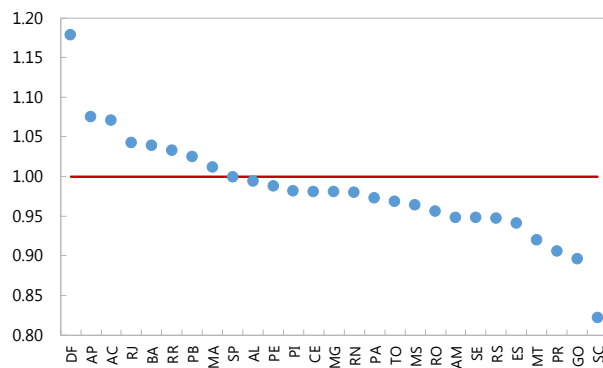
Brazil: National Gini Coefficient (2004-14)
(Index, 0 = absolute equality)



The decline in inequality was pronounced in the period studied, including among regions. Within-state income distributions vary from state to state. In 2014, the Gini coefficient of the most unequal state was 18 percent higher than the national Gini ratio, whereas the Gini of the least unequal state was almost 20 percent lower than the national ratio. These differences are, however, narrower than in the past: the standard deviation of state Gini coefficients decline from 0.035 to 0.033 between 2004 and 2014. Between-states inequality has decreased as a share of total inequality as incomes grew faster in the poorer regions of the North, Northeast, and Midwest (blue, navy, and yellow lines below). Convergence in average incomes led to a decreasing share of total inequality explained by between-state inequality, as depicted also by the Generalized Entropy and Atkinson’s indices.⁴

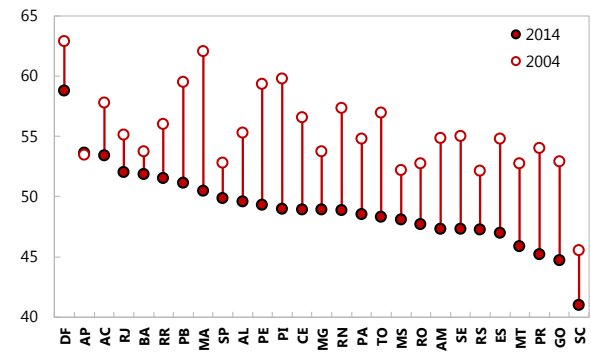
Figure 2. Brazil: Income Inequality in Brazilian States: A Dynamic Decade

Brazil: Relative Gini Coefficient, by State, 2014
(State Gini / National Gini ratio)



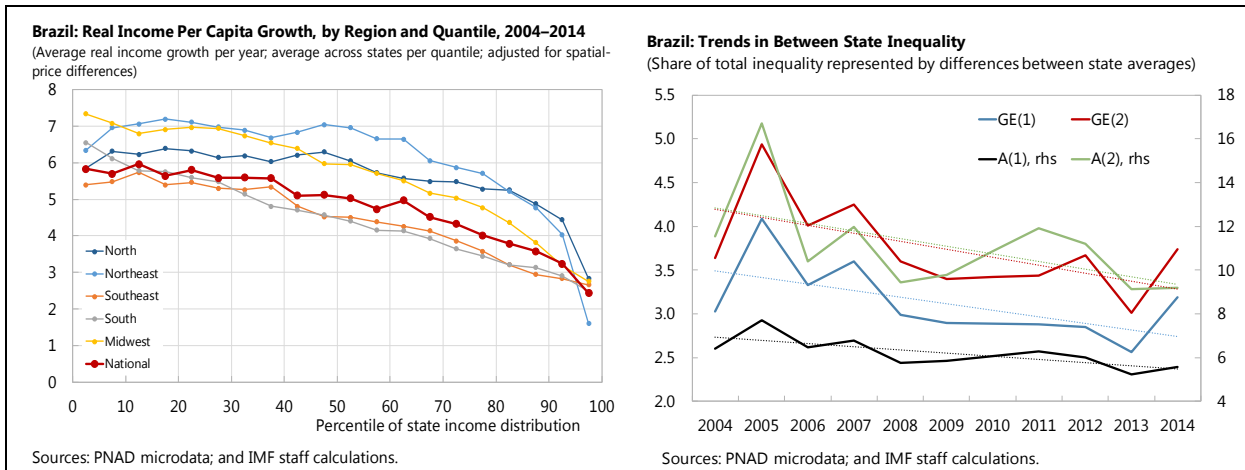
Sources: PNAD microdata; and IMF staff calculations.

Brazil: Gini Coefficient, by State, 2004–2014
(State-wide Gini coefficient)

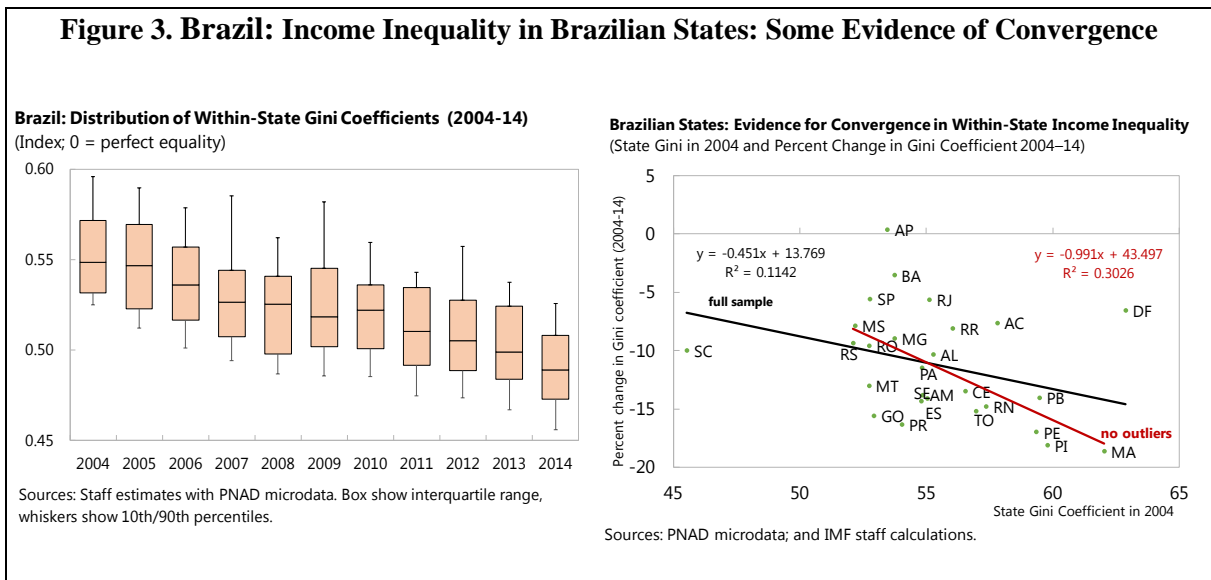


Sources: PNAD microdata; and IMF staff calculations.

⁴ The Generalized Entropy (GE) and Atkinson (A) indices, used as consistency checks, are perfectly decomposable into within and between components.



Inequality within states also dropped. This was driven primarily by substantially higher income growth rates for lower-income households in nearly all states. Inequality has declined relatively more in the states with higher initial inequality in 2004, especially after excluding the outliers (SC and DF), which illustrates convergence in within-state inequality indices across the country.



In Figure 4, we explore how within-state income distributions fit into the national income distribution.⁵ Households belonging to the lowest and those belonging to the highest deciles of the state income distribution also belong to the lowest/highest deciles of the national distribution. In other words, the living standards of the lowest-earning and those of the highest-earning are similar across states and regions. However, depending on the state, the state median household income can fall anywhere between the 30th and the 70th percentile of the national distribution. These differences have shrunk over time, as shown by a more pronounced

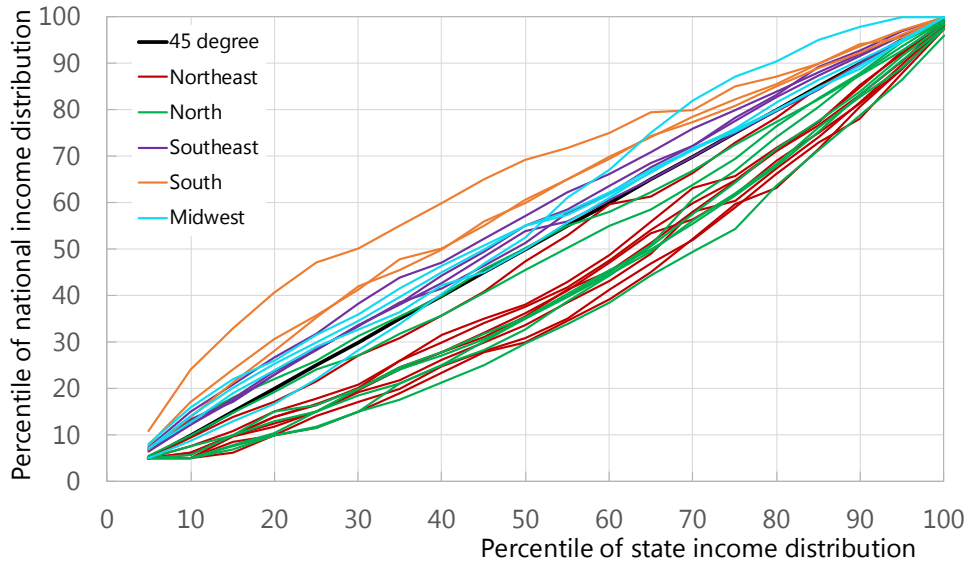
⁵ The different colors in Figure 4 represent households' income per capita distributions of states that belong to the region. For a legend of states see Appendix I.

downward shift of the curve depicting the standard deviation of percentiles between the states and the national income distribution around the 30th to 70th percentiles since 2004 (Figure 5).

Figure 4. Brazil: Income Inequality in Brazilian States – Disaggregated

Brazil: Household Income per Capita Distribution, by State, 2004

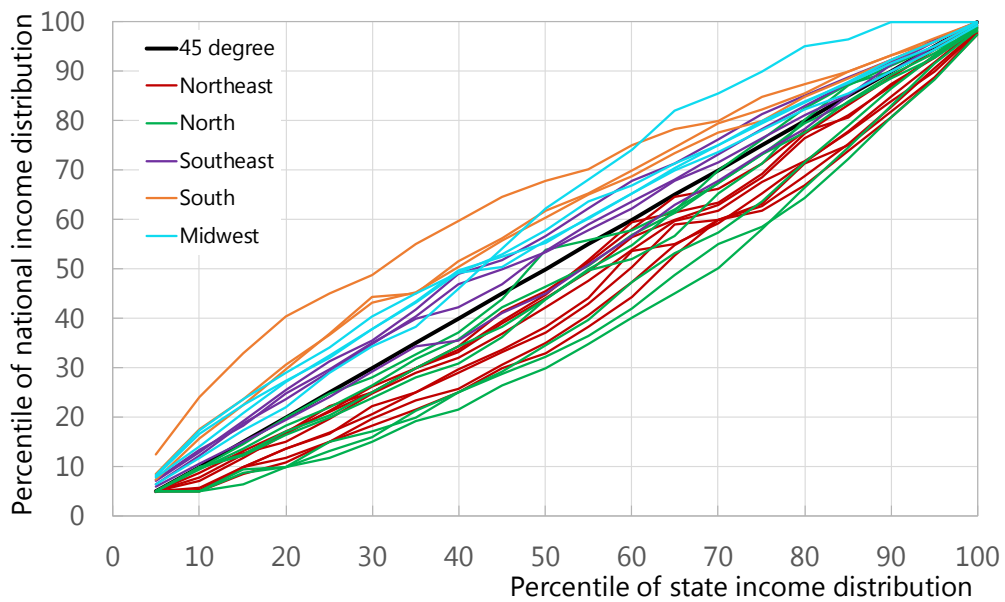
(Percentiles of state-wide and nation-wide household income distribution, PPP adjusted)



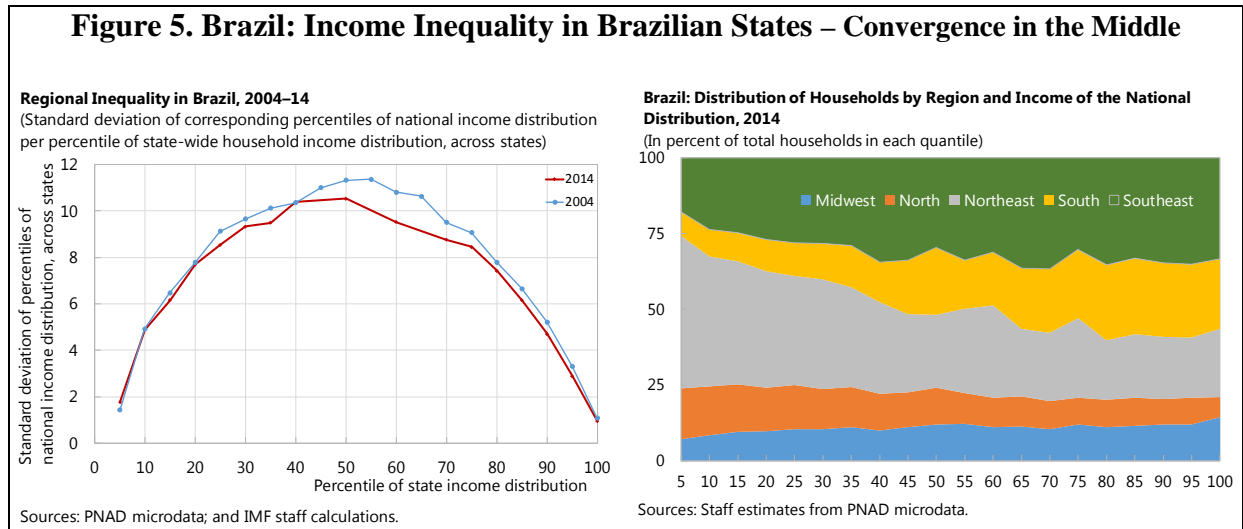
Sources: PNAD microdata; and IMF staff calculations.

Brazil: Household Income per Capita Distribution, by State, 2014

(Percentiles of state-wide and nation-wide household income distribution, PPP adjusted)



Sources: PNAD microdata; and IMF staff calculations.



There is no evidence of reversal of progress with equality in the most recent PNAD (2015). With the drop in employed population, real gross households' earnings contracted in 2015 across all professions and for the first time in 11 years. The real income decline touched the entire income distribution, but, as it was more severe in the higher income brackets, inequality fell slightly. The official Gini index calculated for all income sources fell from 0.497 in 2014 to 0.491 in 2015. The Gini calculated for labor income fell from 0.490 to 0.485 and, in the case of household income, from 0.494 to 0.493.

However, the continuation of the recession through 2016 may have dented equality gains. Earnings from work represent a higher share of total income in the survey and a higher share of the income of households in the lowest quartile. As job destruction continued through 2016, and inflation remained high, the relatively poorer households have suffered more. Preliminary 2016 inequality estimates from *FGV Social* suggest that inequality widened slightly for the first time in 22 years. The World Bank (2017) has estimated that the number of poor in Brazil will likely increase by 2.5–3.6 million by 2017, while the Gini index will increase from 0.51 to 0.52–0.54. Among the “new poor”, young, skilled workers in the service sector will represent the higher share of those falling below the poverty line due to the crisis.

C. Macro-Policies and Inequality Outcomes: Stylized Facts and Regression Analysis

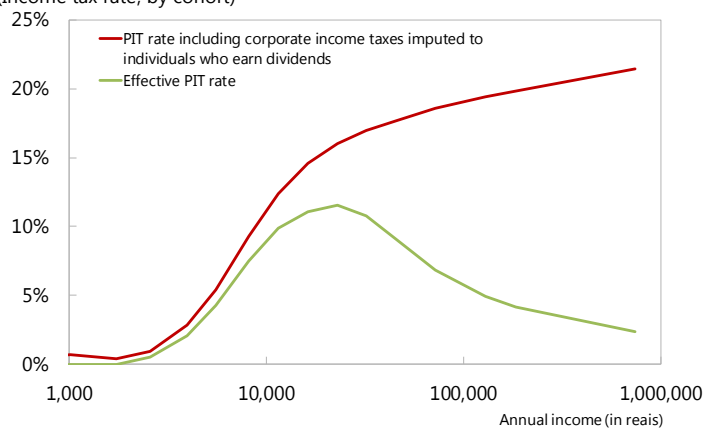
i. Stylized Facts

Tax policy

If achieved through progressive taxation, increases in tax revenues can be correlated with declining inequality. Brazil's overall tax system relies relatively more on indirect taxes, which

are regressive.⁶ Effective personal income tax (PIT) rates, which take into account all the admissible deductions (green line in the chart), do not seem progressive either. However, taking into account the taxation of dividends at corporate level the system's progressivity appears to be restored (red line). Applying standard benefit-tax incidence analysis, Lustig and others (2014) find that personal income taxes in Brazil are progressive and redistributive, and contributed to reducing the Gini of after-tax incomes by 1.9 percent in 2009.

Brazil: Effective PIT Rates 1/
(Income tax rate, by cohort)



Sources: Staff estimates with Receita Federal (Grandes Números, IRPF) data. 1/ Since dividends deductions are intended to avoid double taxation, we augment each cohort's tax burden by adding 15% of the corporate income tax (IRPJ) and 9% of the CSLL.

Minimum wage and expenditure policies

Supported by strong growth, the minimum wage policy in Brazil has sustained upward social mobility for lower classes. The effect of the minimum wage policy on inequality is ambiguous, given its potentially offsetting impact on employment and inflation (Jaumotte and Osorio Buitron, 2015). According to Maurizio (2014), increases in the minimum wage in Brazil led to wage compression, which helped to reduce inequality among wage earners. Indeed, the average hourly wage for a worker with a given level of education rose much faster among the poor than for the rest of the population in the last decade mainly because of the minimum wage policy. This occurred, however, as the increase in the real minimum wage above productivity was accompanied by a decline in the unemployment rate supported by Brazil's relatively strong output growth, helped in turn by favorable factors, such as high commodity prices (IMF, 2015). In such an environment, the trade-off between redistribution and employment embedded in the minimum wage policy was less apparent. But Brazil's contraction in investment and growth

⁶ The ratio of direct to indirect taxes at the general government level was 45 percent in 2016. Brazil relies more on indirect taxes than other Latin American economies and significantly more than OECD countries (OECD, 2010). According to Amaral and others (2016), the average Brazilian worker pays 15 percent of his gross income in income taxes, 3 percent in asset taxes, and 24 percent in consumption taxes. Those making up to R\$3,000 per month pay 24 percent of their gross income in consumption taxes, while those making more than 10,000 pay 17 percent in consumption taxes. While personal income taxes are progressive, excessive reliance on consumption taxes makes the overall system regressive.

(continued...)

after 2014 has reduced labor demand, putting pressures on employment and wages. Further minimum wage increases above productivity growth may affect employment negatively, with the effect being more pronounced for the unskilled workers (IMF, 2015; Jaumotte and Osorio Buitron, 2015). This would in turn lead to higher before-tax (or *gross*) inequality.⁷

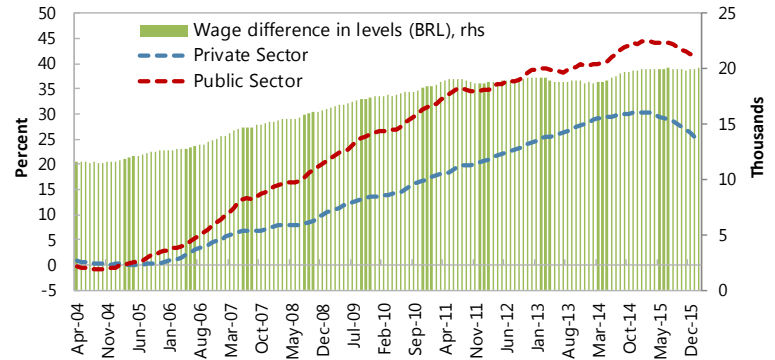
Public sector wage increases were systematically above private sector wage growth and have contributed to a wider difference in average wage levels over time. According to the hedonic theory of wages (Rosen 1974 and 1986), public sector wages should be lower than private sector ones because public sector employees have more stable formal jobs and, at least in

Brazil, enjoy higher retirement

benefits (Cuevas and others 2016 and IMF, 2017). Nevertheless, many studies in the literature find evidence of public sector wage markups in the literature (Clements and others, 2010) including in Brazil (Souza and Medeiros, 2012; Braga and others, 2009). In 2014, the estimated median premium on public sector jobs across comparable professions was about 50 percent up to the secondary education level (Box 2). To the extent that public sector workers' incomes are higher than private sector workers', stronger growth of wages in the public sector may have moderated equality gains achieved in the recent decade.

Bolsa Família is Brazil's flagship social assistance program for reducing poverty. Beneficiary coverage has increased from about 6.5 million households in 2004, when it was founded, to over 14 million in 2014 (56 million people). Budgetary appropriations for the program have also increased from about 0.3 percent of GDP to 0.6 percent of GDP over the same period. The World Bank (2017) estimates that 58 percent of the decline in extreme poverty in Brazil over

Brazil: Real Annual Earnings, per Sector
(12-month rolling change)

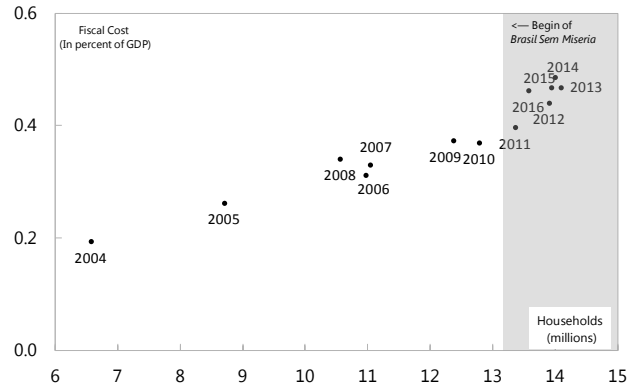


Source: PME/IBGE; and IMF staff estimates.

⁷ According to Silva and others (2015), in over 1/3 of manufacturing firms, value added per worker in 2012–13 increased slower than minimum wage, putting at risk further employment and wage gains, particularly among firms with high concentration of workforce in wage levels around the minimum wage.

2004–14 was due to *Bolsa Família* transfers. Soares and others (2006) report that in 2005 about 80 percent of the *Bolsa Família* and other cash-targeted programs (*Bolsa Escola*, *PETI*, etc.) went to families below the poverty line (half of the minimum wage per capita) and that the program was responsible for 21 percent of the decline in the Gini coefficient between 1995 and 2005.

Brazil: Fiscal Cost and Reach of *Bolsa Família*
(Percent of GDP and millions of households)



Sources: Ministry of Social Development; and IMF staff calculations.

Box 2. Returns to Education and Public-Private Wage Gap

We estimate the returns on education in Brazil by means of two “Mincer” regressions (Mincer, 1974) with identical specifications that relate the log of wages to years of schooling and experience for the public and the private sector separately, for each period $t = [2004, \dots, 2014]$. The model contains more than 50 other controls:

$$\ln(w_{i,t}) = \alpha_t s_{i,t} + \beta_{1,t} e_{i,t} + \beta_{2,t} e_{i,t}^2 + \gamma_t m_{i,t} + \sum_{n=1}^4 \delta_{n,t} r_{i,n,t} + \sum_{n=1}^{13} \zeta_{n,t} o_{i,n,t} + \sum_{n=1}^{13} \theta_{n,t} a_{i,n,t} + \sum_{n=1}^{10} \phi_{n,t} c_{i,n,t} + \sum_{n=1}^{27} \psi_{n,t} d_{i,n,t} + \epsilon_{i,t}$$

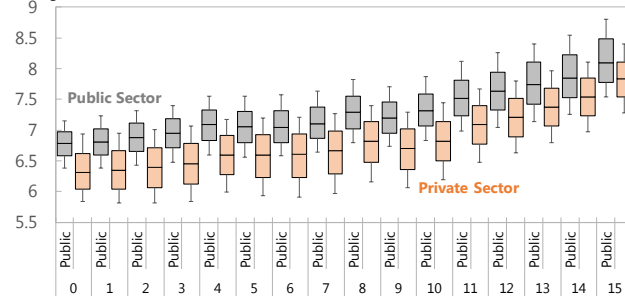
where $w_{i,t}$ is the monthly wage for person i at period t ; $s_{i,t}$ is the years of formal schooling; $e_{i,t}$ is the years of experience (defined as the individual’s age minus years of schooling minus 6—the age when mandatory education starts); $m_{i,t}$ is a gender dummy; $r_{i,n,t}$ are dummies for races; $o_{i,n,t}$ are dummies for occupations (formal/informal worker, military, civil servant, domestic worker, self-employed, etc.); $a_{i,n,t}$ are dummies for sectoral economic activities (agriculture, industry, manufacturing, construction, commerce, etc.); $c_{i,n,t}$ are dummies for worker’s class (director, middle management, administrative, sales, etc.); $d_{i,n,t}$ are dummies for the Brazilian states; and $\epsilon_{i,t}$ is the error term.

In the second step, we use the estimated coefficients from the regressions to generate two vectors of fitted values for each one of the ~150 thousand workers in the sample who belong to either the private or the public sector. The fitted values show the expected log wages for individuals, given the same set of observable characteristics.

We find that predicted earnings are an increasing function of the years of schooling in Brazil for public as well as private sector jobs, but earnings among those in public sector jobs are consistently higher, in line with Souza and Medeiros (201 and 2013b). Up to the secondary education level, the 25 percent lowest predicted earnings in the public sector are higher than the median earnings in the private sector.

Brazil: Predicted Returns on Schooling, 2014

(In log of monthly wages given years of formal education; distribution of predicted wages given 50+ controls for geography, demographics, experience, education, industry, management level, etc.)

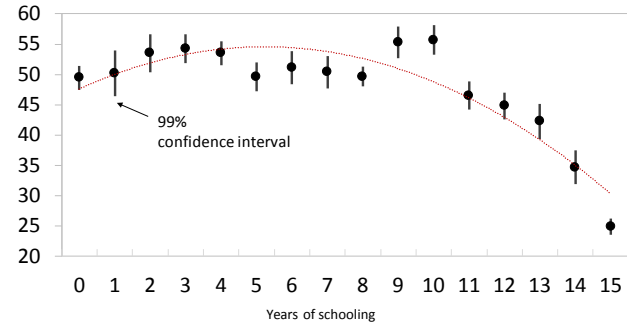


Sources: PNAD microdata; and IMF staff calculations. Boxes show interquartile range. Whiskers show 10th/90th percentiles. We ran Mincerian regressions with the same controls for a sample of ~150,000 obs, calculated predicted values from coefficients resulting from the private and public sectors, and plotted the distributions.

We define the public-sector wage premium as the difference between the two predicted values $p_{i,t} = \ln(\hat{w}^{public}_{i,t}) - \ln(\hat{w}^{private}_{i,t})$. Like Braga and others (2009) and Belluzzo and others (2005), we find some signs of compression of the premium at higher educational levels. However, we find the premium to be high across all years of schooling, which was not the case ten years ago, when they published their study.

Given their observable characteristics, at least 75 percent of workers would benefit today by moving from the private to the public sector in comparable jobs at all education levels.

Brazil: Civil Servants Median Wage Premia, 2014
(In percent difference over predicted private sector wages)



Sources: PNAD microdata; and IMF staff calculations.

While we control for many observable characteristics, the presence of unobservable attributes may bias our estimates, as these characteristics may affect workers' sector choice and earnings. For instance, risk-averse individuals may self-select into relatively safer public jobs, but they may also be those individuals with higher productivity resulting in higher wages. By modelling the transition of individuals across types of contracts and sectors, Emilio and others (2012) show that, under certain assumptions, public sector wage premia in Brazil are either not significantly higher or, where significant, are considerably smaller than those estimated in the literature.

Even when they don't worsen income inequality by themselves, implicit *education subsidies* use up resources that could otherwise be employed to improve income equality. While spending on education may be concomitantly pro-growth and pro-equality (Ostry and others, 2014), it can be also seen as a blanket subsidy and weakly targeted transfers generally constitute an inefficient use of scarce resources. In Brazil, public universities are tuition-free. They are also more accessible to children of wealthier parents, who often have studied in private primary and secondary schools (World Bank, 2016). Indeed, nearly half of the public university student population in the PNAD survey belongs to households in the top quartile of the income distribution, while only 9 percent of university students come from families in the bottom quartile (see Box 3). This type of implicit subsidy benefits the rich disproportionately. Equality of opportunities could be enhanced by redistributing resources away from tertiary education towards improving provision of early childhood and primary schooling which would improve overall spending progressivity (IMF, 2014).

Box 3. An Example of Poorly Targeted Transfers: Public Universities

Over the past decades, the educational level of Brazilians improved significantly. The share of population between 20 and 22 years old that completed at least secondary education increased from 45.5 percent in 2004 to 60.8 percent in 2014, according to data from the PNAD. The improvement was widespread across regions, as depicted by the curves shifting to the right in the figure. At the same time, Brazil has expanded access to tuition—free, tax payer-funded public universities. Between 2000 and 2014 the number of students in public universities more than doubled—from 0.89 million to 1.96 million (Ministry of Education, INEP, 2015).

Students from better-off households are overrepresented in public universities. Nearly half of the public university student population in the sample belongs to households in the top quartile of the income distribution, while only 9 percent of university students comes from the bottom quartile. Meanwhile, about 40 percent of the younger cohorts of the Brazilian population still fails to complete secondary education.

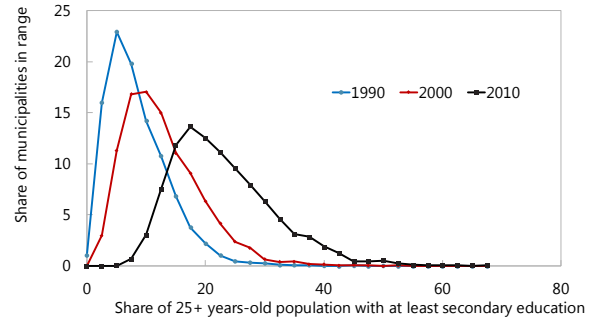
By updating Góes and Duque (2016), we provide a more robust evidence of the relationship between income and access to public universities. We estimate a logit model with PNAD data to obtain the probability of being public university student for individuals between 17 and 24 years old conditional on household’s income per capita and a set of controls:

$$\Pr(y_i = 1 | f_i, X_i) = \frac{e^{\phi f_i + X_i' \gamma}}{1 + e^{\phi f_i + X_i' \gamma}}, \quad y_i \in \{0,1\}$$

where y_i is a categorical variable denoting a student currently in a public university for individual i , f_i is household family income per capita and X_i' is a set of individual controls—which include age, gender, race and regional dummies (Appendix II, Table 6).

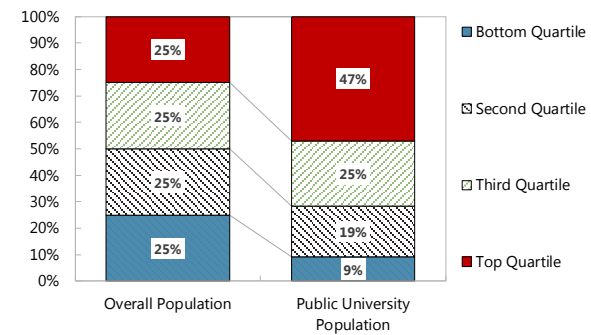
We find that, even after controlling for geographic and demographic characteristics, students from richer households are considerably more likely to attend public universities. In fact, a student in the 25th percentile of the income distribution has a 2 percent probability of attending a public university while the one in the 99th percentile has more than 30 percent probability of attending it. Although the relationship between income and university attendance is

Brazil: Share of Population With Secondary Education
(Distribution of Brazilian municipalities according to share of population with at least secondary education)



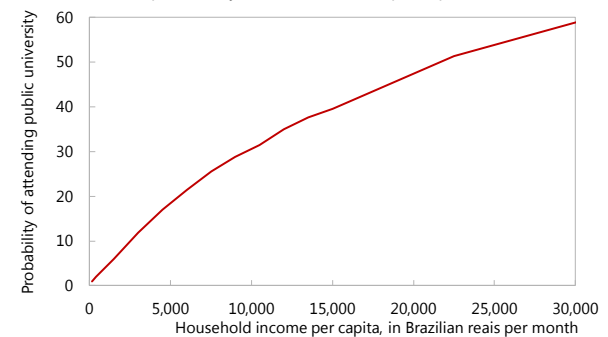
Sources: IMF staff calculations with census data compiled by UNDP.

Brazil: Overrepresentation of Top Quartile in Public Universities, 2014
(Share of overall population and public university population which belong to each quartile of household income per capita)



Sources: PNAD microdata; and IMF staff calculations.

Brazil: Probability of Attending Public University and Household 1/ Income, 2014 (In percent, by household income per capita)



Sources: PNAD microdata; and IMF staff calculations.
1/ Average predicted values from multivariate logit regression for different income cohorts.

Box 3. An Example of Poorly Targeted Transfers: Public Universities (Concluded)

not necessarily causal, the finding is consistent with the intuitive diagnostic that children with richer parents, who can afford to study in private primary and secondary schools, obtain easier access to publicly-funded universities (World Bank, 2016).

Redirecting government spending from tertiary to primary and secondary education would improve overall welfare and equality. Funding a student at the higher education level costs about four times as much as funding a student at the secondary education level in Brazil. This ratio is much higher than the OECD average of 150 percent (OECD, 2014). Given that many Brazilians do not complete secondary education and the rate of return to investment in human capital tends to be higher at lower levels of education (Heckman, 2008), targeting education spending on the poor and cutting subsidies to the rich can generate fiscal savings while making the access to education fairer, and ultimately equality of opportunities better.

ii. Regression Results

Below we present the results from the analysis of the drivers of changes in inequality in a regression framework. We use our data set constructed from the PNAD by aggregating individual data into state-level inequality indicators.⁸ We complement the state-level data with information on annual *Bolsa Família* state budgets and federal income tax revenues collected in states.

We run two sets of regressions. First, we regress the income of the top and bottom quartiles on the average income, civil servants' income, tax revenues, the share of formal sector workers in total employment, the share of civil servants in total employment, schooling, and the per capita *Bolsa Família* budget for each state, adding state dummies to control for time-invariant state-specific characteristics. Complete results are in Table 4 of Appendix II and the model is formally specified below.

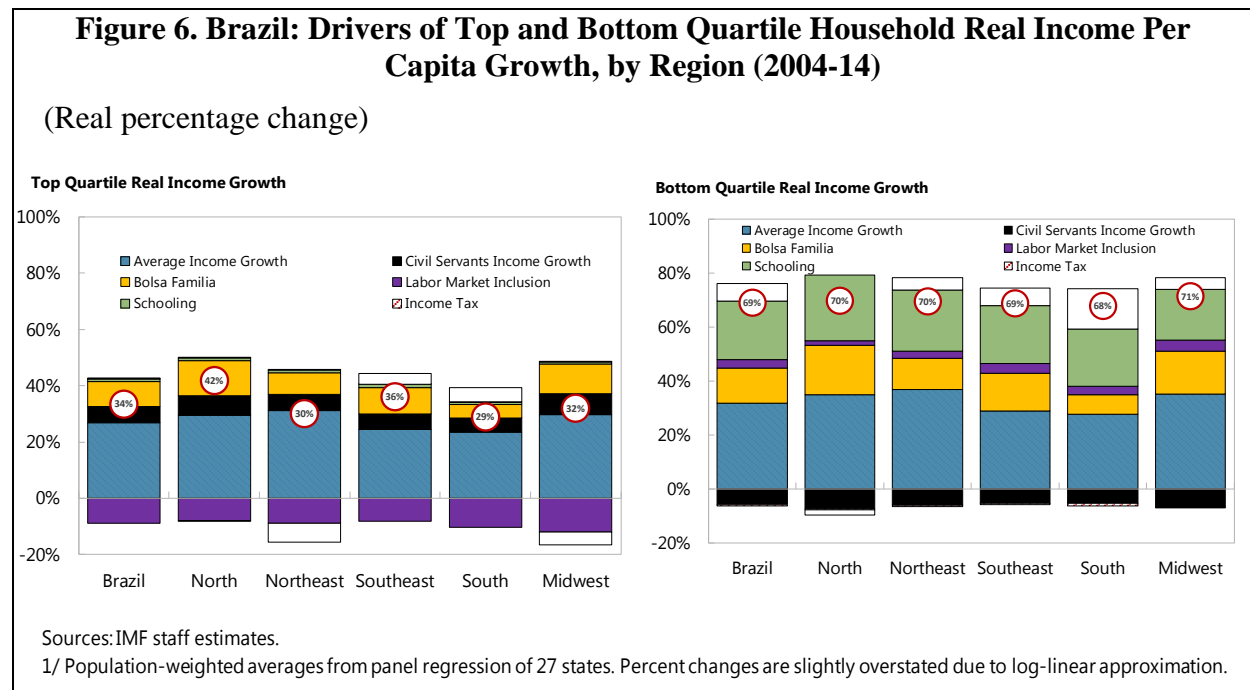
$$\begin{cases} y_{s,t}^{Q1} = \alpha_1 y_{s,t} + \beta_1 b_{s,t} + \omega_1 t_{s,t} + c'_{s,t} \gamma_1 + l'_{s,t} \phi_1 + h'_{s,t} \xi_1 + c_{1,s} + u_{1,s,t} \\ y_{s,t}^{Q4} = \alpha_2 y_{s,t} + \beta_2 b_{s,t} + \omega_2 t_{s,t} + c'_{s,t} \gamma_2 + l'_{s,t} \phi_2 + h'_{s,t} \xi_2 + c_{2,s} + u_{2,s,t} \end{cases} \quad (1)$$

where $y_{s,t}^{Q1}$ and $y_{s,t}^{Q4}$ are the natural logs of spatially price-adjusted average household income per capita for the bottom and top household income per capita quartiles for state s in year t ; $y_{s,t}$ is the natural log of spatially price-adjusted average household income per capita; $b_{s,t}$ is the natural log of spatially price-adjusted *Bolsa Família* per capita expenditures; $t_{s,t}$ are revenues from personal and corporate income taxes collected at the federal level as a share of state GDP;

⁸ See Appendix I for more details on the data sources and the construction of variables.

$c'_{s,t} = [w_{s,t}, k_{s,t}]'$ is a vector of civil servants' characteristics, with $w_{s,t}$ as the natural log of spatially price-adjusted average household income per capita of households headed by civil servants and $k_{s,t}$ as the share of civil servants in the state's workforce; $l'_{s,t} = [e_{s,t}, f_{s,t}]'$ is a vector of labor market characteristics, with $e_{s,t}$ as the employment rate and $f_{s,t}$ as the formalization rate; $h'_{s,t} = [h_{s,t}^{Q1}, h_{s,t}^{Q4}]'$ is a vector of educational characteristics, with $h_{s,t}^{Q1}$ and $h_{s,t}^{Q4}$ as the average schooling, in years, for the bottom and top household income per capita quartiles; $c_{1,s}$ and $c_{2,s}$ are the state-specific intercepts; $u_{1,s,t}$ and $u_{2,s,t}$ are residuals.

By looking separately at the top and bottom quartiles of the income distribution over the period (Figure 6), we find that bottom quartile incomes have been more responsive to overall income growth than top quartiles. In addition, increased schooling significantly raised incomes of the poor, but did not affect incomes of the top quartile. *Bolsa Família* had a higher impact on the bottom quartile incomes, but also appears to have increased the income of the top quartile, likely due to the high estimated multiplier effect of the program.⁹ Finally, labor formalization and civil servants' incomes have had opposite effects on the growth of top and bottom quartile income.



⁹ Neri, Vaz and Ferreira de Souza (2013) estimate the multiplier effect of *Bolsa Família* to be 1.78. Such a high number stems from the targeted nature of the program. Since poor households have higher marginal propensity to consume than richer households, targeted benefits have higher multiplier effects.

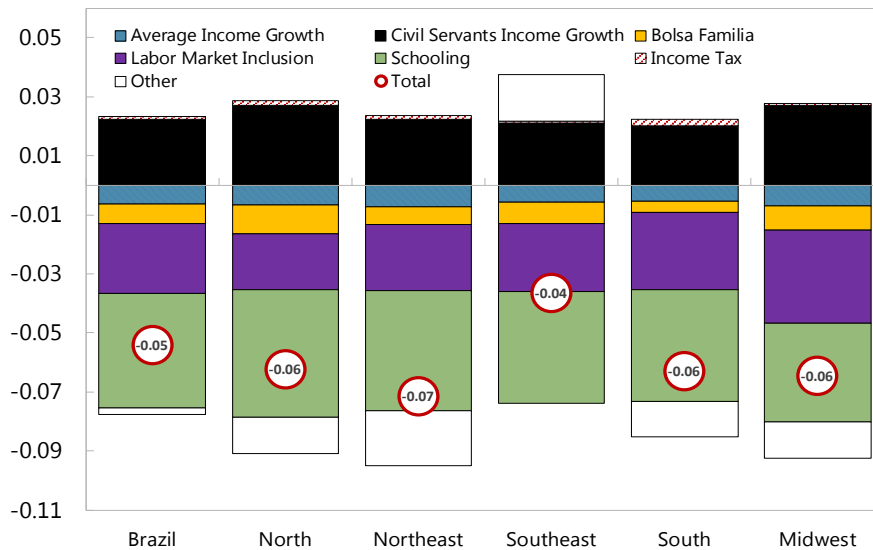
We then used the same set of regressors to explain within-state household income inequality, as specified below:

$$g_{s,t} = \alpha_3 y_{s,t} + \beta_3 b_{s,t} + \omega_3 t_{s,t} + c'_{s,t} \gamma_3 + l'_{s,t} \phi_3 + h'_{s,t} \xi_3 + c_{3,s} + u_{3,s,t} \quad (2)$$

where $g_{s,t}$ is the Gini coefficient for state s at period t ; and the other terms are the same as in equation (1).

We find that employment, labor formalization, income growth, *Bolsa Família* budgets and schooling contribute to explain inequality. The coefficients in the regression (Table 5 in Appendix II) are mostly significant and bear the expected sign, and the trajectories over time of these explanatory variables thus help explain the observed decline in inequality. Together, increased schooling and labor formalization explain the largest share of the decline in the Gini, but growth of average incomes and *Bolsa Família* also contributed to lowering inequality.¹⁰ In contrast, the growth of incomes of civil servants has affected equality negatively. Income taxes are not a significant determinant of inequality, possibly because the PNAD may be underestimating the income of the top 1 percent of the population (see below).

Figure 7. Brazil: Drivers of Within-State Income Inequality, by Region (2004-14) 1/
(Gini points)



Sources: IMF staff estimates.

1/ Population-weighted averages from panel regression of 27 states. Percent changes are slightly overstated due to log-linear approximation

¹⁰ The findings on *Bolsa Família* are in line with previous literature in Brazil which underlines the redistributive power of the program (Neri, 2010; Azzoni and Silveira-Neto, 2012).

Potential data limitations must be kept in mind when interpreting results from our study. It is important to note that in the PNAD income received by the population in the top 1 percent of the income distribution in Brazil may be underreported (Souza, 2013). If income of the richest segment of the population not captured in the PNAD has increased over time, inequality statistics could overstate the decline in inequality in the country. In a recent study by Medeiros and others (2015), the authors combine data from the personal income tax returns (DIRPF) in Brazil with the PNAD and conclude that a growing share of income was received by the top 1 percent between 2006 and 2012 which has caused overall inequality to stagnate over that period. However, such adjustment was not possible in our study as the DIRPF data is not available for the entire period under consideration. Implicit in our approach is also the assumption that estimated parameters are homogeneous and linear across states. This is a limitation by construction which implies that extrapolating results from our estimates to draw conclusions for the future or for specific states must be done cautiously.

D. Conclusions

In this study, we find evidence of a decline in inequality in Brazil, both between as well as within its 27 states from 2004 to 2014, and document the drivers of this phenomenon. Falling inequality can be attributed to convergence in households' incomes in the proximity of the mid-point of the state-wide distribution, which was stronger in more unequal states. We find that growth in incomes and labor formalization all contributed to declining inequality, but faster wage growth in the public sector played the opposite role. In terms of redistribution policies, *Bolsa Família* budgets were progressive, and so were higher schooling levels among the poor.

Against a backdrop of a recession that is eroding incomes of the poor, the policy framework will need to strike a balance between the goals of fiscal sustainability and income equality. The sharp recession has brought to the fore important reform priorities, such as social security, labor market and tax reforms, some of which are already at an advanced stage. Preserving equality gains and moving forward with the inclusiveness agenda will remain key for gathering support for these reforms. This can be achieved without further increases in spending, by moderating civil servants' wage growth and using direct instruments to provide benefits based on need (IMF, 2014), such as *Bolsa Família*. Improved access to education and educational attainment for lower-income families can be achieved by redirecting resources currently funding universal, tuition-free access to tertiary education, while continuing to support university students based on need. The tax system can rely more on direct taxation and less on indirect taxes. Finally, the minimum wage policy should provide appropriate remuneration for the poor without discouraging formal employment.

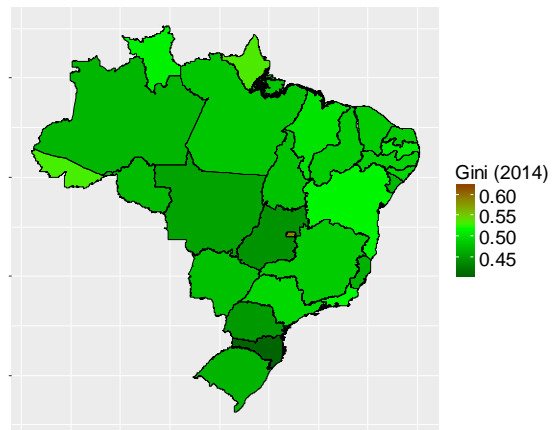
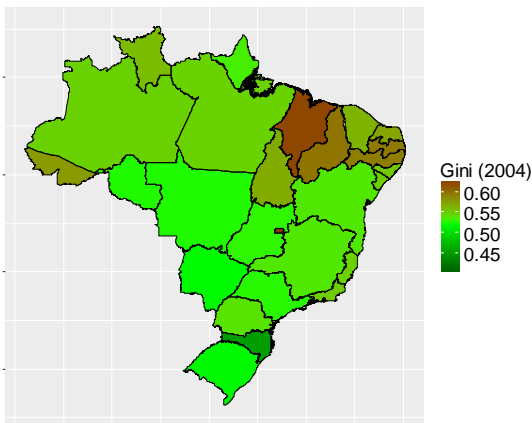
Appendix I. Data and Sources

Legend – States

Decline in Inequality in States 2004–15



Region	Acronym	State
North	AC	Acre
	AM	Amazonas
	AP	Amapá
	PA	Paraná
	RO	Rondônia
	RR	Roraima
	TO	Tocantins
Northeast	AL	Alagoas
	BA	Bahia
	CE	Ceará
	MA	Maranhão
	PB	Paraíba
	PE	Pernambuco
	PI	Piauí
	RN	Rio Grande do Norte
Southeast	ES	Espírito Santo
	MG	Minas Gerais
	RJ	Rio de Janeiro
	SP	São Paulo
South	PR	Paraná
	RS	Rio Grande do Sul
Midwest	MS	Mato Grosso do Sul
	MT	Mato Grosso
	GO	Goiás
	DF	Distrito Federal



Sources: PNAD, and IMF staff calculations.

Data Sources and Definition of Variables

The Households Survey—PNAD

Most of our data consists of a novel dataset constructed by the authors from PNAD microdata. PNAD (*Pesquisa Nacional por Amostra de Domicílios*) is a National Household Survey conducted on a yearly basis. It collects data on nearly 360,000 individuals distributed through about 140,000 households. In total, to build time series for each state between 2004–15, we used around 6 million data points.

The PNAD has two annual datasets. The first one presents collective characteristics of each household while the second one has specific characteristics of each individual. We incorporated the complex survey design of PNAD by using the weights that the survey provides for the relative representativeness of each household/individual and adjusting our estimates and reported errors by double clustering at the state and household levels.

Using the household database, we constructed household income per capita quantiles for states and assessed the dynamics of household characteristics, including consumption patterns, for each quantile. We also constructed time series, for each state, of inequality indices (Gini, General Entropy and Atkinson), based on household income per capita.

Using the individual database, we constructed time series, for each state, for the following indicators: average household income per capita; average wage per active worker; share of formal workers in total population; share of public sector employment in total employment, average years of schooling for adult population (above 16); share of population between 17 and 30 years old in private universities; share of population between 17 and 30 years old in public universities, per capita *Bolsa Família* budget.

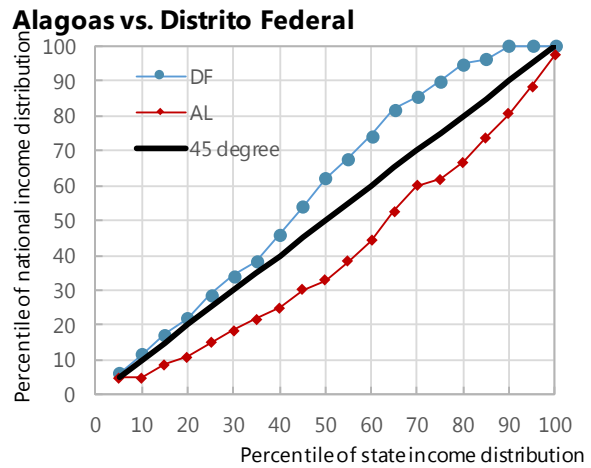
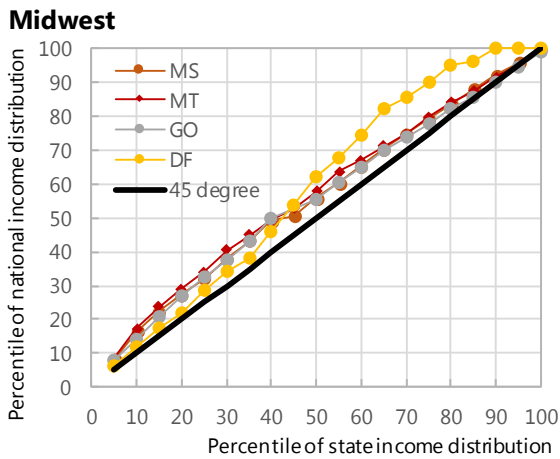
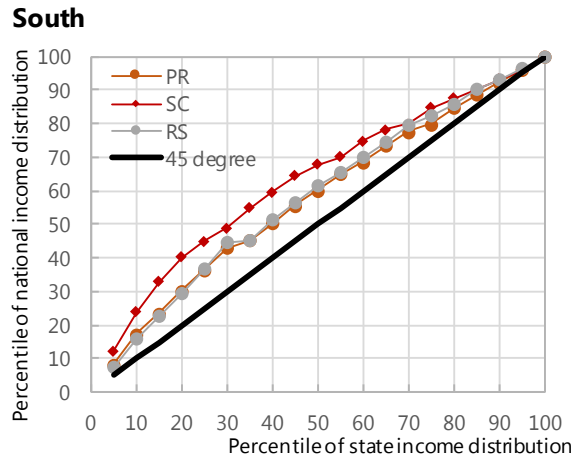
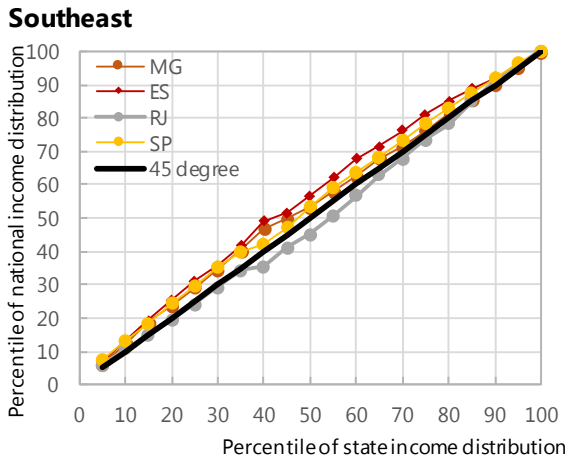
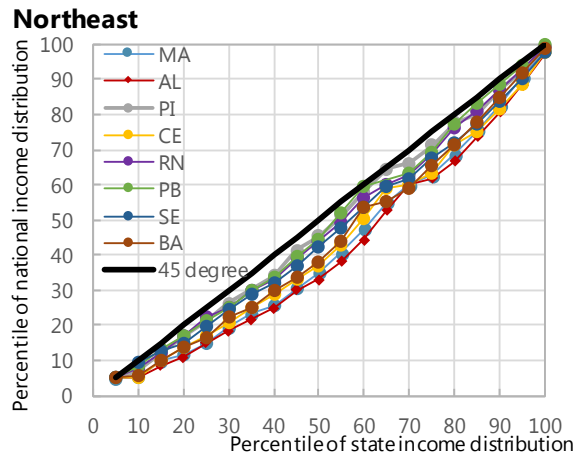
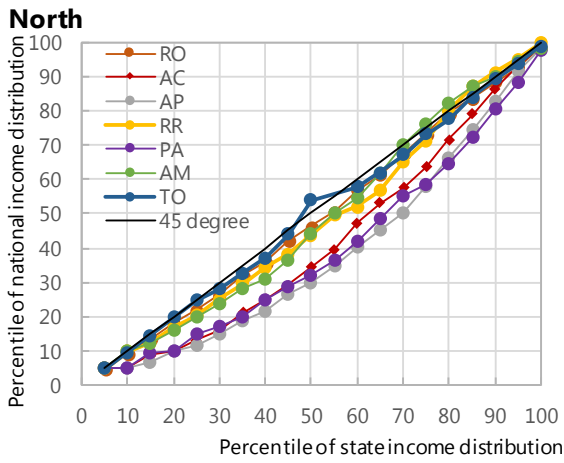
Definition of Variables used in the Baseline Regression

- Data on *Bolsa Família* budgets by state comes from the Brazilian Ministry of Social Development. We used these data to calculate the yearly real per capita outlays. The variable *Bolsa Família* was constructed by dividing the total *Bolsa Família* state budget by the state population after adjusting for spatial price differences and inflation. The indicator adjusted for spatial price differences.
- The **tax revenue** variable is constructed the federal personal and corporate income tax revenues collected by the states and reported by *Receita Federal*, divided by the state GDP from IBGE.
- Approximately between 40 and 80 percent of workers are “informal” in the dataset, depending on the state in which they reside. The **formal work** variable was constructed

from the answers in the PNAD and expressed as the share of formal workers in total for each state:

- “formal worker”
 - Formal contract (*carteira assinada*);
 - Military;
 - Civil servant;
 - Employer/entrepreneur;
 - Domestic employee with a formal contract (*doméstico com carteira assinada*);
 - Unpaid/Voluntary work (*não remunerado*);
 - Self-employed as a manager/director;
 - Self-employed as an artist.
 - “informal worker”
 - No formal contract (*sem carteira assinada*);
 - Domestic with no formal contract (*doméstico sem carteira assinada*);
 - Self-employed (except for manager/director and artist);
 - Self-consumption worker in production;
 - Self-consumption worker in construction.
- The **employment rate** variable is expressed as the share of persons who were working in the reference week in the total labor force (persons economically active, i.e. employed or actively looking for job).
 - The **average income** variable is the average household per capita income for the state aggregated from the household income indicator available in the survey and adjusted for spatial price differences. We base our estimates of inequality on after-tax per capita income as reported in the PNAD, which includes data on labor income, retirement benefits, disability and survivors’ pensions, social transfers and income from financial and real assets.
 - The **civil servant income** is equal to the household income per capita for households whose reference person (respondent) is a civil servant. The indicator is adjusted for spatial price differences.
 - The **schooling** variables is the average number of years of schooling for persons in the lower and top quartiles of the national household income per capita distribution.

Figure 1. Brazil: Household Income Per Capita Distribution, 2014
 (Percentiles of state and national income distributions, adjusted for spatial price differences)



Source: PNAD microdata; and IMF staff calculations.

Table 1. Brazil: Percentile of National Per Capita Income Distribution for Percentile of State-Wide Per Capita Income Distribution, 2014

Percentile of state-wide income per capita distribution	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
RO	5.0	9.4	13.5	18.3	22.0	26.3	31.9	35.7	42.2	46.3	50.6	56.9	61.3	67.5	73.1	79.4	83.6	88.5	92.7	98.5
AC	5.0	5.0	8.7	10.0	13.1	15.8	21.3	25.0	29.2	34.5	39.7	47.4	53.2	57.4	63.6	71.5	79.0	86.3	93.2	98.9
AP	5.0	5.0	6.5	10.0	11.7	15.0	19.1	21.4	26.5	30.0	34.8	40.0	45.0	50.2	58.0	66.3	74.7	82.9	91.4	98.2
RR	5.0	9.9	12.4	17.2	20.3	25.0	29.8	34.3	38.3	43.8	49.6	51.9	56.7	65.3	71.2	78.8	86.6	91.0	95.0	99.7
PA	5.0	5.0	9.4	10.0	14.4	17.0	20.0	24.8	28.4	32.2	36.4	41.9	48.8	55.0	58.4	64.2	72.1	80.5	88.2	97.3
AM	5.0	10.0	12.1	16.3	20.0	23.9	28.0	30.9	36.3	43.9	50.0	54.8	61.8	70.0	76.1	82.4	87.3	90.0	94.3	98.1
TO	5.0	9.7	14.6	19.9	24.8	28.0	32.6	37.1	44.0	53.8	n.a	57.8	61.9	67.3	73.2	77.7	83.9	89.1	93.6	98.8
MA	5.0	5.2	10.0	11.8	15.0	19.7	23.4	25.8	30.7	35.0	40.6	47.3	54.9	60.0	62.7	68.6	75.3	82.6	90.6	98.1
PI	5.0	7.1	11.6	16.6	21.2	26.2	30.0	34.2	41.4	45.5	51.2	58.0	64.5	66.1	71.2	77.7	80.5	87.3	92.8	98.8
CE	5.0	5.0	9.6	13.1	16.4	20.2	25.0	29.0	32.6	36.7	42.5	49.6	58.7	60.0	62.9	71.0	75.0	81.3	88.5	97.5
RN	5.0	7.9	12.3	16.9	22.2	25.0	30.0	33.2	38.9	44.0	49.5	56.5	60.0	63.0	68.5	76.5	81.0	86.8	93.1	99.3
PB	5.0	8.6	13.3	17.1	21.1	25.0	30.0	33.7	39.4	44.7	51.8	59.5	n.a	63.4	69.3	77.4	83.2	88.9	94.3	99.9
PE	5.0	6.1	10.0	12.0	15.6	20.0	24.4	28.3	32.2	37.0	42.6	49.3	51.8	56.7	62.9	70.3	75.4	82.1	89.5	98.0
AL	5.0	5.0	8.6	10.9	15.0	18.4	21.6	25.0	30.0	33.0	38.2	44.3	52.7	59.9	61.8	66.8	73.8	80.6	88.5	97.4
SE	5.0	9.6	12.6	15.0	19.6	24.7	29.0	32.1	36.9	42.3	47.5	53.8	59.6	61.8	67.6	71.8	77.6	83.9	90.0	97.7
BA	5.0	5.7	10.0	13.6	16.7	22.2	25.0	29.7	33.6	38.2	44.0	53.6	55.0	59.1	65.3	71.5	77.8	84.9	91.8	98.7
MG	6.4	12.4	18.8	23.8	29.4	34.9	40.9	48.7	50.0	53.5	58.3	62.7	68.1	71.8	76.7	81.2	85.7	90.1	95.1	100.0
ES	7.1	13.0	19.2	25.4	31.3	35.6	41.7	49.0	51.7	56.7	62.1	67.7	71.4	76.3	81.2	85.0	88.8	92.2	96.0	100.0
RJ	6.0	10.6	15.0	19.5	24.1	29.2	34.3	35.4	41.2	45.0	50.9	56.7	62.9	67.7	73.2	78.3	85.0	91.2	95.9	100.0
SP	7.2	13.5	18.3	24.7	29.6	35.1	40.0	42.1	46.9	53.5	58.9	63.6	68.0	73.2	78.3	82.9	87.4	91.7	95.9	100.0
PR	8.4	17.4	23.5	30.4	36.6	43.0	45.4	50.2	55.5	60.2	65.0	68.7	73.1	77.2	80.0	84.8	88.5	92.1	96.0	100.0
SC	12.4	24.0	32.8	40.3	45.0	48.8	55.0	59.7	64.5	67.9	70.1	75.0	78.3	80.0	84.7	87.4	90.0	93.1	95.9	100.0
RS	7.3	15.8	22.5	29.5	36.7	44.2	45.0	51.4	56.2	61.7	65.0	70.0	74.6	79.3	82.2	85.4	90.0	93.2	96.6	100.0
MS	8.1	16.5	22.4	27.4	32.0	37.9	43.2	49.2	50.5	55.8	60.2	65.2	70.3	75.0	79.4	83.6	87.9	92.2	95.9	100.0
MT	8.4	17.4	23.7	29.0	34.0	40.4	45.0	49.3	52.8	57.9	63.6	67.0	71.3	75.0	80.0	84.0	87.6	91.6	95.0	99.6
GO	7.9	14.1	20.8	27.1	32.5	37.8	43.3	49.6	n.a	55.3	60.3	65.2	70.0	73.7	77.9	82.2	85.5	90.0	94.4	99.1
DF	6.3	11.7	17.4	21.9	28.9	34.3	38.2	46.1	54.0	62.1	67.9	74.2	82.0	85.5	90.0	94.9	96.4	100.0	100.0	100.0
Range (Max - Min)	2	5	6	8	9	9	10	10	10	11	10	10	9	9	8	7	6	5	3	1

Sources: PNAD microdata; and IMF staff calculations.

Table 2. Brazil: Household Income per Capita by State Household Income Percentile, 2014

(Percentile average, in current reais per capita, adjusted for spatial price differences)

Percentile of state-wide income per capita distribution	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
RO	120	223	286	349	398	444	513	574	649	716	780	841	929	1,046	1,208	1,376	1,589	1,913	2,482	5,689
AC	70	150	200	244	279	321	379	426	482	548	621	721	787	860	987	1,143	1,409	1,768	2,664	5,834
AP	71	142	185	223	264	307	347	389	447	499	556	626	687	761	885	1,021	1,258	1,588	2,261	5,541
RR	128	226	273	327	381	430	485	541	610	681	762	789	847	999	1,141	1,452	1,801	2,264	3,046	6,431
PA	89	163	210	258	294	335	382	423	471	528	583	653	762	808	870	986	1,166	1,459	1,981	4,594
AM	137	224	271	324	370	408	461	513	580	674	759	826	942	1,113	1,302	1,540	1,835	2,169	2,721	4,957
TO	113	226	300	362	415	461	528	592	682	813	836	859	935	1,057	1,200	1,342	1,625	2,028	2,602	6,231
MA	84	165	223	267	310	354	408	446	502	566	633	720	827	886	951	1,081	1,271	1,585	2,196	5,151
PI	111	187	264	330	383	443	491	551	636	695	772	874	978	1,031	1,151	1,324	1,468	1,807	2,465	6,098
CE	83	162	225	282	328	379	434	474	534	598	663	763	876	898	967	1,126	1,260	1,508	2,053	5,159
RN	96	199	272	334	391	447	486	540	607	676	754	843	911	951	1,079	1,279	1,453	1,821	2,576	5,851
PB	93	210	281	332	383	445	491	546	622	691	777	902	933	965	1,113	1,325	1,611	1,992	2,905	6,623
PE	77	170	229	273	321	380	418	467	529	590	664	769	789	843	960	1,116	1,274	1,526	2,092	5,197
AL	67	135	207	257	301	346	391	446	483	535	606	684	791	906	936	1,031	1,203	1,458	2,021	4,807
SE	122	218	273	312	361	426	471	523	590	651	726	811	885	934	1,054	1,168	1,342	1,640	2,129	5,420
BA	82	165	227	278	328	390	436	480	541	604	681	800	828	893	1,005	1,148	1,350	1,679	2,356	6,333
MG	147	270	355	416	485	552	629	716	764	795	864	939	1,045	1,158	1,303	1,497	1,729	2,113	2,970	7,702
ES	163	285	366	432	509	574	645	758	787	845	941	1,054	1,161	1,296	1,469	1,654	1,970	2,441	3,404	6,637
RJ	141	240	307	362	417	483	556	596	631	695	763	843	948	1,061	1,197	1,380	1,700	2,217	3,272	7,594
SP	165	285	356	422	493	563	610	652	726	812	883	968	1,072	1,208	1,355	1,575	1,862	2,342	3,382	8,192
PR	197	336	415	497	579	669	728	763	835	911	991	1,082	1,206	1,333	1,469	1,649	1,934	2,404	3,357	7,675
SC	258	416	533	633	700	751	832	895	969	1,058	1,146	1,240	1,355	1,460	1,623	1,846	2,111	2,586	3,379	6,423
RS	175	311	400	488	586	678	705	772	852	925	1,011	1,119	1,242	1,384	1,532	1,744	2,032	2,551	3,522	7,768
MS	190	317	398	456	523	600	669	749	777	838	912	1,010	1,125	1,260	1,400	1,593	1,916	2,382	3,331	7,660
MT	192	332	407	478	551	626	706	741	790	865	964	1,046	1,147	1,280	1,435	1,600	1,860	2,320	3,054	7,037
GO	183	298	382	451	530	599	677	775	799	822	910	1,001	1,098	1,207	1,352	1,531	1,729	2,095	2,787	6,355
DF	151	257	329	398	479	556	611	702	803	930	1,067	1,231	1,488	1,743	2,151	2,732	3,523	4,523	6,344	12,938
Range (Max - Min)	49	71	84	97	110	121	128	138	139	146	155	165	193	230	282	356	464	604	854	1,637

Sources: Authors' estimates with dataset consolidated from PNAD microdata.

Table 3. Brazil: Time Series of Spatial Price Adjustment Factors by State

(Average for the state, relative to national average)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
RO	0.875	0.903	0.930	0.877	0.919	0.959	0.977	0.995	0.874	0.847	0.960
AC	1.042	0.837	0.842	1.034	0.975	0.902	0.938	0.975	0.939	0.909	0.911
AP	1.022	0.970	0.919	1.025	1.065	1.039	1.081	1.122	0.980	1.020	1.061
RR	0.925	1.074	0.966	0.975	1.037	1.070	1.001	0.932	0.919	0.843	0.923
PA	0.929	0.987	0.944	0.960	0.950	0.951	0.954	0.958	0.954	0.912	0.891
AM	1.044	1.068	1.210	1.023	0.919	0.983	1.014	1.045	0.945	1.015	0.933
TO	0.854	0.838	0.875	0.869	0.856	0.810	0.812	0.814	0.835	0.820	0.813
MA	0.828	0.715	0.734	0.804	0.806	0.748	0.740	0.731	0.723	0.762	0.776
PI	0.650	0.675	0.763	0.695	0.780	0.710	0.679	0.648	0.638	0.679	0.668
CE	0.761	0.768	0.752	0.756	0.751	0.763	0.754	0.746	0.754	0.765	0.774
RN	0.759	0.766	0.735	0.777	0.804	0.814	0.791	0.768	0.785	0.778	0.743
PB	0.693	0.713	0.711	0.703	0.730	0.790	0.770	0.750	0.755	0.753	0.792
PE	0.819	0.848	0.809	0.796	0.818	0.801	0.813	0.825	0.877	0.838	0.887
AL	0.699	0.714	0.700	0.717	0.703	0.719	0.712	0.706	0.718	0.721	0.740
SE	0.742	0.727	0.732	0.728	0.760	0.790	0.761	0.732	0.745	0.768	0.758
BA	0.819	0.849	0.854	0.879	0.856	0.854	0.844	0.835	0.856	0.821	0.846
MG	0.872	0.893	0.873	0.889	0.879	0.881	0.892	0.903	0.909	0.940	0.923
ES	0.870	0.881	0.863	0.910	0.888	0.931	0.923	0.916	0.915	0.925	0.890
RJ	1.245	1.225	1.206	1.193	1.213	1.238	1.235	1.232	1.210	1.202	1.201
SP	1.133	1.111	1.102	1.094	1.092	1.103	1.126	1.148	1.158	1.180	1.177
PR	0.892	0.916	0.935	0.965	0.949	0.961	0.951	0.942	0.981	0.976	0.966
SC	0.919	0.996	1.007	1.047	1.019	1.059	1.040	1.022	0.987	1.010	0.996
RS	1.053	1.051	1.061	1.041	1.036	1.018	1.016	1.015	1.005	1.017	1.027
MS	0.883	0.919	0.983	0.927	1.002	0.921	0.950	0.980	0.905	0.954	0.982
MT	1.054	1.076	0.990	0.901	1.085	0.996	0.991	0.987	0.922	0.968	0.913
GO	0.873	0.899	0.870	0.997	0.884	0.926	0.917	0.908	1.035	0.944	0.920
DF	1.286	1.239	1.257	1.256	1.274	1.273	1.300	1.328	1.276	1.254	1.241

Sources: Authors' estimates with dataset consolidated from PNAD microdata.

Table 4. Brazil: Drivers of Top and Bottom Quartile Household Income per Capita (2004–14)

Variables	Dependent Variable, with state fixed effects							
	Spatially price-adjusted bottom quartile HH income per capita, log				Spatially price-adjusted top quartile HH income per capita, log			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Average spatial-price adjusted real HH income per capita, log	1.402*** (0.099)	0.994*** (0.108)	0.722*** (0.079)	0.734*** (0.072)	0.573*** (0.042)	0.496*** (0.053)	0.594*** (0.058)	0.618*** (0.067)
Civil servants' spatial-price adjusted real HH income per capita, log	-0.141 (0.095)	-0.186** (0.073)	-0.131** (0.058)	-0.135** (0.056)	0.182*** (0.041)	0.173*** (0.039)	0.153*** (0.032)	0.145*** (0.034)
Share of civil servants in workforce, pct				-0.002 (0.005)				-0.005 (0.004)
Spatial-price adjusted real Bolsa Familia expenditure per capita, log		0.244*** (0.037)	0.135*** (0.034)	0.134*** (0.033)		0.047** (0.024)	0.092*** (0.030)	0.090*** (0.031)
Share of formal workers in workforce, pct			0.002 (0.002)	0.002 (0.002)			-0.010*** (0.002)	-0.010*** (0.002)
Employment Rate, pct			0.005 (0.005)	0.005 (0.005)			0.001 (0.004)	0.001 (0.004)
Average Formal Schooling Years for Adults, Bottom Quartile			0.157*** (0.017)	0.156*** (0.017)			-0.001 (0.028)	-0.003 (0.026)
Average Formal Schooling Years for Adults, Top Quartile			-0.008 (0.016)	-0.007 (0.016)			0.012 (0.012)	0.015 (0.013)
Federal Income Tax Revenue, share of state GDP		-0.005 (0.015)	-0.013 (0.010)	-0.013 (0.010)		-0.003 (0.010)	0.003 (0.010)	0.003 (0.010)
Constant	-3.139*** (0.354)	-1.186** (0.488)	-0.348 (0.531)	-0.375 (0.512)	2.512*** (0.214)	2.880*** (0.195)	2.281*** (0.452)	2.224*** (0.463)
Observations	297	297	297	297	297	297	297	297
Number of states	27	27	27	27	27	27	27	27
R2 Overall	0.927	0.952	0.966	0.966	0.949	0.950	0.958	0.958
R2 Within	0.905	0.938	0.956	0.956	0.876	0.880	0.898	0.899
R2 Between	1	1	1	1	1	1	1	1

Robust standard errors clustered at the state level in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Sources: Authors' estimates with dataset consolidated from PNAD microdata; Secretaria da Receita Federal data on taxes; and Ministry of Social Development data on *Bolsa Família*.

Table 5. Brazil: Drivers of Within-State Household Income Inequality in Brazil (2004–14)

Variables	Dependent Variable: State Gini Coefficient							
	State Fixed Effects				Random Effects			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Average spatial-price adjusted real HH income per capita, log	-0.158*** (0.021)	-0.092*** (0.030)	-0.036 (0.025)	-0.019 (0.019)	-0.151*** (0.016)	-0.142*** (0.016)	-0.042** (0.017)	-0.039** (0.017)
Civil servants' spatial-price adjusted real HH income per capita, log	0.071*** (0.020)	0.075*** (0.018)	0.065*** (0.015)	0.059*** (0.015)	0.080*** (0.018)	0.101*** (0.018)	0.080*** (0.014)	0.080*** (0.015)
Share of civil servants in workforce, pct				-0.003* (0.002)				-0.001 (0.001)
Spatial-price adjusted real Bolsa Familia expenditure per capita, log		-0.034*** (0.011)	-0.010 (0.010)	-0.011 (0.009)		-0.020*** (0.006)	-0.018*** (0.005)	-0.018*** (0.005)
Share of formal workers in workforce, pct			-0.002** (0.001)	-0.002** (0.001)			-0.002*** (0.001)	-0.002*** (0.001)
Employment Rate, pct			-0.002 (0.001)	-0.002 (0.001)			-0.003*** (0.001)	-0.003*** (0.001)
Average Formal Schooling Years for Adults, Bottom Quartile			-0.027*** (0.007)	-0.028*** (0.007)			-0.024*** (0.006)	-0.023*** (0.005)
Average Formal Schooling Years for Adults, Top Quartile			0.010*** (0.004)	0.012*** (0.004)			0.013*** (0.004)	0.014*** (0.004)
Federal Personal Income Tax Revenue, share of state GDP		-0.008 (0.005)	-0.006 (0.004)	-0.006 (0.004)		-0.007 (0.005)	-0.006* (0.004)	-0.006* (0.004)
Constant	1.017*** (0.084)	0.708*** (0.127)	0.513*** (0.167)	0.475*** (0.147)	0.932*** (0.090)	0.810*** (0.093)	0.591*** (0.093)	0.584*** (0.093)
Observations	297	297	297	297	297	297	297	297
Number of states	27	27	27	27	27	27	27	27
R2 Overall	0.776	0.801	0.842	0.845	0.276	0.407	0.675	0.670
R2 Within	0.445	0.506	0.607	0.617	0.440	0.490	0.598	0.602
R2 Between	1	1	1	1	0.222	0.375	0.745	0.741

Robust standard errors clustered at the state level in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Sources: Authors' estimates with dataset consolidated from PNAD microdata; Secretaria da Receita Federal data on taxes; and Ministry of Social Development data on Bolsa Família.

Table 6. Brazil: Logistic Regression: Determinants of Attending Public University, 2014 1/

Marginal Effects on Probability of Attending Public University		
	(1)	(2)
LN of HH income per capita	0.025*** (0.001)	0.022*** (0.001)
Age		0.001*** (0.000)
Male		-0.004*** (0.001)
Black		-0.014*** (0.003)
Brown		-0.013*** (0.002)
Asian		0.016** (0.007)
Native Brazilian		-0.024* (0.013)
North Dummy		0.021*** (0.002)
Northeast Dummy		0.021*** (0.001)
South Dummy		-0.000 (0.002)
Midwest Dummy		0.013*** (0.002)
Pseudo-R2	0.0716	0.0953
Observations	40,385	40,385

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Sources: PNAD microdata; and IMF staff calculations.

1/ Coefficients denote the expected marginal response in the dependent variable after a unit change in the independent variable at specific points. Continuous variables (age and income) have been calibrated such that coefficients denote the marginal responses at their respective medians. Categorical variables (gender, race, and state dummies) have been calibrated to zero and the coefficients denote the marginal responses after a change from zero to one in the categorical variable. Households' income per capita was adjusted for spatial price differences.

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