

# Intergenerational Mobility of Wages in Brazil\*

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## Abstract

We present evidence on intergenerational mobility of wages in Brazil using a large household survey. We estimate the wage elasticity coefficient through a two-sample instrumental variable procedure (Angrist and Krueger (1992) and Arellano and Meghir (1992)). We find that the degree of intergenerational mobility of wages in Brazil is lower than the one observed in developed countries. The degree of mobility varies across regions and racial groups. Our results also show that wage mobility has been increasing for younger cohorts. We also find evidence of significant nonlinearities in the mobility pattern in Brazil and that the intergenerational transmission of education is related to wage mobility in several ways.

*Keywords:* Intergenerational Mobility, Education, Wages, Instrumental Variable, Transition Matrix.

*JEL Codes:* J62, D31.

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## 1. Introduction

In the last decade, several studies have attempted to estimate the degree of intergenerational mobility of earnings or wages in developed countries.<sup>1</sup> However, due to the lack of suitable data sets, only a few studies have looked at patterns of intergenerational earnings mobility in developing countries.<sup>2</sup> Empirical evidence suggests that mobility is higher in developed than in developing countries.

In this paper, we present evidence on intergenerational mobility of wages in Brazil. We use data drawn from the 1996 mobility supplement of the PNAD 1996, a Brazilian household survey. The PNAD (Pesquisa Nacional por Amostra de Domicílio) is a suitable data set for our purposes, mainly for two reasons. First, it allows for a study of intergenerational persistence of economic status for a large developing country which has experienced high and persistent income inequality in the last decades. Second, the large number of observations of the PNAD allows for the estimation of nonlinearities in the intergenerational mobility pattern.

The mobility supplement of the PNAD 1996 provides information on the education and occupation of the household head's father, but it does not give information on the father's earnings or wage. In order to construct a measure of father's wage we use a two-sample instrumental variable (TSIV) procedure proposed by Angrist and Krueger (1992) and Arellano and Meghir (1992) and applied by Björklund and Jäntti (1997) to the study of intergenerational mobility in the United States and in Sweden. Data on father's education, occupation and year of birth are used to predict father's wage. In particular, we include father's occupation among the instruments to diminish the potential upward bias in the persistence estimate, driven by the direct impact of father's education on his son's wage.

We find that the degree of intergenerational mobility of wages in Brazil is lower than the one observed in developed countries. Moreover, mobility varies across regions and racial groups. In particular, mobility is higher in the Southeast (a rich Brazilian region) than in the Northeast (a poor Brazilian region). Furthermore, mobility is higher among blacks than among whites.

Some studies, including Solon (1992), Mulligan (1997) and Corak and Heisz (1999), have attempted to document nonlinearities in the pattern of intergenerational mobility. Besides being important for descriptive purposes, nonlinearities may provide evidence on economic theories of intergenerational mobility. For example, theories based on the existence of borrowing constraints

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<sup>1</sup>For recent evidence on intergenerational earnings mobility in developed countries, see Mulligan (1997) and Solon (1999) for the United States, Björklund and Jäntti (1997) for Sweden, Dearden et al. (1997) for Great Britain, Couch and Dunn (1997) for Germany, and Corak and Heisz (1999) for Canada. Solon (2002) presents evidence for several developed countries. Earlier studies include Behrman and Taubman (1990), Solon (1992) and Zimmerman (1992).

<sup>2</sup>For evidence on intergenerational earnings mobility in developing countries, see Lillard and Kilburn (1995) for Malaysia, and Hertz (2001) for South Africa. Grawe (2001) presents evidence for Malaysia, Ecuador, Nepal, Pakistan and Peru.

typically predict that mobility of earnings or wages is higher for richer families, since they are less likely to be constrained.<sup>3</sup>

We find evidence of significant nonlinearities in the mobility pattern in Brazil. In particular, mobility is substantially lower for sons of fathers with wage below the median of the wage distribution. On average, mobility increases with the father's wage.

We show that these nonlinearities may help explain the observed differences in mobility patterns between regions and racial groups. Our results indicate a higher persistence of low wages for blacks. In particular, we show that the probability that a black son of a father from the lowest wage quintile will remain in this quintile (47%) is considerably higher than the analogous probability for a white son (25%). On the other hand, persistence of high wages is stronger for whites. In particular, the probability that a son of a father from the highest quintile will remain in this quintile is 23% if the son is black whereas the analogous probability is 50% if he is white.

A comparison between the intergenerational transmission of wages in the Northeast and in the Southeast shows that the main difference in the mobility pattern between the two regions is the degree of persistence observed in the lowest quintile. Specifically, in the Northeast, the probability that a son of a father in the lowest quintile will remain in this quintile is 58%, in comparison to only 24% in the Southeast.

In order to analyze the dynamic pattern of intergenerational mobility in Brazil, we describe the behavior of the degree of mobility of wages for each five-year cohort in the 25-64 age bracket. We find that mobility initially falls, reaching a minimum in the generation born between 1947 and 1951. The cohorts born after that generation have experienced increasing mobility.

As Grawe (2002) and others have noted, the estimation of the degree of intergenerational mobility of earnings or wages may be subject to a life-cycle bias. For this reason, it is possible that the finding that mobility increases across cohorts in Brazil is capturing life-cycle effects instead of true cohort effects. In order to alleviate that problem, we construct a measure of permanent wage for fathers and sons, based on instruments of occupation and education. We find that the degree of intergenerational mobility of permanent wage displays a similar pattern across cohorts, although the increase in mobility for younger generations is slightly less pronounced. This suggests that there has been in fact an increase in mobility across cohorts in Brazil, over and above any possible life-cycle effects.

We then explore the observed nonlinearities in the mobility pattern to have a better understanding of the behavior of mobility across cohorts. The results suggest that mobility may be increasing across cohorts for three reasons. First,

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<sup>3</sup>See Grawe (2001) for a discussion of intergenerational mobility theories based on borrowing constraints and their implications in terms of nonlinearities of the degree of intergenerational mobility.

mobility increases significantly across cohorts for the group of sons whose fathers' wages are below the overall sample median, whereas it is relatively stable for the group above the median. Second, the fraction of fathers in the group above the median, which is characterized by higher mobility, has increased over time, which contributed to increasing the overall degree of mobility. Third, the wages of the sons of poor fathers have increased relative to the wages of the sons of richer fathers.

The increase in the degree of mobility of wages has been strongly related to what has been observed for education. For younger cohorts, sons of less-educated fathers have experienced larger educational progress in comparison to sons of more educated fathers. This is a result of two movements: first, dissemination of primary education for younger cohorts; second, there is evidence of a strong bottleneck in access to college, which withheld sons of fathers with higher schooling from reaching a higher grade. In addition, a fall in the schooling premium, especially for workers with less than a high school degree, contributed to increasing wage mobility for younger cohorts.

The paper is organized as follows. Section 2 presents the empirical methodology and provides a brief discussion of the previous literature. Section 3 presents the data and describes the two-sample instrumental variable procedure used to estimate the intergenerational persistence of wages. Section 4 presents empirical results for the full sample. Section 5 presents the results for different regions and racial groups. Section 6 presents the results on the pattern of intergenerational mobility of wages across cohorts. Section 7 extends these results to permanent measures of wages of fathers and sons. Section 8 explores the relationship between education and changes in wage mobility. Section 9 concludes.

## 2. Methodology and Previous Literature

The econometric model typically used to assess the extent of intergenerational wage mobility is given by

$$y_{s,i} = \alpha + \beta y_{f,i} + \epsilon_i \quad (1)$$

where  $y_{s,i}$  represents the son's permanent log wage,  $y_{f,i}$  represents the father's permanent log wage, and  $\epsilon_i$  is a stochastic term with

$$E(\epsilon_i) = 0, \quad E(\epsilon_i y_{f,i}) = 0, \quad \text{and} \quad E(\epsilon_i^2) = \sigma_\epsilon^2$$

The coefficient  $\beta$  is the elasticity of son's wage with respect to the father's wage, also called degree of intergenerational persistence. The measure  $1 - \beta$  is a measure of the degree of intergenerational mobility.

In order to capture nonlinear patterns of intergenerational mobility, we will also use transition matrices, which give the probability that the son will belong to a particular wage category given the wage category of his father.<sup>4</sup>

Most studies use pairs of fathers and sons' earnings or wages in order to estimate equation (1).<sup>5</sup> Solon (1992) shows that measurement errors attributed to transitory earnings effects may introduce a downward bias in the elasticity estimate. In cases where the same father-son pair may be observed more than once, averaging out wage measures may attenuate such bias. An alternative is to use instruments for father's earnings, such as his education or occupation. However, IV estimates may bias the elasticity estimate upwards, if the choice of instrument has a direct impact on son's wage, as shown by Solon (1992) in the case of education.

Table 1 presents some estimates of the intergenerational elasticity of earnings or wages found in the literature. For the U.S., the mean estimate is 0.40. European countries generally present lower persistence estimates (larger mobility), as is the case of Sweden and Germany. Some recent estimates for developing countries have been found to be larger than the ones observed for developed countries (Grawe (2001)).<sup>6</sup>

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<sup>4</sup>It is important to note that the concept of mobility commonly used in the economic literature and summarized by (1) is very different from the one used in the sociological literature, as in Pastore (1979) and Pastore and Silva (1999). According to the mobility concept used in Pastore (1979) and Pastore and Silva (1999), if all sons move to the status category right above their fathers', that will characterize a high degree of mobility. On the other hand, according to the concept summarized by (1), there would be no mobility in this case, since the relative position of the sons in their status distribution would be the same as their fathers'. We thank an anonymous referee for emphasizing this distinction. We believe the concept used in this paper is more appropriate to study the intergenerational persistence of inequality, which is the focus of our study.

<sup>5</sup>See, for example, Solon (1992), Zimmerman (1992) and Mulligan (1997).

<sup>6</sup>Grawe (2001) uses father's education as an instrument for father's earnings. As argued in Solon (1992), this procedure may introduce an upward bias in the estimates of intergenerational persistence if the father's education has a direct effect on the son's earnings.

Table 1  
Studies of the intergenerational persistence of earnings or wages

Author	Persistence estimate	Country	Method of measurement error correction of father's earnings or wages
Solon (1992)	0.41	U.S.	Average earnings measures
Zimmerman (1992)	0.34	U.S.	Average earnings measures
Couch and Dunn (1997)	0.13	U.S.	Average earnings measures
Couch and Dunn (1997)	0.11	Germany	Average earnings measures
Mulligan (1997)	0.33	U.S.	Average earnings measures
Solon (1992)	0.53	U.S.	IV – Education
Zimmerman (1992)	0.50	U.S.	IV – Wage at other ages
Mulligan (1997)	0.50	U.S.	IV – 5 instruments
Grawe (2001)	0.44	Nepal	TSIV – Education as instrument
Grawe (2001)	0.46	Pakistan	TSIV – Education as instrument
Björklund and Jäntti (1997)	0.42	U.S.	TSIV – Education and Occupation as instruments
Björklund and Jäntti (1997)	0.28	Sweden	TSIV – Education and Occupation as instruments
Grawe (2001)	0.60	Peru	TSIV – Education as instrument

### 3. Data and Instrumental Variable Procedure

In this paper, we use data drawn from the 1996 mobility supplement of the PNAD 1996, a Brazilian household survey. The PNAD (Pesquisa Nacional por Amostra de Domicílio) is an annual household survey conducted by the Brazilian Institute of Geography and Statistics (IBGE).<sup>7</sup>

As discussed above, most studies in the literature use data on pairs of fathers and sons in order to estimate the persistence parameter,  $\beta$ . The PNAD 1996 has a special supplement on intergenerational mobility, which does not give information on the father's earnings or wage but provides information on the education and occupation of the household head's father.<sup>8</sup>

In order to construct a predicted wage variable for the fathers, we use a two-sample instrumental variable (TSIV) procedure. Statistical inference for TSIV is discussed by Angrist and Krueger (1992) and Arellano and Meghir (1992), having been applied by Björklund and Jäntti (1997) to estimate intergenerational earnings mobility in Sweden and in the United States. Our approach can be described as follows.

In the first stage, we construct a sample containing data on wages,<sup>9</sup> education and occupation of male workers, aged between 25 and 64, working 40 or more hours per week in all jobs, living in Brazilian urban areas. We pool data from four waves of PNADs (1976, 1981, 1986, and 1990) to construct this sample of “synthetic”

<sup>7</sup>The PNAD is a nationally representative sample, except for the rural area of the North Region, which is excluded from the sample. The rural North (which corresponds to the area where the Amazon Forest is located) is sparsely populated, and corresponded to only 2.3% of the Brazilian population in 1996. Most of the population in that region gets its subsistence from fishing and hunting activities for its own consumption, which would make them an even smaller fraction of the population of wage earners.

<sup>8</sup>We use information on the father's occupation when the household head was 15 years old.

<sup>9</sup>In order to construct our wage variable, we divided the sum of earnings in all jobs by the number of hours worked in all jobs.

fathers. This sample contains data on 253,798 individuals (from now on referred to as the first-stage sample). We then regress the log of the wage rate on educational and occupational dummies. Some studies have documented significant changes in the schooling premium between cohorts and over time in Brazil.<sup>10</sup> For this reason, we included dummies for the year of birth, which are used in interactions with education and occupation.

In the second stage, the coefficients of the estimated wage equation are used to predict the wage of the actual fathers, that is, the fathers of the sons about whom we have information in the mobility supplement of the PNAD 1996 (from now on referred to as the sample of sons). The sample of sons<sup>11</sup> who reported father's education and occupation used in the second stage contains data on 25,927 individuals aged 25-64 in 1996.<sup>12</sup> The last step consists in estimating the TSIV intergenerational wage elasticity by regressing the log of the son's wage on the log of the father's predicted wage.

In order to perform this TSIV procedure we had to construct the occupational and educational variables of the fathers. We used six groups of occupational categories, according to the classification proposed by Pastore and Silva (1999) to study intergenerational mobility of occupation in Brazil. The occupational categories are ranked in order to capture the amount of skills required to perform each task. The authors classify 927 occupations into six categories: high, medium superior, medium, medium inferior, low superior and low inferior.

Education is a categorical variable for sons and fathers. We used the following categories: no schooling (less than one year at school); incomplete elementary, first cycle education (1<sup>st</sup> to 3<sup>rd</sup> grades); complete elementary, first cycle education (4<sup>th</sup> grade); incomplete elementary, second cycle education (5<sup>th</sup> to 7<sup>th</sup> grades); complete elementary, second cycle education (8<sup>th</sup> grade). For grades higher than the 9<sup>th</sup> grade, we used complete or incomplete high school education (9<sup>th</sup> to 11<sup>th</sup> grades) and complete or incomplete college education (higher than the 11<sup>th</sup> grade).<sup>13</sup>

<sup>10</sup>Menezes-Filho et al. (2003) and Ferreira (2003) find a substantial decrease over time in the log wage difference between workers with complete 8<sup>th</sup> grade and workers with complete 4<sup>th</sup> grade. Lam and Levison (1992) found similar results for younger cohorts.

<sup>11</sup>The sample is restricted to males in order to avoid issues related to women's labor force participation. Most of the literature on intergenerational earnings mobility includes only males in the analysis. See Chadwick and Solon (2002) for an exception.

<sup>12</sup>Mobility studies typically use a narrower age range for sons (in most cases, between 25 and 35 years). We use a broader range for two reasons. First, we want to be able to analyze the behavior of the persistence of wages across cohorts. Second, as we observed above, some studies have documented the existence of a life-cycle bias in persistence estimates. By using a broad age bracket for sons, we intend to reduce this bias.

<sup>13</sup>The sample of sons contains more details on sons' and fathers' educational status. More specifically, it contains information on whether the individual finished high school and if he graduated from college. Because this information is not available in the first-stage sample, we could not include these categories as dummies in the first stage regression and use it to predict the father's wage in the second stage. In some of the tables in the text, we will present more

Since the PNAD 1996 does not provide information about the father's age, we assumed that the father was born 34 years earlier than the son. We construct such estimate based on information from the Brazilian Demographic Census. The average age difference between mothers and their offspring is 30 years, estimated from the Demographic Censuses of 1950-1970. Since this difference is stable across the Censuses, we assume that it is the same for the years before 1950. In addition, from the Census data we obtain an average age difference between spouses of 4 years. By adding both pieces of information, we obtain an age difference of 34 years between fathers and sons.

Table 2 shows information on the father's occupation and educational attainment in the sample of sons.<sup>14</sup> With respect to education, 34% of sons have fathers with less than one year in school, and 84% of sons reported having fathers with at most 4 years of schooling.

Table 2  
Father's characteristics (sample of sons)

Father's schooling**	Unweighted N	Weighted percentage(%)	Predicted wage*	Occupational ranking (%)***				
				High	M-S	M	M-I	L-S
0	8,872	34.2	1.1	0.6	2.8	1.7	15.6	41.3
1-3	7,535	29.1	1.7	1.2	4.3	4.1	31.9	35.5
4	5,436	21.0	2.6	1.9	6.9	9.8	45.4	25.3
5-7	718	2.8	2.9	3.4	7.9	12.6	52.4	17.6
8	1,072	4.1	4.2	3.6	11.2	23.3	47.3	11.3
9-10	206	0.8	5.7	5.6	19.0	24.8	35.2	10.1
11	1,116	4.3	6.3	11.2	21.3	31.1	30.2	5.0
12-15	84	0.3	10.9	12.4	33.2	27.3	21.6	4.9
16	888	3.4	13.4	49.9	21.2	19.3	7.8	1.2
Total	25,927	100.0	2.5	3.3	6.0	7.1	29.4	31.5

Note:

\* Hourly real wage predicted for the father based on occupation and education reported by his son.

Measured in 1996 Reais.

\*\*The educational categories are: No schooling (0); Incomplete elementary, first cycle education (1-3);

Complete elementary, first cycle (4); Incomplete elementary, second cycle (5-7);

Complete elementary, second cycle (8); Incomplete high school education (9-10);

Complete high school education (11); Incomplete college education (12-15); Complete college education (16).

\*\*\*Occupational Rankings: M-S, for Medium Superior; M, for Medium; M-I, for Medium Inferior;

L-S, for Low Superior; L-I, for Low Inferior.

The father's occupational rank captures cognitive skills not necessarily transmitted through formal learning. For example, 11% of fathers with completed high school education are classified as working in high-skill activities. However, a strong positive correlation between occupational ranking and educational attainment indicates that formal learning is complementary to the skills needed to perform more sophisticated tasks. Finally, father's predicted wage is positively

detailed educational categories than those effectively used in the construction of the instrumental variable for the father's wage. In these cases, the educational categories are: No schooling (0); Incomplete elementary, first cycle education (1-3); Complete elementary, first cycle (4); Incomplete elementary, second cycle (5-7); Complete elementary, second cycle (8); Incomplete high school education (9-10); Complete high school education (11); Incomplete college education (12-15); Complete college education (16).

<sup>14</sup>The results reported throughout this paper use sample weights provided by IBGE to produce a representative sample of individuals for the Brazilian population. Sample sizes reported refer to the unweighted number of observations. All regressions and summary statistics are calculated using the sample weights.



correlated with the number of years in school, with some indication of convexity. This can be seen by observing that returns on schooling are substantially larger at the college level.

Table 3 presents some descriptive statistics on intergenerational mobility based on the sample of sons. We can observe that the son's occupational rank and education are highly correlated with his father's education. For example, the probability that the individual performs a high-skill demanding task is 40.5% for those whose father has completed college education and just 1.4% for those whose fathers do not have any formal schooling. Son's average schooling grows monotonically with father's schooling, but it is roughly the same for sons of fathers with more than complete elementary education and with less than complete college education. Reported sons' wage rates are strongly correlated with fathers' education as well.

Table 3  
Son's characteristics according to father's schooling (sample of sons)

Father's schooling**	Average schooling	Average wage*	Son's characteristics					
			Occupational ranking (%)***					
			High	M-S	M	M-I	L-S	L-I
0	3.9	2.7	1.4	5.2	6.5	50.0	24.8	12.1
1-3	6.3	4.1	4.0	8.7	10.9	53.2	17.8	5.4
4	8.9	6.3	8.4	15.2	17.8	44.9	11.5	2.3
5-7	9.6	5.8	9.4	13.3	18.8	46.1	9.8	2.6
8	11.0	8.9	15.9	19.7	21.2	36.2	6.3	0.7
9-10	12.0	9.8	21.2	19.8	25.8	25.4	7.1	0.7
11	12.4	11.3	18.9	24.6	24.3	26.6	5.1	0.5
12-15	12.7	15.0	25.3	20.5	31.6	17.1	4.1	1.5
16	14.1	15.3	40.5	25.8	17.3	13.2	2.7	0.5

Note:

\*Observed son's hourly real wage, measured in 1996 Reais.

\*\*The educational categories are:

No schooling (0); Incomplete elementary, first cycle education (1-3);

Complete elementary, first cycle (4); Incomplete elementary, second cycle (5-7);

Complete elementary, second cycle (8); Incomplete high school education (9-10);

Complete high school education (11); Incomplete college education (12-15);

Complete college education (16).

\*\*\*Occupational Rankings: M-S, for Medium Superior; M, for medium;

M-I, for Medium Inferior; L-S, for Low Superior; L-I, for Low Inferior.

Since the youngest father in that sample is assumed to be 34 years older than someone who was 25 years old in 1996, the sample of individuals whose characteristics should match those reported by the sons (from now on called the sample of fathers) must contain only a subset of the first-stage sample, that is, those individuals born before 1938.<sup>15</sup>

Table 4 describes summary statistics for the sample of fathers. The sample contains 59,340 observations. The average number of years in school is 3.7, ranging from 1.7 years for individuals at the very bottom of the occupational rank to

<sup>15</sup>In most studies, the sample of fathers coincide with the sample used in the first-stage regression. Because we do not know the exact age difference between fathers and sons, a broader first-stage sample makes it easier to perform sensitivity analysis with different assumptions for the difference between father's and son's age. We report these results in the Appendix.

11.1 years for individuals classified in the most skilled occupational group. The hourly wage rate varies even more, from 1.2 Real per hour to 16.8 Reais per hour, respectively for the lowest and the highest occupational rank.

Table 4  
Father's characteristics (sample of fathers)

Occupational ranking	Education**	Real wage*	N	Frequency
High	11.2	16.8	3,274	6%
Medium superior	7.5	10.8	5,520	9%
Medium	6.1	6.6	7,832	13%
Medium inferior	3.3	3.1	17,780	30%
Low superior	1.9	1.8	16,671	28%
Low inferior	1.7	1.2	8,263	14%
Average	3.7	4.3	59,340	100%

Source: PNADs 1976, 1981, 1986, 1990.

Note: The sample contains males, working more than 40 weekly hours, born before 1938 and aged between 25 and 64 years old in the selected years.

\*Observed hourly real wage measured in 1996 Reais.

\*\*The midpoint of each educational category is taken to calculate the average schooling. For example, we assume two years of schooling for all individuals who completed between one and three years of education.

For complete or incomplete college education, it is assumed the value of 15.

A necessary condition for the TSIV estimator to be consistent is that the distribution of observable characteristics in the sample of fathers must be similar to the distribution of father's characteristics reported by the sons.<sup>16</sup> Table 5 (first and third columns) compares the sons' reports on fathers' occupation and education (obtained from the sample of sons) with the synthetic fathers' reports of their own characteristics (obtained from the sample of fathers). We can observe that the synthetic fathers have higher schooling and more qualified occupations than the actual fathers (based on their sons' reports).<sup>17</sup> The average education of the sample of fathers is 3.7 schooling years, compared to 2.9 for the actual fathers. The proportion of fathers who performed low skill tasks is 43.4% in the sample of fathers and 54.2% in the sample of sons.

The discrepancy between the two samples is likely a result of selecting only individuals who were working in the sample of (synthetic) fathers. We did so because we included only individuals who earned labor income in order to perform the first-stage regression. However, the actual fathers, whose education and occupation are reported by their sons in 1996, may be working or not in 1976,

<sup>16</sup>The PNAD is a nationally representative sample of the population of sons. However, since the information about fathers is retrospective, there might be a concern about the representativeness of fathers included in the sample. For this reason, we need to compare the distribution of observable characteristics in the sample of fathers to the distribution of father's characteristics reported by the sons.

<sup>17</sup>The midpoint of each educational category is taken to calculate the average schooling. For example, we assume two years of schooling for all individuals who completed between one and three years of education. For complete or incomplete college education, it is assumed the value of 15. In order to calculate the average occupational ranking, we assume the value of one for high rank occupations; 2 for medium superior; 3 for medium; 4 for medium inferior; 5 for low superior; 6 for low inferior.

1981, 1986 and 1990. When we add the individuals who were not working to the original sample of fathers, the two distributions (the sons' reports and the synthetic fathers' reports) look quite similar (Table 5, second and third columns). In particular, the average education and occupational ranking reported by the sons are very close to the ones reported by the fathers.<sup>18</sup>

Table 5  
Descriptive statistics for Brazilian samples of fathers and sons

	Father's own report		Son's report of father's characteristics
	Sample of father's***	Expanded sample of father's****	
Average schooling*	3.7	3.1	2.9
Educational categories	%	%	%
0	29.3	35.9	34.9
1-3	27.0	26.2	29.4
4	20.1	17.7	21.7
5-7	8.5	7.8	2.4
8	4.7	4.0	3.7
9-11	4.8	4.2	4.6
more than 11	5.7	4.2	3.3
Average occupational ranking**	4.1	4.3	4.5
Occupational ranking	%	%	%
High	5.0	4.8	3.3
Medium superior	9.6	8.8	6.0
Medium	11.9	9.6	7.1
Medium inferior	30.1	24.3	29.4
Low superior	28.6	36.0	31.5
Low inferior	14.8	16.5	22.7

Source: PNAD 1976, 1981, 1986, 1990, for the sample of fathers and PNAD 1996 for the sample of sons.

Note:

\*The midpoint of each educational category is taken to calculate the average schooling. For example, we assume two years of schooling for all individuals who completed between one and three years of education. For complete or incomplete college education, it is assumed the value of 15.

\*\*In order to calculate the average occupational ranking, we assume the value of one for high rank occupations; 2 for medium superior; 3 for medium; 4 for medium inferior; 5 for low superior; 6 for low inferior.

\*\*\*The sample of fathers contains only individuals who were working in the selected years.

\*\*\*\*The expanded sample of fathers contains individuals working or not in the selected years.

<sup>18</sup>The two reports have roughly the same proportion of medium occupation categories (specifically, 42.7% for the expanded sample of fathers and 42.5% for the sample of sons), but the expanded sample of fathers has a slightly larger proportion of high rank occupations. The sons' reports have a slightly larger frequency of individuals with less than five completed years in school, and slightly lower frequency of those between five and seven completed years in school.

#### 4. Intergenerational Mobility of Wages in the Full Sample

In this section, we present results for the intergenerational mobility of wages in the full sample. We first estimate (1) by two-sample instrumental variable (TSIV) for the full sample.<sup>19</sup> As control variables<sup>20</sup> we use four regional dummies, a quadratic polynomial for son's age, and a dummy for blacks (including mulattos).<sup>21</sup> As shown in Table 6, the degree of persistence ( $\beta$  coefficient) in Brazil is 0.58, which means that, if the father's wage is 100% above the mean, the son's wage is expected to be 58% above the mean.

Table 6 also presents persistence estimates for different combinations of control variables. The coefficients are always significant at the 1% level.<sup>22</sup> The estimation of (1) for the United States typically includes the age of the father and of the son (and the respective age variables squared) as controls (see, for example, Solon (1992)). The PNAD, however, does not provide information on father's age. Using only the age and age squared of the son as controls, we obtain a value of  $\beta$  equal to 0.66.

Table 6  
Intergenerational persistence of wages in Brazil – PNAD 1996

Dependent variable: son's log wage						
	(a)	(b)	(c)	(d)	(e)	(f)
Father's log wage	0.58*	0.66*	0.59*	0.55*	0.59*	0.73*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Adjusted R squared	0.29	0.22	0.27	0.25	0.24	0.19

Note: Bootstrapping standard errors are in parenthesis.

Control variables are:

(a) son's age (linear and squared variables), dummies for region, dummy for blacks.

(b) son's age (linear and squared variables).

(c) son's age (linear and squared variables), dummy for blacks.

(d) dummy for blacks.

(e) dummies for regions.

(f) no controls.

\*significant at the 1% confidence level.

<sup>19</sup>Unless said otherwise, all estimations are performed using the cohort dummies for father's occupation, education and year of birth as instruments.

<sup>20</sup>These control variables refer to the sons' characteristics. In particular, the sons do not report their fathers' age, race or region of residence.

<sup>21</sup>In the PNAD individuals report their own race. We will follow the PNAD terminology and use the term race to denote the individual's ethnicity or skin color. The questionnaire defines five racial groups: indigenous, white, Asian, black and mulatto. In this paper, blacks are those individuals who declared themselves as blacks or mulattos. We will present results only for blacks and whites, since the other racial groups correspond to only 1.1% of the sample.

<sup>22</sup>In every regression the standard error of the persistence coefficient is obtained through the use of a bootstrap procedure. First, we draw a first-stage bootstrap sample containing 150,000 observations, from which we estimate the parameters used to generate a son's predicted father's wage (first-stage regression). Then, we randomly draw a bootstrap sample of sons with 5,000 observations, for whom we generate measures of the predicted father's wage and run the second-stage regression, retaining the persistence estimate. We repeat this procedure 500 times. The bootstrap standard error is the standard deviation of the distribution of persistence estimates.

The degree of persistence of wages that we found for Brazil is very high in comparison with other countries, especially if we consider the estimate obtained from the specification that is closest to the ones commonly used in the literature. As we discussed in Section 2, the mean estimate of persistence of earnings or wages in the U.S. presented in Table 1 is 0.40, and the estimates for other developed countries are even smaller.

Dunn (2004) estimated the degree of intergenerational persistence of earnings in Brazil using a similar TSIV methodology and found a value of 0.69. Besides using earnings instead of wages, an important difference between his procedure and ours is that he used only father's education as an instrument. Since we expect father's education to have a direct effect on son's wage, this procedure tends to produce an upward bias in the persistence estimate.<sup>23,24</sup>

In order to assess the robustness of our persistence estimates, Table 7 presents estimated persistence coefficients obtained with the use of different instruments for the father's wage.

Table 7

Intergenerational persistence of wages in Brazil, different instruments – PNAD 1996

Dependent variable: son's log wage			
	Occupation+education	Education	Occupation
Father's log wage	0.58* (0.01)	0.60* (0.01)	0.52* (0.01)

Note: Bootstrapping standard errors are in parenthesis.

Each estimation contains a full set of control variables: a quadratic age polynomial, race and regional dummies.

\*Significant at the 1% confidence level.

Table 7 shows that the degree of wage persistence is significantly smaller when only occupation is used as an instrument for father's wage (0.52) than when only education is used as instrument (0.60). This suggests that the use of father's education as an instrument may produce an upward bias in the persistence estimates, which justifies our choice for a broader set of instruments. We will still keep father's education as an instrument since nearly all studies in the literature that adopt either an IV or a TSIV procedure use this variable as an instrument.

The degree of persistence,  $\beta$ , is a summary measure of immobility. In order to analyze in detail the mobility pattern of wages in Brazil, we use different procedures to describe the persistence for different levels of father's wage.

<sup>23</sup>In addition, Dunn (2004) used a sample of sons aged 25-34 in 1996, whereas we use a broader age range (25-64). Dunn used a sample of fathers aged 30-50 with positive earnings in 1976 to obtain his estimate of earnings persistence.

<sup>24</sup>Bourguignon et al. (2003) use a micro-econometric technique to simulate what the distribution of outcomes (earnings and household income) would be if observed circumstances (including family background) were the same for all individuals. They found that observed circumstances are a major source of outcome inequality in Brazil. In terms of the mobility concept used in our paper, their results may be interpreted as implying that earnings mobility is low in Brazil.

Figure 1 plots the mean of the son's log wage as a function of the father's log wage. It suggests a nonlinear relationship between son's and father's wage. Persistence is stronger at the extremes of the father's wage distribution. In particular, the degree of persistence is smaller for sons of middle-wage fathers than for sons of fathers in the lower and upper bounds of the father's wage distribution.

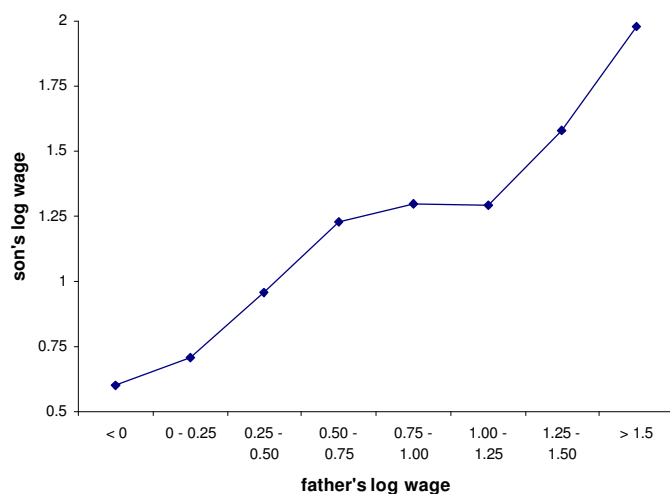


Figure 1  
Conditional mean of son's log wage

Table 8 presents additional evidence of nonlinearities in the mobility pattern. We regress the log of the son's wage on the log of the father's wage and its square.<sup>25</sup> We find that the coefficient on the linear term is positive and the coefficient on the quadratic term is negative and significantly different from zero at the 5% level. This result shows that persistence falls with father's wage on average.<sup>26</sup>

In particular, the degree of persistence is 0.62 for sons of fathers whose wages are below the median, whereas for sons of fathers with wages above the median the persistence estimate is 0.53. Overall, this evidence is consistent with standard theories of intergenerational mobility based on borrowing constraints,

<sup>25</sup>A cubic specification was found not to be statistically significant. The same cubic specification was found to be statistically significant when we did not include controls in the regression. This last evidence is compatible with the cubic shape of Figure 1, where no controls are used.

<sup>26</sup>The evidence of concavity in the son-father log wage profile is also observed when we use only occupation as an instrument. When we use only education as an instrument, however, evidence suggests a convex pattern, even though the positive coefficient on the squared log wage of the father is not statistically different from zero.

which predict that mobility is higher for richer families to the extent that they are less likely to be constrained.<sup>27</sup>

Table 8  
Evidence of nonlinearities in the persistence of wages

Dependent variable: son's log wage			
	(1)	(2)	(3)
Father's log wage	0.62*	0.53*	0.63*
	(.036)	(.013)	(.017)
Father's log wage squared	—	—	-0.03**
			(.008)

Note: Bootstrapping standard errors are in parenthesis.  
Each estimation contains a full set of control variables:  
son's age (linear and squared variables), dummies for region and race.  
(1) Sample of sons with father's wage below the median.  
(2) Sample of sons with father's wage above the median.  
(3) Full sample.

\*significant at the 1% confidence level.

\*\*significant at the 5% confidence level.

In order to analyze the pattern of intergenerational mobility in wages in greater detail, we present the transition matrix for wages in Table 9. As mentioned in Section 2, this matrix gives the fraction of sons in each wage category given the category of father's wages.

Table 9  
Transition matrix for wages (by wage quintile) – Brazil, PNAD 96

Father/son	Bottom	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	Top
Bottom	35	26	19	13	7
2 <sup>nd</sup>	29	25	21	15	10
3 <sup>rd</sup>	17	21	23	21	18
4 <sup>th</sup>	11	17	23	24	25
Top	7	11	15	24	43

Note: Values are expressed in %.  
The marked area corresponds to the conditional median.

Table 9 displays some interesting patterns.<sup>28</sup> First, there is strong persistence at the extremes of the conditional distribution of the son's wage. The fraction of sons of fathers in the poorest quintile (bottom quintile) that remained in this quintile is 35%, whereas the fraction of sons of fathers in the richest quintile (top quintile) that remained in this quintile is 43%. This suggests that high

<sup>27</sup>Grawe (2001) argues, however, that the implication that persistence declines with father's wages is not robust to variations in the specification of the wage function, in particular with respect to the way in which ability affects wages. In fact, borrowing constraints may be also consistent with convex mobility patterns. Moreover, concave patterns do not necessarily indicate the presence of borrowing constraints. Grawe suggests the use of quantile regressions as a further test of the presence of borrowing constraints. This procedure is implemented for the PNAD data in Andrade et al. (2004).

<sup>28</sup>The quintiles mentioned in all transition matrices are the quintiles of the overall wage distribution, respectively for fathers and sons.

intergenerational persistence is driven not only by a “poverty trap” (defined as a high probability of staying in the same status as the father, if the father has low wage) but by a “wealth trap” as well.

Second, Table 9 also shows that the probability that an individual will move from the lowest to the highest wage category (65%) is higher than the probability of falling from the highest to the lowest wage category (57%).<sup>29</sup>

Third, the table confirms the evidence of strong persistence of wages in Brazil. For example, the probability that a son of a father in the bottom quintile will move to the top quintile is only 7%, whereas the analogous probability for a son of a father in the top quintile is 43%.

Figure 2 shows the cumulative distribution function of sons’ wages for selected quintiles of father’s wages. The probability density function of sons of fathers in the third quintile is close to a uniform distribution, which leads to an almost linear cumulative distribution. This is another way to look at the large differences in the probability of being rich or poor depending on the family background.

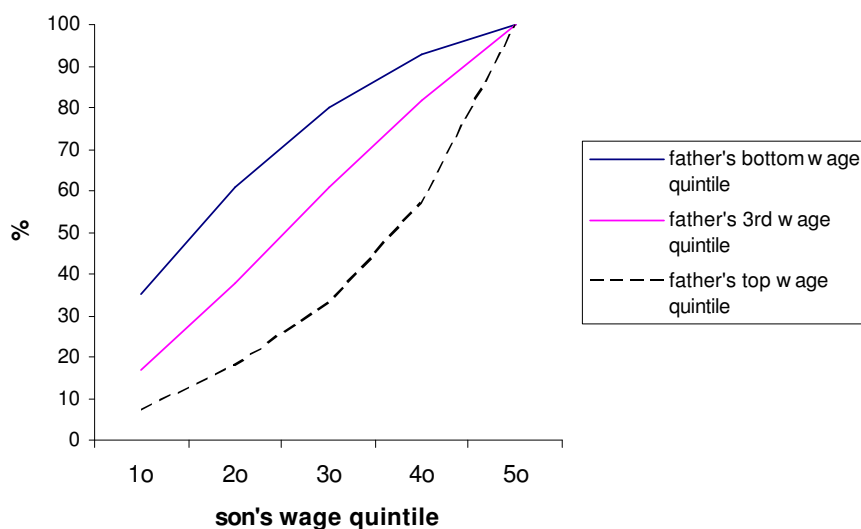


Figure 2  
Cumulative distribution of son's wage, conditional on father's wage

<sup>29</sup>This result is consistent with the pattern observed in the United States (Zimmerman, 1992) and in Great Britain (Dearden et al., 1997).



## 5. Mobility Patterns for Different Subpopulations

In this section, we look at different patterns of intergenerational mobility for different subpopulations. Particularly, we compare black and white sons, and sons living in different regions of the country.

The degree of persistence is considerably higher in the Northeast (0.73), a poor Brazilian region, than in the Southeast (0.54), a rich Brazilian region, and for whites (0.60) in comparison with blacks (0.53). Table 10 presents the main results.<sup>30</sup>

Table 10

Intergenerational persistence of wages in Brazil, different subpopulations – PNAD 1996

Dependent variable: son's log wage						
	Northeast	Southeast	South	Midwest	Blacks	Whites
Father's log wage	0.73* (0.02)	0.54* (0.01)	0.62* (0.02)	0.55* (0.03)	0.53* (0.01)	0.60* (0.01)
Adjusted R squared	0.28	0.25	0.23	0.20	0.18	0.24
Number of obs.	5,913	9,804	5,551	2,968	10,199	15,726

Note: Bootstrapping standard errors are in parenthesis.

Each estimation includes the son's age (linear and squared variables) as control variables.

In addition, the regressions by region include dummies for race and the regressions by race include dummies for region.

\*Significant at the 1% confidence level.

### 5.1 Different racial groups

Table 10 shows that mobility among black sons is higher than between white ones. The analysis of the transition matrix can sharpen our understanding about the patterns underlying these differences. Tables 11 and 12 present transition matrices for black and white sons.

Table 11

Transition matrix for wages (by wage quintile) – blacks

Father/son	Bottom	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	Top
Bottom	47	25	16	9	3
2 <sup>nd</sup>	39	28	17	11	5
3 <sup>rd</sup>	27	24	23	16	10
4 <sup>th</sup>	21	24	23	20	12
Top	14	18	20	25	23

Note: Values are expressed in %.

The marked area corresponds to the median.

<sup>30</sup>We do not present the results for the North Region because the PNAD data are not representative of this region. In particular, the PNAD does not provide data for rural areas in the North Region.

Table 12  
Transition matrix for wages (by wage quintile) – whites

Father/son	Bottom	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	Top
Bottom	25	26	22	16	11
2 <sup>nd</sup>	12	20	23	24	21
3 <sup>rd</sup>	12	20	23	24	21
4 <sup>th</sup>	7	15	22	26	30
Top	4	9	14	23	50

Note: Values are expressed in %.  
The marked area corresponds to the median.

The shape of the transition matrices is very different for these two subpopulations.<sup>31</sup> Blacks have large intergenerational persistence of low wages, while whites have large persistence at high wage levels. Accordingly, the probability that a black whose father was at the bottom quintile will remain at that quintile (47%) is considerably higher than the analogous probability for whites (25%). On the other hand, the probability that a white whose father was located at the top quintile of the wage distribution will remain in this quintile is 50%, compared to an analogous probability of 23% for blacks.

The conditional median of son's wage is positively correlated with father's wage for the white population. For blacks, the conditional median wages are lumped at the 2<sup>nd</sup> quintile for the sons of fathers at the bottom, 2<sup>nd</sup> and 3<sup>rd</sup> quintile and at the 3<sup>rd</sup> quintile for sons of fathers at the 4<sup>th</sup> and top quintile. This leads to a larger mobility among blacks than among whites, but this happens because most blacks do not reach the highest quintiles regardless of the value of their father's wage.

It is important to observe, however, that the race variable may be capturing the persistence of other non-observable determinants of economic status rather than intrinsically racial effects (such as discrimination). One possible explanation is that black and white sons of fathers with the same level of hourly wage may have different levels of parental asset income, which, in the presence of borrowing constraints, is an important determinant of educational investment.

## 5.2 Different regional groups

Brazil has a large heterogeneity across country regions. Per capita GDP is about three times higher in the Southeast (the richest region) than in the Northeast (the poorest region). As shown in Table 10, the degree of persistence varies substantially across regions, reaching the highest value in the Northeast (0.73) and the smallest in the Southeast (0.54). Tables 13 and 14 present transition matrices for the Northeast and the Southeast.

<sup>31</sup>As mentioned in a previous note, the quintiles used in all transition matrices, including the ones for race and region, refer to the overall wage distribution, respectively for fathers and sons.

Table 13  
Transition matrix for wages (by wage quintile) – Northeast

Father/son	Bottom	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	Top
Bottom	58	22	10	6	3
2 <sup>nd</sup>	53	23	12	7	5
3 <sup>rd</sup>	37	25	16	13	9
4 <sup>th</sup>	27	21	19	17	16
Top	14	13	14	22	36

Note: Values are expressed in %.  
The marked area corresponds to the median.

Table 14  
Transition matrix for wages (by wage quintile) – Southeast

Father/son	Bottom	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	Top
Bottom	24	27	24	16	9
2 <sup>nd</sup>	16	25	26	21	12
3 <sup>rd</sup>	10	18	25	25	22
4 <sup>th</sup>	8	16	23	26	27
Top	4	10	15	24	47

Note: Values are expressed in %.  
The marked area corresponds to the median.

The comparison between the intergenerational transmission of wages in the Northeast and the Southeast shows that one important difference between the two regions is the persistence in the bottom quintile. In the Northeast, the probability that a son of a father in the bottom quintile will remain in this quintile is 58%. The same pattern is observed for sons of fathers located in the second quintile, for whom the probability of descending to the first quintile is very large (53%). The corresponding probabilities are much lower in the Southeast (24% and 16%, respectively).<sup>32</sup> Since a substantial fraction of the fathers in the Northeast have predicted wages in the lowest quintile (25%), this result may help explain the significant difference in the persistence coefficients presented in Table 10.

On the other hand, persistence for higher wages is considerably larger in the Southeast, since the probability of staying in the highest quintile is 47%, compared to 36% in the Northeast, but these fathers represent only 20% and 15% of the Southeast and Northeast populations, respectively.

Once one escapes from poverty, the conditional median is strongly related to the father's wage in the Northeast. In the Southeast, the son's median wage conditional on father's wage is the same for individuals whose fathers are in the second and third quintiles, and again for fathers in the fourth and top quintile, which leads to smaller persistence estimates in the Southeast.

<sup>32</sup>It should be noted that selection bias caused by migration of the most skilled sons from the Northeast to the Southeast might cause an upward bias in the persistence in the Northeast, especially for poor families (for which migration is substantial).

## 6. Intergenerational Mobility of Wages over Time: Cohort Analysis

In order to analyze the dynamic pattern of intergenerational mobility of wages in Brazil, we describe the behavior of the degree of persistence of wages for each five-year cohort in the 25-64 age bracket. Figures 3-5 show the behavior of the degree of persistence across cohorts for the country as a whole, selected regions, and racial groups.

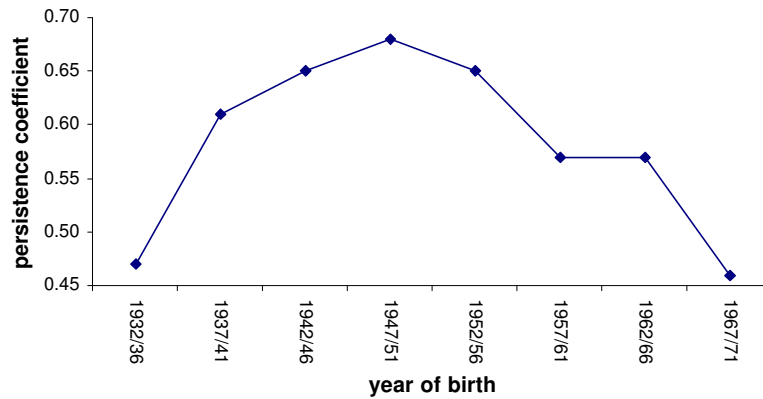


Figure 3  
Intergenerational persistence of wages according to cohort

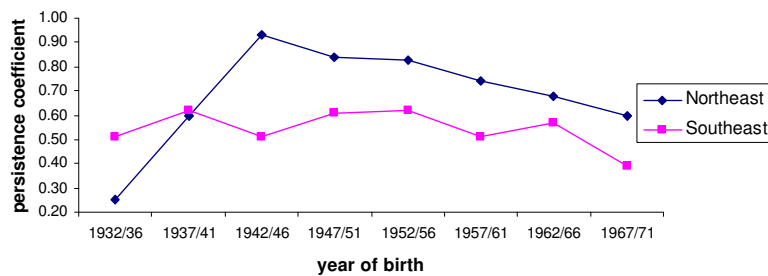


Figure 4  
Intergenerational persistence of wages according to cohort and region

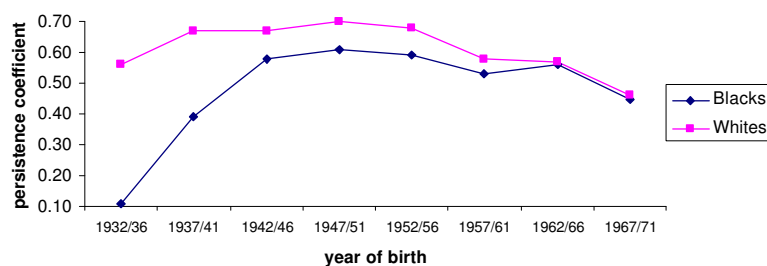


Figure 5  
Intergenerational persistence of wages according to cohort and race

The figures show that, for the country as a whole, persistence rises for five-year cohorts born between 1932 and 1951, and falls continually for younger cohorts. In particular, the estimated degree of persistence falls from 0.68 for the cohorts born between 1947 and 1951 to 0.46 for the cohort born in 1967/1971.<sup>33</sup>

The degree of intergenerational persistence of wages varies substantially across geographic regions and over time. Particularly, it shows a negative trend for every region since the cohort born in 1942/1946, especially in the Northeast. The Northeast has larger persistence for all cohorts born after 1941.

Intergenerational wage persistence is smaller for blacks than for whites for all cohorts, even though they are very similar for young cohorts. It increases for the cohorts born between 1932 and 1951 and declines thereafter. For whites, mobility increases continuously for generations born after 1947/51, being relatively stable until then.

One should keep in mind, however, the impossibility of identifying cohort and age effects from a cross-section of just one year. Persistence may be falling for younger cohorts because the son's wage at younger ages is less related to the father's permanent wage, compared to the son's wage at older ages.<sup>34</sup> Such bias could lead to an increase in intergenerational mobility such as the one observed above. In the next two sections, we check the robustness of the observed fall in wage persistence by taking two different steps. In Section 7, we construct measures of permanent wages for fathers and sons. In Section 8, we look at the behavior of educational mobility, since education does not vary much over the life cycle.

<sup>33</sup>Dunn (2004) also found a similar increase in mobility for younger generations.

<sup>34</sup>See Grawe (2002) for details.

## 7. Intergenerational Mobility of Wages over Time: Cohort Analysis with Permanent Wages

In order to check whether a life-cycle bias is actually driving the results, we replace fathers' and sons' wages by measures of permanent wages. We construct these permanent wage measures by using data on education and occupation to compute predicted wage variables for fathers and sons. However, instead of using year of birth cohort dummies, as in our TSIV procedure, we compute predicted wages when both fathers and sons are 40 years old. Figure 6 displays the evolution of the intergenerational persistence of permanent wages across cohorts.

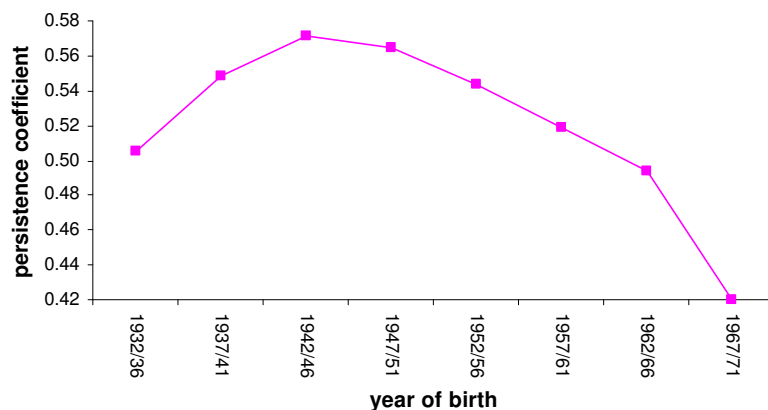


Figure 6  
Intergenerational persistence of permanent wages according to cohort

The mobility pattern of permanent wages across cohorts is similar to the observed for son's current wages in Figure 3. Table 15 compares the persistence coefficients obtained from using current and permanent wage concepts. One difference is that in the first case the persistence coefficient reaches its peak for the cohort born in 1947/1951, while the one associated with permanent wages peaks for the cohort born in 1942/1946.

Table 15 shows that the patterns are not only similar qualitatively, but quantitatively as well. Specifically, for the cohort born in 1932/1936, the persistence estimate is 0.47 for son's current wages and 0.51 for permanent wages. For the cohort born in 1967/1971, the persistence estimates are equal to 0.46 and 0.42, respectively. This suggests that most of the increase in mobility across cohorts is not an artifact of a life-cycle bias.

Table 15  
Intergenerational persistence of wages, different wage measures

Son's year of birth	Current wage*	Permanent wage**
1932/36	0.47	0.51
1937/41	0.61	0.55
1942/46	0.65	0.57
1947/51	0.68	0.57
1952/56	0.65	0.55
1957/61	0.57	0.52
1962/66	0.57	0.50
1967/71	0.46	0.42

Note:

\*The persistence estimate based on the current sons' wage takes into account interactions between education, occupation and cohort dummies in constructing the father's predicted wage. It is obtained from a regression in which the son's reported wage is the dependent variable and the father's predicted wage is the explanatory variable.

\*\*The persistence estimate based on the permanent wage uses the son's predicted wage as the dependent variable and the father's predicted wage as the explanatory variable, both computed at age 40.

Given that persistence is falling across cohorts, we would like to have a better understanding of the mechanism that is generating this outcome. In order to analyze in detail the evolution of intergenerational mobility of wages across cohorts, we use two different approaches: sample partition and the conditional mean function.

First, we divide the sample into two groups, consisting of the sons with fathers' wages below and above the overall sample median, respectively. Then we estimate (1) for each group and each cohort. Table 16 presents the results.

Table 16  
Intergenerational persistence of permanent wages according to cohort and subsamples

Son's year of birth	1932/36	1937/41	1942/46	1947/51	1952/56	1957/61	1962/66	1967/71
Father's wage below the median	0.55* (0.07)	0.69* (0.06)	0.68* (0.05)	0.74* (0.05)	0.67* (0.04)	0.66* (0.04)	0.69* (0.04)	0.55* (0.04)
Father's wage above the median	0.40* (0.07)	0.37* (0.06)	0.55* (0.04)	0.48* (0.03)	0.49* (0.02)	0.48* (0.02)	0.49* (0.02)	0.43* (0.02)
Proportion of fathers with wage above the median (%)	27.1	28.5	30.5	36.5	41.3	45.8	49.9	48.1
Mean persistence	0.51	0.55	0.57	0.57	0.55	0.52	0.50	0.42

Note:

(1) Bootstrapping standard errors are in parenthesis.

(2) We take the median of the overall sample as reference.

(3) All regressions use a full set of controls: age and squared age, and dummies for blacks and regions.

\*Significant at the 1% confidence level.

We can observe that persistence is always higher for sons of fathers with wages below the overall median. Table 16 suggests that wage persistence may have declined for two reasons. First, the fraction of fathers with wages above the overall sample median increases from 27% for the sons born in 1932/1936 to 50% for the cohort born in 1962/1966.<sup>35</sup> This fact contributed to a reduction in persistence, since persistence is smaller for the group with wages above the median.

<sup>35</sup>Table 16 shows that the fraction of fathers with wages above the median falls slightly for

Second, we observe a significant decline in persistence for the cohorts born after 1951 for the group of fathers with wages below the median, and a relative stability of persistence for the group above the median.<sup>36</sup>

Figure 7 plots the mean of the son's log wage as a function of the father's log wage for two selected cohorts. We can observe that the increase in mobility for the younger cohort results, at least partially, from the flatter conditional wage profile for the latter. In particular, the permanent wage of the sons of poor fathers increased between the 1942/1946 and 1962/1966 cohorts. Moreover, the permanent wage of the sons of middle-wage fathers did not increase and it even decreased for rich fathers.

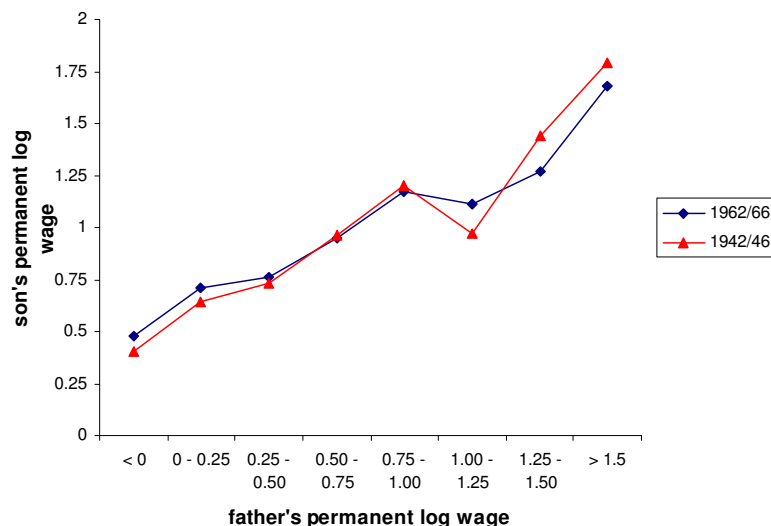


Figure 7  
Conditional mean of son's permanent log wage – selected cohorts

the cohort born in 1967/1971. One possible reason is that we exclude sons who still live with their parents from the sample, which correspond to 38% of sons born in 1967/1971. For this cohort, sons who still live with their parents have, on average, higher schooling than sons who are household heads. In particular, the average schooling of the latter is 6.6, whereas it corresponds to 7 years for the former. If the parents excluded from the sample also have higher average schooling, this may contribute to reducing the fraction of fathers with wages above the median for the 1967/1971 cohort. For the other cohorts, this exclusion is not significant. For the cohort born in 1962/1966 only 19% of the sons live with their parents, and this fraction is insignificant for the other cohorts.

<sup>36</sup>The degree of persistence falls from the cohort born in 1962/1966 to the one born in 1967/1971, especially for the group below the median. This can result, however, from the fact that the sons in the younger cohort may not have completed their education.



## 8. Intergenerational Mobility of Education, Schooling Premium, and Wage Mobility

One may ask what is driving the fall in wage persistence for younger cohorts, especially among poor families. In this section, we assess to what extent educational mobility is contributing to the observed pattern of wage mobility across cohorts. Specifically, we estimate the degree of intergenerational educational mobility by using education instead of wages as a measure of economic status in (1).<sup>37</sup> Figure 8 shows the behavior of the degree of persistence of education across cohorts.

The figure shows that the increase in wage mobility for younger cohorts replicates a similar behavior for educational mobility. In particular, we observe that mobility increases continuously for generations born after 1951. Since education does not vary much with the life cycle, except for some late graduation for the better-educated individuals, this provides further evidence that the increase in wage mobility is not an effect of a life-cycle bias.

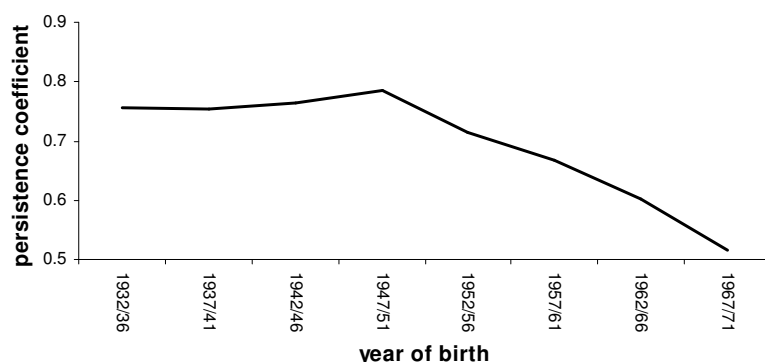


Figure 8  
Intergenerational persistence of education according to cohort

The increase in mobility across cohorts has been caused by educational progress, especially for sons of less-educated fathers. While for the cohort born in 1942/1946 the average education for sons of fathers with no schooling was 2.5 years, the corresponding average for the 1962/1966 cohort was 4.1 years, as shown in Table 17. Meanwhile, the average education of sons of fathers with more than eight and less than 11 years of schooling did not increase for the cohort born in 1962/1966 relative to the one born in 1942/1946.

<sup>37</sup>See Ferreira and Veloso (2003) for a more detailed analysis of intergenerational mobility of education in Brazil.

Such evolution may be a consequence of differences in the degree of access to educational goods in Brazil, depending on fathers' wages. Poor fathers' offspring have gained access to basic education during the last forty years. This explains why the average education of this group almost doubled in twenty years. Sons of fathers that earn a median wage (whose schooling completion is in the bracket between eight and eleven years) did not improve their education compared to their parents, which indicates the existence of a bottleneck in the access to tertiary education in Brazil.<sup>38</sup>

This result has a direct implication for the evolution of the average permanent wage for younger cohorts, shown in Figure 7: it increases for sons of poor fathers and it is strikingly stable for sons of fathers that earn a median wage.

Table 17

Average son's educational attainment according to son's cohort and father's education

Father's education	Son's education (years)		
	1942/46	1957/61	1962/66
0	2.5	3.7	4.1
1-3	5.0	6.3	6.3
4	8.1	8.9	8.9
5-7	8.6	9.7	9.6
8	11.2	11.4	10.6
9-10	12.0	12.2	12.2
11	12.6	12.6	12.2
12-15	11.7	13.4	13.8
16	13.5	14.2	14.1

Note:

The educational categories are: No schooling (0);  
 Incomplete elementary, first cycle education (1-3);  
 Complete elementary, first cycle (4);  
 Incomplete elementary, second cycle (5-7);  
 Complete elementary, second cycle (8);  
 Incomplete high school education (9-10);  
 Complete high school education (11);  
 Incomplete college education (12-15);  
 Complete college education (16).

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.

The average schooling premium has been decreasing over time in Brazil. For example, Ferreira (2003) documents a diminishing impact of education on wages for grades below college. Jointly with the improvement in basic education, the fall of returns to education may be an important factor behind the increase in wage mobility for those sons of fathers who are below the median of the wage distribution. Ferreira (2003) also shows that the college premium has been rising over time, which may be part of the explanation why mobility is not increasing among the sons of fathers above the median wage.<sup>39</sup>

<sup>38</sup>Tertiary education in Brazil corresponds to values for the educational variable greater than 11 (complete high school).

<sup>39</sup>In addition, Ferreira (2003) shows that the returns to schooling in Brazil have a convex

## 9. Conclusion

In this paper, we presented evidence on intergenerational mobility of hourly wages in Brazil. We found that the degree of intergenerational mobility of wages in Brazil is lower than the one observed in developed countries. Moreover, mobility varies across regions and racial groups. In particular, mobility is higher in the Southeast (a rich Brazilian region) than in the Northeast (a poor Brazilian region). Furthermore, mobility is higher among blacks than among whites.

We found evidence of significant nonlinearities in the mobility pattern. In particular, wage persistence falls with father's wage on average, which is compatible with some theories of borrowing constraints. We also showed that these nonlinearities might help explain the observed differences in mobility patterns between regions and racial groups.

In particular, the mobility pattern for blacks and for the Northeast are characterized by high persistence in the bottom quintile of fathers' wages and low persistence at high wages, in comparison with the patterns observed for whites and for the Southeast, respectively.

In order to describe the dynamic pattern of intergenerational mobility in Brazil, we analyzed the behavior of the degree of mobility of wages for each five-year cohort in the 25-64 age bracket. We found that intergenerational persistence shows an inverted-U shape, reaching a maximum in the generation born in 1947/51, and decreasing for cohorts born thereafter.

In order to reduce a possible life-cycle bias in the estimates of wage persistence, we checked the robustness of our results by taking two different steps. The first procedure was to construct measures of permanent wages for fathers and sons and to estimate the degree of persistence of permanent wages across cohorts. The results were qualitatively and quantitatively similar to the ones obtained using sons' current wages, which suggests that the increase in mobility is not an artifact of life-cycle biases.

The results suggest that mobility may be increasing across cohorts for three reasons. First, mobility increases significantly across cohorts for the group of sons with father's wage below the overall sample median, whereas it is relatively stable for the group above the median. Second, the fraction of fathers in the group above the median, which is characterized by higher mobility, has increased over time, which contributed to increasing the overall degree of mobility. Third, the wages of the sons of poor fathers have increased relative to the wages of the sons of richer fathers.

The second procedure that we used was to analyze the role of educational mobility in generating the observed pattern of wage persistence across cohorts. The idea was that, since the educational level is more stable over the life cycle, the

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shape, being smaller for lower educational grades. Such profile may help explain the nonlinear pattern of intergenerational persistence of wage, especially the convex shape at the upper end of the father's wage distribution observed in Figure 1.

persistence coefficient is less likely to be subject to a life-cycle bias. We showed that the intergenerational transmission of education is closely associated with the behavior of wage mobility across cohorts.

An increase in the access of the poor to elementary education has been gradually observed in Brazil during the last forty years. As a consequence, sons of relatively less-educated fathers have experienced an improvement in their education and wages. In addition, educational progress has been sluggish among the sons of fathers who already had a basic education or a high school diploma. Such evidence of barriers to access to college education in Brazil is behind the relatively small increase in wages of those individuals.

As a result, the average educational and wage distance between the sons of the relatively poor and the sons of the relatively rich has been reduced across cohorts, contributing to an increase in intergenerational wage mobility.

Lastly, the fall in the schooling premium at basic educational levels documented by other studies and the convex shape of schooling returns seem to be strongly related to the evolution as well as to the nonlinear pattern of wage mobility in Brazil.

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## Appendix

Table A.1  
Wage persistence under different assumptions for age differences  
between fathers and sons

Dependent variable: son's log wage				
	(a)	(b)	(c)	(d)
Father's log wage	0.58*	0.59*	0.60*	0.61*
	(0.01)	(0.01)	(0.01)	(0.01)
Adjusted R squared	0.29	0.30	0.30	0.30

Note: Bootstrapping standard errors are in parenthesis.  
Each estimation contains a full set of control variables:  
age and squared age, and dummies for blacks and regions.

Assumptions for Age Difference:

(a) 34 years

(b) 30 years

(c) 25 years

(d) 20 years

\*significant at the 1% confidence level.