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A more level playing field?

Explaining the decline in earnings inequality in Brazil, 1995-2012

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Abstract:

The Gini coefficient of labour earnings in Brazil fell by 20% between 1995 and 2012, from 0.5 to 0.4. The decline was even larger by other measures, with the 90-10 percentile ratio falling by almost 40%. Although the conventional explanation of falling returns to education did play a role, a RIF regression-based decomposition analysis suggests that substantial reductions in the gender, race and spatial wage gaps, *conditional* on human capital and institutional variables, explain the lion's share of the decline in earnings inequality. Lower male, white, urban and Southeast wage premia, alongside lower formal-informal wage gaps, account for 6.3 of the ten Gini points difference between 1995 and 2012. Although rising minimum wages contributed to the decline during 2004-2012, they had no such effect during 1995-2002.

Keywords: Earnings inequality; Brazil; RIF Regressions

JEL Codes: D31, J31

1. Introduction

Long one of the world's most unequal countries, Brazil has experienced a non-trivial reduction in income inequality since macroeconomic stabilization around 1994-1995. The Gini coefficient for the country's distribution of household per capita income fell by 12%, from 0.59 in 1995 to 0.52 in 2012. The decline was particularly pronounced since 2003, a period during which average incomes grew relatively rapidly – by as much as 40% overall – and poverty fell sharply. Brazil was not alone: similar trajectories were observed in a number of other Latin American countries – such as Argentina, Peru and Ecuador - over the same period.[1]

This performance has naturally attracted widespread attention, both among researchers and among policy-makers in other countries. Interest has been piqued in Africa, for example, where a handful of countries – including South Africa, Namibia and Botswana – also have very high levels of inequality. Brazil is often seen as a more relevant case study for these countries than, say, nations in Europe or North America: it is also a developing country, albeit with somewhat higher levels of per capita income. It is also a primary commodity exporter, benefitting (at the time) from the commodity price boom. And, having been on the receiving end of the historical transatlantic slave trade, it has a very substantial population of African origin. It is natural, therefore, that there should be interest from many quarters on whether there might be any lessons from the Brazilian experience with poverty and inequality reduction in a context of rising incomes.

Much of the popular discourse on this subject has typically stressed the role of fiscal redistribution as a key driver of Brazil's inequality decline. In 2003, Brazil's federal government launched a conditional cash transfer (CCT) program, named *Bolsa Família*, which has since reached upwards of 50 million people, and become one of the world's largest CCT programs.

Although changes in the distribution of non-labour incomes – including Bolsa Família, the *Benefício de Prestação Continuada* (BPC) and non-contributory rural pensions – have indeed contributed to the reduction in household income inequality, the best available estimates put this contribution at between 35% and 50% of the

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[1] See López-Calva and Lustig (2010) for the classic account of this recent decline in Latin American inequality.

overall decline (Barros et al. 2010; Azevedo et al. 2013). Another 10% or so has been attributed to demographic factors, chiefly the rapid decline in family sizes, which has been most pronounced among poorer households.

The remaining 40-55% of the decline in inequality in household incomes is attributed to changes in the distribution of labour earnings. Indeed, visual inspection of Figures 1 and 2 suggests that real labour earnings and (per capita) household incomes have behaved similarly in the 1995 – 2012 period. Figure 1 shows the evolution in *levels*, for mean and median labour earnings (in green) and for mean household per capita income.

Figure 1: Household incomes and labour earnings in Brazil, 1995-2012: levels.
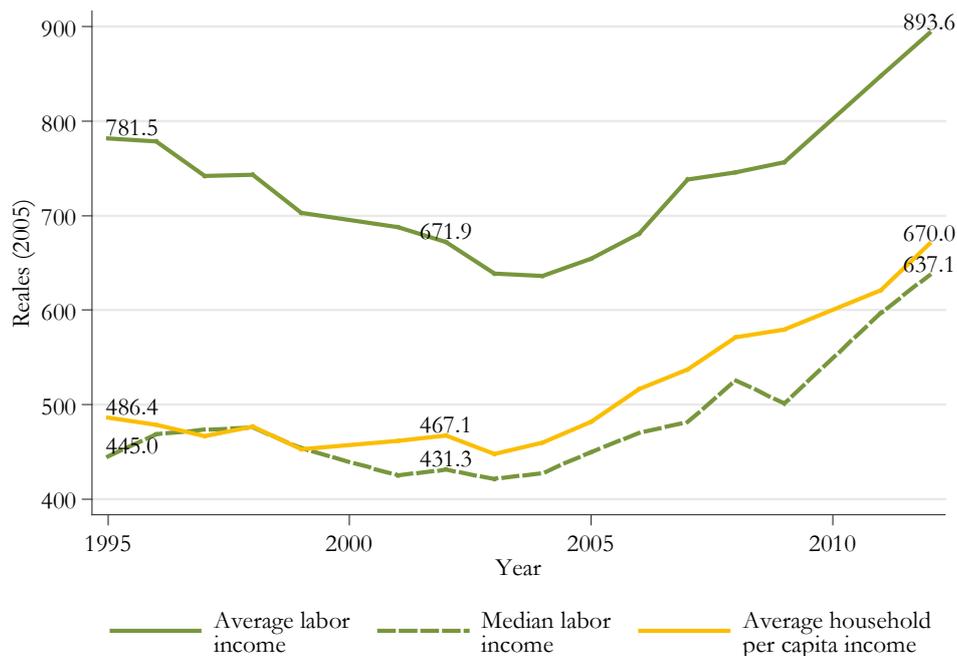
Figure 1 suggests that it may be helpful to distinguish between two sub-periods. From 1995 to 2002, both earnings and household incomes were stable or declining. More precisely, median labour earnings and average household per capita incomes were roughly constant, while mean labour earnings fell by almost 15%. (Of course, a falling mean with a stable median is immediately suggestive of falling inequality, as we shall see in a moment.) The situation changed around 2002-03, when

all three series begin to trend sharply upward. Average earnings in the labour market, for example, experienced an increase of about 40% from 2002 to 2012. Median earnings and household incomes also grew rapidly in this second sub-period.[2]

There is no correspondingly sharp break in the series when one looks at the trends in *inequality*, rather than in levels. Figure 2 shows the point estimates and 95% confidence intervals for the Gini coefficients of total household income per capita (in yellow) and of labour earnings (in green). During 1995-2002, the decline in income inequality is clearly less rapid than that in labour earnings, for which the Gini loses three points. But both appear to be falling throughout. The second sub-period sees a continuation in the decline in labour earning inequality, and an acceleration in the decline for household incomes. Over the full seventeen years, income inequality falls by about 12% and earnings inequality by as much as 20%, when both are measured by the Gini coefficient. Furthermore, Figure 3 shows that the decline in earnings inequality is robust to the choice of index: the reductions are actually larger when measured by the Theil (T) index, and by the 90-10 percentile ratio, at 34% and 37% respectively.

Figure 2: Household incomes and labour earnings in Brazil, 1995-2012: inequality.
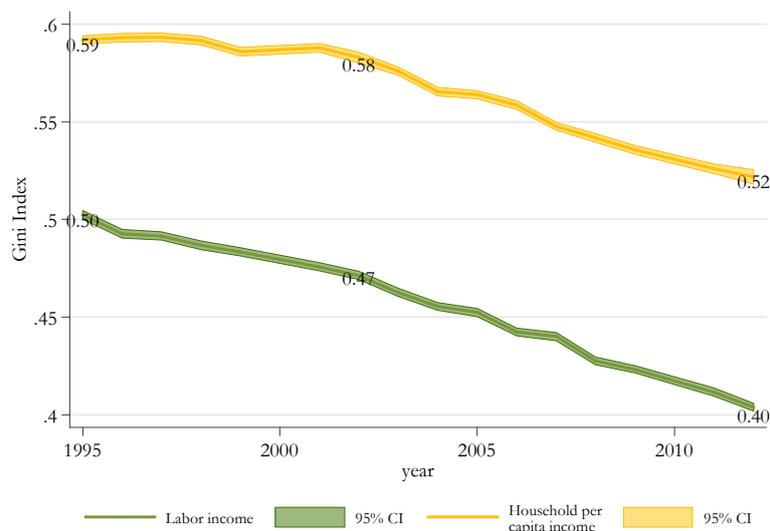
Note: The Gini index of labor income covers all the occupied employees between 18 and 65 years. The Gini index of household per capita income covers the entire population.

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[2] The causes of this inflection and of the boom decade of 2002-2013 go beyond the scope of this paper. 2002 was of course the year when President Luis Inácio Lula da Silva took office. It is also now commonly viewed as the beginning of the commodity price super-cycle, which benefited all commodity exporting countries in Latin America, as well as most resource-rich countries in Africa.

Figure 3: Changes in earnings inequality in Brazil, 1995-2012: different indices.
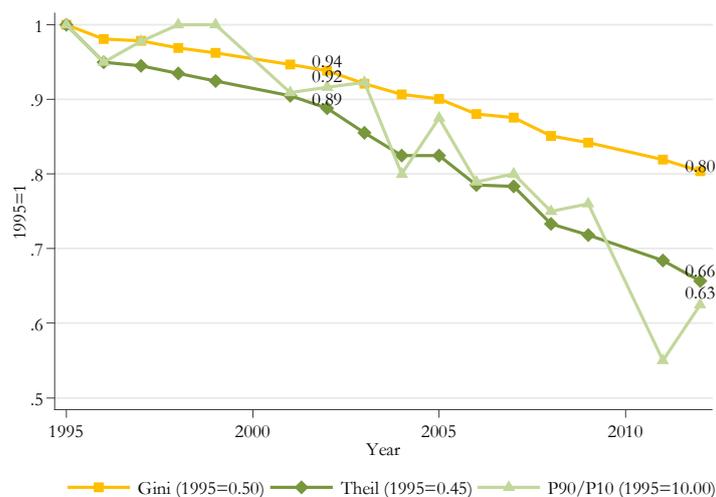
This paper investigates the determinants of these trends in both the levels and the inequality in labour earnings in Brazil during 1995-2012. We do so by means of rigorous statistical decomposition techniques aimed at assessing the relative magnitudes of each of four groups of candidate explanatory factors, namely: (i) human capital; (ii) labour market institutions; (iii) demographic composition of the labour force; and (iv) spatial segmentation. As is standard in labour economics, for each group of factors, we separate out what can be attributed to changes in the distribution of the observable worker characteristics themselves - the composition or endowment effect – and what is due to changes in returns to those characteristics - the pay structure effect.[3]

We do not focus only on average earnings, and are in fact primarily interested in changes in the dispersion or inequality present in the earnings distribution, such as those described above. We therefore follow recent decomposition methods based on Firpo et al. (2009) and Fortin et al. (2011) to separately measure the quantitative impact that each of these different factors had on changes in the earnings distribution.

Unlike most of the previous literature, our results highlight the importance of demographic, spatial and institutional factors in explaining the decrease in earnings inequality over the period being analyzed. While increases in the stock of human capital in the Brazilian labour force – both in terms of years of education and

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[3] This follows a long tradition that can be traced back to Oaxaca (1973) and Blinder (1973).

experience – account for an important share of the increase in *levels* of pay, human capital is a relatively small contributor to the decline in inequality. Institutional factors do play a role – largely through the increase in the share of formal employment. Perhaps most surprisingly, a substantial share of the decline in earnings inequality can be attributed to lower gender and race wage gaps, and to lower urban and regional wage premia, *conditional* on educational and institutional factors.

The paper is organized as follows. The next section reviews the candidate explanatory factors in more detail, and discusses the institutional context. Section 3 briefly describes the data used in the analysis. The empirical method is described in Section 4 and Section 5 presents the results. Section 6 concludes.

## 2. Candidate explanations and institutional background

The recent literature -- e.g. Barros et al. (2010), Ferreira et al. (2008) -- suggests two main (and clearly related) mechanisms that may account for this reduction in earnings inequality: (i) rising levels of educational attainment in the labour force, particularly at the secondary level; and (ii) a decline in the wage schooling premium. In other words, they suggest that the dominant explanation for falling wage inequality in Brazil lay firmly in the domain of human capital: as the supply of educated workers rose faster than the demand for them, skill premia (or returns to education) fell, leading to a more compressed wage distribution.

While, as we will see, both of these mechanisms (within the human capital group) did play a role, other factors besides rising levels of educational attainment and reductions in the school premium were at play during these seventeen years. These include changes in Brazil's labour market institutions, such as the level and coverage of minimum wages, and the degree of enforcement of formal employment contracts. They also include changes in the gender and racial composition of the labour force, and in the corresponding wage premia. And finally, there were also changes in the relative importance of differential spatial areas: both rural versus urban, and across the country's five main geographical regions (North, Northeast, Center-West, Southeast and South), and in the associated wage gaps.

We look at each of the four groups of candidate explanatory factors in turn, beginning with **human capital**. Figure 4 documents changes in the two standard components of human capital: education and experience. Panel A shows the cumulative distribution functions for years of schooling in the working age population (18-65), at three points in time: 1996, 2003 and 2012. These distribution functions clearly illustrate a rather dramatic expansion in the supply of years of schooling in the labour force. The proportion of the working age population with at least ten years of schooling, for example, increased from 25% to 55% between 1996 and 2012.[4]

In the absence of information on actual experience per worker, Panel B of Figure 4 shows the evolution of the age structure of the working age population. With higher levels of schooling and longer life expectancy it is no surprise that it is easier to find older workers than 20 years ago. The proportion of working-age population aged 30 or over increased from 60 to 67% (a 10% increase over the period), and those aged 45 or over increased from 25% to 33% (a 32% increase). Given that age correlates closely with labour market experience, the panel illustrates another channel through which the human capital stock in the Brazilian labour force was rising over this period.

Figure 4: Changes in the distribution of human capital: 1995-2012.

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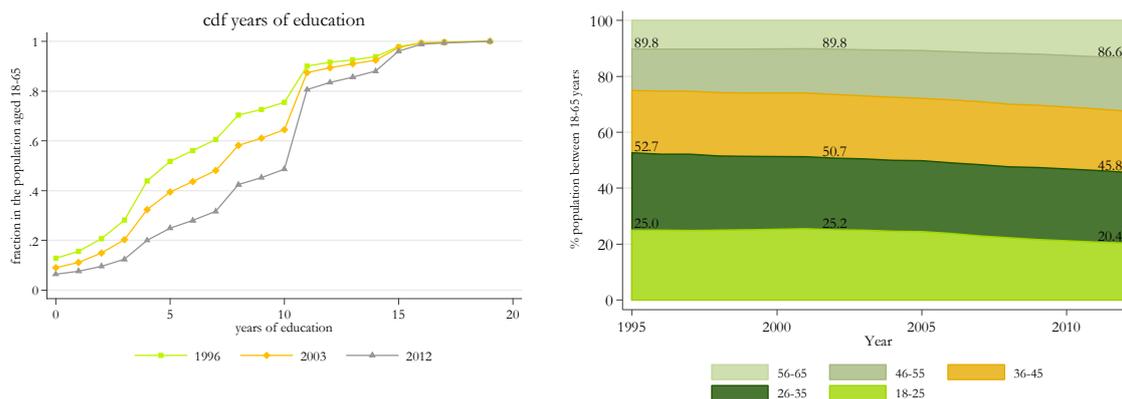
[4] This increase in the supply of educated workers reflects educational policy changes dating back to the late 1980s, but also the subsequent decentralization of basic education funding from the state level to municipal level, as well as changes in the funding system with the creation of FUNDEB (*Fundo Nacional para o Desenvolvimento da Educação Básica*) to reallocate funding according to demand.

The second group of candidate explanatory factors concerns changes in Brazil's **labour market institutions**. Under this heading, we focus on two variables in particular: changes in the level and coverage of the national minimum wage; and changes in the extent of formal and informal employment, as well as self-employment. Figure 5 below plots the trajectory of minimum wages in the 1995-2012 period, alongside those of mean and median wages. While real mean and median earnings increased by 14% and 43% respectively, real minimum wage increased by 103% (i.e. more than doubled) over the full period. Interestingly, the bulk of that increase took place in the second sub-period: between 2002 and 2012, the real minimum wage index in Figure 5 rose from 1.20 to 2.03.

Figure 5: Minimum wages and the evolution of earnings: 1995-2012.
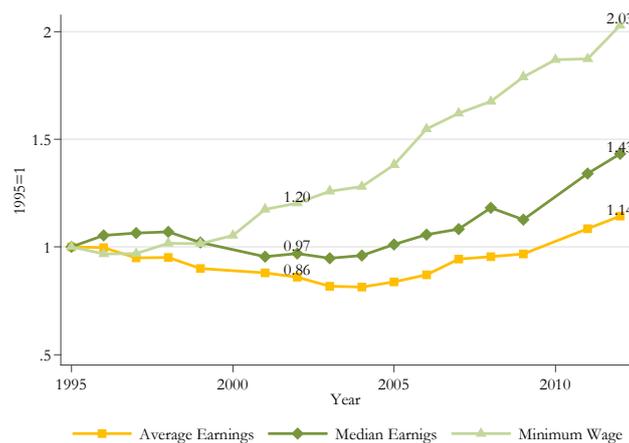
The effect of these trends on the earnings distribution can be inferred from inspection of Figure 6, which plots the density functions for real earnings for the years 1995-96, 2002-03 and 2011-12. Vertical lines indicate the values of the minimum wage in each year, and the corresponding spikes are clearly visible. One can also see how the earnings distribution moved to the right and became more compressed as time passed. Nevertheless, although such a large increase in minimum wages is clearly associated with a move of density mass to the right, there is a non-negligible mass of workers that remains below the minimum wage threshold: Over the full period, the proportion of employed workers earning strictly below than the minimum wage

actually *increased* by about five percentage points. This fact turns out to have important consequences for our results.

The relative extents of formal and informal employment also changed during this period, with a marked increase in the proportion of workers with formal labour contracts (*carteira de trabalho assinada*). This trend has two main causes. The first one is the economic boom that reduced unemployment rates to record levels and thus reduced job insecurity and increased the leverage of workers to demand that the labour contract be formalized. The second one is basically institutional and has to do with a more active role of two Brazilian institutions, the Brazilian Public Prosecutor's Office – PPO (*Ministério Público*) and the Ministry of Labour and Employment (MLE).

Figure 6: Earnings distributions and minimum wage spikes: 1996, 2003 and 2012.

The bandwith is .07 for all the periods
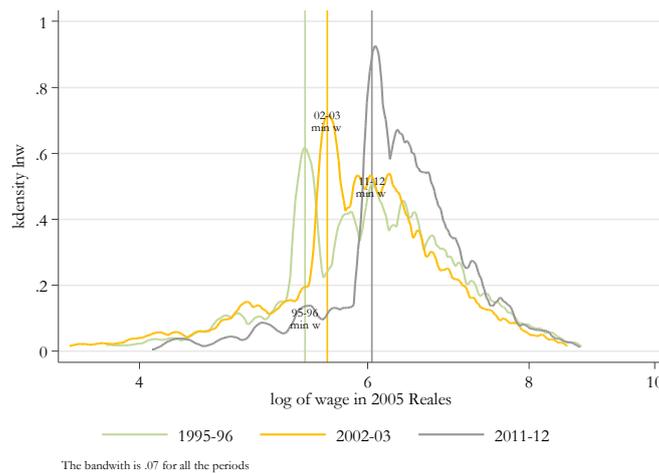
Since the 1988 Constitution, PPO was allotted much more autonomy, discretionary power, and a wider range of attributions. It has increased its work with civil society actors to solve social problems that lie behind the defense of collective rights. In particular, PPO has a division called *Ministério Público do Trabalho* that is responsible for enforcing labour legislation. That work goes above and beyond the operative oversight at individual firms operated by the MLE to enforce labour laws. While MLE oversees and punishes individual firms, PPO intervenes directly with employer's associations, proposing deadlines for reduction in overall informality in given economic sectors (*Termos de Ajustamento de Conduta*).

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Labour inspection procedures in Brazil conducted by MLE also changed during the period being analyzed. In 1995, several important changes were established with the goal of improving the efficiency of labour inspection. Since then, formal employment has expanded significantly. Corseuil, Almeida and Carneiro (2012) document a causal relationship between changes in labour inspection and increases in formal employment using municipality level data from 1996 to 2006 on labour inspection intensity and job flows.

Whatever the exact causes, the fact is that the proportion of employed workers under formal contracts increased by over a fifth, from 48% to 58% over the complete period, as shown in Figure 7 (Panel A). This came at the expense of both informal and self-employment. Panel B of Figure 7 illustrates the aforementioned increase in the proportion of workers earning below the minimum wage, from 12% to 17% of the labour force: despite the enhanced levels of enforcement and rising formalization, a doubling of the real level of the minimum wage proved to be too large to go alongside an increase in coverage.

**Figure 7: Formalization and the minimum wage, 1995-2012.**
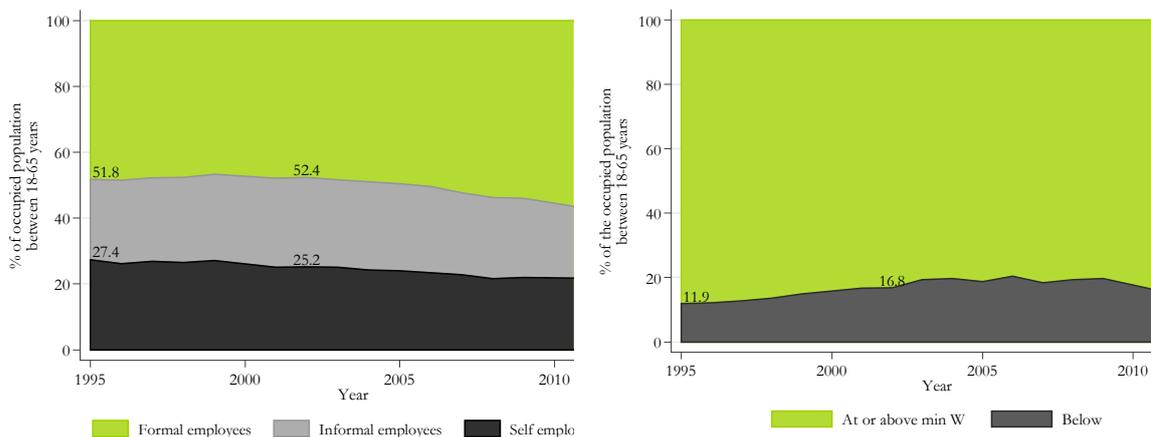
The third group of candidate explanations for declining earnings inequality concerns changes in the **demographic composition of the labour force** and in the wage premia accruing to workers of different races and genders. As Figure 8 illustrates, there was a substantial increase in female labour force participation over this period, as a result of

which the proportion of female workers increased by 10%, from 38% to 42% of all workers (Panel B). This trend reflects increases in women's educational attainment levels, and possibly also a decrease in the occupational segregation by gender in the labour force. More recently, there were also large increases in the provision of public child care, with annual increases in the number of enrolled children of around 7%, according to the Ministry of Education. It is likely that such an increase might also have had an impact on female labour force participation.

Panel B of Figure 8 shows that the proportion of non-white workers (mostly Afro-Brazilians and people of mixed race) in the working-age population increased by ten percentage points, to just over 53% of the total. The decomposition exercise we describe in Section 4 will allow us not only to assess whether these changes in composition played a role in the changes in the earnings distribution, but also whether there were any changes in the wage gaps between these different categories of workers, controlling for human capital and institutional factors.[5]

Figure 8: Demographic changes in the working-age population, 1995-2012.
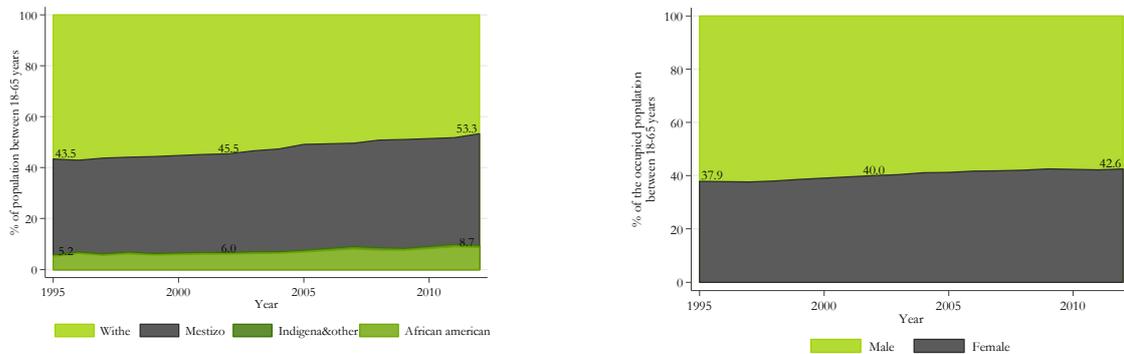
Finally, the fourth set of candidate explanatory factors comprises changes in the **spatial composition** of the labour force, as well as in the returns to those location factors. Panel A in Figure 9 below indicates the continued trend towards a more urban

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[5] Until the early 1980s, the existence of such wage gaps was generally interpreted as a measure of labor market discrimination. Although we are now more careful, because of various omitted variables that may well be correlated with race or gender (such as the probability of taking time off for child care, or quality of education), it is of course still quite possible that some of these gaps do reflect active discrimination.

labour force, with the rural share of the working-age population decreasing by 26%, from 19% to 14% of the total. Changes in the regional composition of the labour force were not particularly pronounced, as illustrated by Panel B. Nevertheless, there was a reduction of about 4 percentage points in the share of working-age individuals located in the Southeast, by far the most populous and economically dominant region of the country. This share loss was partly offset by a corresponding gain in the Center-West region, home to Brazil's most important agribusiness areas.

Before we turn to a discussion of the econometric method we use to decompose the changes in average earnings and in earnings inequality into components due to each of these four groups of candidate explanations, the next section briefly describes the data used for the analysis.

Figure 9: Changes in the geography of the working-age population, 1995-2012.
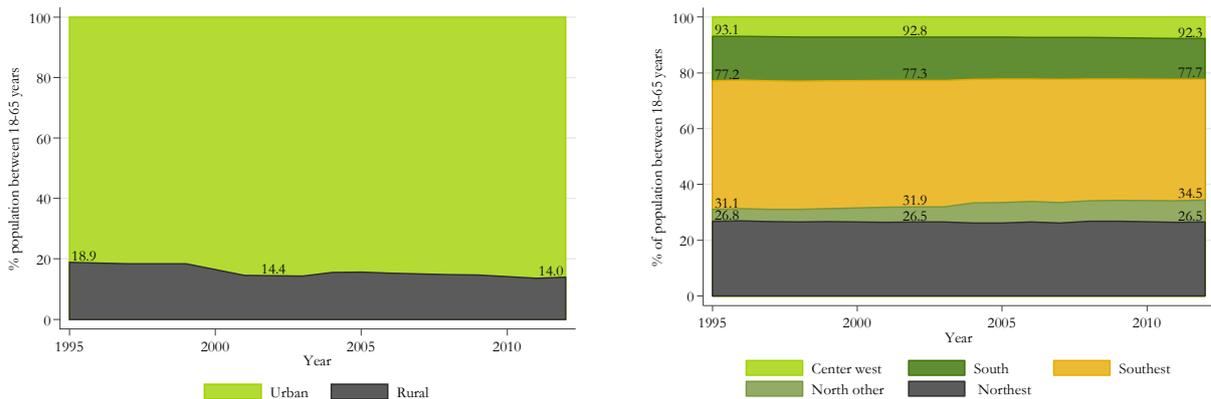
3. Data

The main data source for this study is the *Pesquisa Nacional por Amostra de Domicilios* (PNAD), and the period of analysis is 1995-2012. The PNAD is an annual, representative household survey, covering both rural and urban areas.[6] It is fielded by the Brazilian Census Bureau (the Instituto Brasileiro de Geografia e Estatística, IBGE) every year, except for census years.

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[6] Except for the rural areas of Acre, Amapá, Amazonas, Pará, Rondonia and Roraima states, which correspond to the Amazon rainforest. These areas, which according to census data account for 2.3 per cent of the Brazilian population, are excluded from the survey before 2003.

The following filters were applied to the data. We considered all workers aged 18-65 who reported positive earnings during the survey´s reference week. Our measure of earnings is total monthly earnings from all occupations, and it is expressed in real values using the CPI deflator with base-year 2005. Monthly earnings are trimmed at the 1st and 99th percentiles. Sample sizes differ somewhat per year, but about 130,000 individuals per year are included on average.

All variables entered in the analysis are categorical. As regards worker skills we consider six categories of educational attainment: primary incomplete or less, primary complete, secondary incomplete, secondary complete, tertiary incomplete and complete tertiary. Demographic characteristics include a gender dummy and age, which is divided in five year intervals.

We distinguish three characteristics of the job. Workers are classified as formal employees if they have a job that is properly registered in their "carteira de trabalho". Those employees whose employers have not registered their job in the "carteira de trabalho" are considered informal employees. Finally, we also include in the analysis own-account or self-employed workers ("conta própria) as a separate category.

The analysis distinguishes between rural and urban workers. Rural and urban areas are defined following the Brazilian census definitions. Finally, we include in the analysis an indicator variable for workers below or at the national minimum wage in a given year. Minimum wage information is collected from ILOSTAST Database.

4. Methodology

As discussed in Section 2, both the distribution of relevant characteristics over the population and their returns have changed over time, and one expects that these changes would affect the behavior of earnings. In fact, we also saw in Section 1 that mean earnings and inequality measures of the earnings distribution did also change over the 1995-2012 period. So we now briefly discuss how to connect changes in covariates and returns to features of the earnings distribution.

If one is interested in comparing average earnings between two time periods, say t = 1 and t = 2; then it is possible to apply the method proposed by Blinder (1973) and

Oaxaca (1973). Let us follow their seminal papers and postulate that earnings are linear and separable in observable and unobservable characteristics for each time period $t = 1$ and $t = 2$:

(1) $Y_t = X\beta_t + \varepsilon_t,\ for\ t = 1, 2,$

where X is vector of length k and β is a parameter vector of same size. Let $D_t = 1$ be an indicator of being observed at time $t = 2$. We also write a pooled model for earnings that combines both time periods:

(1)' $Y = X\beta + \varepsilon,$

If unobservable components are mean independent of observable ones (and normalized to have same mean) then the overall mean earnings gap can be written as

(2) $\mathrm{E}[Y \mid D_t = 1] - \mathrm{E}[Y \mid D_t = 0]$

$$= \mathrm{E}[X \mid D_t = 1]'(\beta_2 - \beta) + \mathrm{E}[X \mid D_t = 0]'(\beta - \beta_1)$$

$$+ (\mathrm{E}[X \mid D_t = 1] - \mathrm{E}[X \mid D_t = 0])'\beta$$

Replacing expected values by sample averages (variables with an 'upper bar') and parameters by estimates (βs with a 'hat') we get an estimate of the overall mean earnings gap:

(3) $\bar{Y}_2 - \bar{Y}_1 = \left[\bar{X}_2'(\hat{\beta}_2 - \hat{\beta}) + \bar{X}_1'(\hat{\beta} - \hat{\beta}_1)\right] + (\bar{X}_2' - \bar{X}_1')\hat{\beta} = \widehat{\Delta}_S^\mu + \widehat{\Delta}_X^\mu.$

The first term of the sum in equation (3) is the estimated **pay structure effect**, $\widehat{\Delta}_S^\mu = \bar{X}_2'(\hat{\beta}_2 - \hat{\beta}) + \bar{X}_1'(\hat{\beta} - \hat{\beta}_1)$, while the second term is the estimated **composition effect**, $\widehat{\Delta}_X^\mu = (\bar{X}_2' - \bar{X}_1')\hat{\beta}$. As their names and formulae make clear, $\widehat{\Delta}_S^\mu$ is an estimate of how changes in average earnings can be explained by changes in returns, or premia, whereas $\widehat{\Delta}_X^\mu$ is an estimate of how changes in average earnings can be explained by changes in the distribution of covariates.

Because of the additive linearity assumption, it is easy to compute the various elements of a detailed decomposition, in which each term corresponds to a single covariate or observable characteristic. The structure and composition effects can be written in terms of sums over the explanatory variables, such as,

(4) $\widehat{\Delta}_S^\mu = \sum_{j=1}^k \bar{X}_{2,j}'(\hat{\beta}_{2,j} - \hat{\beta}_j) + \bar{X}_{1,j}'(\hat{\beta}_j - \hat{\beta}_{1,j})$

(5) $\widehat{\Delta}_X^\mu = \sum_{j=1}^k (\bar{X}'_{2,j} - \bar{X}'_{1,j})\hat{\beta}_j$

where $(\bar{X}'_{2,j} - \bar{X}'_{1,j})\hat{\beta}_j$ and $\bar{X}'_{2,j}(\hat{\beta}_{2,j} - \hat{\beta}_j) + \bar{X}'_{1,j}(\hat{\beta}_j - \hat{\beta}_{1,j})$ are the respective contributions of the jth covariate to the composition and wage structure effects.

In our model, we allow for an intercept, which means that $X_{t,1}=1$ for $t=1,2$. That means that the structure effect will have a component $(\hat{\beta}_{2,1} - \hat{\beta}_{1,1})$ that will reflect changes in returns to unobservables.

Since we are ultimately interested in learning how covariates have separately impacted not only mean earnings but other features of its distribution, we also use the method based on re-centered influence function (RIF) regressions introduced in Firpo, Fortin, and Lemieux (2009). Using RIF-regressions as a way to extend the method by Oaxaca and Blinder to functionals of the distribution, such as quantiles and inequality measures, has been extensively discussed in Fortin, Lemieux and Firpo (2011).

RIF-regression methods provide a simple way of performing detailed decompositions for a statistic of the earnings distribution, as long as that statistic admits an influence function. The influence function can be understood as the leading part of a linearization procedure. Therefore, by using influence functions one can approximate non-linear functionals of the distribution, such as the Gini and quantiles, by an expectation.

In fact, RIF-regressions are used exactly in the same way as standard regressions in Oaxaca-Blinder decompositions, except that the dependent variable, Y, is replaced by the (re-centered) influence function of the statistic of interest. For now, let υ be a functional of the earnings distribution. In this paper, our choices for υ are the mean μ, or the Gini coefficient G. Then the structure and composition effects for a functional υ can be written in terms of sums over the explanatory variables

(6) $\widehat{\Delta}_S^\upsilon = \sum_{j=1}^k \bar{X}'_{2,j}(\hat{\beta}_{2,j}^\upsilon - \hat{\beta}_j^\upsilon) + \bar{X}'_{1,j}(\hat{\beta}_j^\upsilon - \hat{\beta}_{1,j}^\upsilon)$

(7) $\widehat{\Delta}_X^\upsilon = \sum_{j=1}^k (\bar{X}'_{2,j} - \bar{X}'_{1,j})\hat{\beta}_j^\upsilon$

where $\hat{\beta}_{t,j}^\upsilon$ and $\hat{\beta}_j^\upsilon$ correspond respectively to the coefficients associated with covariate j in a regression of the re-centered influence function of υ on X for period t and for the pooling of the two periods. Interestingly, if $\upsilon = \mu$, then RIF equals Y, so the standard

OLS regression used in the traditional Oaxaca – Blinder method is a special case of the decomposition method using RIF.[7]

Finally, note that the detailed elements of both the structure and the composition effects can be computed in the same way as we did for the mean.

5. Results

Our discussion of results is organized in three parts. First, we briefly report on a "streamlined" OLS version of Equation (1), in order to describe the evolution of returns to the characteristics in each of our four groups of explanatory variables. Second, we report the results of the decomposition of changes in mean earnings into endowment (or composition) and pay structure effects for each group, both for 1995-2012 and for each sub-period. Third, we report the analogous decomposition for the Gini coefficient of earnings (i.e. when $v = G$).

Table 1 presents the estimates of four OLS regressions (i.e. with $v = \mu$) of real earnings on the covariates discussed in Section 2. Each regression was estimated on pooled year-pair samples, as follows: 1995-1996, 2002-2003, 2004-2005 and 2011-2012. The human capital group is represented by five categorical variables for educational age, and another five for educational attainment. The reference group in the case of education corresponds to individuals with tertiary education completed. For the age variable, it is the 56-65 bracket. Labour market institutional variables include a dummy for earning a wage lower than the minimum wage; and two dummies of formality status: informal and self-employment (formal employment is the reference category). The demographic composition variables are a four-category race variable (in which whites are excluded) and a gender dummy. Spatial composition includes a rural dummy, as well as a five-category regional variable that excludes the center-west region as the reference category.

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[7] In our RIF regressions we faced the problem that our regressors were indicator variables representing values of categorical variables. It is well-known in the literature that followed the Oaxaca & Blinder decomposition methods, that results are not invariant to the choice of the excluded category (Oaxaca and Ransom, 1999 and Yun, 2005). Several attempts to solve the invariance problem were proposed in the literature. In our case we do not impose restrictions on the parameters beyond the usual one of dropping one from each set of dummies and including the constant. We have, however, a relatively flexible model as, besides having these dummies, we also have interactions of educational group dummies and age group dummies (human capital), regional dummies and rural (geography), race and gender (demographics).

Table 1. Returns to observable worker characteristics

	1995-96	2002-03	2004-05	2011-12
	coef/se	coef/se	coef/se	coef/se
18-25	-0.189***	-0.283***	-0.285***	-0.285***
	(0.007)	(0.006)	(0.005)	(0.005)
26-35	0.028***	-0.060***	-0.077***	-0.110***
	(0.007)	(0.005)	(0.005)	(0.005)
36-45	0.149***	0.046***	0.030***	-0.026***
	(0.007)	(0.005)	(0.005)	(0.005)
46-55	0.121***	0.074***	0.070***	0.018***
	(0.007)	(0.006)	(0.006)	(0.005)
Primary or less	-1.228***	-1.150***	-1.082***	-0.907***
	(0.007)	(0.006)	(0.005)	(0.005)
Secondary incomplete	-0.959***	-0.976***	-0.922***	-0.790***
	(0.008)	(0.006)	(0.006)	(0.005)
Secondary	-0.696***	-0.777***	-0.738***	-0.654***
	(0.008)	(0.006)	(0.006)	(0.004)
Tertiary Incomplete	-0.466***	-0.479***	-0.453***	-0.417***
	(0.010)	(0.008)	(0.007)	(0.006)
Below minimum wage	-1.082***	-1.073***	-1.070***	-0.974***
	(0.004)	(0.003)	(0.003)	(0.003)
Self employment	0.049***	-0.031***	-0.038***	0.067***
	(0.004)	(0.003)	(0.003)	(0.003)
Informal	-0.193***	-0.131***	-0.103***	-0.045***
	(0.004)	(0.003)	(0.003)	(0.003)
'Mestiço'	-0.137***	-0.102***	-0.097***	-0.081***
	(0.003)	(0.003)	(0.002)	(0.002)
Indigenous & other	0.197***	0.061***	0.073***	0.034**
	(0.025)	(0.018)	(0.018)	(0.013)
African-American	-0.183***	-0.119***	-0.109***	-0.092***
	(0.006)	(0.004)	(0.004)	(0.003)
Female	-0.413***	-0.328***	-0.323***	-0.287***
	(0.003)	(0.002)	(0.002)	(0.002)
Rural	-0.235***	-0.120***	-0.103***	-0.125***
	(0.004)	(0.003)	(0.003)	(0.003)
Northeast	-0.214***	-0.218***	-0.229***	-0.216***
	(0.005)	(0.004)	(0.003)	(0.003)
North	-0.055***	-0.094***	-0.075***	-0.106***
	(0.007)	(0.004)	(0.004)	(0.004)
Southeast	0.085***	0.024***	-0.005	-0.018***
	(0.005)	(0.004)	(0.003)	(0.003)
South	-0.001	-0.025***	-0.019***	-0.008**
	(0.005)	(0.004)	(0.004)	(0.004)
Constant	7.645***	7.557***	7.514***	7.628***

	(0.010)	(0.008)	(0.008)	(0.006)
Nr. of obs.	215,062	264,673	282,802	270,563
Adjusted R2	0.584	0.639	0.642	0.592

note: *** p<0.01, ** p<0.05, * p<0.1

Comparing coefficients across the four columns reveals some important changes over the period 1995-2012. In the **human capital group**, we do observe a sharp decrease in returns to education. In 1995/96, the conditional difference between the average college graduate earnings and the earnings of workers with no education was 1.23 log points. By 2011-12, this difference had fallen to 0.91 log points. If we look instead at the wage premium of college with respect to secondary completed education, differences over time are smaller but the pattern is similar. In 2011-12 the log difference was 0.65, five points lower than in 1995-96 (0.70). Most of the observed fall in the wage premium takes place in the second sub-period considered, i.e., during the 2000s, a feature that is shared with other Latin American countries (Gasparini et al. 2011). Returns to experience or age became less of an "inverted U-shape" and are now basically increasing in age: returns fell for prime-aged workers (those aged 25-55), but rose for older workers. The returns for those aged 55-65 (with respect to the youngest in the sample) increase in 10 log points.

The **labour market institution variables** suggest that rising minimum wages may indeed have led to some earnings compression, as the conditional gap between those earning the minimum wage or higher and those below it fell from 1.08 to 0.98 log points. Informal sector employees used to earn 0.19 log points less than observationally comparable formal sector workers in 1995-96, but this gap was reduced to a mere 0.05 log points by 2011-12.

There were also some impressive changes in returns to the **demographic and spatial** variables. Beginning with gender, the male-female wage gap fell from 0.41 to 0.29, sharing a common trend with the rest of LAC (Ñopo, 2012). For race, the wage gap between black and white workers fell from 0.18 to 0.09, with similar declines observed for mixed race (or "mestiço") workers.[8] As regards urban-rural differences in

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[8] The positive coefficient observed for the somewhat counter-intuitively named "indigenous and other" category is driven by the fact that the largest group in that category consists of workers of Asian

pay across observationally equivalent workers, we observe a strong convergence process during the late 1990s. This pattern is a continuation of trends observed through the late 1980s and early 1990s (Ferreira, Leite and Litchfield, 2008), and appears to stabilize during the 2000s. By 2011/12, the wage gap of rural workers with respect to urban workers had fallen to 12%, from 23% in 1995/96. Regionally, the most noteworthy change is a sharp improvement in the relative position of the Center West region, which overtakes the South-East as the region commanding the largest conditional premium. Relative to the Center West, gaps for the North and Northeast actually increase somewhat.

Along with the evolution in the distribution of covariates described in Section 2, these changes in returns paint a complex picture of distributional movement. To better understand these complex dynamics, we now report two versions of the RIF regression-based decompositions described in Section 4: one for average earnings and one for the Gini coefficient. For greater functional-form flexibility when building the counterfactual earning distributions, we saturate the model within each group: instead of basing the remainder of the analysis on the regressions reported in Table 1 above, we now use a specification with full interactions within groups. In the case of human capital, for example, we include 24 dummy variables in the model, which correspond to a full set of interactions between 5 education classes (primary or less, secondary incomplete, secondary, tertiary incomplete and tertiary) and 5 age classes (18-25, 26-35, 36-45, 46-55, 56-65). The reference category for this group corresponds to individuals with tertiary education completed in the age bracket 56-65. Similar interactions are used for the other groups of variables, and the (finer) reference category is always the one with highest earnings in the pooled sample, as before.

The choice of the reference category in Oaxaca-Blinder decompositions is not innocuous, and there is not an a priori "best choice" as extensively discussed in the literature (see for example Gardeazabal and Ugidos 2004 and Fortin, Lemieux, and Firpo, 2011). The rationale behind our choice is a practical one. 1995-2012 is a period of rapid inequality reduction in Brazil. Hence, earnings of the most disadvantaged


(primarily Japanese) origin. These workers have typically commanded a premium over observationally comparable white workers.

groups grew much faster that earnings of the most advantaged. By selecting the most advantaged as our reference category we minimize the role of the unobserved component in the decompositions.

Figure 10 summarizes the decomposition of changes in average earnings. It shows the contribution of endowments (i.e., changes in the composition) and structure (i.e., changes in the returns) in each of the variable groups for the period 1995-2012, and then for each of the two sub-periods: 1995-2003 and 2004-2012. Note the sharp differences in changes in average earnings across the sub-periods: while the expansion of 2003-2012 brought about an accumulated increase in earnings of 38 percent, 1996-2002 is a period of earnings moderation, with a total loss of real average earnings of 12 percent.

Part of this decline may be attributed to macroeconomic factors. In particular, the 1999 currency crisis was associated with a large GDP decline. It is perhaps for this reason that the bulk of the earnings losses during the first period are explained by structure effects — i.e., by changes in the returns to the characteristics considered in the analysis, and not by changes in the composition of the labour force. Indeed, the largest structure effect in that sub-period corresponds to the constant term, suggesting a broad-based wage decline across all subgroups of workers – consistent with an economy-wide recession.

Figure 10: A decomposition of changes in average earnings in Brazil.
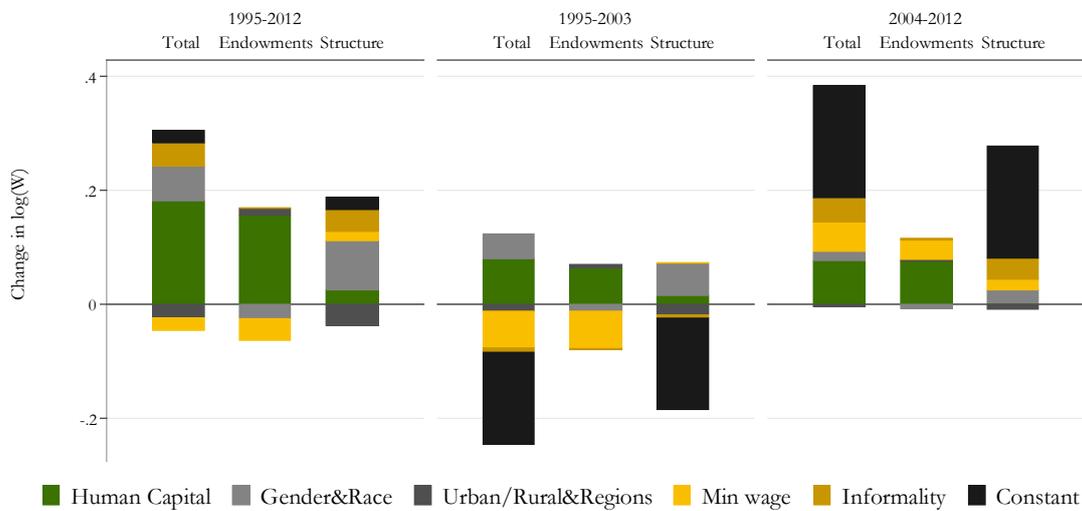
Instead, during the expansion of 2004-2012, both composition and structure effects contribute to average earnings growth. For the period as a whole, human capital stands out as the main contributor to the increase in average earnings, to a great extent due to the expansion of endowments, although changes in the returns (structure) also contributed positively during the last decade. Thus, the rapid expansion of educational attainment that we documented earlier did translate into higher wages. The overall effect of human capital for the whole period accounts for an 18 percent raise in average earnings, divided almost identically between the two sub-periods considered.

Minimum wages and informality had very different effects during the two sub-periods. Starting with the most recent changes, the joint impact of formalization and minimum wages was very positive for average earnings during 2004-2012. This positive impact was largely driven by the evolution of the returns to formal employment, which contributed to some 4 percent increase in average earnings, and by changes in the composition of workers affected by the minimum wage—which contributed with a 3.5 percent increase in earnings, while changes in the returns added 1.8 percent.

In sharp contrast, even if 1995-2003 was a period of relatively slow growth in the minimum wage, an increasing number of Brazilian workers fell below mandated minimum wages. Compositional changes associated with a rising share of workers below the minimum wage during 1995-2003 account for some 2 percent of the observed reduction in average earnings during this period.

Demographic factors strongly contributed to rising mean earnings, both during the period as a whole and for each sub-period. These changes operated fundamentally through changes in the joint returns of gender and ethnicity, in order words to reductions in the female and non-white earnings penalties in the Brazilian labour market. These reductions operated through increases in pay for women, Afro-Brazilians and mixed-race workers, contributing to increases in average earnings. Finally, spatial factors were relatively muted in both periods, but did contribute to higher total earnings, largely through gains in rural areas, and in the Center West region.

Figure 11 presents the decomposition results for the Gini coefficient of earnings, in a manner analogous to Figure 10. First and foremost, it suggests that the reduction in inequality during both sub-periods – and hence, evidently, also for the whole period – is fundamentally associated with changes in the structure of pay in the labour market. In contrast, the composition or endowment effects were inequality-enhancing. In other words, had changes in the structure of pay not taken place, inequality would have increased by 3.6 Gini points due to changes in the composition of the labour force. Counterbalancing the role of compositional changes, the joint contribution of changes in the structure of pay pushed inequality down by 12.6 Gini points, resulting in the observed inequality reduction of 9 Gini points.

Figure 11: A decomposition of changes in earnings inequality in Brazil.
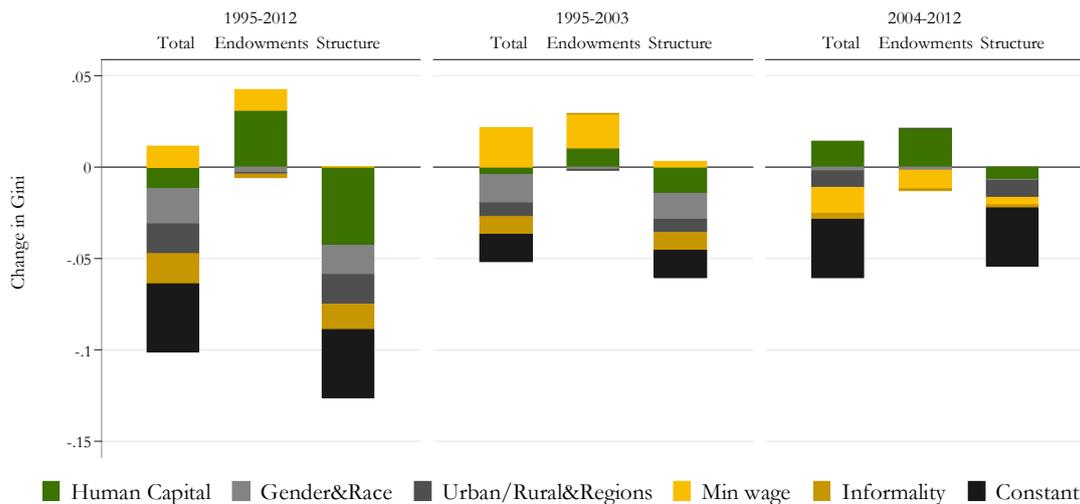
Looking across our four groups of candidate explanatory variables, it seems that demographic and spatial factors - alongside changes the nature of jobs (e.g. informality) - accounted for most of the overall inequality reduction observed in Brazil during the last seventeen years.

The role of **human capital** was more limited, largely because the powerful inequality-reducing structure effects (arising from falling returns to schooling) were partly offset by inequality-enhancing changes in endowments (i.e. ageing, and the expansion of educational attainment). These compositional changes reflect the large

inflow of better educated workers during the last two decades; changes in experience were less dramatic. In the first sub-period (1995-2003) the joint impact of education and experience on inequality is more relatively muted, pushing inequality downwards by 0.4 Gini points. During this period, the inequality-enhancing effect of educational upgrading is more than compensated for by changes in the returns to human capital. But during 2004-2012 the expansion of educational attainment accelerates. As a result, the overall contribution of human capital goes against the tide of inequality reduction in the country, pushing the Gini upwards by 1.4 points.[9]

This inequality-increasing effect of educational expansions is an example of the so-called "paradox of progress", first identified by Bourguignon, Ferreira and Lustig (2005). The effect refers to the fact that even equalizing changes in educational attainment can result in higher inequality, as a greater mass of the distribution of workers have educational levels corresponding to the steepest segments of the earnings-education profile.[10]

In terms of **labour market institutions**, it turns out that changes in returns and in the share of workers associated with the minimum wage were mildly regressive overall: changes in minimum wages are associated with a small increase in inequality, of 1.2 Gini points for the period as a whole. This effect is driven primarily by changes in the share of workers who are at or above the minimum wage. But the average effect for the period as a whole hides big differences across sub-periods. During 1995-2003, a growth in the proportion of workers earning below the minimum wage was associated with a rise of inequality. As noted earlier, this period was characterized by a reduction in average earnings, partly driven by the financial crisis in 1999. Even if minimum wages grew slowly during this period, the negative macroeconomic context pushed an increasing number of workers below the minimum wage line. Compositional changes associated with the minimum wage capture this effect.

During 2004-2012, on the other hand, changes in the minimum wage are associated with a reduction in inequality. The rapid expansion of the 2000s was

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[9] This last result is consistent with evidence for other Latin American countries during the same decade (Fernández-Sierra and Messina, 2014).

[10] For a recent discussion in the Latin American context see Battistón, García-Domench and Gasparini (2014).

accompanied by even faster increases in the minimum wage which, interestingly, does not appear to be associated with increases in non-compliance. On the contrary, the share of workers below the minimum wage remained stable and even fell during the very last years, possibly due to a combination of high growth and more effective labour inspections. Thus, composition and structure effects worked in the same direction, pushing inequality down during the sub-period.

Finally, changes associated with **demographic and spatial factors,** as well as **informality** jointly accounted for the bulk of the reduction in the Gini coefficient of labour incomes in Brazil during 1995-2012. In fact, these three sets of variables had a quantitatively similar role in the overall reduction of inequality: Gender and race contributed a reduction of 1.9 Gini points; whereas the joint contribution of regional and urban/rural factors was 1.7 points. Exactly the same amount (1.7 points) was associated with changes in the nature of jobs, in favor of formalization.

In all three cases, these contributions are driven almost entirely by the structure effect, while changes in the composition of the labour force across these three broad dimensions played a much more limited role. Hence, the closing gap between female and male pay, between non-whites and whites, and between rural and urban areas, was the dominant factor behind the observed trends in inequality reduction in Brazil. This is perhaps not entirely surprising, considering that Brazil started the period with very large gaps in these three dimensions (Ñopo, 2012). Nevertheless, the combination of one particular aspect of labour market institutions (formalization) with a generally more level playing field across races, gender and spatial areas in the labour market has not featured prominently in the account of the decline in Brazilian inequality over the last two decades – an omission we hope this paper rectifies.

6. Conclusions

After decades of rising or roughly stable income inequality, the period since macroeconomic stabilization in 1994 has seen a steady decline in income dispersion in Brazil. While increases in the volume and improvements in the targeting of social transfers have played a role in that decline, perhaps its most important driver has been

a reduction in inequality in labour earnings: Between 1995 and 2012 the Gini coefficient for earnings fell by 20% and other measures such as p90-p10 ratio by almost 40%.

The dominant narrative in the literature attributes that decline primarily to human capital dynamics: a substantial increase in years of schooling for working-age adults has translated into a rising supply of skills, followed by a decline in the returns to those skills in the labour market (revealing, presumably, that demand for skills has failed to keep pace with supply). Our analysis draws on RIF regression-based decompositions to investigate the relative roles of a broader set of potential determinants including - beside human capital - changes in labour market institutions (minimum wages and the enforcement of formal employment), in demographic characteristics of the labour force (chiefly race and gender), and in spatial factors.

We find that the decline in earnings inequality between 1995 and 2012 was driven primarily by changes in the structure of remuneration in the Brazilian labour market, rather than directly by changes in the distribution of worker characteristics. (The main exception to that was the inequality-augmenting effect of the increase in years of schooling across the population.) These changes in pay structure can be understood very straight-forwardly as declines in various different wage premia: In addition to declining schooling premia, the period was also characterized by reductions in the gender wage gap (with women's earnings rising faster than men's), the racial wage gaps (with wages for people of color rising faster than for whites), and the urban-rural wage gap (with wages rising faster in rural areas). Each of these gaps was, of course, estimated conditionally on the full set of observable characteristics, in a within-group saturated model.

Another gap whose narrowing contributed to the overall equalization was that between formal ("com carteira") and informal ("sem carteira") employees. While these changes in the structure of the labour market are equilibrium phenomena, which reflect market forces such as an increase in the bargaining power of workers vis-à-vis their employers, we have argued that they also reflect changes in enforcement patterns by government institutions. Another key institutional variable we considered was the real minimum wage, which more than doubled over the period, generating a

formidable spike in the density function of earnings by 2012. As suspected, this rise in the minimum wage contributed to falling inequality in the 2004-2012 sub-period. However, its more lackluster performance between 1995 and 2003, combined with a much softer labour market then, meant that the overall impact of minimum wages in the whole period was inequality-increasing.

All in all – and in stark contrast to earlier documented periods – the story of these seventeen years was a happy one in Brazilian labour markets. Unemployment fell and earnings rose. Not only did average earnings rise, but they rose by most for those groups of workers who used to earn the least. There was indeed a compression in the schooling wage premia, which used to be unusually large in Brazil. But even more impressive were the reductions in wage gaps among workers that are observationally equivalent in terms of their human capital, but differ along such dimensions as race, gender, location and type of job. Whatever the deeper determinants of these changes – which invite much more detailed research – they appear consistent with a more level playing field in the Brazilian labour market.

Are there any lessons from this analysis for African countries embarking in their own policy struggles for a fairer and less unequal labour market? This is a difficult question, because local context and institutions matter a great deal, and there are non-trivial differences between Brazil's economy and those of most African countries. Nevertheless, four general implications appear to be broad enough that they must apply, in some locally coherent form, to most other countries: (i) an educated labour force is a more productive labour force and, if education is promoted wisely, with a focus on primary and secondary levels, it leads to greater prosperity *and* greater equity; (ii) all forms of discrimination – among the sexes, ethnic groups, or other forms – tend to be both inefficient and inequitable. Encouraging female education, reduction in fertility rates, and greater labour force participation has contributed to growth in average earnings, and to a less unequal distribution in Brazil. (iii) Integrate the rural areas, and the workers who live there: greater connectivity and less labour market segmentation between cities and the countryside are an ongoing part of Brazil's recently successful fight against poverty and inequality. (iv) Finally, do not fear fiscal

redistribution: well-designed transfer programs are perfectly consistent with vibrant labour markets, with rising average wages and declining dispersion.

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