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Intergenerational Income and Educational Mobility
An analysis between the 1970's and the 2010's in Brazil

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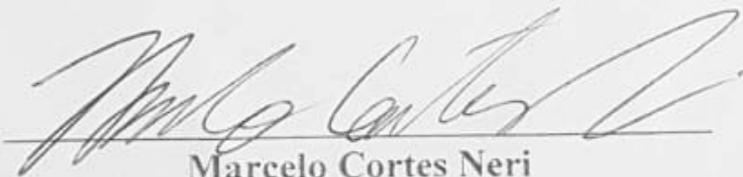
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"Même la nuit la plus sombre prendra fin et le
soleil se lèvera" - [Hugo and Hapgood \(1887\)](#)

"L'Égalité a un organe : l'instruction gratuite et obligatoire. (...)
De l'école identique sort la société égale" - [Hugo and Hapgood \(1887\)](#)

"It is time for us all to decide who we are" - [Boublil et al. \(1986\)](#)

Abstract

This paper analyzes the intergenerational income mobility, as an opportunities equalizing process, in Brazil over the last 40 years. Using the theoretical framework from [Becker \(1994\)](#) and [Benabou and Ok \(2001\)](#), I try to answer the following questions: (1) Was there a stronger opportunities equalizing process from 1990-99 to 2014, in relation to its previous period, from 1972-81 to 1996? And (2) If so, was this dynamic driven by the educational improvements in the period or by the labor market changes between generations? Estimating fathers' income by Two Samples Instrument Variable method, our results show that this period was marked by an opportunities equalizing process that did get stronger in its second half, with intergenerational persistence of income falling from 0.76 in 1996 to 0.56 in 2014. Adding controls the difference persists on the level of 20p.p. It's also shown that persistence of income had a higher fall for poor families. Also, microsimulating a decomposition between schooling mobility process and education premium on wages in each generation, the results show that it was the schooling expansion, that reduced intergenerational persistence of education, the main driver of this dynamics. A decomposition of Intergenerational Elasticity of Income confirms the main role of the increase of public education provision between cohorts, while labor market changes accounted for most of increase of intergenerational mobility within cohorts.

Keywords: Income, Inequality, Brazil, Equality of Opportunities

Resumo

Este artigo analisa a mobilidade de renda intergeracional, como um processo de equalização de oportunidades, no Brasil nos últimos 40 anos. Utilizando o referencial teórico de [Becker \(1994\)](#) e [Benabou and Ok \(2001\)](#), busca-se responder às seguintes questões: (1) houve um processo de equalização de oportunidades mais forte de 1990-99 a 2014, em relação ao período anterior, de 1972-81 a 1996? E (2) Se sim, essa dinâmica foi impulsionada pelas melhorias educacionais no período ou pelas mudanças do mercado de trabalho entre gerações? Estimando a renda dos pais pelo método Variáveis Instrumentais em Dois Estágios, nossos resultados mostram que esse período foi marcado por um processo de equalização de oportunidades que se fortaleceu na segunda metade, com a persistência da renda intergeracional caindo de 0,76 em 1996 para 0,56 em 2014. Adicionando controles, a diferença persiste no nível de 20p.p. Também é mostrado que a persistência da renda teve uma queda maior para as famílias mais pobres. Além disso, microssimulando uma decomposição entre o processo de mobilidade escolar e o ganho salarial por anos de estudo em cada geração, os resultados mostram que foi a expansão da escolaridade, que reduziu a persistência intergeracional da educação, o principal motor dessa dinâmica. A decomposição da Elasticidade de Renda Intergeracional confirma o papel principal do aumento da provisão de educação pública entre as coortes, enquanto as mudanças no mercado de trabalho representaram a maior parte do aumento da mobilidade intergeracional dentro das coortes.

Palavras Chave: Renda, Desigualdade, Brasil, Igualdade de Oportunidades

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1 Introduction

The intergenerational elasticity of income, as introduced by [Becker \(1994\)](#), is an indicator that expresses the inequality of opportunities, because it associates the chances of an individual reaching a certain social position from the socioeconomic position of their parents. Intergenerational educational and income mobility in Latin America is low compared to developed countries, revealing mechanisms of greater persistence of inequalities and problems of social justice.

[Benabou and Ok \(2001\)](#) develops a framework for evaluating intergenerational income mobility, conceptualizing it as an equalizing process. Therefore, a process of mobility is perfectly opportunities equalizing when the second generation has the same expected income, regardless of the income distribution of the fathers. In this case, although the income performed by sons and daughters may present inequality, such variations would be due only to unanticipated shocks. In general, a mobility process is defined as an equalizing (or progressive) if, for any initial distribution of income, the distribution of expected incomes is more egalitarian.

The aim of this study is to estimate the Intergenerational Elasticity of Education and Income in Brazil, initially between two cohorts of fathers and children on two 20 years periods (from the 1970s to 1990s and from 1990s to 2010s). I also use [Benabou and Ok \(2001\)](#) framework, in order to compare both mobility processes regarding gender and race heterogeneity, and also fathers' income class'. Finally, there is an investigation on the main channels of the mobility dynamic in that periods.

The entry in the 2000s marks a favorable decade for Latin America countries and Brazil. In addition to economic growth, increased exports and reduced external vulnerability, the country is recognized internationally for its success in fighting poverty in this period. The good performance was made possible by a combination of elements that have long been overlooked: high rates of household per capita income growth and continuous reduction of income inequality. Both indicators improved more rapidly since 2004, and began to show signs of stagnation from 2013. In fact, from 2014 the economic and political crisis intensified, and since then Brazil lives a period of severe instability.

However, a recent study of the Organization for Economic Cooperation and Development points out that in Brazil the socioeconomic status of the parents still plays an important role in their descendants' position in society. In fact, the persistence of socioeconomic status is still very high between generations, indicating a low intergenerational mobility in Brazil. The study estimates that it would be necessary nine generations for a child born in a low-income family to reach the average income level.

According to [Barros and Mendonça \(1995\)](#), inequality of results is the sum of two components: the first one comes from the individual differences in preparation, while the last one is unrelated to differences in preparation. The second component is generated during competition, when individuals supply their skills in the labor market. The first one, on the other hand, is related to the formation and revealing of skills, generated in the first decades of life.

Unequal conditions can be classified based on whether or not the preparation process is characterized by equal opportunity. When differences in preparation are acquired in circumstances marked by equal opportunities, they can be considered fair insofar as they do not create inequality but only reveal inequality of skills. However, preparation differentials acquired in circumstances marked by inequality of opportunity are socially and ethically undesirable as far as the rewarding differences of equally prepared participants occurring due to discrimination and segmentation in competition.

Although at some level all sources of inequality undesirable, they differ fundamentally with respect to the type of intervention they require. The first requires policies that lead to an improvement in the degree of equality of opportunity, while the second requires changes

in the rules of the society in such a way that, during the competition, similarly prepared participants are equally treated.

Equality of opportunities, therefore, is a social outcome where all inequality would be orthogonal to their initial conditions. Some empirical studies ([Faravelli, 2007](#); [Cappelen et al., 2010](#)) show that redistribution preferences diverse when people are informed about nature of observed inequality. [Alesina et al. \(2017\)](#) show that, for a set of industrialized society, people disapprove anti inequality policies, but when it is accountable for factors beyond individual control.

One of the most important mechanism to reduce inequality of opportunities is the access and quality of education. During this period there was an increase in the average schooling of the Brazilian population, from 6 years of study in 2001 to 7.8 in 2014 for people over 25 years of age. Several programs were implemented to increase the access of the less favored population to tertiary education (FIES, PROUNI, quotas) and even to technical education (PRONATEC).

[Ferreira and Veloso \(2006\)](#) shows that there's been an increase in mobility across cohorts, caused mainly by educational progress, especially for sons of less-educated fathers. Poor fathers' sons and daughter have gained access to basic education during the last decades, explaining the almost double in the average education of this group from the 1970s to middle 1990s. Besides the evolution of the educational attainment, the authors argue that changes in the pattern of the education premium may have an important role in explaining changes in wage persistence over time and across different segments of fathers' wage distribution.

[Mahlmeister et al. \(2017\)](#) used data from the social mobility supplements of PNADs 1996 and 2014 to compare the Intergenerational Educational Mobility in Brazil. The authors show, through an analysis among age cohorts, a decrease in the intergenerational persistence of schooling over time. However, they found a trend towards an increase in educational persistence at the upper end of this distribution, and a reduction in the bottom.

Adapting [Pero and Szerman \(2008\)](#) and [Ferreira and Veloso \(2006\)](#) methodology in order to consider a occupational status typology developed by [Valle Silva \(1992\)](#), this study perform a Two Stage Least Squares, combining four editions of Brazilian National Household Sample Survey (PNAD), in order to compare two mobility processes from the 1970s to 1996, and the 1990s to 2014. I estimate schooling and occupational status returns in labor income in for fathers of 11-20 years old children in 1977 and 1995, imputing the estimated coefficients on PNADs 1996 and 2014, in which householders report educational level and occupations of their fathers. This way, it's possible to estimate the dynamics of both mobility processes for adults around 30 years old.

Our main results show that Intergenerational Elasticity of Education and Income were around 0.75 in 1996 for the first cohort of Brazilian born between 1957 and 1966 and their fathers. In 2014, the cohort born 18 years latter and their fathers have had experienced a decrease of Intergenerational Elasticity of Education to 0.45, and 0.55 considering income. It's shown that the stronger fall were observed in poorer and more vulnerable groups, but considering income it remained stable for richer families.

Following the theoretical framework of [Benabou and Ok \(2001\)](#), results show that the equalizing opportunities process in the last 40 years gets stronger on the second half of the period, from 1990-99 to 2014, even considering the heterogeneity of gender and race and fathers' income class. The difference between both periods was relevant and statistically significant.

For a better understanding of this dynamics, a new Intergenerational Elasticity of Income is simulated for 1996 and 2014, exchanging their educational mobility processes, in order to compare to another simulation, exchanging their fathers' and children' education premium.

This first exercise showed that the increase of educational mobility was the main driver of the decrease of Intergenerational Elasticity of Income, since the first simulation generated a smaller β_1 in 1996 and a higher one in 2014. This results holds for general population and its gender and race groups.

The second exercise is to decompose β_1 into two components: ‘inheritance of pure income’ and ‘inheritance of mediated income’, the second one being a multiplicative of the association of fathers’ income with children’ education (related to educational mobility) and the education premium of children controlling by fathers’ income (related to the difference of education premium between generations).

The results complements the conclusions of the first exercise: ‘inheritance of pure income’ was stable between 1996 and 2014, so ‘inheritance of mediated income’ fall was the only accountable for the loss of 20 p.p. of Intergenerational Elasticity of Income. It’s shown that the smaller effect of fathers’ income on children’ education on the last period were determinant for 56% of this decrease, being the main accountable for the changes on mobility of income.

The article is structure as follows: in the section 2, we make a bibliographical review on equality of opportunities and social mobility in Brazil, focusing mainly on the measure of income persistence through generations. Next, in section 3 we detail our methodology to estimate fathers’ income, to apply Benabou and Ok (2001) and to simulate different income mobility dynamics exchanging intergenerational schooling elasticity and education premium of both generations from one mobility process to another. Finally, section 4 and 5 show the results, 6 adds a section of a multiple cohorts analysis for both periods and section 7 concludes.

2 Equality of Opportunities in Brazil

2.1 Equality of Opportunities: a bibliographic review

Equality of opportunity is a popular concept of fairness, developed by economics literature on a few key contributions from philosophy, including Dworkin (1981), Arneson (1999) and Cohen (1989). In its broader sense, it means that anyone’s outcomes would be all endogenous only to individual choices.

The economics literature on (in)equality of opportunities have gained a major shift after the contributions of Roemer (1993) and Roemer (1998), who decomposes individual outcomes (denoted u) into both circumstance (denoted c) and effort (denoted e) consequences in a society with a chosen policy ϕ . So, we follow:

$$u = f(c, e, \phi) \tag{1}$$

Circumstances and efforts are defined by individual responsibility, where the first one are those determinants for which people are not responsible. Bourguignon et al. (2005) note that circumstance variables are exogenous by definition, but that “effort” variables can also be affected by circumstances and policies, implying that:

$$u = f(c, e(c, \phi), \phi) \tag{2}$$

Differences in circumstances are typically taken as an indication that people are of a different type. For any list of circumstances, such as social class, race, natural talents etc., society is to be separated by types according to individuals’ value of these factors, with people who have the same values of these factors falling into the same type.

A type may thus consist of all individuals of a sufficiently similar family social class or race and gender. By construction, individuals within the same type are considered to be in the same circumstances and, thus, to have an equal ability to achieve advantage. Within

each type, therefore, people’s differential achievement is considered to be entirely due to the different choices they made.

Many studies in economics considers equality of opportunities as an better social goal than equality of outcomes. According to [Bourguignon and de Hollanda Guimarães Ferreira \(2000\)](#), since people care differently about income and leisure, it would be more reasonable to equal opportunities, in order to every person seek their own objectives on a common background.

That puts equality of opportunities in the center of the main public policy goals. According to [Peragine \(2004\)](#), in the perspective presented above, economic inequalities due to factors beyond the individual responsibility are to be compensated by society, while inequalities due to personal responsibility are not.

On that same view, [Hufe et al. \(2018\)](#) states that, normatively, the principle of equality of opportunities derives to the policy recommendation of compensation for unequal circumstances. That means that, for any social inequality due exclusively to different circumstances c associated with types should be subject of social policy ϕ .

Not only economists seem to prefer an opportunity egalitarian society rather than an outcome egalitarian one. [Faravelli \(2007\)](#) [Cappelen et al. \(2010\)](#) show that, when informed about the nature of observed inequality, redistribution preferences are higher when the distances in society are mainly due to circumstances. Also, [Alesina et al. \(2017\)](#) show that, for a set of industrialized countries, people disapprove anti inequality policies, but approve them when they’re accountable for factors beyond individual control, what matters for social cohesion.

2.2 Intergenerational Elasticity of Income and Education

Despite having a broader meaning, as presented above, in this work, inequality of opportunities will be considered the distance of outcomes between individuals associated with their fathers’ outcomes. This concept is mainly linked to intergenerational mobility, that is, how much one’s outcomes from are not due to their family’s previously.

The underlying idea of equality of opportunities in the intergenerational mobility sense is that poor children would have the same opportunities for success as rich children, where those who work hard are able to succeed, regardless of family background. Therefore, a policy ϕ in a opportunity egalitarian society would be oriented to reduce the expected outcome $y_{i,t}$ of the individuals i in time t given their fathers outcome $y_{if,t-1}$ in time $t-1$.

Perhaps the most basic empirical relationship in literature of intergenerational mobility as equality of opportunities relates the earnings of parents to that of their children. This work considers mainly the benchmark regression:

$$\log y_{i,t} = \beta_0 + \beta_1 \times \log y_{if,t-1} + \epsilon_{i,t} \quad (3)$$

Where $y_{i,t}$ is the income of the individual i on year t , and $y_{if,t-1}$ is his father income on year $t - 1$. Given this equation β_1 is the intergenerational elasticity of income. That is a measure of how much of the relative position of a father his son is expected to inherit on average (or, as we will see latter, on the median). If a father’s income is 100% above the mean (or median) of his generation, if β is equal to 0.5, than his son’s income is expected to be 50% above the mean (or median) of his generation.

Its complement, $(1 - \beta)$, is often interpreted as a synthetic measure of intergenerational mobility, meaning that, lesser the β , higher the intergenerational income convergence.

We will also consider the intergenerational elasticity of education, following the equation:

$$S_{i,t} = \alpha_0 + \alpha_1 \times S_{if,t-1} + \xi_{i,t} \quad (4)$$

Where S is the schooling variable, represented by years of study. This equation might have advantages in relation to the prior, as argued by [Black and Devereux \(2010\)](#): "as a practical matter, education has advantages over earnings in terms of estimation; with education, measurement issues are much less difficult. People tend to complete education by their mid twenties so, unlike with lifetime earnings, analysis can successfully take place when children are relatively early in the life-cycle".

2.3 Intergenerational Elasticity of Income and Education in Brazil

Due to its advantages exposed above, income and schooling persistence through generations has been a very popular measure of (in)equality of opportunities in Latin America, including Brazil.

According to [Ferreira and Veloso \(2003\)](#), cross-generational educational mobility in Brazil is based on data from the 1996 PNAD supplement, which is lower than in all developed and developing countries except Colombia. Still, mobility varies between regions and race, being greater in the South and Southeast and for the white population than in the North and Northeast and for the black population. Furthermore, with the exception of children with parents at the top of the distribution of years of study, there is a greater intergenerational persistence of education for children of parents with low schooling.

The results of [Ferreira and Veloso \(2003\)](#) are in line with [Behrman et al. \(2001\)](#), which shows a correlation between parents' education and the considerably higher education of children in four Latin American countries, including Brazil, in relation to the United States, in addition to the fact that Brazilians have among them the highest correlation, even compared to Colombia, with a slightly lower intergenerational transmission coefficient of education.

In Brazil, according to [Barros and Mendonça \(1997\)](#), the transmission mechanisms of education from parent to child is greater than the same in relation to income, which shows that the mechanisms of transmission from parent to child of education were stronger than those of income. With more updated data, [Gonçalves and Neto \(2013\)](#) investigate if there was a greater Intergenerational Educational Mobility in the Metropolitan Region of Recife, with microdata made available on the subject by the Nabuco Foundation (Fundaj), finding a considerable reduction in educational persistence between the generations between 1996 and 2010, indicating that the strong schooling of the population played a leading role in this process of almost 15 years.

[Torche \(2011\)](#) finds significant results for the role of education in increasing social mobility in the United States, where there is a low intergenerational transmission of schooling between parents with a university degree and their respective children. Such intergenerational persistence of education, however, grows as much for fewer years of parenting as for more, forming an intergenerational U-education curve.

[Mahlmeister et al. \(2017\)](#) used data from the social mobility supplements of PNADs 1996 and 2014 to compare the Intergenerational Educational Mobility in Brazil. The degree of Intergenerational Elasticity of Education in Brazil in 2014 is 0.49, lower than in 1996 (0.68). However, the mobility pattern is not linear with the level of parental schooling. Dividing the sample according to parents' education, the authors show a coefficient of persistence of 0.95 for children of parents with three years or less of schooling, and 0.38 for children of parents with more than three years of schooling.

Moreover, the result of a regression of the son's education into a two-order polynomial in the father's education confirms the evidence of non-linearity in the transmission of educational inequality between generations, since the quadratic term is negative and significant, denoting that the persistence is lower for children of parents with higher schooling. Finally, they found a trend towards an increase in educational persistence at the upper end of this distribution, and a reduction in the bottom.

Educational mobility is a large determinant of Intergenerational Income Mobility, since schooling can impact the earnings by two primary channels: first, raising productivity via human capital accumulation (Becker, 1994), lowering the cost of information acquisition (Rosenzweig, 1995) and acquirement of skills, experience and knowledge.

Also, signaling through education (Spence, 1978), due to labor markets' asymmetric information, functions as a way to produce credible pieces of information to make employers more willing to hire workers for higher wages. Griffin and Edwards (1993) estimates for Brazil from a mincerian equation the rate of return to an additional year of schooling between 12.8 and 15.1%

Few articles analyze intergenerational income mobility in Brazil, using the National Household Sample Survey edition of 1996. E (2007) analyses the intergenerational mobility of wages and estimate an intergenerational elasticity among men with 25 to 34 years old of 0.69. Ferreira and Veloso (2006) estimate of intergenerational mobility of earnings and found a intergenerational earnings elasticity of 0.73. The authors show non-linearly throughout the distribution, increasing with the income of the parents. Pero and Szerman (2008) finds a coefficient of 0.715 for labor income and 0.737 for life-cycle adjusted labor income.

Pero and Szerman (2008) also show that the intergenerational income mobility process in Brazil reduces the Gini coefficient of "initial" incomes from .60 to .40 of the expected incomes. This result means that 66.6 percent of the observed inequality in 1996 between the 1957-1966 cohort was due to inequalities inherited from the previous generation. In other words, the inequality of opportunities contributes to about 65 percent of the income inequality in Brazil. We find similar results for this period following a alternative method for estimate fathers' income, and also show that, for 2014, 50 % of observed inequality in 1975-1984 cohort was due to inequalities inherited from the previous generation.

Following an alternative approach, Bourguignon et al. (2005) making a distinction between "effort" and "circumstance" effects on earnings to determine inequality of opportunities in Brazil, finding that circumstances were accountable for around 10 to 37% of Theil index, depending on the cohort, and 6% of its impact coming from direct effect.

Recently, OECD (2018) stated that a lack of mobility is more prominent at the bottom and at the top of the social ladder, preventing upward mobility for many. For high-inequality and low-mobility countries, such as Brazil, it would take nine generations or more for those born in low-income families to approach the mean income in their society.

2.4 Determinants of Intergenerational Elasticity of Income

Solon (2004) states that individuals from wealthy families have higher incomes because of earlier investments in human capital. He develops a model to understand intergenerational mobility changes over time, exploring intergenerational elasticity variations when the steady state is perturbed by earnings return to human capital or the progressivity of public investment in human capital.

In Solon's model, take the following relation:

$$h_{i,t} = \theta \log(I_{if,t-1} + G_{if,t-1}) + e_{i,t} \quad (5)$$

Where $h_{i,t}$ is human capital in t , $I_{i,t-1}$ is his parents' investment in his education in $t-1$, $G_{i,t-1}$ is the governmental expenditure in education, θ is a positive marginal product for human capital investment and $e_{i,t}$ is the individual's human capital endowment, that is independent to parents' and government investments. Solon (2004) follows Becker (1994) on assuming that this last term can be expressed by the following equation:

$$e_{i,t} = \delta + \lambda e_{if,t-1} + v_{i,t} \quad (6)$$

where v is a white-noise error term and λ is the heritability coefficient. This way, the an individual income (in log) is a function as expressed below:

$$y_{it} = \mu + ph_{it} \quad (7)$$

Where p is the earnings return to human capital, but that also can be interpreted as equivalent to $\gamma_{1,t}$, from equation 10, considering schooling as an expression of human capital. Solon (2004), following these equations, demonstrates that, when income inequality in t and $t-1$ are the same, the Intergenerational Elasticity of Income β_1 can expressed by the following equation:

$$\beta_1 = \frac{(1 - \Upsilon)\theta p + \lambda}{1 + (1 - \Upsilon)\theta p \lambda} \quad (8)$$

Where Υ is the progressivity of the public spending in education. This equation shows that the intergenerational elasticity is greater as: (1) the heritability coefficient λ is greater; (2) human capital investment is more productive (θ is greater); (3) the earnings return to human capital is greater (p is greater); and (4) public investment in children's education is less progressive Υ is less positive.

Considering a mobility process where $y_{i,t}$ and $y_{i,f,t-1}$ variances are not the same, it's demonstrated that intergenerational elasticity of income follows the equation below.

$$\beta_1 = \frac{p_t}{p_{t-1}} \left[\frac{(1 - \Upsilon_t)\theta p_{t-1} + \lambda + (\Upsilon_{t-1} - \Upsilon_t)(1 - \Upsilon_{t-1})\theta^2 p_{t-1}^2 \lambda}{1 + (1 - \Upsilon_{t-1})\theta p_{t-1} \lambda} \right] \quad (9)$$

Equation 9, despite being cumbersome, shows some closeness to equation 15, since both show a positive relationship between β_1 and the proportion of human capital (or schooling) earnings from the last to the first generation (p or γ_1). Also, both relate indirectly through Υ and φ_1 , since an increase of the progressivity in public expenditure on education would generate an increase in the Intergenerational Educational Mobility. Therefore, both equations 15 and 9 show that the Intergenerational Elasticity of Income depends positively on the Intergenerational association of human capital earnings and the Intergenerational Educational Elasticity.

Solon's conclusions may be also be verified empirically, as we will demonstrate below. Let's say that an individual's income is a function of his level of schooling. Then, we have:

$$(\gamma_{0,t} + \gamma_{1,t} \times S_{i,t} + \varepsilon_{i,t}) = \beta_0 + \beta_1 \times (\gamma_{0,t-1} + \gamma_{1,t-1} \times S_{i,f,t-1} + \varepsilon_{i,f,t-1}) + \varepsilon_{i,t} \quad (10)$$

Now, let's say we are interested in the expected income generated by this process. Then, we have:

$$E(\gamma_{0,t} + \gamma_{1,t} \times S_{i,t} + \varepsilon_{i,t}) = E[\beta_0 + \beta_1 \times (\gamma_{0,t-1} + \gamma_{1,t-1} \times S_{i,f,t-1} + \varepsilon_{i,f,t-1}) + \varepsilon_{i,t}] \quad (11)$$

$$\gamma_{0,t} + \gamma_{1,t} \times E(S_{i,t}) = \beta_0 + \beta_1 \times \gamma_{0,t-1} + \gamma_{1,t-1} \times E(S_{i,f,t-1}) \quad (12)$$

Where it's assumed that $E(\varepsilon_{i,t}) = E(\varepsilon_{i,f,t-1}) = E(\varepsilon_{i,t}) = 0$. Then, we can consider a schooling intergenerational mobility process, where:

$$\gamma_{0,t} + \gamma_{1,t} \times E(\alpha_{0,t} + \alpha_{1,t} \times S_{i,f,t-1} + \xi_{i,t}) = \beta_0 + \beta_1 \times (\gamma_{0,t-1} + \gamma_{1,t-1} \times E(S_{i,f,t-1})) \quad (13)$$

$$\gamma_{0,t} + \gamma_{1,t} \times (\alpha_{0,t} + \alpha_{1,t} \times E(S_{i,f,t-1})) = \beta_0 + \beta_1 \times (\gamma_{0,t-1} + \gamma_{1,t-1} \times E(S_{i,f,t-1})) \quad (14)$$

Assuming that $E(\xi_{i,t}) = 0$. Recomposing the terms of this equation, we have:

$$\beta_1 = \frac{\gamma_{0,t} + \gamma_{1,t}\alpha_{0,t} - \beta_0 + \gamma_{1,t}\alpha_{1,t} \times E(S_{if,t-1})}{\gamma_{0,t-1} + \gamma_{1,t-1} \times E(S_{if,t-1})} \quad (15)$$

This equation shows that Intergenerational Elasticity of Income, or β_1 , is increasing in $\gamma_{1,t}$ and in $\alpha_{1,t}$, and decreasing in $\gamma_{1,t-1}$. That means that the persistence of income through generations is stronger when the schooling earnings in t and the intergenerational persistence of education from t-1 to t are higher, and when schooling earnings in t-1 are lower.

Table 1 summarizes the determinants of Intergenerational Elasticity of Income, showing three stages from first to second generation, where, on initial years, prior public investment in education for the parents matters the most, followed in the intermediary years, when parents are adults, by the Labor Market Structure (including schooling earnings) and public investment in education for their children, so that in the final years, when the children are adults, their schooling level determines their wages accordingly to the new Labor Market Structure.

Table 1: Determinants of Intergenerational Elasticity of Income

First Generation		Second Generation	
Initial Years	Intermediary Years	Final Years	
Public Education Investments	Labor Market Structure	Public Education Investments	Labor Market Structure

Black and Devereux (2010), observed that these relations between Intergenerational Income and Educational Mobility highlight the role for public provision or financing of education to equalize opportunities. So, in the next session, we will highlight the main points of educational policy recent history in Brazil.

2.5 Brazilian Investment in Education

According to Kerstenetzky (2012), Latin America internal heterogeneity justifies the identification of well-being regimes, with specific deficits of "commodification", that is, the degree of insertion in the formal labor market, and the extension and quality of the social protection and provision of opportunities ("de-commodification").

However, with the 80s and 90s wave of re-democratization, Latin America starts incorporating social rights into the public agenda, even with this trajectory being challenged by the debt crisis, fiscal adjustment and subsequent reforms in social policies (Huber, 2010; Haggard Kaufman, 2008). In the, 2000s, Taking the region as a whole, social spending expanded continuously, from 10% of GDP between 1990 and 1995, to 16% in 2008, while the tax burden increased from about 20% to 28% of the product in the same period (Kerstenetzky (2012)).

In Brazil, Oliveira (1999) subdivide social spending trends in four group of years: 1980-84, with strong contraction of public spending in the social area; 1985-89, when there's a considerable expansion of social spending and a significant advance in the decentralization process, despite no concerns about its efficiency, gradually worsening the conditions of its financing; 1990-94, in which there is a new contraction of expenses in the social area, despite the increase in the tax burden; 1994-95, when social spending for the three levels of government recovers the levels achieved in the late 1980s as a proportion of GDP (even

surpassing them), while initiatives are being taken to better organize the decentralization process of among government spheres, which reinforces their tendency to specialize in certain areas.

In Brazil official data on Public Spending starts only in 2000, but there's been many estimates of its levels and trends from before that year. [Menezes \(2008\)](#) aggregates all constitutional taxes linkages to education since 1930s, showing that, 1934 and 1946 Constitutions linked 10 and 20% of tax the federal and states revenues, respectively (municipal revenues linkages went from 10 in the first one to 20% in the last one).

In 1967 Constitution, no tax revenue were linked to the sector, what changed with the 1969 Constitutional Amendment n° 1, that linked 20% of municipal revenue, and the 1983 Constitutional Amendment n° 24, that linked 25% of municipal and state revenues, and 13% of federal revenue. Finally, 1988 Constitution raised the percentage of federal linkage to 18%, maintaining the other ones.

Table 2 shows a historical series of education public spending estimates from the 60s to 1988, showing that, until early 80s, its level remained around 2.5 and 2.8% of GDP and 10% of all public spending. After 1983 Constitutional Amendment n° 24, however, Brazil investment in education jumped to 3.74% of GDP and 15% of total public spending.

Table 2: Education Public Spending in Brazil

	% of GDP	% of Public Revenues
1966-70	2.70	11.26
1971-75	2.81	11.10
1976-80	2.50	9.96
1981-85	2.66	10.48
1986-88	3.74	15.14
1990s	4.00	14.76
2000s	4.20	12.87
2011-2015	5.04	15.5

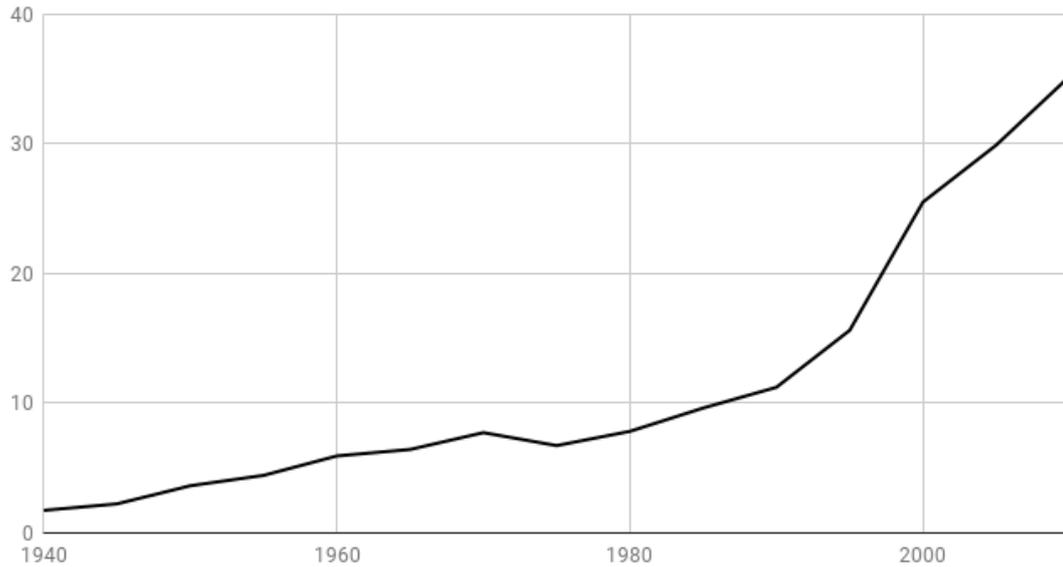
Source: Oliveira (2010), Maduro Jr. (2007), Almeida (2001) Brazilian Minister of Education

According to [Almeida \(2001\)](#), public spending in education remained around 3.8% of GDP in 1994, raising to 4.3% only 5 years later, in 1999. On the second half of that decade, there were major changes in this sector, such as 1996s National Education Basic Guidelines Law (n° 9394), and the implementation of the Fund for Maintenance and Development of Elementary Education and Valorization of the Magisterium (Fundef), that was extended to all Basic Education in the 2000s.

In this period of increasing public expenditure in Education, there were major improvements on school attendance through the last decades. Figure 1 shows that, while from 1940 to 1990 (which means half of a century) the 15-24 years old population with completed secondary schooling went only from around 1.7 to 11.2%, an average increase of less than 0.2 percentage point per year. A decade latter, however, this proportion rose to more than 25%, and then 10 years latter to 35%, average annual increases of 1.3 and 1.0 percentage points, respectively.

Figure 1

15-24 years old Population with Completed Secondary Schooling (%)



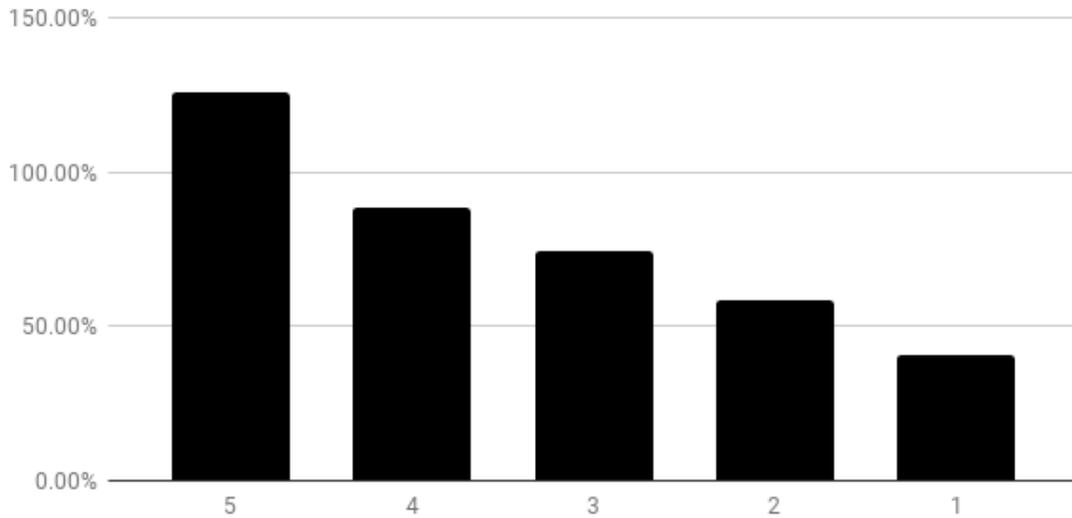
Source: Barro and Lee (2013)

Further data measures the accelerating pace of education in Brazil. According to the National Sample Household Survey (called PNAD), in the 1980s about 25 percent of children 7-14 were out of school, and almost 50 percent of 15-17 year olds were in the same situation. However, from the end of the first half of the 1990s these rates accelerate rapidly, until, as early as 2001, these percentages fell to around 2 and 15 percent, respectively.

This structural change in educational attainment was largely progressive. Looking at children born in 1957-66 and in 1975-84 by their fathers' labor income quintile, figure 2 shows a major increase in poorest children years of study from 1977 to 1995 (when they were 11 to 20 years old), above 100%, while for the richest sons and daughters this rise did not reach 50%.

Figure 2

Percentual change in 1957-66 and 1975-84 sons' years of study by their fathers' labor income quintile from 1977 to 1995



Source: PNAD 1977 and 1995

So, after four centuries of educational exclusion among the poorest of the population, Brazil has gone through the last 30 years of rapid expansion of basic and university school attendance. Governmental educational policies in the first decades of the year 2000 were marked by inclusion programs in Higher Education (FIES, PROUNI, and quotas), as well as a greater effort for training and professional qualification with vocational education.

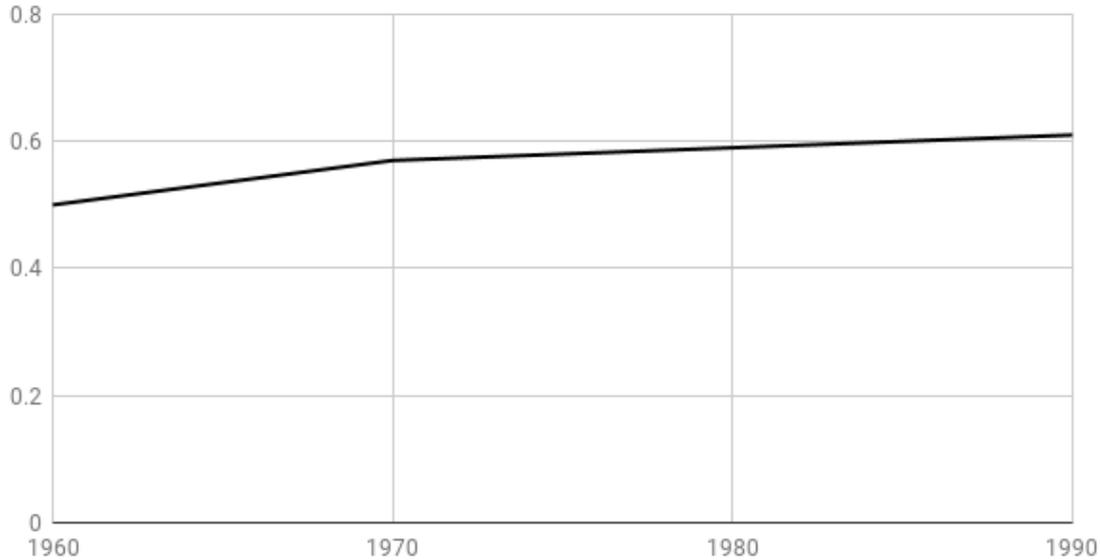
However, despite educational policy has had a major shift after the middle 1980s, persistence of income through generations also depends on the labor market features in each generation, specially on the education premium dynamics. [Ferreira and Veloso \(2006\)](#) states that "besides the evolution of the educational distribution over time, the shape and changes in the pattern of the schooling premium may have an important role in explaining changes in wage persistence over time and across different segments of fathers' wage distribution".

2.6 Brazilian Labor Market

Inequality in labor market was a very high and persistent in Brazil through the second half of the 20th Century. After high rates of urbanization and its own "boom" in the 60-70s, Brazilian economy did not achieve any decrease, but rather an increase in any income concentration index, as shown in [Figure 3](#).

Figure 3

Labor Force Individual Income Gini Coefficient



Source: Barros, Mendonça and Rocha (2013)

[Langoni \(1973\)](#) was the first one to introduce the causes of the high and increasing inequality in Brazil. Following [Becker \(1964\)](#) and using a log-linear Mincer model with census data, it was stated that "the largest income differences are associated with differences in levels of education" ([Langoni, 1973](#), p. 110), meaning that the inequality in schooling as much as its high and rising wage returns were responsible for income concentration level and trend.

[Fishlow \(1975\)](#), while criticizing most of Langoni conclusions, states that the educational policies adopted by the 1964 regime consolidated and reproduced already existing inequalities in Brazilian society. According to his study, the previous levels of family income that fundamentally determine access to education, not the opposite.

Following some conclusions showed in Subsection 2.5, [Malan \(1974\)](#) and [Fishlow \(1975\)](#) argue that access to education was monopolized by the higher income classes, and the probability of poor children making higher incomes in the future was relatively low and heavily influenced by parental status. Therefore, to the extent that the privileged class had a "monopoly" on access to education, there would be no condition of equal opportunities, which guaranteed the very reproduction and perpetuation of existing inequalities.

Besides earnings inequality explained by education, [Wells \(1974\)](#) states that, following developed country experiences, a reduction in income concentration also comes from the formation of an independent trade union movement and other institutional factors, such as the minimum wage. In fact, both unions and minimum wage were heavily controlled by dictatorship government at the time, as stated by [Furtado \(1972\)](#) and [Bacha \(1975\)](#).

Yet, an alternative explanation for the rise in inequality is given by [CEPAL \(2010\)](#), looking at the productive heterogeneity led by industrialization in the 1950-80 period. Citing [Furtado \(1964\)](#), [Sunkel \(1970\)](#) and [Pinto \(1970\)](#), in the Latin American model of productive and social heterogeneity, a small part of the population appropriated a substantial portion of the considerable increase in productivity that occurred in the economy as a whole on those decades. However, they mention, the increase in productivity that later accompanied industrialization allowed a gradual improvement in the performance of

workers, increasingly absorbed by modern sectors in permanent expansion.

After the seventies, Brazil faced a tremendous rise in inflation rates and went through a economic "lost decade", which induced, after 20 years of military rule, the initial stages of the transition to democracy. With strong demands 'to redeem the social debt', a common expression in the mid-eighties, the first ten years of re-democratisation (1985-94) saw much progressive social legislation, but since, the beginning of the nineties, labor market faced major negative impacts due to trade liberalization, when Brazil cuts its tariffs from 63% in 1986 to 15% in 1994 according to [Menezes-Filho and Scorzafave \(2009\)](#).

[Menezes-Filho and Mundler \(2007\)](#) analyzes the labour reallocation in response to this liberalization, showing that the share of displaced workers with no reallocation for four years rises from 13% to 22% in the same period. The authors argue that employment is reducing in comparative-advantage and exporters sectors since their productivity increased faster than their production. This way, workers of those sectors went mainly to informal or self-employment sector. After 1999, job creation raised gradually, including the industrial sector, but mainly in services.

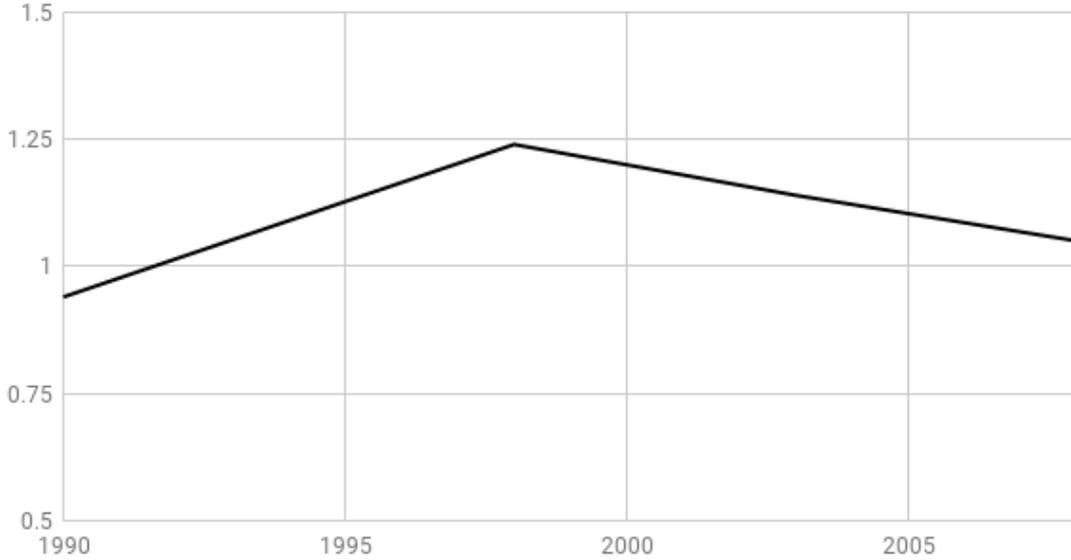
Over the 2000s, income inequality declined in Brazil, due to minimum wage real gains policy, social programs expansion and new labor market dynamics, according to [Barbosa Filho \(2013\)](#). [Firpo and Reis \(2007\)](#) show the minimum wage was very important in reducing inequality in the country, mainly in the high inflation period. Also, labor market mobility increased towards labor formalization in Brazil, which was associated with the more stable macroeconomic environment of higher and stable growth rates, the increase in the Brazilian credit market and the educational policy. [Neri \(2010\)](#) argues that the labor market dynamics improved due to the increased importance of educated workers, which increased the number of employees that receive higher wages. [Barbosa Filho \(2013\)](#) shows that between 2002 and 2009 there was an increase in real wages for the low educational groups and a real wage decrease for the highly educated groups.

Despite having significant impact on inequality in the 2000s, the rise in the schooling level of the Brazilian labor force in the 1990s had not the same effect, with maintenance of its high levels. [Menezes-Filho et al. \(2006\)](#) shows that this puzzle was due to two forces acting in opposite directions: the compression effect (returns to education) inducing a reduction in dispersion, and the composition effect contributing to a rise in inequality. Since education distribution of the workforce began to equalize, the composition effect started contributing to a decline in inequality 10 years latter.

An alternative explanation for the stability in the high rates of inequality in the 1990s was strong increase in the sector dispersion of productivity, led by years of trade liberalization. As Figure ?? shows, between 1990 and 1998 the coefficient of dispersion of productivity between sectors increased, falling later in the 2000s.

Figure 4

Productivity Dispersion Index in Latin America



Source: Economic Commission for Latin America and the Caribbean; “América Latina y el Caribe. Series históricas de estadísticas económicas 1950-2008”, Cuadernos estadísticos, N 37 (LC/G.2415-P), Santiago de Chile, 2009

Messina and Silva (2018) also showed that, in South America, the exchange rate depreciated significantly in the second half of the 1990s and appreciated significantly in the 2000s. Hence, the prices of tradable goods rose relative to nontradable goods in the second half of the 1990s and fell during the 2000s boom period.

The authors also show that, in Brazil, the wage premium for highly experienced workers declined faster than the wage premium for young workers, while the share of skilled workers who were highly experienced increased much more rapidly than the share of those who were inexperienced. So, during the 2000s, changes in the labor supply were not the only driver on the evolution of the skill premium, but also slowdown in the demand for skilled labor.

3 Methodology and data

3.1 Estimating fathers’ income by TSIV

According to the theoretical framework exposed above, the variables of interest to evaluate the intergenerational mobility process is the labor income of the father and the expected income of the son. We explore the Socio-Occupational Mobility data from Brazilian National Sample Household Survey (PNAD), a cross-section of nearly 350,000 individuals conducted yearly from the mid 70s to 2015 by the Brazilian Institute of Geography and Statistics (IBGE). Almost every year, PNAD has additional questions regarding a specific topic, called a Thematic Supplement. In 1996 and 2014, it had additional data about socio-occupational characteristics of the population at least 16 years old and their families, but when aged 15 years old. Since we do not have information on fathers’ income, what we overcome implementing a Two Stages Instrument Variable, applied by Bjorklund and Jantti (1997) and Pero and Szerman (2008).

According to Bjorklund and Jantti (1997), the TSIV estimator is equivalent to the

standard IV estimator if: (i) the two samples are from the same superpopulation (i.e., the sample moments have the same limiting values), and (ii) the sons' report of their fathers' characteristics is not noisier than the fathers' own.

To implement the TSIV, it was used the National Household Sample Surveys of 2014 and 1995, and the editions from 1996 and 1977. The first and third ones, referred as "sons' sample", give information about their income, as well as the parent's characteristics of educational levels and occupation reported by the sons. In the other hand, the 1995 and 1977's sample, or the "parents' samples" give data about the father's incomes and characteristics in a synthetic way. We will restrict our sample to individuals from 30 to 39 years old, to get a age cohort that will allow us to compare similar historical times. With this restrictions, we are comparing a mobility process from the years 1972-81 to 1996 and 1990-99 to 2014.

An important difference between PNAD from 1996 and 2014 is that, while the first one asks the fathers' schooling and occupation only to the responsible for the household and his/her husband/wife, while in the last one the question was answered by any one randomly selected in the household. This way, in order to make the two datasets comparable, we will use only the first category of role in the household. Also, since 1996 PNAD does not have individuals from rural cities in the North Region (except for the ones in Tocantins State), we will have to exclude them in the 2014 edition. Finally, our sample is also restricted only for those who reported fathers' education and had an occupation with positive income in the labor market with at least 40 work hours per week.

In 1996 and 2014 sample, the education of the parents is reported in different categories, which leads us to aggregate all schooling variables in 9 levels, including for sons. Also, occupations were reported in about 300 codes from different categorizations in the 70's, the 90's and 2000's. So, in order to make all samples comparable, we aggregate their occupations codes following the class schema developed by [Valle Silva \(1992\)](#), which creates a occupational variable with 17 categories¹.

This way, we have in both samples 17 dummies for each occupational category, besides 9 educational levels. For 1996, we used 1977 PNAD for estimating schooling and occupational status returns, following [Pero and Szerman \(2008\)](#), and, for 2014, we used 1995 PNAD, maintaining the same time gap for both periods. The specification for 1996 or 2014 follows as showed, below.

$$Y_{i1977/1995} = \gamma_0 + \gamma_1 \times S_i + \gamma_2 \times Ocup_i + \gamma_3 \times Man_i + \varepsilon_i \quad (16)$$

Where $Y_{i1977/1995}$ is vector of the observed napierian log of labor income of all men and women in working 40 hours/week or more, that have children born from 1957 to 1966 (for the 1977 sample) or from 1975 to 1984 (for the 1995 sample). S_i is their schooling level, $Ocup_i$ is a matrix of dummies for their occupational category (the base is the category "Rural Workers") and Man_i is a dummy for their gender (the base is the category "Women"). Finally, γ_0 , γ_1 , γ_2 and γ_3 are parameters to be estimated (where γ_2 is vector of 16 parameters), and ε_i is the vector of residuals.

After estimating the parameters for these observed characteristics, we input them in the 1996 and 2014 samples, that have the declared schooling level and occupational category of the fathers' surveyed. Then, we have a expected fathers' labor income, given by the equation:

$$\hat{Y}_{if1996/2014} = \hat{\gamma}_0 + \hat{\gamma}_3 + \hat{\gamma}_1 \times S_{if} + \hat{\gamma}_2 \times Ocup_{if} \quad (17)$$

Where S_{if} is the vector of individuals i fathers' schooling level and $Ocup_{if}$ is their matrix of fathers' dummies for occupational categories. Note that γ_3 , that is the parameter

¹[Valle Silva \(1992\)](#) actually creates 18 occupational classes, but we will be able only to categorize 17 of them

associated with gender is summed to the equation without any dummy, since all fathers are naturally men.

3.2 Descriptive Statistics

The sample from 1996 has almost 12,400 individuals that, when weighted, represents almost 6 million individuals from the total population. 2014 sample, on the other hand, has almost 2,570 individuals that, when weighted, represents little more than 1.5 million from the total population.

Table 3, shows some descriptive statistics about the samples. For fathers, there is a very sharp rise in average schooling, that rose from 3 to 5 years of study, a difference of 66.6%.

For Valle Silva (1992) occupational classes², table 3 shows that fathers have similar distribution of occupations and educational levels in fathers and children's sample, in both periods.

As one can see, in both double of samples there's a similarly highly unequal schooling distribution, but with strong rise in mean years of schooling for fathers and children, that rose from around 3 to 4.8 (fathers) and 6.9 to 10.5 (children). Since schooling mean and Gini reported shows similar levels and trends for all double of samples, allowing us to rely on the consistency of the TSIV.

²To check what each class mean, its full classification is on Table 21, in the appendix, section 7

Table 3: Fathers' occupational and educational distribution in fathers' and children's samples

	1977 (fathers)	1996 (children)	1995 (fathers)	2014 (children)
nvs 1	0.010	0.008	0.014	0.019
nvs 2	0.033	0.019	0.046	0.037
nvs 3	0.007	0.009	0.010	0.021
nvs 4	0.015	0.016	0.022	0.015
nvs 5	0.032	0.017	0.025	0.030
nvs 6	0.069	0.076	0.107	0.071
nvs 7	0.000	0.000	0.000	0.000
nvs 8	0.043	0.045	0.042	0.050
nvs 9	0.061	0.046	0.084	0.085
nvs 10	0.137	0.134	0.178	0.191
nvs 11	0.076	0.070	0.107	0.096
nvs 12	0.036	0.029	0.055	0.050
nvs 13	0.015	0.009	0.021	0.011
nvs 14	0.001	0.000	0.001	0.000
nvs 15	0.027	0.022	0.018	0.008
nvs 16	0.012	0.010	0.014	0.012
nvs 17	0.186	0.264	0.138	0.153
nvs 18	0.197	0.225	0.119	0.152
Education				
0 years of schooling	0.31	0.35	0.21	0.27
2 years of schooling	0.30	0.30	0.20	0.15
4 years of schooling	0.18	0.21	0.25	0.25
6 years of schooling	0.09	0.03	0.08	0.03
8 years of schooling	0.04	0.04	0.08	0.09
10 years of schooling	0.01	0.01	0.02	0.01
11 years of schooling	0.03	0.04	0.09	0.12
13 years of schooling	0.01	0.00	0.01	0.01
16 years of schooling	0.03	0.03	0.06	0.07
Fathers' Schooling Mean	3.22	2.90	4.80	4.89
Parents' Schooling Gini	0.564	0.590	0.496	0.529
Childrens' Schooling Mean	—	6.85	—	10.36
Childrens' Schooling Gini	—	0.387	—	0.218

Source: Author' tabulations from PNADs 1977 and 1996; 1995 and 2014

Following [Pero \(2002\)](#), we will group occupations into 9 categories, according to [Scalon \(1999\)](#) categorization, in order to analyze the changes through generations in occupations. Table 4 shows that there were similar trends between the 1970s to 1996 and the 1990s to 2014, but with some important differences.

Starting by the similarities, both periods show a sharp decrease in the share of rural occupations, from around 50% to 33% on fathers' and children 1996 sample, and from around 21% to only 5% on fathers' and children 2014 sample. On the other hand, in both samples we see an sensible increase between generations of the share of Professional, Non Routine Manual and Qualified Manual occupations. Finally, Employers Owners remained stable through generations in 1996 and 2014 sample, around 7.5 and 10.5%, respectively.

Table 4: Fathers and Children Occupational Distribution through generations by Categorization

Scalon (1999) Categories	Valle Silva (1992) Categories	1996 sample		2014 sample	
		Fathers (1972-81)	Children	Fathers (1990-99)	Children
Professional	nvs1	0.85%	1.88%	2.15%	4.07%
	nvs3	0.95%	2.02%	1.65%	4.69%
Managers	nvs2	1.89%	3.58%	5.66%	6.76%
	nvs4	1.65%	1.51%	2.59%	2.22%
Employers Owners	nvs6	7.64%	7.37%	10.48%	10.86%
Non routine manual	nvs5	1.74%	3.06%	4.58%	7.73%
	nvs8	4.51%	5.09%	6.73%	10.15%
Own account owners	nvs7	-	-	-	-
Qualified manual	nvs9	4.57%	8.32%	8.20%	8.59%
	nvs11	6.98%	9.56%	10.47%	14.86%
Unqualified manual	nvs10	13.36%	18.78%	17.07%	15.64%
	nvs12	2.86%	5.07%	6.97%	8.14%
	nvs13	0.89%	1.07%	1.76%	1.25%
	nvs14	0.05%	0.03%	0.08%	0.00%
Rural Employers	nvs15	2.22%	0.80%	0.78%	0.00%
	nvs16	1.01%	1.16%	1.78%	0.90%
Rural employees	nvs17	26.36%	15.68%	7.94%	0.00%
	nvs18	22.47%	15.01%	11.13%	4.14%

Source: Author' tabulations from PNADs 1977 and 1996; 1995 and 2014

Now, on the differences between periods, while in the 1996 sample Unqualified Manual occupations increased their share from 17% to 25% through generations, in the 2014 sample it remained stable around 24-25%. Also, while managing occupations share raised from 3 to 5% in 1996 sample, in the 2014 it was stable on 8-9%.

3.3 Estimating Intergenerational Elasticities and Comparing Intergenerational Mobility Processes

Since we can estimate fathers' income, it is possible to get the coefficients and then have the expected income from two mobility process (that we will call M_{1996} and M_{2014}), and two fathers' income distribution (that we will call F_{1996} and F_{2014}).

We then present our econometric model:

$$Y_i = \beta_0 + \beta_1 \hat{Y}_{if} + \epsilon_i \quad (18)$$

Where Y_i is the napierian log of labor income of the individual i , \hat{Y}_{if} is his father expected napierian log of labor income. Currency is established in 2012 prices in all samples, in order to maintain comparability between values. Since ages of father and son matter on earnings and, consequently, there might be a lifecycle bias in β_1 , we will, additionally, following the lifecycle adjustment proposed by Haider and Solon (2006), where we make an orthogonal projection of the income of individuals in a constant, age and age squared, then take the residuals from this projection as the income variable to be used in the other regressions.

Instead of using a mean function of linear regression, one may use the conditional median function $Q_q(y|x)$, where the median is the 50th percentile. While OLS minimizes $\sum e_i^2$, median regression, also known as least-absolute-deviations (LAD) regression, minimizes $\sum |e_i|$.

The main advantage of the median regression is invariant to monotonic transformations, such as $\ln(\cdot)$, so the quantiles of $\ln(y)$, a monotone transform of y , are $\ln(Q_q(y))$, and the inverse transformation may be used to translate the results back to y . This is not possible for the mean regression since $E[\ln(y)] \neq \ln[E(y)]$.

A similar methodology will be used to estimate intergenerational elasticities of education. The only difference will be the use of a GLS mean regression, the level of son schooling with fathers' schooling reported by their children, following [Ferreira and Veloso \(2003\)](#), rather than a logarithmic median regression.

However, despite being useful as a synthetic measure of intergenerational mobility, the intergenerational earnings elasticity β_1 may be incomplete if there is any non linearity or heterogeneity in the relationship between fathers and their descendants, and β_1 decreases for some groups (let's say, for instance, for poor families), while it rises or remains stable for others (such as for rich families). In this case, in order to declare a mobility process to be more opportunities equalizing than another, we will need another framework, that will be presented in the next subsection.

3.4 Intergenerational Mobility Processes with Heterogeneity

Besides estimating a general intergenerational elasticity of income, we will check for any non linearity in this coefficient by fathers' income. To do so, we will create three classes of individuals, according to their fathers labor income, from the poorest to the richest one. That way, our model will have the following specification:

$$Y_i = \begin{cases} \beta_{0,1} + \beta_{1,1}\hat{Y}_{if} + \epsilon_i, & \text{if } \hat{Y}_{if} < \hat{Y}_{f1} \\ \beta_{0,2} + \beta_{1,2}\hat{Y}_{if} + \epsilon_i, & \text{if } \hat{Y}_{f1} \leq \hat{Y}_{if} < \hat{Y}_{f2} \\ \beta_{0,3} + \beta_{1,3}\hat{Y}_{if} + \epsilon_i, & \text{if } \hat{Y}_{f2} \leq \hat{Y}_{if} \end{cases} \quad (19)$$

Where \hat{Y}_{f1} and \hat{Y}_{f2} are the thresholds between the three classes, from splitting the fathers by the richest and the poorest third, besides the one in the middle.

Also, alternatively, I will estimate β_1 for each racial and gender group, that is, for white men, black men, white women and black women.

3.5 Theoretical Framework for Evaluating Heterogeneous Mobility Processes

In order to deal with heterogeneity, we will combine the intergenerational elasticity approach with [Benabou and Ok \(2001\)](#) theoretical framework to identify and compare an intergenerational mobility processes. Following, we present its theoretical framework.

A income distribution may be identified by a cumulative distribution function (cdf) $F : \mathbb{R}^+ \Rightarrow [0, 1]$, with mean μ_F . Let's denote as $F(X)$ the class of income distribution. The generalized inverse of a distribution $F \in F(X)$ is defined as

$$F^{-1}(p) \equiv \inf\{y \in X : F(y) \geq p\}, \quad 0 \leq p \leq 1 \quad (20)$$

which corresponds to the variable value of the person whose rank in the distribution is p . The Lorenz curve associated with F can be defined as the graph of the function:

$$L_F(p) \equiv 1/\mu_F \int_0^p F^{-1}(q) dq, \quad 0 \leq p \leq 1 \quad (21)$$

When $L_F(p)$ is the proportion of the total (or mean) amount of income relative to the less resourceful p of individuals. An F distribution Lorenz-dominates another distribution G when

$$L_F(p) \geq L_G(p) \quad \forall p \in [0, 1] \quad (22)$$

Which is denoted as $F \succ_L G$.

A mobility process on X , denoted $M(X)$, is a function $M : R^+ \times X \rightarrow [0, 1]$ such that $M(\cdot|y) \in F(X) \quad \forall y \in X$. Thus, $M(x|y)$ is the probability that an individual with a income value y today will have x tomorrow. This process must be continuous and strictly monotone.

Let a society be defined as the triplet (X, F, M) consisting of a set of income X , an initial distribution $F \in F(X)$ and a mobility process $M \in M(X)$. Benabou and Ok (2001) denote opportunities as the expected earnings in t relative to income y in $t-1$.

Let $e_M(y)$ be the conditional expectation of income from a intergenerational process, its distribution induced by (X, F, M) is then given by the cdf

$$\lambda_{F,M(x)} = F(e_M^{-1}(x)) \quad \forall x \in e_M(X) \quad (23)$$

with support $e_M(X)$.

Now, the case when there is perfect equality of opportunities when the expected income conditional to any fathers' earnings inequality is zero. So, it is possible to generalize this intuition stating that a mobility process in a society is equalizer in opportunities when it leads to a ex-ante income prospects that are more evenly distributed than initial earnings endowment, no matter how unevenly distributed it was. Formally, that can be written as

$$\lambda_{F,M} \succ_L F \quad \forall F \in F(X) \quad (24)$$

Now, to compare different mobility processes, it is possible to declare a process M to be more equalizing than N if the expected income of individuals with fathers' in different social positions are more equally distributed under M than under N , no matter the parents' social position distribution. More formally, one can declare $M \succ_{eq} N$ if

$$\lambda_{F,M} \succ_L \lambda_{F,N} \quad \forall F \in F(X) \quad (25)$$

So, summarizing, a intergenerational mobility process M can be declared equalizer if, for any initial inequality, the expected sons and daughters' income are more evenly distributed than the fathers' income, and it can be declared more equalizing than another process N if, again for any initial inequality, it generates a more evenly expected descendants' income distribution (or if the expected descendants' income distribution in M Lorenz-dominates the one in N).

In a mobility process with heterogeneity, we use equation 19 to define our variable $e_M(X)$ as presented:

$$e_M(X)_i = \begin{cases} \beta_{0,1} + \beta_{1,1}\hat{Y}_{if}, & \text{if } \hat{Y}_{if} < \hat{Y}_{f1} \\ \beta_{0,2} + \beta_{1,2}\hat{Y}_{if}, & \text{if } \hat{Y}_{f1} \leq \hat{Y}_{if} < \hat{Y}_{f2} \\ \beta_{0,3} + \beta_{1,3}\hat{Y}_{if}, & \text{if } \hat{Y}_{f2} \leq \hat{Y}_{if} \end{cases} \quad (26)$$

Where we subtract the error term ϵ_i . That will be used for the evaluation of the mobility processes M_{1996} and M_{2014} regarding heterogeneity by fathers' income class. We will also apply the same framework regarding heterogeneity by gender and race.

We will not be able to compare the two mobility process from any fathers' income distribution, but it will be possible to simulate M_{1996} and M_{2014} for two different distributions F , from 1972-81 and 1990-99. This way, we will declare a mobility process to be more equalizing than other if it generates a more evenly distributed expected sons' income in both fathers' earnings distribution.

3.6 Simulating and comparing counterfactual Mobility Processes

Besides quantifying intergenerational elasticities of income and comparing intergenerational mobility processes, this paper tries to understand the main determinants of its dynamics. That means that, if we can say that the intergenerational elasticity of income decreased from 1977-1996 to 1995-2014, what was more relevant to this movement, if a reduction of the schooling earnings from the first to the latter generation, or the reduction of the Intergenerational Educational Mobility of education.

So, we will assume that an individual's and his father's labor income depends on their level of schooling, their gender and their occupational class. Then, we estimate education earnings for all samples as in equation 16. This way, we will have $\gamma_{1,t}$ and $\gamma_{1,t-1}$ from equation 10 for 1977-1996 and 1995-2014.

Also, we will have already estimated intergenerational elasticity of education (φ , from equation 13) for both $M96$ and $M14$. So, let's assume an mincerian-related equation for labor income:

$$Y_{i,t} = \gamma_{0,t} + \gamma_{1,t} \times S_{i,t} + \gamma_{2,t} \times Ocup_{i,t} + \gamma_{3,t} \times Man_{i,t} + \varepsilon_{i,t} \quad (27)$$

And also, we have equation for the Intergenerational Elasticity of Schooling, where

$$S_{i,t} = \alpha_{0,t} + \alpha_{1,t} \times S_{if,t-1} + \epsilon_{i,t} \quad (28)$$

To study the effects of changes in education premium and schooling mobility in both periods, we simulate what would happen to income levels in four different counterfactual scenarios:

- 1996's sons and daughters schooling level following the mobility process from 1995-2014 [Counterfactual 1.1].

$$\begin{cases} S_{i,1996cf} = \alpha_{0,1996} + \alpha_{1,2014} \times S_{if,1972-81} + \epsilon_{i,1996} \\ Y_{i,1996} = \gamma_{0,1996} + \gamma_{1,1996} \times S_{i,1996cf} + \gamma_{2,1996} \times Ocup_{i,1996} + \gamma_{3,1996} \times Man_{i,1996} + \varepsilon_{i,1996} \end{cases} \quad (29)$$

- 1996's sons and daughters and 1977's fathers schooling earnings replaced by the ones estimated in 1995 and 2014, respectively [Counterfactual 1.2].

$$\begin{cases} Y_{i,1996cf} = \gamma_{0,1996} + \gamma_{1,2014} \times S_{i,1996} + \gamma_{2,1996} \times Ocup_{i,1996} + \gamma_{3,1996} \times Man_{i,1996} + \varepsilon_{i,1996} \\ Y_{if,1977cf} = \gamma_{if,1977} + \gamma_{if,1995} \times S_{if,1977} + \gamma_{if,1977} \times Ocup_{if,1977} + \gamma_{if,1977} \times Man_{if,1977} + \varepsilon_{if,1977} \end{cases} \quad (30)$$

- 2014's sons and daughters schooling level following the education mobility process from 1977-1996 [Counterfactual 2.1].

$$\begin{cases} S_{i,2014cf} = \alpha_{0,2014} + \alpha_{1,1996} \times S_{if,1990-99} + \epsilon_{i,2014} \\ Y_{i,2014} = \gamma_{0,2014} + \gamma_{1,2014} \times S_{i,2014cf} + \gamma_{2,2014} \times Ocup_{i,2014} + \gamma_{3,2014} \times Man_{i,2014} + \varepsilon_{i,2014} \end{cases} \quad (31)$$

- 2014's sons and daughters and 1995's fathers schooling earnings replaced by the ones estimated in 1996 and 1977, respectively [Counterfactual 2.2].

$$\begin{cases} Y_{i,2014cf} = \gamma_{0,2014} + \gamma_{1,1996} \times S_{i,2014} + \gamma_{2,2014} \times Ocup_{i,2014} + \gamma_{3,2014} \times Man_{i,2014} + \varepsilon_{i,2014} \\ Y_{if,1995cf} = \gamma_{if,1995} + \gamma_{if,1977} \times S_{if,1995} + \gamma_{if,1995} \times Ocup_{if,1995} + \gamma_{if,1995} \times Man_{if,1995} + \varepsilon_{if,1995} \end{cases} \quad (32)$$

Considering that everything else will be maintained constant, our counterfactual scenarios will generate two different intergenerational elasticities of income for each period. This way, it is going to be possible to declare either the intergenerational mobility of schooling or schooling earnings dynamics between both generations as the main driver if two conditions are met:

- The intergenerational elasticity of income generated by Counterfactual 1.1 is lower than the one generated by Counterfactual 1.2 or vice-versa.
- The intergenerational elasticity of income generated by Counterfactual 2.1 is higher than the one generated by Counterfactual 2.2 or vice-versa.

We will make this procedure for both life-cycle adjusted and not-adjusted income, estimating .

3.7 Coefficients Estimation

Table 5, below, shows the coefficients of the LAD median regression in 1977 and 1995 for labor income of house-holding fathers of children born in 1957-66 and 1975-84, respectively, and also in 1996 and 2014 for labor income of householders born in 1957-66 and 1975-84. The personal characteristics associated, as described above, are schooling level, occupational category and a dummy for gender (1=man). The bootstrap standard errors are presented below the coefficients, in parenthesis.

The main conclusions one sees in the table below is the significant decrease in schooling coefficient on labor income. From 1977 to 1996 it has gone from 11.4% to 10.2%, a difference of 1.2 p.p. On the other hand, from 1995 to 2014 that its decrease was even sharper, from 10.5% to 8.1%, a difference of 2.4 p.p. the double of the first one.

Table 5: Labor Income Regression Coefficients for All Samples

	1977 (fathers)	1996 (children)	1995 (fathers)	2014 (children)
Schooling	0.113693*** (0.0015574)	0.1019369*** (0.0019129)	0.1049822*** (0.0019304)	0.0809374*** (0.0039929)
Man dummy	0.563858*** (0.0120796)	0.4077475*** (0.0276325)	0.4365559*** (0.0276423)	0.3855681*** (0.0267794)
nvs1	1.221709*** (0.031669)	1.202832*** (0.0720409)	1.428061*** (0.0561318)	1.204625*** (0.1263072)
nvs2	1.116349*** (0.0286755)	0.8796268*** (0.0522147)	1.042798*** (0.0398853)	0.6731524*** (0.0788121)
nvs3	0.8433729*** (0.0271495)	0.9566528*** (0.0695428)	1.00107*** (0.0616196)	0.790904*** (0.1181314)
nvs4	1.097027*** (0.0382443)	0.6876617*** (0.0654453)	0.7692017*** (0.0237325)	0.3491321*** (0.0787301)
nvs5	0.4906225*** (0.017512)	0.3383256*** (0.0396659)	0.4437794*** (0.0360818)	0.0838284 (0.068792)
nvs6	1.097027*** (0.0208363)	0.8166363*** (0.034061)	0.9162908*** (0.0198592)	0.4049211*** (0.0804733)
nvs7	- -	- -	- -	- -
nvs8	0.7339692*** (0.0185094)	0.5730817*** (0.0358406)	0.6931472*** (0.0309457)	0.5759339*** (0.0530421)
nvs9	0.6889048*** (0.0158292)	0.5293809*** (0.0408887)	0.6514186*** (0.0198716)	0.2870822*** (0.0573102)
nvs10	0.4097075*** (0.0165483)	0.3273629*** (0.0314311)	0.4199287*** (0.0109945)	0.1250882** (0.0521386)
nvs11	0.5302997*** (0.0196371)	0.4599616*** (0.0374009)	0.6009654*** (0.0222814)	0.0643244 (0.0516364)
nvs12	0.1541505*** (0.0046728)	0.1019369*** (0.0252178)	0.1322462*** (0.0166381)	0.0603013 (0.046382)
nvs13	0.4615189*** (0.0259696)	0.2865408*** (0.0419087)	0.4054646*** (0.0347165)	-0.0001206 (0.105251)
nvs14	-0.0689931 (0.1371489)	-0.205015 (0.3152298)	-0.2565913 (0.2274395)	- -
nvs15	1.070441*** (0.0312523)	0.7962253*** (0.1878131)	0.9795444*** (0.0603574)	- -
nvs16	0.3671478*** (0.0296429)	0.236818*** (0.0561571)	0.2099644*** (0.0094627)	0.2631955*** (0.0931767)
nvs17	0.0450644** (0.0186912)	-0.2027326*** (0.0531269)	-0.0263584 (0.0302389)	- -
Constant	5.582774*** (0.0126941)	5.57232*** (0.0289737)	5.548628*** (0.032776)	5.919933*** (0.0360953)

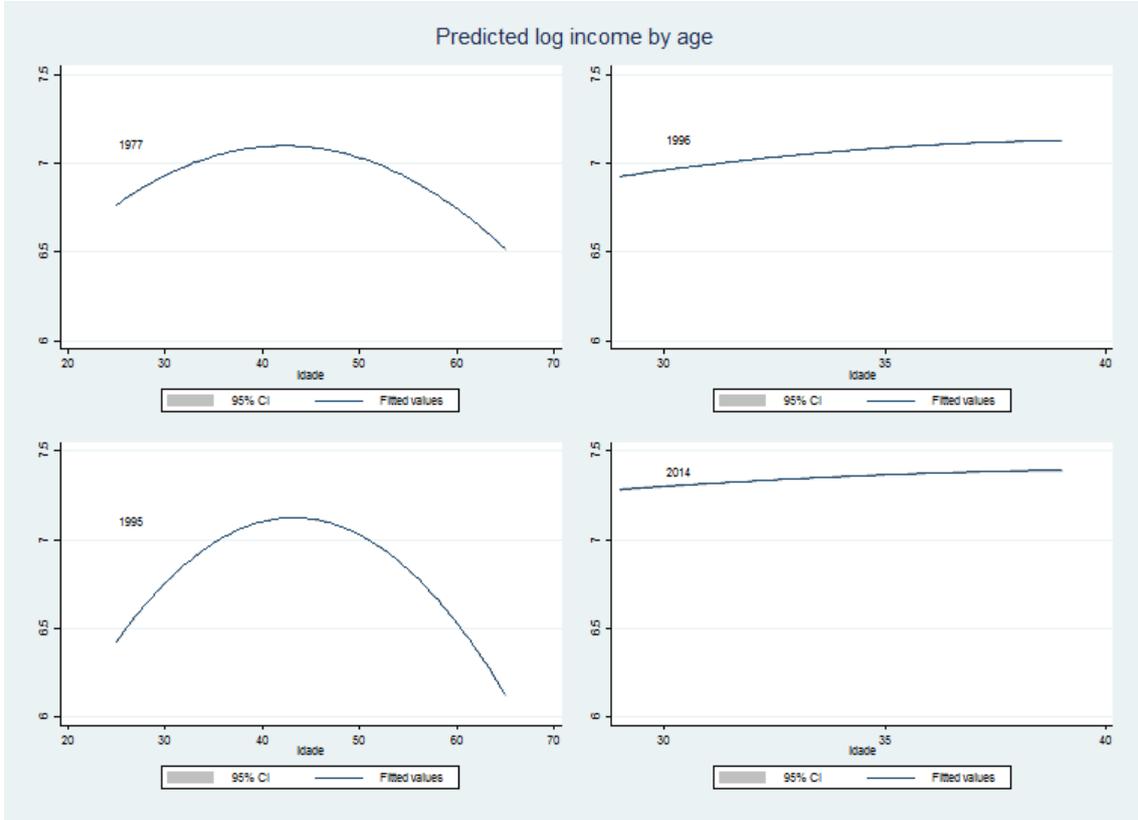
Source: author' estimates from PNADs 1977 and 1996; 1995 and 2014

* for significant at 10%, ** for significance at 5% and *** for significance at 1%.

However, these coefficients are possibly differently biased due to distinct distributions and means in the life-cycle of fathers and children between samples. Figure 5 shows that labor income and age has a quadratic relationship from 25 to 65 in all samples. Also, while

the mean age of fathers of children born from 1957 to 1966 in 1977 is 41,7, it goes to 44,5 in 1995 fathers of children born from 1975 to 1984.

Figure 5



Source: author' estimates from PNADs 1977 and 1996; 1995 and 2014

In order to correct differences in the life cycle between parents and children, we will follow [Pero and Szerman \(2008\)](#) and use the residuals method, that consists of (i) making an orthogonal projection of income of individuals at a constant, age and age squared; (ii) take the residuals of this projection as the income variable to be used in the other regressions.

$$Y_i = \beta_0 + \beta_1 \times Age_i + \beta_2 \times Age_i^2 + \epsilon_i \quad (33)$$

Where this new variable, to be named "Adjusted Labor Income", is represented in the equation above as ϵ_i .

Table 6 shows no big differences in the whole story, but a little increase in 1977 and 1996 fathers and children education premium, while in 1995 and 2014 the movement goes in opposite directions: while there is a decrease in fathers' education premium, in children' sample it increases more than all others, from 8.1 to 8.3%, leading to a lesser difference between generations, from 2.4 p.p. to 1.7.

Table 6: Adjusted Labor Income Regression Coefficients for All Samples

	1977 (fathers)	1996 (children)	1995 (fathers)	2014 (children)
Schooling	0.1157471*** (0.0016124)	0.102736*** (0.0018939)	0.1008242*** (0.0017525)	0.0833318*** (0.0040172)
Man dummy	0.578144*** (0.0108824)	0.4257973*** (0.0278109)	0.4981584*** (0.0166596)	0.3906831*** (0.030569)
nvs1	1.168206*** (0.0369189)	1.186028*** (0.0783283)	1.350073*** (0.0433905)	1.181459*** (0.0995102)
nvs2	1.056605*** (0.0214412)	0.8775457*** (0.0392055)	0.9545781*** (0.0308557)	0.6369525*** (0.088786)
nvs3	0.7803353*** (0.0503507)	0.9336435*** (0.0608123)	0.9378895*** (0.0646276)	0.7571032*** (0.0838754)
nvs4	1.051359*** (0.0136687)	0.6630089*** (0.05341)	0.7472559*** (0.0428222)	0.3468648*** (0.1063888)
nvs5	0.4376916*** (0.0223182)	0.3483415*** (0.0293989)	0.3964287*** (0.0326033)	0.0724324 (0.0634144)
nvs6	1.047958*** (0.0112305)	0.8450596*** (0.0338777)	0.9283399*** (0.023023)	0.4161942*** (0.0701606)
nvs7	- -	- -	- -	- -
nvs8	0.6504392*** (0.0209897)	0.606209*** (0.0308502)	0.6693848*** (0.0291572)	0.5608306*** (0.0514675)
nvs9	0.6485644*** (0.0185982)	0.5294778*** (0.0336449)	0.559687*** (0.0158113)	0.2751279*** (0.0441945)
nvs10	0.3718854*** (0.0100412)	0.3350718*** (0.0186195)	0.3625303*** (0.0134495)	0.1271668*** (0.0467431)
nvs11	0.520731*** (0.0109779)	0.4586897*** (0.0259389)	0.5353674*** (0.0168182)	0.0675556 (0.0419708)
nvs12	0.1189225*** (0.013587)	0.0899957*** (0.0300366)	0.0842909*** (0.0173473)	0.0349476 (0.0586329)
nvs13	0.4156129*** (0.0274009)	0.2687559*** (0.0440676)	0.3464702*** (0.0453424)	-0.0116487 (0.0892879)
nvs14	-0.0849465 (0.1034331)	-0.2722878 (0.2565059)	-0.2539833 (0.1964689)	- -
nvs15	1.058205*** (0.0287474)	0.7834165*** (0.2014505)	1.031658*** (0.0773554)	- -
nvs16	0.3321938*** (0.0214642)	0.2439301*** (0.0626398)	0.1362001*** (0.0523692)	0.2352843** (0.1101324)
nvs17	0.0269116** (0.01266)	-0.2149296*** (0.0469742)	-0.0277335 (0.0277395)	- -
Constant	-1.319581*** (0.0145529)	-1.510419*** (0.0330407)	-1.393857*** (0.0191067)	-1.454438*** (0.0479876)

Source: author' estimates from PNADs 1977 and 1996; 1995 and 2014

* for significant at 10%, ** for significance at 5% and *** for significance at 1%.

4 Results

4.1 Intergenerational Elasticity of Education and Income for 1996 and 2014 data

Table 7 shows the intergenerational elasticity of education, income and life-cycle adjusted income. As it's possible to see, there is a higher (but decreasing) persistence coefficient between fathers' and children' schooling and labor earnings in 1996 than in 2014.

In 1996, one observe a positive coefficient of 0.742 in Intergenerational Elasticity of Education, which means that, if the father's has 1 year of study above the mean, his children schooling is expected to be 0.742 above the mean. For labor income and adjusted labor income it goes to 0.757 and 0.763, which means that, for a father's labor income 100% above the median, his children labor income is expected to be 75.7% or 76.3% above the median, indicating a very similar level of persistence of education and earnings for that generations.

Eighteen years latter, however, Intergenerational Elasticity of Education decreases to 0.441 in 2014 sample, while in for Labor Income and Adjusted Income the decrease is smoother, to 0.530 and 0.560, respectively. This first result shows that, despite intergenerational persistence reduced for all variables, schooling led the biggest decrease. That might be due to a lesser increase in occupations mobility, but its reasons go beyond the scope of this article.

Table 7: Estimates of Intergenerational Elasticity

	1996	2014	Difference	Significant?
Education (α_1)	0.742	0.441	-0.301	Yes
Labor Income (β_1)	0.757	0.530	-0.226	Yes
Adjusted Labor Income (β_1)	0.763	0.560	-0.203	Yes

Source: author' estimates from PNADs 1977 and 1996; 1995 and 2014

Similarly to [Ferreira and Veloso \(2006\)](#), we add control variables for the four regional dummies, a dummy for women and a dummy for blacks. As shown in Table 8, neither the levels or trends change significantly, with the degree of persistence of education (α_1) varying from 0.742 to 0.687 in 1996, decreasing to a level from 0.441 to 0.420 in 2014. Labor Income (β_1), on the other hand goes from a coefficient between 0.757 and 0.688 to around 0.530 and 0.491. With a Life-Cycle adjustment, in 1996 β_1 varies from 0.763 and 0.705, while in 2014 it decreases to a level from 0.560 to 0.513.

Table 8: Intergenerational Elasticities with controls

	(a)	(b)	(c)	(d)	(e)	
α_1	1996	0.687	0.737	0.696	0.728	0.742
	2014	0.420	0.437	0.425	0.436	0.441
	Difference	0.267	0.300	0.272	0.292	0.301
	Significant?	Yes	Yes	Yes	Yes	Yes
β_1	1996	0.688	0.766	0.689	0.723	0.757
	2014	0.491	0.524	0.491	0.515	0.530
	Difference	0.198	0.243	0.198	0.209	0.226
	Significant?	Yes	Yes	Yes	Yes	Yes
Adj β_1	1996	0.705	0.773	0.691	0.741	0.763
	2014	0.517	0.561	0.513	0.546	0.560
	Difference	0.188	0.212	0.178	0.194	0.203
	Significant?	Yes	Yes	Yes	Yes	Yes

Source: author's estimates from PNADs 1977 and 1996; 1995 and 2014

Note: control variables are: (e) no controls; (d) regional dummies; (c) black dummy; (b) male dummy; (a) all cited dummies combined

Tables 9 and 10 report the estimates for Intergenerational Elasticity of Education, Income and Adjusted Income by racial and gender or by fathers' income class sub population. As one may see, black men in 1996 held the position of the highest persistence of schooling through generations, statistically significant at 95% confidence above white men and white women (but not black women, whose 95% confidence upper bound is above its previous sub population median coefficient). In 2014, however, it was between black population that α_1 had its larger decrease, mainly for black women, for whom intergenerational elasticity of education decreased 0.411, to 0.259. For all sub populations, α_1 had a statistically significant fall, at 95% confidence.

For labor income, however, results tell a slightly different story. In 1996 descendants' generation, the highest coefficient of intergenerational persistence were in white male population, around 0.7 with or without Life-Cycle adjustment. Black women held the position of lower persistence of income through generations, what was maintained in the next generation, in 2014 - 1 for that sub population went from around 0.6 to less than 0.35. Depending on what type of labor income, results show whether a decrease in intergenerational elasticity for White men and women, or for White men, Black men and women, but not White women. The only group that is shown to have had a reduction in Intergenerational Elasticity of Income by both types is White men population.

Table 9: Estimates of Intergenerational Elasticity (β_1) with Gender and Race Heterogeneity

Education	95% IC Inf Bound	α_{96}	95% IC Upper Bound	95% IC Inf Bound	α_{14}	95% IC Upper Bound	Difference	Significant?
White Men	0.666	0.687	0.708	0.425	0.462	0.500	-0.225	Yes
Black Men	0.713	0.751	0.788	0.429	0.475	0.522	-0.275	Yes
White Women	0.512	0.566	0.621	0.289	0.347	0.406	-0.219	Yes
Black Women	0.573	0.670	0.767	0.176	0.259	0.342	-0.411	Yes
Labor Income	95% IC Inf Bound	β_{96}	95% IC Upper Bound	95% IC Inf Bound	β_{14}	95% IC Upper Bound	Difference	Significant?
White Men	0.657	0.701	0.746	0.467	0.539	0.610	-0.163	Yes
Black Men	0.592	0.658	0.725	0.351	0.483	0.614	-0.175	No
White Women	0.603	0.659	0.715	0.453	0.525	0.597	-0.134	Yes
Black Women	0.438	0.602	0.766	0.171	0.311	0.451	-0.291	No
Adjusted Labor Income	95% IC Inf Bound	β_{96}	95% IC Upper Bound	95% IC Inf Bound	β_{14}	95% IC Upper Bound	Difference	Significant?
White Men	0.674	0.708	0.742	0.514	0.570	0.627	-0.138	Yes
Black Men	0.650	0.692	0.734	0.346	0.473	0.600	-0.220	Yes
White Women	0.618	0.679	0.741	0.483	0.573	0.663	-0.106	No
Black Women	0.497	0.626	0.755	0.187	0.337	0.487	-0.289	Yes

Source: author' estimates from PNADs 1977 and 1996; 1995 and 2014

Now, Table 10 reports the coefficients by fathers' income class, from 3^o third (poorest class) to 1^o third (richest class). As one may see, in 1996 and 2014 intergenerational persistence of education and income is higher in the poorest families. However, in 2014 the differences between coefficients from the 3^o to 2^o and 1^o classes are not statistically significant. Also, while intergenerational elasticity of educational has had a significant decrease for all classes, for income it was only in the 3^o third that the coefficient had a statistically significant fall.

Table 10: Intergenerational Elasticity of Education and Income by Fathers' Income Class

Education (by fathers' income class)	95% IC Inf Bound	α_{96}	95% IC Upper Bound	95% IC Inf Bound	α_{14}	95% IC Upper Bound	Difference	Significant?
3 ^o Class	0.958	1.057	1.157	0.390	0.549	0.708	-0.509	Yes
2 ^o Class	0.481	0.560	0.640	0.093	0.208	0.324	-0.352	Yes
1 ^o Class	0.437	0.460	0.484	0.279	0.335	0.390	-0.126	Yes
Education (by fathers' adjusted income class)	95% IC Inf Bound	α_{96}	95% IC Upper Bound	95% IC Inf Bound	α_{14}	95% IC Upper Bound	Difference	Significant?
3 ^o Class	0.958	1.057	1.157	0.386	0.544	0.703	-0.513	Yes
2 ^o Class	0.481	0.560	0.640	0.165	0.261	0.358	-0.299	Yes
1 ^o Class	0.437	0.460	0.484	0.274	0.327	0.380	-0.134	Yes
Labor Income	95% IC Inf Bound	β_{96}	95% IC Upper Bound	95% IC Inf Bound	β_{14}	95% IC Upper Bound	Difference	Significant?
3 ^o Class	1.313	1.637	1.961	0.747	0.974	1.201	-0.663	Yes
2 ^o Class	0.361	0.545	0.728	0.314	0.727	1.140	0.183	No
1 ^o Class	0.640	0.698	0.756	0.547	0.699	0.851	0.001	No
Adjusted Labor Income	95% IC Inf Bound	β_{96}	95% IC Upper Bound	95% IC Inf Bound	β_{14}	95% IC Upper Bound	Difference	Significant?
3 ^o Class	1.464	1.700	1.937	0.872	1.022	1.172	-0.678	Yes
2 ^o Class	0.397	0.661	0.926	0.326	0.668	1.010	0.007	No
1 ^o Class	0.662	0.704	0.747	0.659	0.814	0.970	0.110	No

Source: author' estimates from PNADs 1977 and 1996; 1995 and 2014

These findings, following [Grawe \(2001\)](#), suggest that there might be borrowing constraints in the poorest families, which might decrease intergenerational mobility. Since this non linear pattern was reduced, and differences between classes are statistically not significant in 2014 - despite the coefficient remains higher for the third class -, there is evidence that somewhat these constraints were significantly lower in that period, what is consistent with the credit boom to the middle and lower classes in the 1990s and 2000s.

These findings are also consistent with [Ferreira and Veloso \(2006\)](#) and [Gaviria \(2002\)](#), who found a clear difference in the non-linear pattern in persistence of income, interpreting

it as an additional evidence that borrowing constraints may play an important role in explaining the intergenerational mobility in Brazil.

4.2 Comparing Mobility Processes with Heterogeneity by Gender and Race and Fathers' Income Class

We now apply Benabou and Ok (2001) to compare the income mobility processes between 1972-81 to 1996 and 1990-99 to 2014, considering gender and race and fathers' income class heterogeneity.

The results are summarized in Table 11. As we can see, whether with F_{1996} or F_{2014} , around 20 years latter expected son's income Gini varies from 0.243 to 0.275 with M_{2014} , while with process M_{1996} , it varies between 0.34 and 0.38. That means that, both expected sons and daughters' earnings are more evenly distributed than fathers', and, for both fathers' earnings distribution, M_{2014} generates a lower $e_M(Y_F)$ inequality than M_{1996} . The result remains the same with adjusted income, as shows Table 12.

Table 11: Comparison between M14 and M96 for Income with Gender and Race Heterogeneity

	1996 sample	2014 sample
Fathers' income Gini F	0.45	0.48
Expected descendants' income Gini from M_{1996}	0.340	0.375
$\rho_{M_{1996}}^{RS}$	0.11	0.12
$\lambda_{F, M_{1996}}$ Lorenz-dominates F?	Yes	Yes
Expected descendants' income Gini from M_{2014}	0.243	0.275
$\rho_{M_{2014}}^{RS}$	0.21	0.21
$\lambda_{F, M_{2014}}$ Lorenz dominates F?	Yes	Yes
$Gini(e_{M_{1996}}(Y_F)) - Gini(e_{M_{2014}}(Y_F))$	0.10	0.10
$M_{2014} \succsim M_{1996}$?	Yes	Yes

Source: author' estimates from PNADs 1977 and 1996; 1995 and 2014

Table 12: Comparison between M14 and M96 for Adjusted Income with Gender and Race Heterogeneity

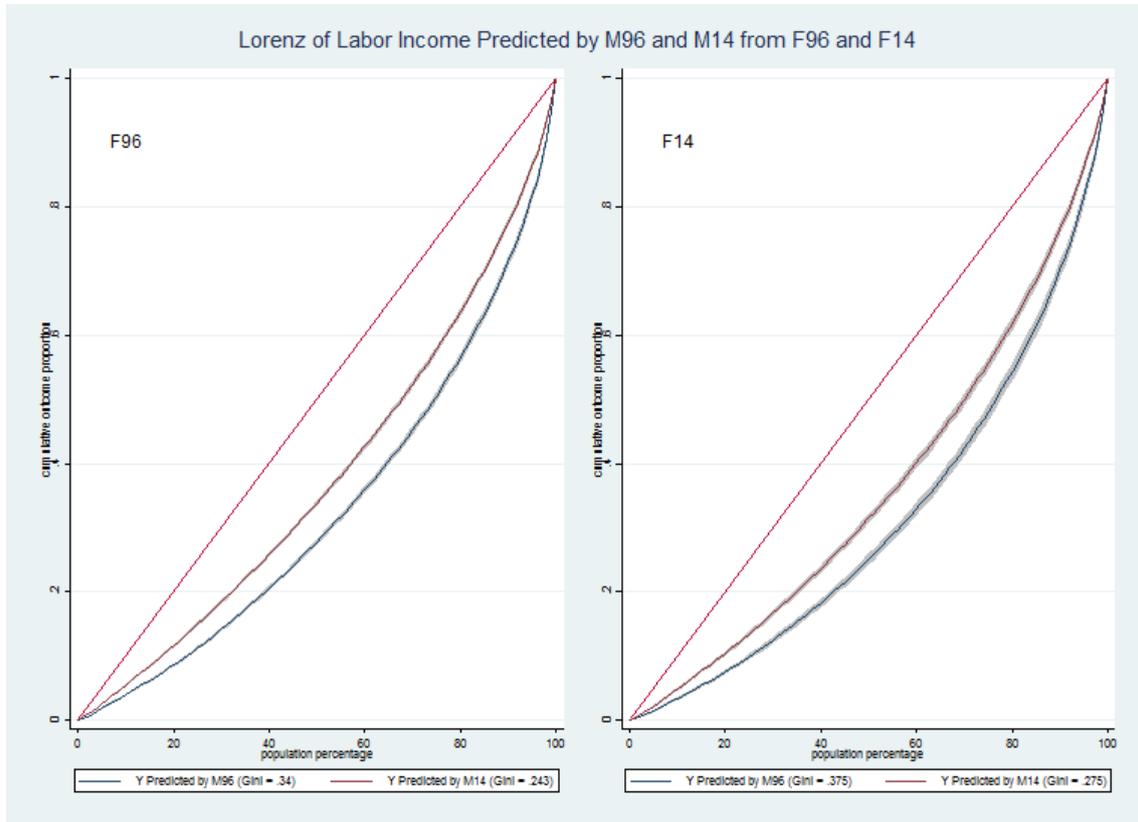
	1996 sample	2014 sample
Fathers' income Gini F	0.44	0.46
Expected descendants' income Gini from M_{1996}	0.342	0.369
$\rho_{M_{1996}}^{RS}$	0.097	0.093
$\lambda_{F, M_{1996}}$ Lorenz-dominates F?	Yes	Yes
Expected descendants' income Gini from M_{2014}	0.250	0.278
$\rho_{M_{2014}}^{RS}$	0.198	0.197
$\lambda_{F, M_{2014}}$ Lorenz dominates F?	Yes	Yes
$Gini(e_{M_{1996}}(Y_F)) - Gini(e_{M_{2014}}(Y_F))$	0.101	0.104
$M_{2014} \succsim M_{1996} ?$	Yes	Yes

Source: author' estimates from PNADs 1977 and 1996; 1995 and 2014

According to our Theoretical Framework, exposed in section 3.5, both M_{1996} and M_{2014} processes were opportunities equalizers, once their expected sons' income distribution generated were more equal than fathers' earnings, for any point of its distribution - meaning that $\lambda_{F, M}$ Lorenz-dominates F.

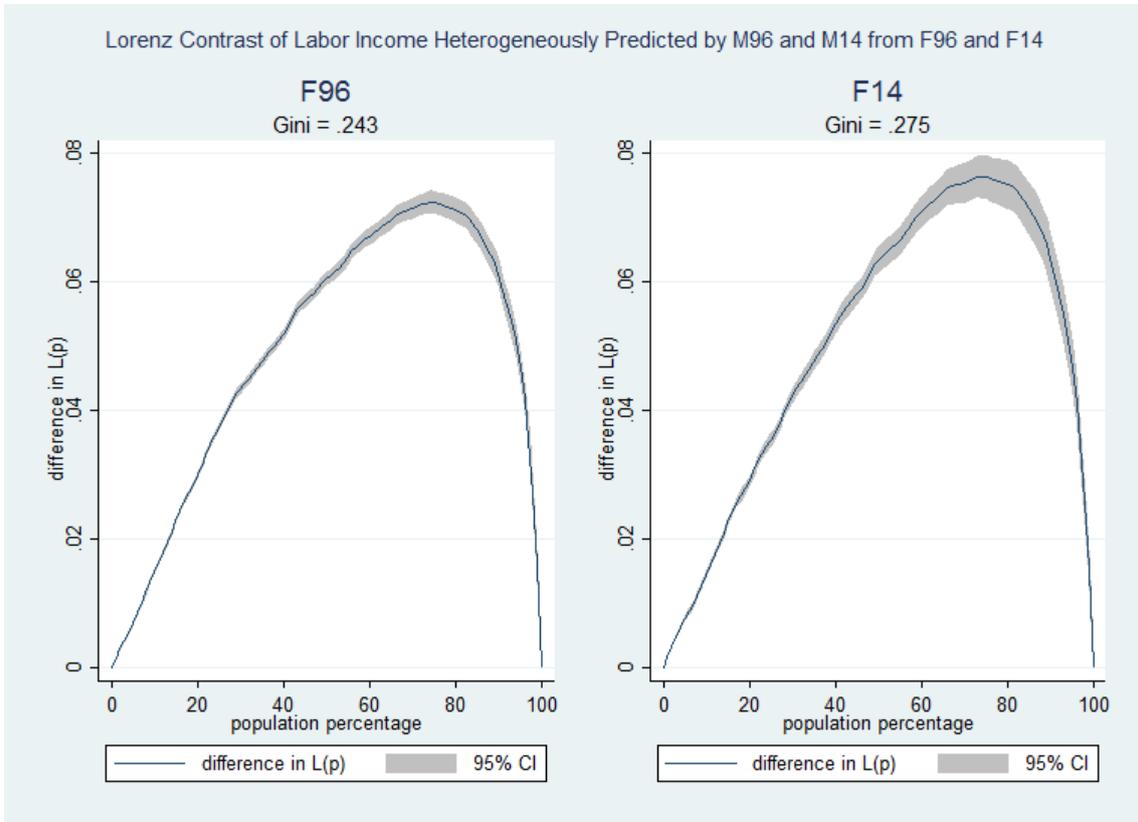
Figures 7 and 9 show the difference between cumulative income (adjusted and not adjusted) from M_{1996} and M_{2014} for each 1% of population percentage, for F96 and F14. Since the difference between both Lorenz Curves were higher than zero for any point between extremes, even for a 95% confidence interval, both from 1972-81 and 1990-99 fathers' income distribution, we can say that $\lambda_{F, M_{2014}}$ Lorenz-dominates $\lambda_{F, M_{1996}}$ for F_{1996} and F_{2014} . That means, according to Benabou and Ok (2001), that, even regarding gender and race heterogeneity, one may declare the mobility process from 1990-99 to 2014 more opportunities equalizing than from 1972-81 to 1996.

Figure 6



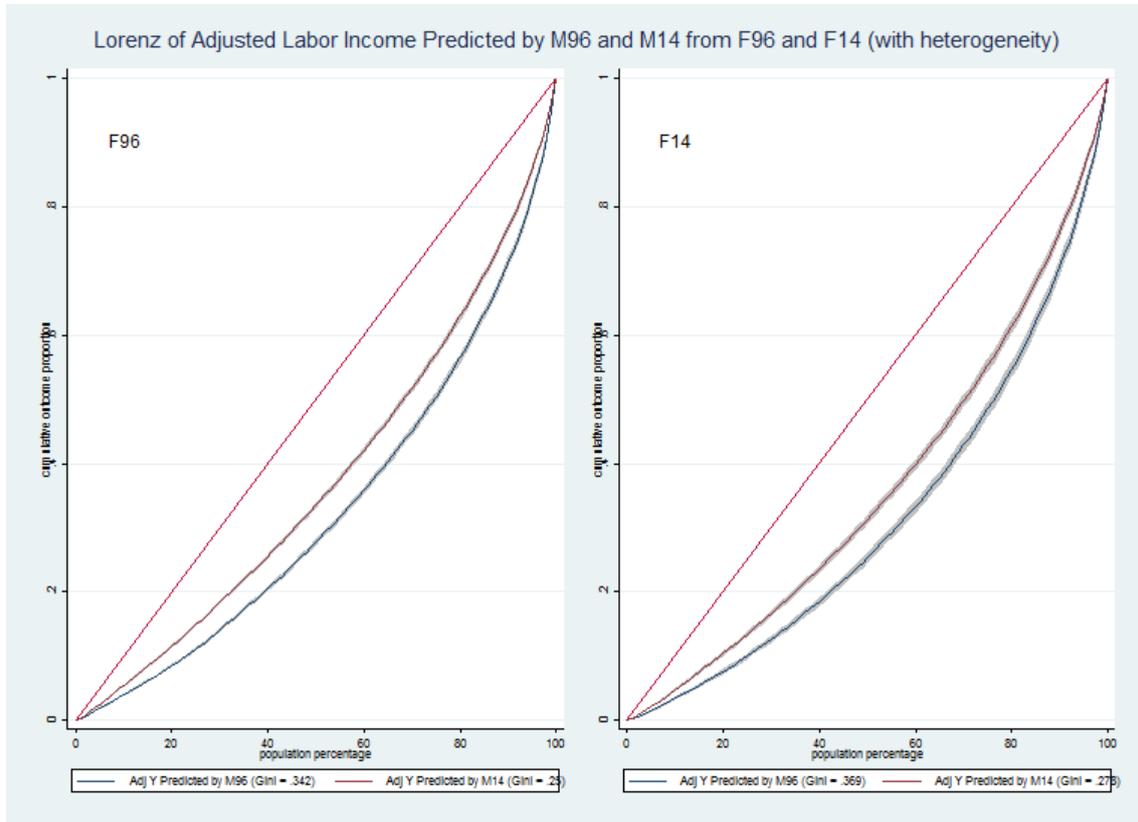
Source: author's estimates from PNADs 1977 and 1996; 1995 and 2014

Figure 7



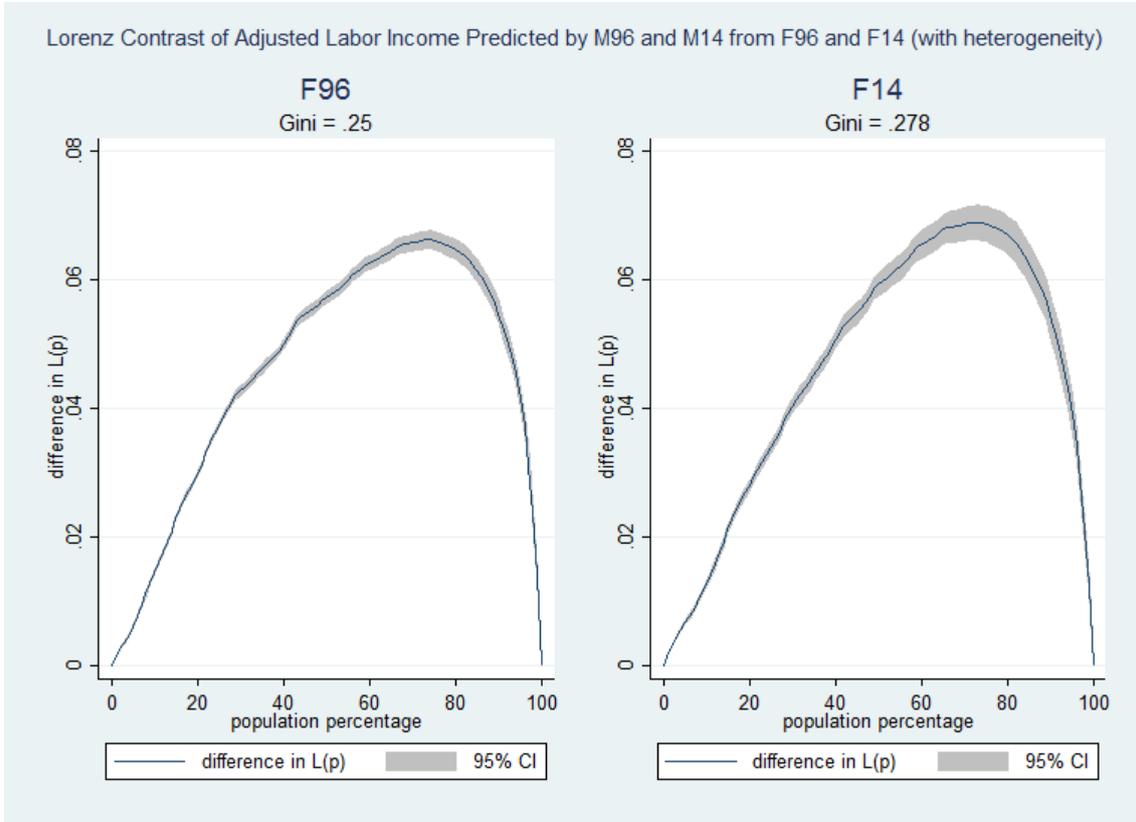
Source: author' estimates from PNADs 1977 and 1996; 1995 and 2014

Figure 8



Source: author's estimates from PNADs 1977 and 1996; 1995 and 2014

Figure 9



Source: author' estimates from PNADs 1977 and 1996; 1995 and 2014

Regarding the Mobility Processes with heterogeneity by fathers' income class, Table 13 and 14 show similar results, with M_{14} generating a more evenly distributed expected income than M_{96} , with or without the Life-Cycle Adjustment.

Table 13: Comparison between M14 and M96 for Income with Fathers' Income Class Heterogeneity

	1996 sample	2014 sample
Fathers' income Gini F	0.45	0.48
Expected descendants' income Gini from M_{1996}	0.310	0.348
$\rho_{M_{1996}}^{RS}$	0.140	0.132
$\lambda_{F, M_{1996}}$ Lorenz-dominates F?	Yes	Yes
Expected descendants' income Gini from M_{2014}	0.215	0.257
$\rho_{M_{2014}}^{RS}$	0.235	0.223
$\lambda_{F, M_{2014}}$ Lorenz dominates F?	Yes	Yes
$Gini(e_{M_{1996}}(Y_F)) - Gini(e_{M_{2014}}(Y_F))$	0.105	0.091
$M_{2014} \succsim M_{1996}$?	Yes	Yes

Source: author' estimates from PNADs 1977 and 1996; 1995 and 2014

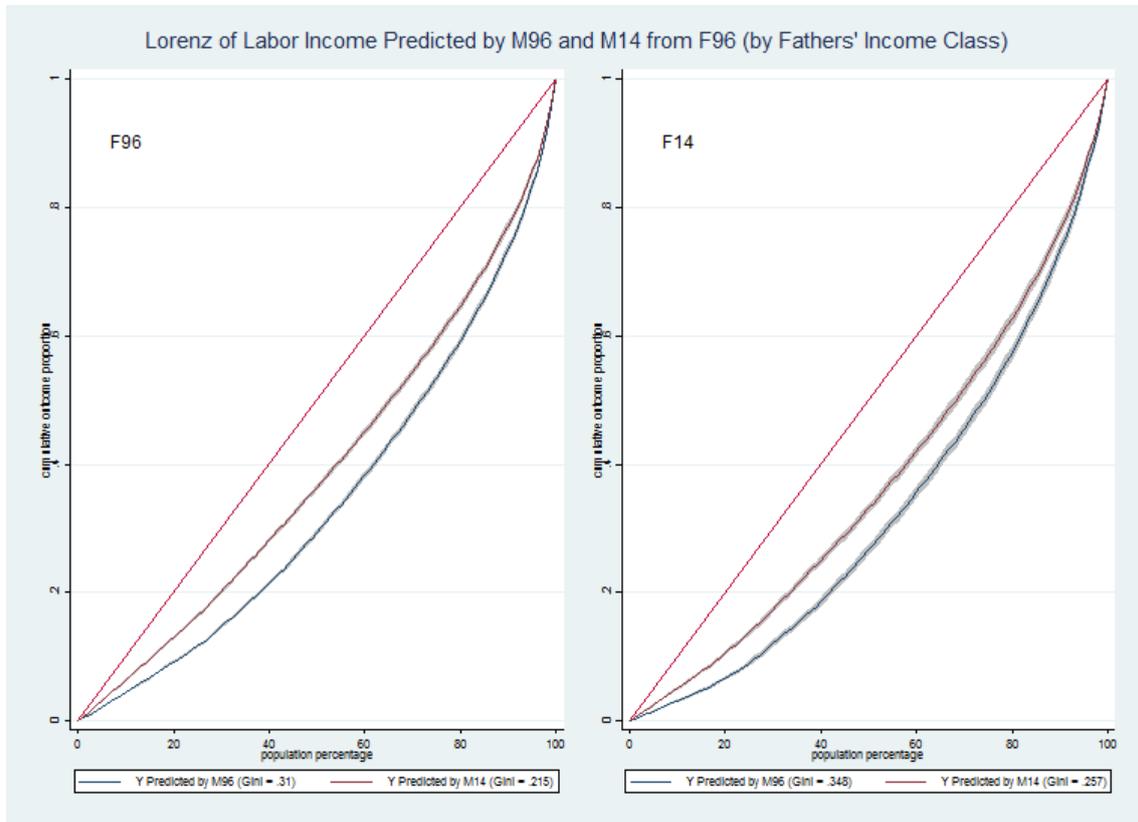
Table 14: Comparison between M14 and M96 for Adjusted Income with Fathers' Income Class Heterogeneity

	1996 sample	2014 sample
Fathers' income Gini F	0.44	0.46
Expected descendants' income Gini from M_{1996}	0.312	0.342
$\rho_{M_{1996}}^{RS}$	0.128	0.118
$\lambda_{F, M_{1996}}$ Lorenz-dominates F?	Yes	Yes
Expected descendants' income Gini from M_{2014}	0.228	0.260
$\rho_{M_{2014}}^{RS}$	0.212	0.200
$\lambda_{F, M_{2014}}$ Lorenz dominates F?	Yes	Yes
$Gini(e_{M_{1996}}(Y_F)) - Gini(e_{M_{2014}}(Y_F))$	0.100	0.082
$M_{2014} \succsim M_{1996}$?	Yes	Yes

Source: author' estimates from PNADs 1977 and 1996; 1995 and 2014

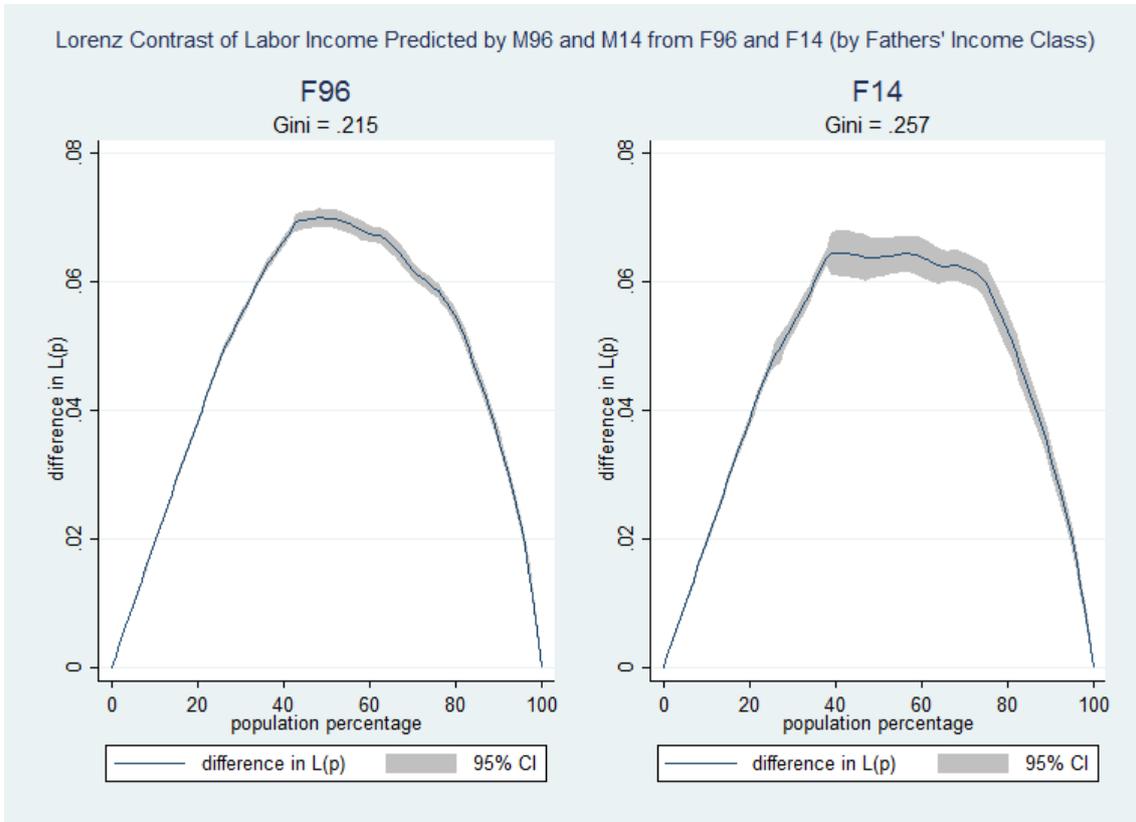
Figures 10 and 11 show a higher cumulative expected income generated by M_{14} , meaning that $\lambda_{F, M_{14}} \succsim_L \lambda_{F, M_{96}}$ for both fathers distribution.

Figure 10



Source: author' estimates from PNADs 1977 and 1996; 1995 and 2014

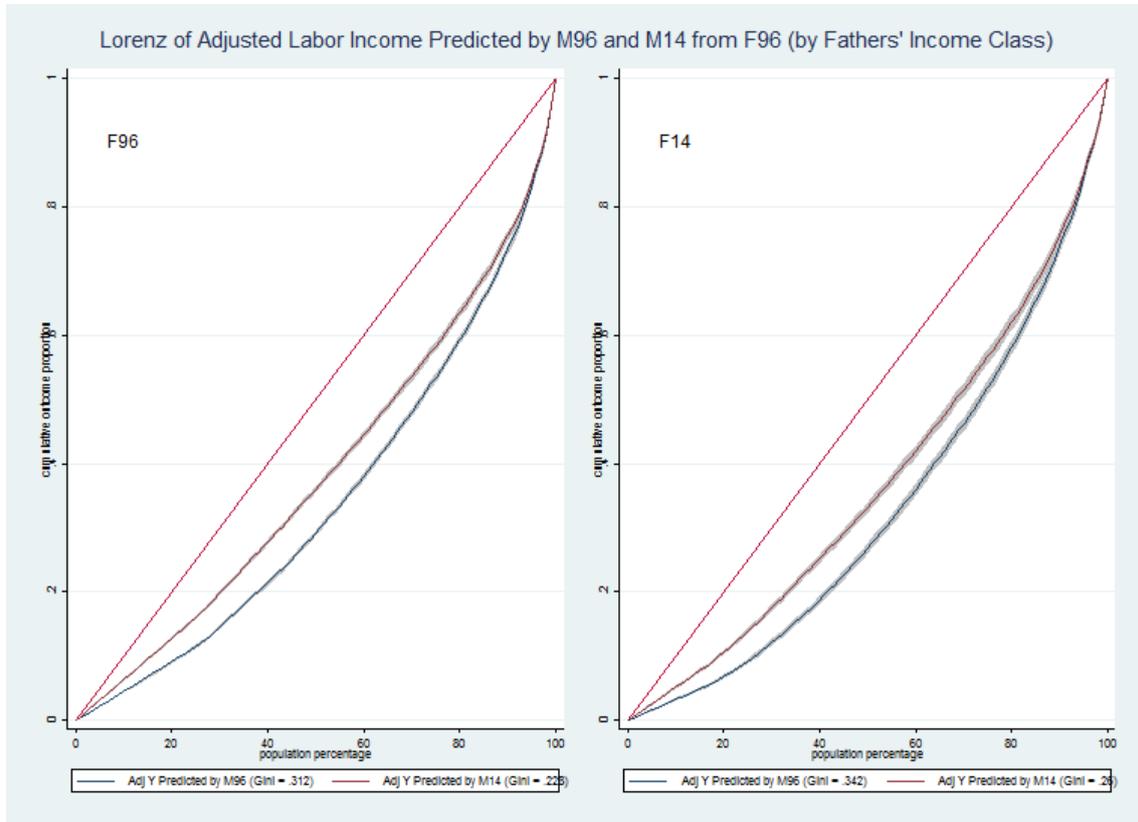
Figure 11



Source: author' estimates from PNADs 1977 and 1996; 1995 and 2014

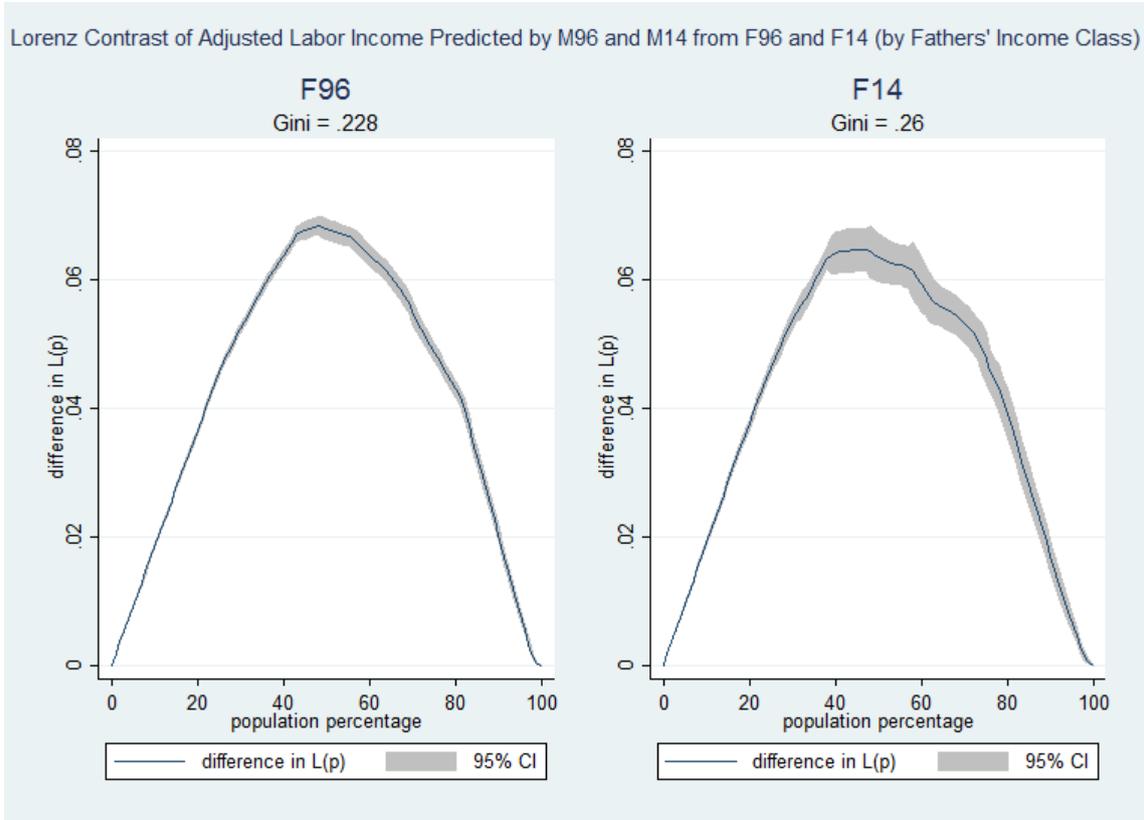
Once again, we change labor income by adjusted labor income. This time, Figure 13 shows that in the last percents of F , the cumulative expected income is equal when generated rather by M_{14} of M_{96} . However, since Lorenz-dominance relationship admits superior or equal values of cumulative income, then one may still declare the period of 1990-99 to 2014 as opportunities equalizer than 1972-81 to 1996 with fathers' income class heterogeneity.

Figure 12



Source: author' estimates from PNADs 1977 and 1996; 1995 and 2014

Figure 13



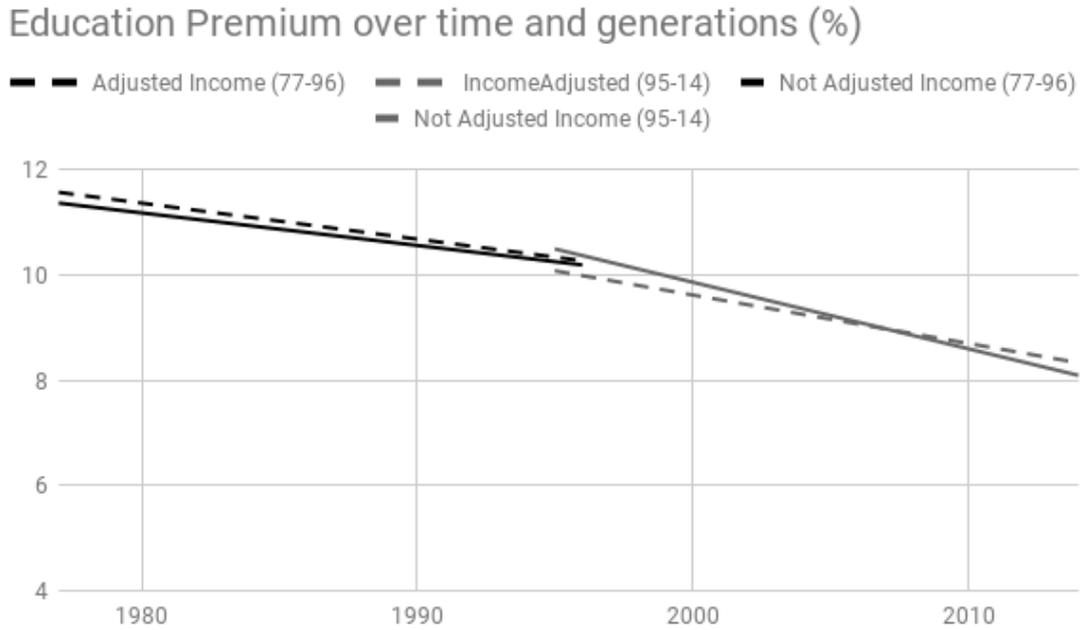
Source: author' estimates from PNADs 1977 and 1996; 1995 and 2014

In the Appendix, Figures 17, 18, 19 and 20 exploit a welfaristic extension to the results above, with generalized Lorenz curves and contrasts showing that, not only M_{14} generated a more evenly distributed expected income than M_{96} , but also with higher average values. This results indicate that opportunities were more equalized in the last period and society had a higher increase in resources, what is consistent with labor market improvements in the 2000s.

5 Analysis of the main determinants of Intergenerational Income Mobility dynamics

As it was possible to see in tables 5 and 6, education premium on labor income has had a long term decrease, which got stronger in the 2000s, as figure 14 shows. That means that the labor market changes might have been responsible for a intergenerational mobility itself.

Figure 14



Source: author' estimates from PNADs 1977 and 1996; 1995 and 2014

Education premium responds to supply and demand dynamics. As seen in Figure 1, over the last 40 years, educational attainment in Brazil has had a major and fast increase for younger cohorts. This movement, as documented in the literature, had a strong impact on returns of education.

However, [Messina and Silva \(2018\)](#) argues that not all of this falling in education premium might be due to an increase in qualified labor supply in the 2000s. Terms of trade changes in that period have also played a role in increasing the relative price of non tradable sectors, which employ less qualified workers, rising their wages above the mean.

[Adão \(2015\)](#) shows that changes of comparative and absolute advantage have impact on the mean and distribution of wages, nonparametrically identified from the cross-regional variation in the sectoral responses of employment and wages to observable sector-level demand shifters, quantifying that shocks to world commodity prices account for 5–10% of the fall in Brazilian wage inequality between 1991 and 2010.

As seen in Figure 2, the increase in qualified labor supply over the last decades was significantly progressive, with children from the poorest families doubling their years of study mean, while the ones from the richest quintile were able to perform only 1/3 as good. These progressiveness led to, as it was reported above, a major reduction on the persistence of education through generations, specially among black women, as we can see in Figure ???. Table 10 also shows that the intergenerational elasticity of education had its major decrease among Brazilians who were from the poorest fathers.

5.1 Counterfactual Intergenerational Elasticities of Income

Since subsections 4.1 and 4.2 provided evidence that cohort born between 1975 and 1984 had a higher education and income mobility than the one born from 1957 to 1966, one might ask the determinants of this dynamic. As exposed in subsection 3.6, in order to test whether the main driver of the decrease of intergenerational elasticity of income was a stronger expansion in education provision or a faster fall in education returns, one may

simulate 1996 and 2014 coefficients exchanging both features from each other, and check which one would be responsible for the bigger changes.

First, we will exchange the educational mobility processes (denoted as α) from M_{14} and M_{96} . Then, we will exchange the education premium (denoted as γ of previous fathers' and current children' generations from 2014 and 1996. Intergenerational Elasticity of Income is expected to decrease in 1996, since the period from 1990-99 to 2014 had a higher mobility of education and a stronger decrease in education premium. In the same way, in 2014, β_1 is expected to increase. Therefore, the simulation with higher decrease in 1996 and higher increase in 2014 will indicate the main driver of the mobility of income in that period.

Table 15 display the results of the simulations. It shows what was expected: both educational mobility and educational premium seems to have been accountable for the decrease in Intergenerational Elasticity of Income between the two periods. In both PNADs, however, exchanging mobility of education leads to higher changes in β_1 (decrease in 1996 and increase in 2014) than exchanging education premium, despite in 2014 the difference is not significant at 95% confidence level.

Table 15: Simulations of Intergenerational Elasticity of Income

	β_1	Difference from Observed β_1	Significant?
1996	0.757	-	
1996 with α_{14}	0.608	-0.149	Yes
1996 with γ_t and γ_{t-1} from 2014	0.677	-0.080	Yes
Difference between Simulations	0.069	-	-
Significant?	Yes	-	-
2014	0.530		
2014 with α_{96}	0.648	0.117	Yes
2014 with γ_t and γ_{t-1} from 1996	0.569	0.039	Yes
Difference between Simulations	-0.078	-	-
Significant?	No	-	-

Source: author' estimates from PNADs 1977 and 1996; 1995 and 2014

When the same simulations are run for Intergenerational Elasticity of Life-Cycle Adjustment Income, reported in Table 16, results seem to be more conclusive: exchanging educational mobility processes leads to higher changes than exchanging education premium (in 1996 the difference in β_1 is not even statistically significant), and the difference between simulations surpasses 10 p.p. in both samples, both significantly at a 95% confidence level.

Table 16: Simulations of Intergenerational Elasticity of Life-Cycle Adjusted Income

	β_1	Difference from Observed β_1	Significant?
1996	0.763	-	
1996 with α_{14}	0.622	-0.141	Yes
1996 with γ_t and γ_{t-1} from 2014	0.732	-0.031	No
Difference between Simulations	0.110	-	-
Significant?	Yes	-	-
2014	0.559		
2014 with α_{96}	0.689	0.130	Yes
2014 with γ_t and γ_{t-1} from 1996	0.582	0.023	Yes
Difference between Simulations	-0.107	-	-
Significant?	Yes	-	-

Source: author's estimates from PNADs 1977 and 1996; 1995 and 2014

One may now run the same simulations for all demographic group analyzed in subsection 4.1. Since an exchange in education premium for parents might artificially change their income position, the simulations will not be performed by fathers' income class. Table 17 reports the results for both not adjusted and adjusted income. Despite all coefficients move on the same direction, in 2014 there was no statistically significant difference between simulations, mostly due to a smaller sample (only 2571 observations), for which a four demographic group decomposition substantially increase bootstrap standard errors. So, the analysis will focus on 1996.

Table 17: Simulations of Intergenerational Elasticity of Income by Gender and Race

Not adjusted labor income				
	White Men	Black Men	White Women	Black Women
1996	0.701	0.658	0.659	0.602
1996 with α_{14}	0.295	0.255	0.315	0.234
1996 with γ_t and γ_{t-1} from 2014	0.638	0.600	0.622	0.540
Difference	-0.343	-0.345	-0.307	-0.306
Significance	Yes	Yes	Yes	No
Adjusted labor income				
	White Men	Black Men	White Women	Black Women
1996	0.708	0.692	0.679	0.626
1996 with α_{14}	0.298	0.269	0.333	0.247
1996 with γ_t and γ_{t-1} from 2014	0.682	0.638	0.667	0.559
Difference	-0.384	-0.369	-0.335	-0.312
Significance	Yes	Yes	Yes	Yes
2014	0.570	0.473	0.573	0.337
2014 with α_{96}	0.653	0.609	0.658	0.444
2014 with γ_t and γ_{t-1} from 1996	0.608	0.486	0.564	0.326
Difference	0.045	0.123	0.094	0.118
Significance	No	No	No	No

Source: author' estimates from PNADs 1977 and 1996; 1995 and 2014

As seen for all population, the increase in educational mobility seems be more accountable for the the decrease of Intergenerational Income Mobility. Considering only adjusted labor income, all four groups had a higher decrease of β_1 in 1996 exchanging α than γ_t and γ_{t-1} . The difference between simulations is specially higher for men and for whites, suggesting that the faster decrease in education premium between generations from 1990-99 to 2014 was more relevant in reducing intergenerational persistence of income to the most socially marginalized groups. That also might be due because whites have had fathers with higher educational level, but there's no apparent reason for men and women differ because of that.

5.2 Decomposing Intergenerational Elasticity of Income

This results provided in subsection 5.1 strongly indicate that increasing educational mobility significantly affected income mobility between the older cohort (1996) and the younger (2014). In order to get some robustness, one may follow [Bloome and Western \(2011\)](#), who decomposes intergenerational elasticity of income into two parts: (1) the association between the fathers' income and the children' irrespective of the children' education, and (2) another component reflecting both educational mobility and the economic returns on the education attained by the children. The decomposition follows the equation below:

$$\beta_1 = \beta_{1|s} + \epsilon \quad (34)$$

The first component, $\beta_{1|s}$, is the 'inheritance of pure income', that is, the regression coefficient of the log of the children' income on the log of paternal income controlling for the

children’ education. The second component, ϵ , is interpreted as the ‘inheritance of mediated income’, that is, the ‘association’ of the father’s income via the children’ education on their income.

The inheritance of mediated income is given by the formula:

$$\epsilon = \omega_{t-1} \times \gamma_{t|Y_{if,t-1}} \quad (35)$$

where ω_{t-1} is the regression coefficient of the children’ education on the father’s income (that is, the association of father’s income with their children educational level, which is itself related to educational mobility) and $\gamma_{t|Y_{if,t-1}}$ is the regression coefficient of the children’ income on their schooling controlling for the father’s income, this one negatively related to the difference between education premium from generation.

Table 18 shows the decomposition of β_1 by the components exposed above. The results are similar to previous’, but also bring new conclusions. First, it’s possible to see that the ‘inheritance of pure income’ was stable in that period, with an upward bias, around 0.25 and 0.3. That means that, when not considering any dynamics related to education, income persistence remained on the same level between almost 40 years, exposing the role of ‘inheritance of mediated income’ dynamics to the overall increase of income mobility.

Table 18: Decomposition of Intergenerational Elasticity of Income

Not adjusted Income				
	β_1	$\beta_{1 s}$	ω_{t-1}	$\gamma_{t Y_{if,t-1}}$
1996	0.757	0.248	4.086	0.124
2014	0.530	0.282	2.850	0.087
Adjusted Income				
	β_1	$\beta_{1 s}$	ω_{t-1}	$\gamma_{t Y_{if,t-1}}$
1996	0.763	0.255	4.141	0.123
2014	0.560	0.280	2.964	0.094

Source: author’s estimates from PNADs 1977 and 1996; 1995 and 2014

Considering the ‘inheritance of mediated income’ fall of 45%, we may use the log of the variation, in order to get additive terms, as expressed below.

$$\ln \frac{\epsilon_{14}}{\epsilon_{96}} = (\ln \omega_{90-99,14} - \ln \omega_{72-81,96}) + (\ln \gamma_{14|Y_{if,1990-99}} - \ln \gamma_{96|Y_{if,1972-81}}) \quad (36)$$

Having additive terms, one may calculate the percentage of the fall in ‘inheritance of mediated income’ due to the association of fathers’ earnings with children’ schooling and the education premium of children controlled by fathers’ income. Considering only Life-Cycle Adjusted Income, the first term was accountable for 56% of the change in ‘inheritance of mediated income’, while the second one, was accountable for 44% of it.

Summarizing, these two exercises leads to the same conclusions: the difference of children’ schooling between highly educated (and frequently richer) families and the ones with low educated fathers (and frequently poorer) strongly reduced between 1996 and 2014, and this change was accountable for most of the fall on the association between fathers’ and children’ income, even more than the strong reduction of education premium on that period.

6 Cohort Analysis

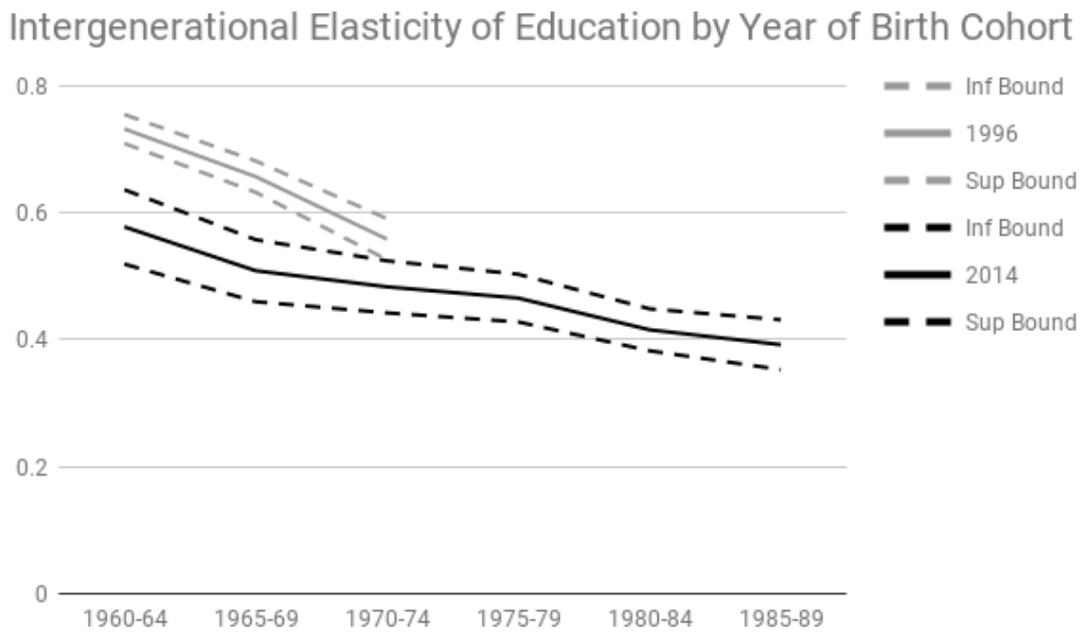
In this section, in order to analyze the dynamic pattern of Intergenerational Income and Educational Mobility in Brazil, it’s analyzed the behavior of the degree of persistence of

schooling and earnings for each five-year cohort in both periods. The bounds for older and younger cohorts were established considering the minimization of selection bias, since householders are not expected to be too young, and data limitation, once PNAD only starts more continually after 1976.

So, a regression of adjusted income on education, occupation and gender is performed on a set of 5 years spaced PNADs for each cohort, from 1977 (for the fathers of children born between 1960 and 64) to 2002 (for the fathers of children born between 1985 and 89). The three older cohorts will be aged from 21 to 36 in 1996 and 39 to 54 in 2014, while the three younger cohorts will be aged from 24 to 39 in 2014.

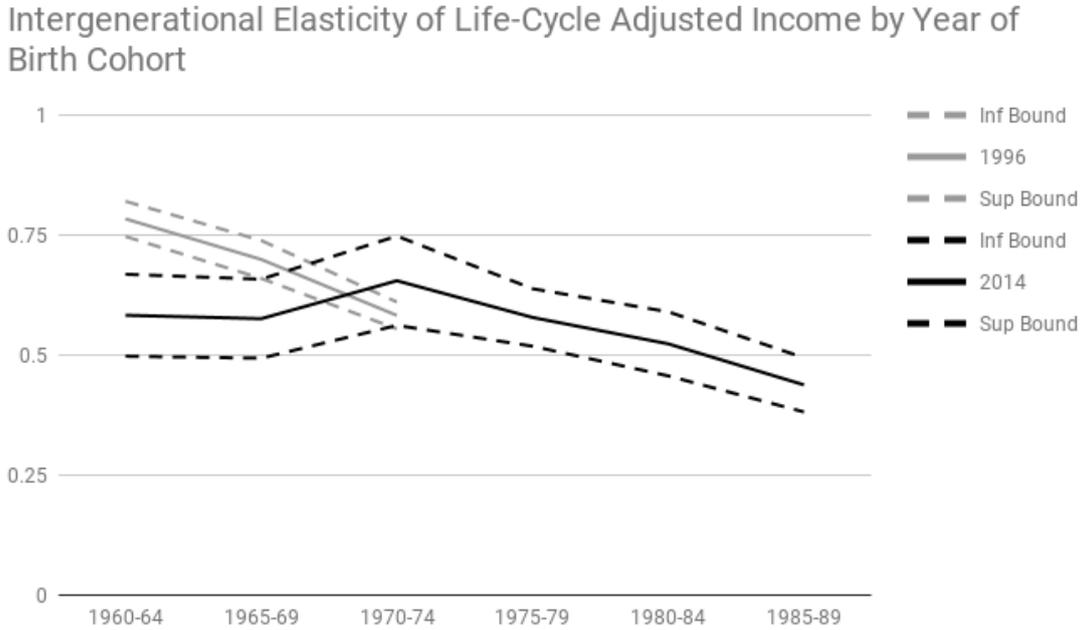
Figures 15 and 16 display the evolution of the intergenerational elasticity of education and Life-Time adjusted income across cohorts by year, respectively.

Figure 15



Source: author' estimates from PNADs 1977; 1982; 1987; 1992; 1996; 1997; 2002; 2014

Figure 16



Source: author' estimates from PNADs 1977; 1982; 1987; 1992; 1996; 1997; 2002; 2014

The figures show that persistence of education and income falls continually for younger cohorts in 1996 sample. While for education this movement is the same in 2014, Intergenerational Elasticity of Adjusted Income remains statistically stable from 1960-64 to 1970-74 cohorts, then starting to fall for younger cohorts, reaching 0.44 for householders born between 1985 and 1989.

Also, figures show that Intergenerational Elasticity of Education decreased between 1996 and 2014 for the same older cohorts. Despite contrary to intuition, since the education cycle is expected to be completed for most by the 20s, a large provision (and demand) of public and private education for adults in the 2000s and 2010s was sufficient to sensitively decrease the persistence of schooling. Table 19, displaying school attendance rate by level and birth cohorts nine and two years before the last sample, shows that adults pursued higher schooling levels, specially tertiary education.

Table 19: School Attendance by Year of Birth Cohort

	Cohort	Regular Elementary school	Regular High school	Continuation school (elementary)	Continuation school (high school)	University/ college	Adult education (literacy)	Prep school for vestibular	Masters or doctorate	Total
2005	1960-64	0.3%	0.3%	0.5%	0.5%	1.1%	0.8%	0.0%	0.3%	3.8%
	1965-69	0.6%	0.6%	0.8%	0.7%	1.8%	0.7%	0.1%	0.3%	5.5%
	1970-74	1.0%	1.0%	1.0%	0.8%	2.6%	0.8%	0.1%	0.4%	7.7%
2012	1960-64	0.1%	0.2%	0.4%	0.2%	1.2%	0.2%	0.0%	0.2%	2.6%
	1965-69	0.1%	0.2%	0.4%	0.3%	1.5%	0.1%	0.0%	0.2%	2.9%
	1970-74	0.2%	0.3%	0.5%	0.4%	2.4%	0.2%	0.0%	0.3%	4.4%

Source: Tabulations from PNADs 2005 and 2012

Also, adjusted income decreased between 1996 and 2014 for some cohorts two older cohorts, born between 1960-64 and 1965-70. That might be due to the increase in education mobility, but also education premium may have been playing a role (possibly even in the opposite direction, as suggests stability of income persistence for 1970-74 cohort from 1996 to 2014).

The same decomposition of β_1 can be performed by cohort and year, in order to check

the dynamics of persistence of income determinants within year and between cohorts (and vice versa). Table 20 reports the estimates.

Table 20: Decomposition of Intergenerational Elasticity of Adjusted Income by year and cohort

Cohort	1996				2014			
	β_1	$\beta_{1 s}$	ω_{t-1}	$\gamma_{t Y_{i.f,t-1}}$	β_1	$\beta_{1 s}$	ω_{t-1}	$\gamma_{t Y_{i.f,t-1}}$
1960-64	0.784	0.253	4.276	0.124	0.583	0.208	3.756	0.100
1965-69	0.699	0.274	3.799	0.112	0.575	0.330	3.191	0.077
1970-74	0.582	0.254	3.406	0.097	0.655	0.345	3.119	0.099
1975-79					0.578	0.257	3.019	0.107
1980-84					0.523	0.253	2.783	0.097
1985-89					0.437	0.211	2.654	0.085

Source: author' estimates from PNADs 1977; 1982; 1987; 1992; 1996; 1997; 2002; 2014

The results above lead to meaningful conclusions. First, despite the coefficient of ‘inheritance of pure income’ have some variations in 2014, there’s no statistically significant difference on its estimates by all years and cohorts. That means that almost all variations on persistence of income are due to ‘inheritance of mediated income’ dynamics.

Analyzing the same cohorts over time, it’s possible to see a relevant fall on education premium given fathers’ income ($\gamma_{t|Y_{i.f,t-1}}$) in the two older cohorts, but not in the third one. There’s also a significant but smaller fall on the association of fathers’ income with their children’ schooling (ω_{t-1}), as it would be expected. In 1960-64 and 1965-69 cohorts, the first component is accountable for around 65% of the decrease in between 1996 and 2014.

Now, regarding the differences between the oldest and newest cohort in 2014, there are different conclusions. The cohort born between 1960-64 has a education premium given fathers’ income of 0.10, while for the one born in 1985-89 it’s slightly smaller, of 0.085 (a difference of 1.5%). On the other hand, the association of fathers’ income with their children’ schooling varies significantly more between the oldest and newest cohorts, from 3.76 to 2.66, respectively, a fall of 30%. The first component, on this analysis, is accountable for only 32% of the fall in ‘inheritance of mediated income’, while the second one accounts for 68% of it.

These results reinforce the ones of Subsection 5, adding new information. As reported before, in the labor market, differences of education premium between fathers and their children have been deepened between 1996 and 2014, while public education provision has largely increased for children from poor and less educated families. Table 20 shows that the labor market changes on that period were accountable for most of the fall in persistence of income within cohorts, and the public policy changes accounted for most of it between cohorts - as it would be expected, since the minimum age for starting school was mostly the same in that period.

7 Conclusions

In this paper, we developed an analysis of 40 years of a intergenerational mobility process for Brazil split in two: 1972-81 to 1996 and 1990-99 to 2014. Reproducing [Pero and Szerman \(2008\)](#) methodology, we match available data in Brazil, combining a Two Samples Instrument Variable (TSIV) used by for estimating fathers’ income in 1996 PNAD, with an occupational categorization developed by [Valle e Silva \(1992\)](#). Following this approach, we used 1977 and 1995 PNADs to estimate schooling, occupational categories and gender returns in labor income, imputing the estimated coefficients on 1996 and 2014 PNAD’s

supplement for socio occupational characteristics of the population at least 16 years old and their families, but when aged 15 years old. This way, we have estimated fathers' and their descendants' labor income in the same dataset, allowing us to make an analysis for intergenerational mobility.

It's shown that Intergenerational Elasticity of Education and Income decreased significantly between 1996 and 2014, specially the first one. Coefficient falls were from around 0.75 to 0.45 considering education and to 0.55 considering income.

Also, analyzing α_1 and β_1 by demographic group and fathers' income class, results show that the fall in persistence of education and income were strong on poorer families and marginalized groups. However, on the most privileged groups of society, coefficients had smaller changes. In order to consider this heterogeneity, an equality of opportunities theoretical framework developed by [Benabou and Ok \(2001\)](#) was adapted to compare the mobility processes of 1972-81 to 1996 and 1990-99 to 2014.

Using this theoretical framework, it was considered that equalization of opportunities is stronger when expected sons and daughters' income distribution generated by a mobility process Lorenz-dominates another one. Strictly, it must holds for any parents' observed income distribution, but we test it only for both periods compared: 1972-81 to 1996 (M_{1996}) and 1990-99 to 2014 (M_{2014}).

It's found that, for this period of 40 years in Brazil, the last period, from 1990-99 to 2014 was more opportunities equalizing than the first, since for both fathers' income distribution (from either 1972-81 or 1990-99), the mobility process from the second period (M_{2014}) generated a more evenly distributed sons' expected income, which we show that Lorenz-dominates the distribution from M_{1996} , considering gender and race or fathers' income class differences.

In order to check the determinants of this relevant fall of Intergenerational Elasticity of Income, two exercises were made: the first was a simulation of 1996 and 2014 β_1 exchanging the education mobility processes and exchanging the fathers' and children' education premium. The second one was a decomposition of β_1 into two additive terms, from which one of them is broke into two multiplicative terms related to the effected of fathers' income into schooling and the association between fathers' children' education premium.

Both results showed that the sharp increase of educational mobility was the main driver of the fall of Intergenerational Income Mobility, even more than the increase of the difference between generations of the education premium. That shows that educational policies in the last period, around the nineties, were more accountable for the increase of income mobility than the labor market favorable dynamics in the 2000s.

This study has shown that, Brazil still have a long way for achieving equality of opportunities. However, it's shown that the last decades have been advancing on that matter, with previous generations' outcomes getting progressively lesser relevance for currents', with education provision having a major role for that matter. These conclusions follow recent studies that reinforces the role of educational policies on intergenerational mobility, such as [Chetty et al. \(2017\)](#), that highlights colleges role as potential engines of upward mobility, and [Biasi \(2019\)](#), that finds that equalization of school inputs has a large effect on mobility, especially for low-income students. .

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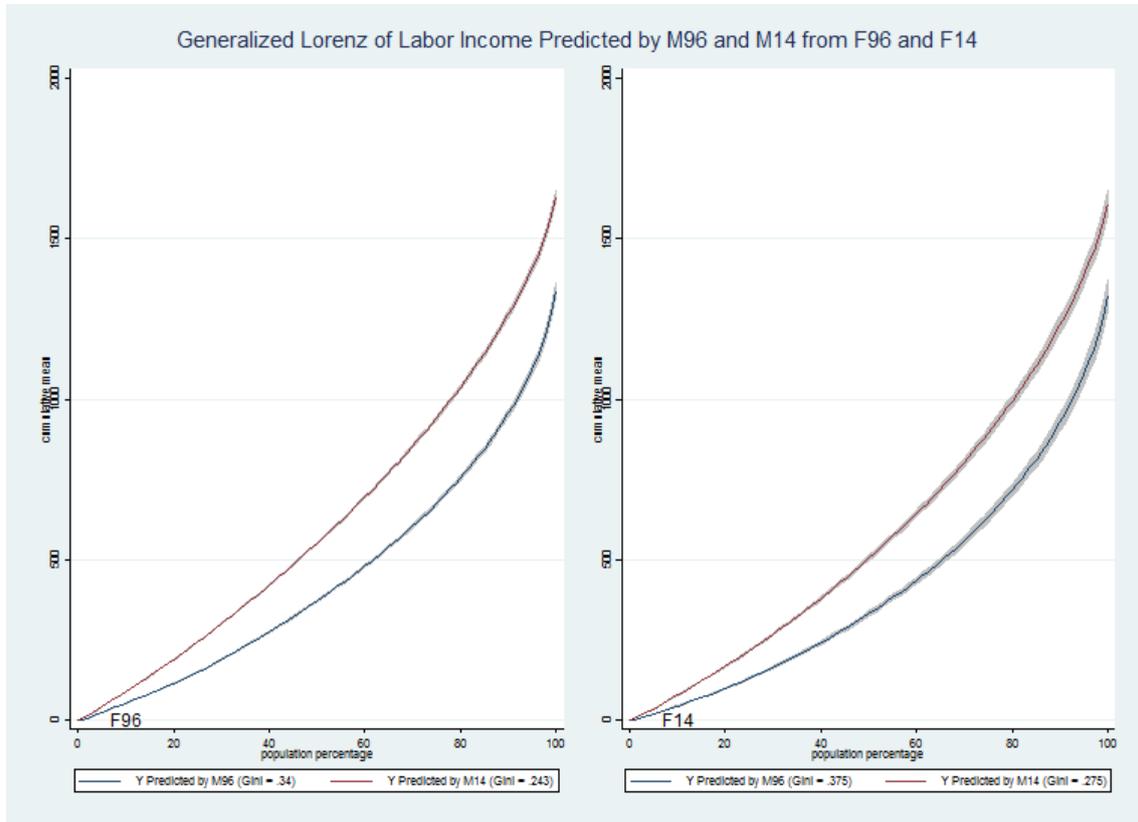
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Appendices

Table 21: [Valle Silva \(1992\)](#) Occupational Categories

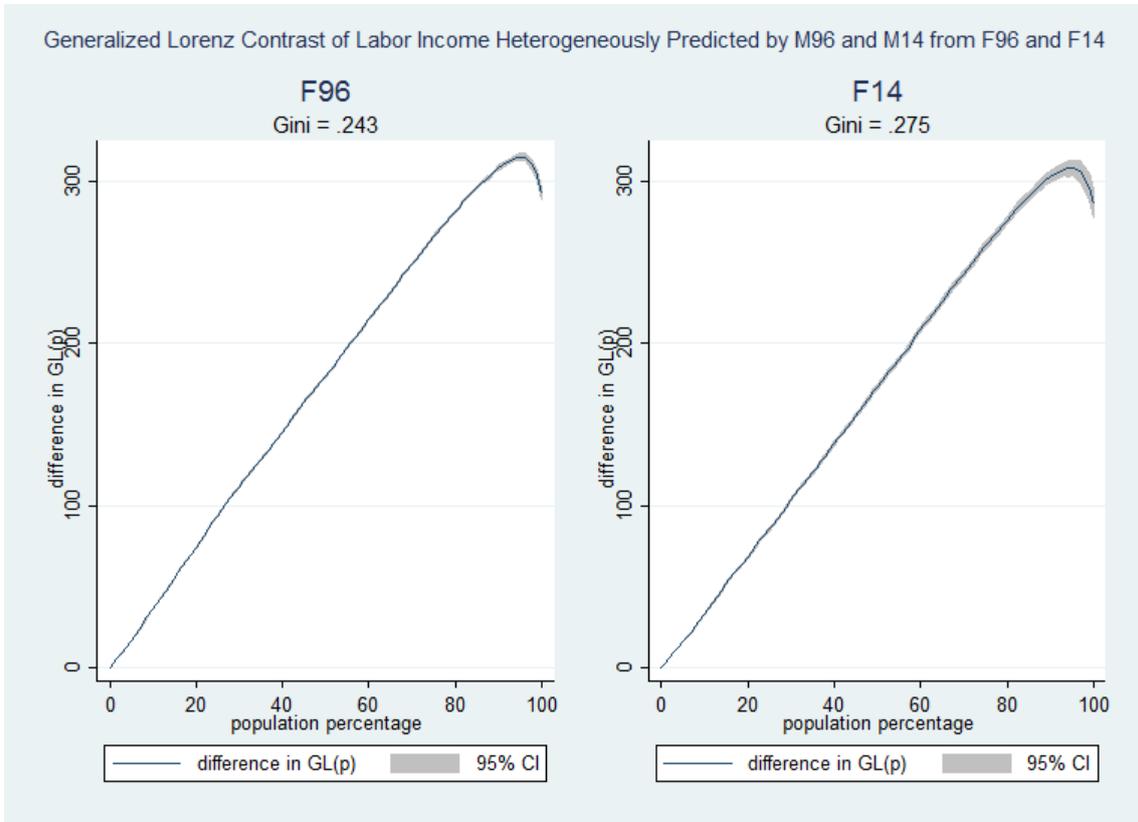
ivs	Category	Occupations
1	Liberal Professionals	Engineer; higher education teacher; lawyers; doctors; economists
2	Senior managers and managers	Director, advisor and head of the public service; administrators
3	Professionals	Chemical; Systems Analyst; 2nd grade teacher; officers of the Armed Forces; delegates and police commissioners
4	Administrative functions (execution)	Technical and tax tribute; administrative assistants; brokers; notary; scrivener
5	Routine non-manual and office functions	Boxes; secretaries; receptionists, administrative assistant; bailiffs
6	Owners (employer) in industry, commerce and services	Employer in industry; merchant; owner of hotel and board; transport entrepreneur and others
7	Self-employed entrepreneurs (without employees)	Traders on their own; ownership of services on their own; hotel owners and pension owners
8	Technicians, artists and supervisors of manual labor	Chemical technician; ungraded nurses; teacher of 1st grade; radio, sound, television and film operators; masters
9	Hand workers in modern industries	Mechanics; welding machines; assemblers of electrical and electronic equipment; electricians; typographers
10	Hand workers in traditional industries	Tailors and dressmakers; masons; plumbers; bakers; drunkard
11	Manual workers in services in general	Drivers; telephone operators; waiters; hairdressers; recyclers
12	Domestic workers	Housekeeper; concierge; elevator operator; guards and watchmen; gardeners
13	Street vendors	Feirantes; sweetmeats; ticket office; newspaper and magazine sellers; shorts
14	Artisans	Craftsman; tenant; upholstery; straw hatter; basketmaker and steersman
15	Owners (employers) in the primary sector	Farmers; cattle ranchers; poultry farmers and small animal breeders; other agricultural owners; entrepreneurs of the vegetal extraction and fishing
16	Technicians and administrators in the primary sector	Managers and managers in agriculture; agricultural technician; tractor driver and other operators; operators of ore and stone extraction machines; masters and technicians of mining companies
17	Autonomous agricultural producers	Autonomous agricultural producers
18	Rural workers.	Other agricultural workers; tappers; loggers; miners; manual workers

Figure 17



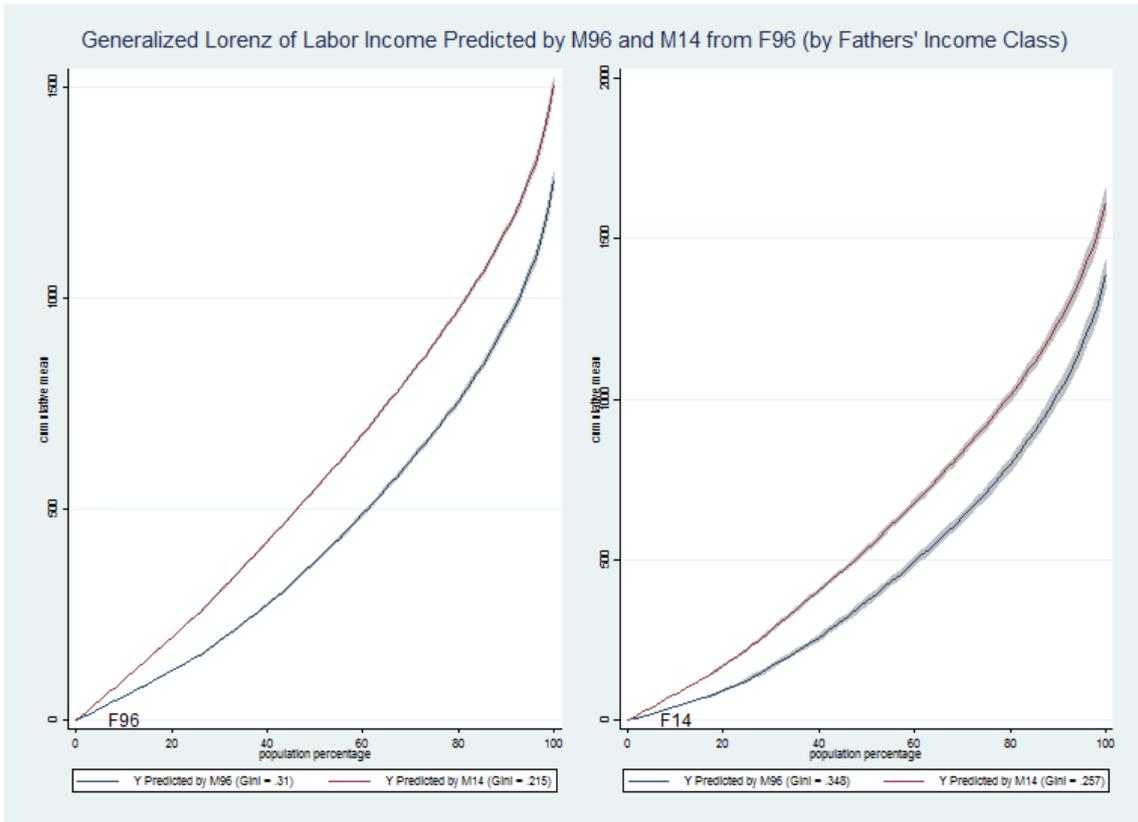
Source: author' estimates from PNADs 1977 and 1996; 1995 and 2014

Figure 18



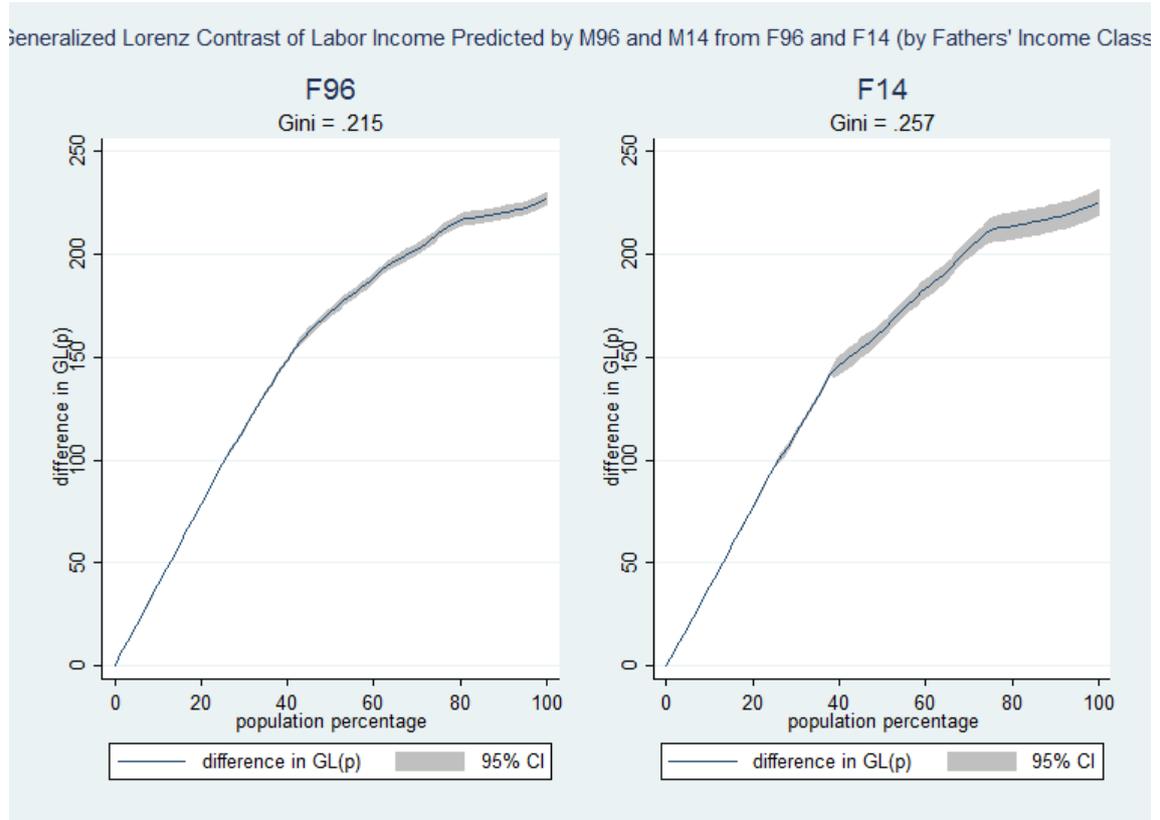
Source: author' estimates from PNADs 1977 and 1996; 1995 and 2014

Figure 19



Source: author' estimates from PNADs 1977 and 1996; 1995 and 2014

Figure 20



Source: author' estimates from PNADs 1977 and 1996; 1995 and 2014