# The equalizing third of a century: An evaluation of equality of opportunities in Brazil for almost 40 years

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## Abstract

This paper evaluates the opportunities equalizing process in Brazil over the last 20 years. Using the theoretical framework from Benabou and Ok (2001), we try to answer the following questions: (1) Was there an mobility process in Brazil for almost 40 years, from 1976-81 to 2014, equalizer of opportunities? (2) If it was, when was this mobility process stronger, from 1976-81 to 1996, or from 1994-99 to 2014? Combining this methodology with a educational level persistence through generations approach, our results show that this period was marked by a opportunities equalizing process, that got stronger in its second half. This paper helps to get a better understanding of the last decades of Brazil regarding the development of a fair society.

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# 1 Introduction

The entry in the 2000s marks a favorable period 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 descendents' 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.

The intergenerational mobility 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.

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).

Mahlmeister et al. (2017) used data from the social mobility supplements of PNADs 1996 and 2014 to compare the intergenerational mobility of education 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.

This article aims to analyze the evolution of the intergenerational mobility of education in Brazil using the equalizer approach proposed by Benabou and Ok (2001), in which the notion of mobility is associated with equal opportunities. For the intergenerational case, we adapt the ideia of the authors identifying the opportunities as expected schooling of the descendents from the mobility process and the parents' schooling. In general, a mobility process is defined as an equalizer (or progressive) if, for any initial distribution of schooling, the distribution of expected schooling is more egalitarian. From this approach, the evolution of intergenerational mobility as an equalizer process will be analyzed comparing 1996 and 2014.

Our main results show that, following this theoretical framework, there was a opportunities equalizing mobility process between 1976 and 2014. Also, we see that this process was stronger in the second half of the period, from 1994-98 to 2014, than in the first, from 1976-81 to 1996. The difference between both periods was strong and statistically significant.

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 persistence of educational level through generations. Then, in the 3 we present the theoretical framework used by Benabou and Ok (2001) to identify and compare opportunities equalizing mobility process, showing how we adapt it for Brazil. Next, in section 4 we detail how we use this theoretical framework to empirically analyze the period in question.

Finally, section 5 show our results and section 6 concludes.

## 2 Social Mobility and Inequality in Brazil

Equality of opportunity is a popular concept of fairness, in which one's social position would be all endogenous to individuals. This concept is mainly linked to intergenerational social mobility, that is, how much outcomes from sons are not due to their previous family social position. So, in Latin America, including, Brazil, educational persistence trough generations has been a very popular measure of (in)equality of opportunities in the literature.

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 intergenerational association of schooling 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 mobility of education 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 it finds 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.

After four centuries of educational exclusion among the poorest of the population, Brazil has gone through the last 20 years of rapid expansion of basic and university school attendance. 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.

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 technical education. So, not only did the country witness a great educational inclusion at its basic level, but also the access to Higher Education with a strong expansion of vacancies in universities, mainly fomented in the second half of the 1990s, with the increase in the number of private universities, following the approval of the Basic Education Directives Law of 1996 and Decree nº 2.207 , in 1997, both in order to create a regulation for private higher education, in relation to the quality of courses offered according to Traina-Chacon and Calderón (2015).

Mahlmeister et al. (2017) used data from the social mobility supplements of PNADs 1996 and 2014 to compare the intergenerational mobility of education in Brazil. The degree of intergenerational persistence 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.

Our analysis contributes to this literature applying the idea of Benabou and Ok (2001) of income intergerantional mobility as an equalizer process. In this way, a process of mobility is perfectly equalizer of opportunities when the sons have the same expected income, regardless of the incomes of the parents. In this case, although the income performed by the son may present inequality, such variations would be due only to unanticipated shocks. In general, a mobility process is defined as an equalizer (or progressive) if, for any initial distribution of income, the distribution of expected incomes is more egalitarian. Pero and Szerman (2008) show that the intergerational 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.

This article combines the intergenerational mobility of education approach for Brazil with Benabou and Ok (2001) theoretical framework to identify and compare an equalizer opportunities process from two main recent periods of 15-20 years each, as we will expose in the next section.

## 3 Theoretical Framework

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

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

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:

$$L_F(p) \equiv 1/\mu_F \int_0^p F^{-1}(q)dq, \quad 0 \leq p \leq 1 \tag{2}$$

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

$$L_F(p) \geq L_G(p) \quad \forall p \in [0, 1] \tag{3}$$

Which is denoted as $F \succsim_L G$.

A mobility process on X, denoted M(X), is a function $M : R^+ \times X \to [0,1]$ such that $M(.|y) \in F(X) \quad \forall y \in X$. Thus, M(x|y) is the probability that an individual with any variable 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 any variable 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 incomes in t relative to income y in t-1. We will, otherwise, denote it as the expected schooling of the son in t relative to schooling of the father in t-1.

The main reason why we use schooling rather than income is due to lack of data in Household . However, we do not find this adaptation limiting, since education has a very well documented positive effect on wages in Brazil. OECD shows, for example, that relative earnings of workers with college degree is 150% above average upper secondary education job wages, while Griffin and Edwards (1993) estimates from a mincerian equation the rate of return to an additional year of schooling between 12.8 and 15.1% and Stefani 2006, looking at heterogeneities in labor returns of education, shows that one more year of study might have been responsible for a rise of 28% on wages in 1996.

There are two primary channels by which education can impact labor income. The first one is by raising productivity via human capital accumulation (see Becker (1994)). Not only does human capital lower cost of information acquisition (see Rosenzweig (1995)), but also as workers acquire skills, experience and knowledge, a wider array of what they can produce, and how efficiently, becomes available.

The second is through signaling (see Spence (1978)). The idea is that, due to labor markets' asymmetric information, high school diplomas, college degrees and other forms of education certificates act as signals. As they're costly to acquire, these credible pieces of information make employers more willing to hire workers with more, better signals and also to do so for higher wages.

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

$$\lambda_{F,M(x)} = F(e_M^{-1}(x)) \quad \forall x \in e_M(X) \tag{4}$$

with support $e_M(X)$.

Now, the case when there is perfect equality of opportunities when the expected schooling conditional to fathers' education 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 educational prospects that are more evenly distributed than initial schooling endowment, no matter how unevenly distributed it was. Formally, that can be written as

$$\lambda_{F,M} \succsim_L F \quad \forall F \in F(X) \tag{5}$$

Now, to compare different mobility processes, it is possible to declare a process M to be more equalizing than N if the expected schooling of individuals with parents' 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 $M \succsim_{eq} N$ if

$$\lambda_{F,M} \succsim_L \lambda_{F,N} \quad \forall F \in F(X) \tag{6}$$

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

# 4 Methodology and data

According to the theoretical framework exposed above, the variables of interest to evaluate the intergenerational mobility process is the schooling of the father and the expected schooling of the son. We then present our econometric model:

$$S_{Ci} = \beta_0 + \beta_1 S_{Fi} + \beta_2 Z_i + \epsilon_i \tag{7}$$

Where $S_C i$ is the schooling of the individual i, $S_F i$ is his father schooling, $Z_i$ are dummy controls highly associated with both previous variables and that should have zero coefficient in a context of equality of opportunities[1]. The, our variable $e_M(X)$ is defined as presented:

$$e_M(X) = \beta_0 + \beta_1 S_{Fi} + \beta_2 Z_i \tag{8}$$

Where we subtract from (7) the error term $\epsilon_i$.

This paper uses data from the 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). PNAD has data on numerous characteristics of the population, such as labor, income and education. 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.

One information this supplements brings is the parents' schooling, that is reported by his son. This way, it is possible to get the coefficients from a General Least Squares (GLS) method and then have the expected schooling from two mobility process ($M_{1996}$ and $M_{2014}$), and two fathers' schooling distribution ($F_{1996}$ and $F_{2014}$).

However, the variable that represents the level of schooling of the father has the drawback of being categorical. Because of that, we follow Ferreira and Veloso (2003) to assign the numerical values of years of schooling for the different parental education categories. The father's schooling assumes value 0 if the son reports that the father has less than 1 year of study; 2, whether he completed the first, second or third grade of elementary school, but did not complete the fourth; 4 if he completed the fourth grade; 6, if he completed the fifth, sixth or seventh grade, but did not complete the eighth; 8, if he has completed eighth grade; 10, if he has incomplete secondary education; 11, if he has completed high school; 13, if you have completed but not completed tertiary education; 16, if he has a college degree.

An important difference between PNAD from 1996 and 2014 is that, while the first one asks the fathers' schooling only to the responsible for the household and his/her husband/wife, in the last one, the question was answered by any one randomly selected in the household. This way, in order the make the two datasets comparable, we will use only these two first categories of role in the household. Also, we will restrict our sample to men from 30 and 35 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 1976-81 to 1996 and 1994-99 to 2014. 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, we will restrict our sample only to men between 30 and 35 that lives in the municipality he was born. That way, the location dummies on our econometric model will be valid to the location the individuals were born, escaping from some endogeneity. This

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[1]This variables are attributed to individual's race and location, including the region, and whether his municipality was in a Metropolitan Region and whether it was a rural city

way, in our sample from 1996 we will have almost 4,700 individuals that, when weighted, represent almost 2,300,000 individuals from the total population. Our 2014 sample, on the other way, have little more than 1,000 individuals that, when weighted, represent little more than 570,000 from the total population.

Table 1, shows some descriptive statistics about our samples. In any year, we are considering a very urbanized population, concentrated in Southeast and Northeast regions. In 1996 sample, the mean schooling of the sons were slightly lower than 7 years of schooling, while fathers' was only almost 3. Also, fathers' schooling was vastly unevenly distributed, while sons' schooling was somewhat more equal. In 2014 sample, the mean schooling rose for both fathers and sons, but only the distribution of the last one got really more equalized, while the first one was just a little more even.

Table 1: Descriptive statistics of 1996 and 2014 samples

|  | 1996 sample | 2014 sample |
| --- | --- | --- |
| Sons' years of schooling mean | 6.97 | 10.41 |
| Fathers' years of schooling mean | 2.94 | 4.63 |
| Sons' years of schooling Gini | 0.36 | 0.18 |
| Fathers' years of schooling Gini | 0.59 | 0.57 |
| Black population proportion | 38.4% | 49.0% |
| Metropolitan population proportion | 27.3% | 35.3% |
| Rural population proportion | 21.5% | 17.2% |
| North population proportion | 3.3% | 5.0% |
| Center-West population proportion | 4.4% | 5.2% |
| Southeast population proportion | 46.6% | 46.4% |
| South population proportion | 16.5% | 19.2% |
| Northeast population proportion | 29.3% | 24.3% |

Source: Brazilian National Sample Household Survey

We will not be able to compare the two mobility process from any fathers' schooling distribution, but it will be possible to simulate the $M_{1996}$ and $M_{2014}$ for two different distributions F, from 1976-81 and 1994-99. This way, we will declare a mobility process to be more equalizing than other if it generates a more evenly distributed expected sons' schooling in both fathers' schooling distribution.

## 5   Results

Table 2 shows the coefficients from our robust regressions for expected sons' schooling. As it's possible to see, there is a higher (but decreasing) correlation between fathers' and sons' formal education in 1996 than in 2014: while in the first dataset, we show a positive coefficient of 0.92 from the linear term and a negative coefficient of -0.03 of the quadratic term, the same ones were 0.05 and 0.013 for the 2014 sample. Also, in this last one, the coefficient estimated for the linear term was not statistically significant.

Table 2: Coefficients from 1996 and 2014 regressions to son's schooling

|  | 1996 sample | 2014 sample |
|---|---|---|
| Father's education | 0.9196973 | 0.0511536 |
|  | (0.041424) ∗ ∗∗ | (0.0621219) |
| Quadratic term | −0.029054 | 0.013079 |
|  | (0.0026585) ∗ ∗∗ | (0.0038085) ∗ ∗∗ |
| Black dummy | −1.259801 | −1.24596 |
|  | (0.1211442) ∗ ∗∗ | (0.2234861) ∗ ∗∗ |
| North dummy | 0.2115896 | 1.071349 |
|  | (0.267096) | (0.4194751) ∗ ∗∗ |
| Southeast dummy | 0.3546064 | 0.6379511 |
|  | (0.1326564) ∗ ∗∗ | (0.268891) ∗∗ |
| South dummy | 0.3294117 | 0.5569039 |
|  | (0.1696434)∗ | (0.3278203)∗ |
| Center West dummy | 0.7360976 | 1.266131 |
|  | (0.2148782) ∗ ∗∗ | (0.3539072) ∗ ∗∗ |
| Metropolitan Area dummy | 0.8948564 | 0.6138957 |
|  | (0.1336712) ∗ ∗∗ | (0.2185378) ∗ ∗∗ |
| Rural Area Dummy | −2.105421 | −2.4138 |
|  | (0.1304271) ∗ ∗∗ | (0.3355701) ∗ ∗∗ |
| Constant | 5.324062 | 9.865389 |
|  | (0.1561362) ∗ ∗∗ | (0.3137809) ∗ ∗∗ |

Source: Brazilian National Sample Household Survey

The results are summarized in Table 5. As we can see, whether with $F_{1996}$ or $F_{2014}$, 20 years latter expected son's schooling Gini is 0.11 with $M_{2014}$, while with process $M_{1996}$, it varies between 0.24 or 0.25. Also, Graphs 3 and 4 shows that, for both fathers' schooling distribution, $M_{2014}$ process Lorenz-dominates $M_{1996}$. Finally, both expected sons' schooling are more evenly distributed then fathers'.

Table 3: Results

|  | 1996 sample | 2014 sample |
|---|---|---|
| Fathers' schooling Gini F | 0.59 | 0.57 |
| Expected sons' schooling Gini from $M_{1996}$ | 0.24 | 0.25 |
| $\lambda_{F,M_{1996}}$ Lorenz-dominates F? | Yes | Yes |
| Expected sons' schooling Gini from $M_{2014}$ | 0.11 | 0.11 |
| $\lambda_{F,M_{2014}}$ Lorenz dominates F? | Yes | Yes |
| Difference between $e_M(S_F)$ Gini from $M_{2014}$ and $M_{1996}$ | 0.13 | 0.14 |
| $M_{2014} \succsim M_{1996}$ ? | Yes | Yes |

According to our Theoretical Framework, exposed in section 3, both $M_{1996}$ and $M_{2014}$ processes were opportunities equalizers, once their expected sons' schooling distribution generated were more equal than fathers' schooling, for any point of its distribution - meaning that $\lambda_{F,M}$ Lorenz-dominates F, as Figures 1 to 4 show.

Also, since $\lambda_{F,M_{2014}}$ Lorenz-dominates $\lambda_{F,M_{1996}}$, we can say that the mobility process from 1994-99 to 2014 was more opportunities equalizer than from 1976-81 to 1996. The difference between both Lorenz Curves were higher than zero for any point between extremes, even for a 95% confidence interval, both from 1976-81 and 1994-99 fathers' schooling distribution.
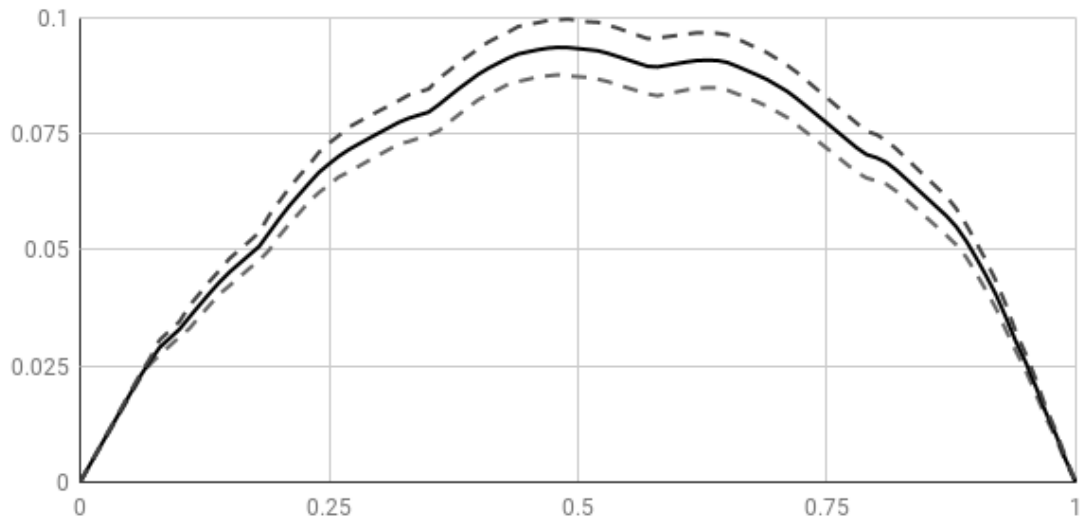
Figure 1



Lorenz Curves with 1996's data
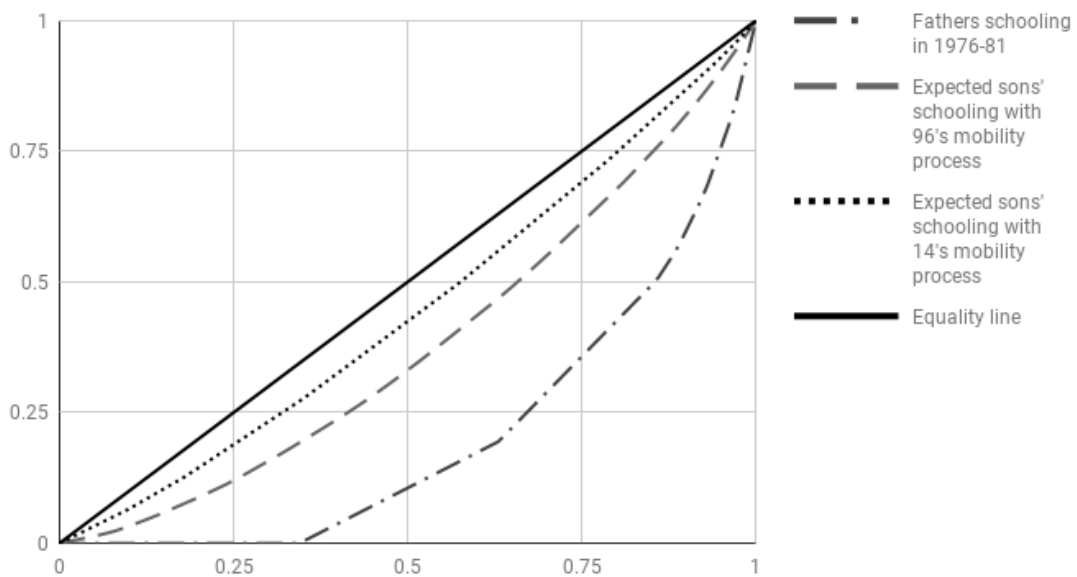
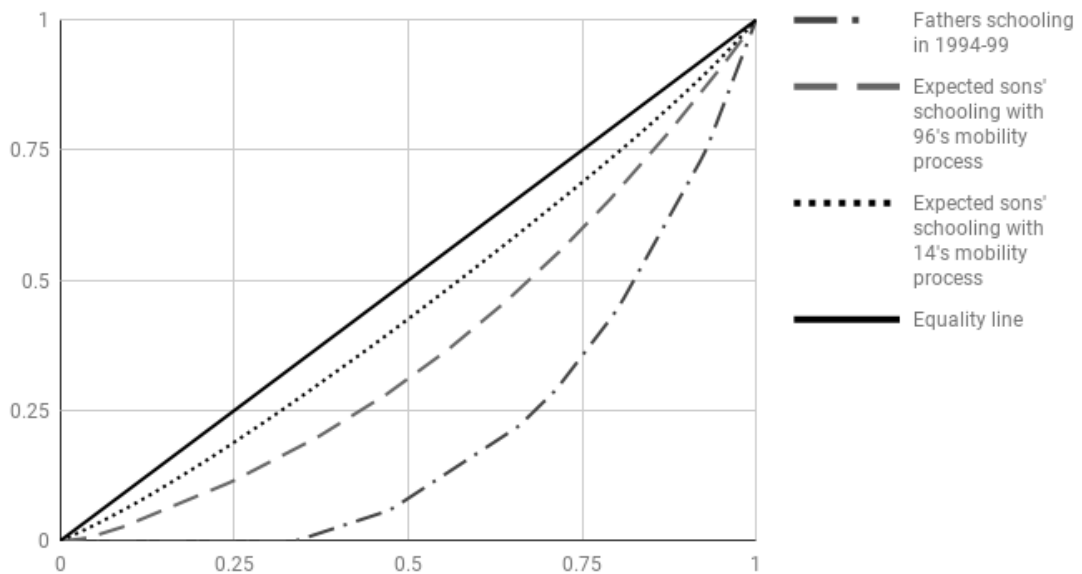Source: Brazilian National Sample Household Survey

Figure 2

Difference between Lorenz curve from 2014 and 1996 mobility
process by centil of 1976-81 fathers distribution



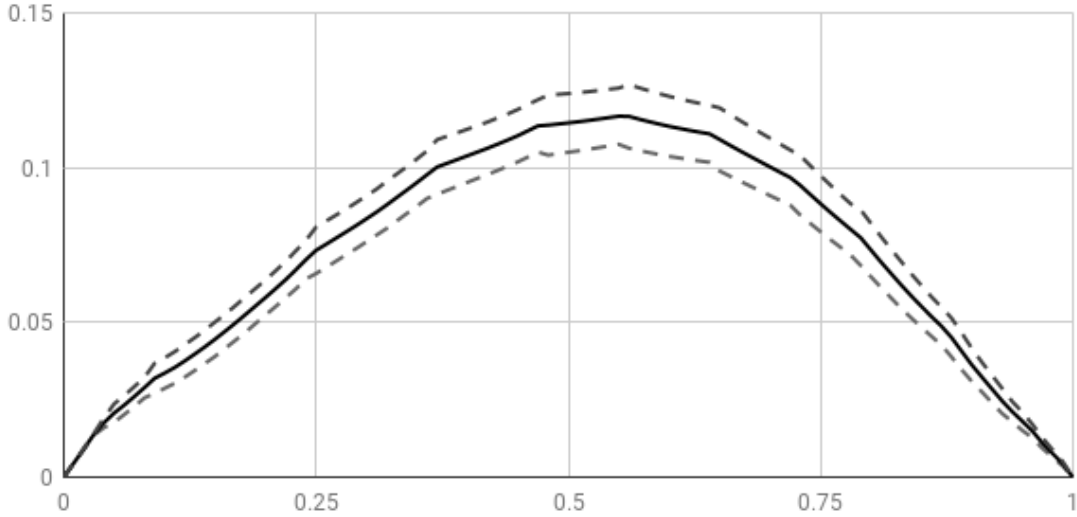Source: Brazilian National Sample Household Survey

Figure 3

Lorenz Curves with 2014 data



Source: Brazilian National Sample Household Survey

Figure 4

Difference between Lorenz curve from 2014 and 1996 mobility process by centil of 1994-99 fathers distribution



Source: Brazilian National Sample Household Survey

# 6  Conclusions

In this paper, we developed an analysis of almost 40 years of a intergenerational mobility process split in two: 1976-81 to 1996 and 1994-99 to 2014. Exposing a theoretical framework from Benabou and Ok (2001), we adapt its methodological procedure to match available data in Brazil, exchanging income for schooling as metric - what we argue not to be limiting, since education has a very well documented strong and positive effect on wages in Brazil.

Following this approach and combining it with the , equality of opportunities is stronger when expected sons' schooling distribution Lorenz-dominates the parents' observed. Also, a mobility process may be considered as more opportunities equalizer than other when the first one's expected sons' schooling Lorenz-dominates the last. Strictly, it must holds for any parents' observed schooling, but we test it only for both periods compared: 1976-81 to 1996 ($M_{1996}$) and 1994-99 to 2014 ($M_{2014}$).

In order to calculate expected sons' schooling, we use PNAD's supplement data for socio occupational characteristics of the population at least 16 years old and their families, but when aged 15 years old. We make use of a General Least Squares econometric model for generate coefficients for parents' schooling effect on sons', adding controls also related to opportunities equality, such as sex, race and place of birth. We restricted our sample to men and their fathers, for those who live in the cities where they were born, in order to reduce our biases.

Our results have shown that, for this period of almost 40 years in Brazil, opportunities were equalized, with expected sons' schooling inequality getting lower than parents' observed educational level. Also, it's shown that, for both parents' education distribution (from either 1976-81 or 1994-99), the mobility process from the second period generated a more evenly distributed sons' expected schooling. Considering, then, that $M_{2014}$ expected sons' education distribution Lorenz-dominates $M_{1996}$'s, it's proved that the latter period was more opportunities equalizer than the first.

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