

# Return on Human Capital: Quantile Regression Evidence in Brazil 2003-2013

Wellington Ribeiro Justo<sup>1,\*</sup>, Nataniele dos Santos Alencar<sup>2</sup>,  
Matheus Oliveira de Alencar<sup>2</sup>, Denis Fernandes Alves<sup>3</sup>

<sup>1</sup>Economic Department, URCA/PPGECON, UFPE, Brazil

<sup>2</sup>Rural Economic Department, MAER/UFC, Brazil

<sup>3</sup>Economic Department, PPGECON, UFRN/GETEDRU, Brazil

**Abstract** This paper undertakes an empirical examination of rates of return on human capital in Brazil through the period of macroeconomic stabilization and crisis (2003-2013). An appropriate empirical strategy is to fit the earnings model using the quantile regression. Counterfactual analysis is considerate. The results aim that there is evidence for reducing inequality in rates of return to education in Brazil differently from last decade. There was also a decrease in the wage gap between genders.

**Keywords** Earnings, Human capital, Inequality, Quantile regression, Counterfactual analysis

## 1. Introduction

In the last 20 years, the development countries have undergone a process of substantial reform, especially in economy. Following the international economic instability in the 1970 and 80 of the past secular, a lot of economies implementers programs to solve external account imbalances and controlling high inflation rates. From the mid 1980s, many of these countries undertook unprecedented economic reforms involving trade liberalization, privatization of state companies, and the deregulation of financial, labor and goods markets. These reforms have been allowed very rapidly and give rise profound economic changes (Arbache, 2000).

In the international literature, papers such as: Kats and Murphy (1992), Arbache (1998) between others have been showed that economics changes effects in the short and long terms in the labor market, especially in the increasing of the inequalities earnings between the works with higher and lower qualification and the increasing of the unemployment, between the works with lower qualification, in the development countries. However there are discrepancies in term of knowledge of effects these changes in development countries.

In the point of view about theoretical outline researchers

such as Murphy and Welch (1992), Juhn, (1999) between others have fundament in validity of Heckscher-Ohlin (H-O) model to investigate the behavioral of returns of variables of human capital how results of structural changes in demand favorable to higher qualification works. Contrary to H-O model, researchers such as Robins and Gindling (1999) shows increasing in relative demand favorable to higher qualification works in development countries.

Evidences to Brazil suggest increasing in returns of variables of human capital after economics reforms. Arbache (1999) try explicating the improving of increasing of inequality in Brazil in 90s. Other empirical approach used for treat variable return of human capital has been quintile regression models. Silveira Neto and Campelo (2003), Araújo Júnior and Silveira Neto (2004) between others has explore this methodology. Especially to analyses the behavioral of returns of human capital variable in Brazil after economic liberalization, to stand out Arabsheibani, Carneiro e Henley (2003).

Justo (2006) examined the rates of return to human capital in Brazil through the period of macroeconomic stabilization and trade liberalization (1992-2002). The results aim that there were evidence for growing inequality in rates of return to education in Brazil.

In the last perspective, this paper try improvement in term of literature completes some gap. Such as: works with recent dates, put important variables to control of human capital human and compare the return of human capital between men and woman and analyses the behavioral differentials of earnings between agricultural sectors in another in the economy. This paper worry, in the point of view theoretical and empirical, to analysis the impact of

\* Corresponding author:

justowr@yahoo.com.br (Wellington Ribeiro Justo)

Published online at <http://journal.sapub.org/ijfa>

Copyright © 2018 The Author(s). Published by Scientific & Academic Publishing

This work is licensed under the Creative Commons Attribution International

License (CC BY). <http://creativecommons.org/licenses/by/4.0/>

economic period in worked market. Estimate quantiles regressions of human capital to get the pictures of human capital in different points of earnings distribution in Brazil, using dates of Brazilian household surveys - PNAD (National Research of Sample household) for 2003, 2011 and 2013. This period includes the two governments of Luis Inacio Lula da Silva and part of President Dilma Rousseff's mandates before the crisis provoked by the economic policy that strongly affected the labor market and culminated in the impeachment process.

The reminder of the paper is structured as follows: beside this introduction, in the next section shows some theoretical aspects about human capital. Section 3 does a descriptive analyses profile of human capital, considering years of schooling, old, years of experience, interaction term between years of schooling and years of experience, suggesting the idea of inequality at the different points of earnings distribution and inter regional of variables of human capital. Section 4 presents econometrics results and a counterfactual exercise. Section 5 concludes.

## 2. Empirical approach

In theory of human capital, Arabsheibani (1988) arguments that the investment in human capital increasing earning's individuals, once that the acquisition of education increasing the productivity. Another explication is that education act only as a filter or a screen. Then arises an important question in returns of education studies, if in fact, formal education acts as a selection, separating the more able individuals (and educated) of the less able (and educated). In the screening hypotheses, Arrow (1973) observes that at the point of hiring worker's productivity is unknown to employers and argues therefore that employers use education as a proxy for latent productivity. In competitive sectors of the labour market returns to subsequent education after hiring will be lower. In non-competitive sectors of the labour market returns to subsequent education after hiring will be lower. It is therefore possible that the value of education as a screen may vary across the earnings distribution because of differing degrees of competition. In particular screening may be more important in the top of distribution, where insider power may be more important.

According Arabsheibani, Carneiro and Henley (2003) the empirical literature on screening distinguishes between the weak form and strong form of the hypothesis (Psacharopoulos, 1979; Arabsheibani and Rees, 1998). The weak form states that employers will pay a higher initial salary to recruits with higher levels of schooling, but is agnostic about the shape of the subsequent experience-earnings profile. The strong form states that employers will continue pay high salaries even after observing working on the job, because education continues to enhance productivity as experience on the job rises. However, the experience-earnings profiles of an educated worker will converge over time that of a non-educated

worker, as the original hiring "mistake" is gradually corrected. Psacharopoulos (1979) proposes what has become known as P(sacharopoulos) test as a method of empirical investigation.

With intention of investigate the returns of human capital tends and test the strong hypothesis using the model according Arabsheibani, Carneiro e Henley (2003). Assume that log earnings for individuals assume that log hourly earnings for individual  $i$ ,  $y_i$ , are determined according a Mincerian earnings function of the following form:

$$y_j = a_0 + a_1 S_j + a_2 E_j + a_3 E_j^2 + a_4 S_j E_j + b' Z_j + u_j \quad (1)$$

Where  $S$  is years of education,  $E$  is years of experience,  $Z$  are other socio-economic variables affecting earnings,  $a$  and  $b$  are coefficients and  $u$  is a disturbance term. The inclusion of the interaction term between years of experience and years of education provides a straightforward test of convergent experience-earnings profiles under the strong screening hypothesis (Lee, 1980). If the hypotheses holds then  $a_4 < 0$ , otherwise  $a_4 > 0$ .

Researchers have shown that modeling average earnings (i.e. OLS) fails to reveal that effect of education on earning is non-constant across the conditional distribution wage (Buchinsky, 1994, 1998; Machado and Mata, 2001; Bauer and Haisken-DeNew, 2001; Hartog, Pereira and Vieira, 2001) and also Brazilian researches such as Silveira Neto and Campelo (2003), Araújo Júnior and Silveira Neto (2004), Justo (2012), Justo; Alencar; Alencar (2017). This reinforces the need to investigate the screening hypothesis across the earnings distribution. An appropriate empirical strategy is to fit the earnings model across different points in the conditional sample distribution, using the quantile regression method. This was first introduced by Koenker and Bassett (1978). Assume  $y_i$ ,  $i = 1, \dots, n$ , is a sample of observations on log earnings, and that  $X_i$  is a  $K \times 1$  vector comprising the education, experience and other control characteristics contained on the right-hand side of equation (1). The quantile regression model can be expressed as:

$$y_i = X_i' \beta_\theta + u_{\theta i}, \text{Quant}_\theta(y_i | X_i) = X_i' \beta_\theta, \theta \in (0, 1) \quad (2)$$

Where  $\text{Quant}_\theta(y_i | X_i)$  denotes the quantile  $\theta$  of log earnings conditional on the regressor vector. Following Koenker and Bassett (1978), the regression quantile  $\theta$  can be defined as the solution to the problem:

$$\min_b \frac{1}{n} \left[ \sum_{i: y_i - x_i' b \geq 0} q |y_i - x_i' b| + \sum_{i: y_i - x_i' b < 0} (1-q) |y_i - x_i' b| \right] \quad (3)$$

$$= \min_b \frac{1}{n} \sum_{i=1}^n r_q(u_{qi})$$

where  $\rho_\theta(\cdot)$  is known as the "check function" and is defined as:

$$r_q(u_{qi}) = \begin{cases} qu_{qi} & \text{if } u_{qi} \geq 0 \\ (q-1)u_{qi} & \text{if } u_{qi} < 0 \end{cases}$$

Estimation is by minimizing the sum of weighted absolute deviations and can be performed using linear programming methods (Buchinsky 1998). An estimated variance-covariance matrix for the chosen system of quantile regressions is obtained using a bootstrap re-sampling method. Quantile regression coefficients can be interpreted by considering the partial derivative of the conditional quantile with respect to a particular regressor. This equates to the marginal change in the  $\theta$ th conditional quantile due to a marginal change in the regressor. It is however important to note that sample individual who is in the  $\theta$ th conditional quantile may no longer remain in that quantile if his or her characteristic measured by the particular regressor changes. So, for example, rates of return to additional years of schooling or experience as captured by the estimated coefficients apply to an individual remaining in a particular conditional quantile.

### 3. Data Source and Description

In this paper use data drawn from de 2003, 2011 and 2013 Brazilian household surveys (Pesquisa Nacional por Amostragem de Domicílios, PNAD). The PNADs are a series of nationally representative household surveys conducted more or less annually since 1976, using a consistent methodology by the Instituto Brasileiro de Geografia e Estatística (IBGE). The sample is composed of individuals between the ages of 18 and 65, with non-null wage who report earnings and hours of work data and information on human capital and the other controls used for estimation purposes.

Hourly earnings are defined as reported monthly earnings divided by 4.33 and then divided by reported weekly hours of work. Table 1 reports summary descriptive information for each year on log (hourly earnings), along with descriptive statistics on years of education, years of experience (defined as age - (6 + years of schooling)), educationxexperience and the regional dummies<sup>1</sup>.

**Table 1.** Descriptive Statistics

Variable	2003		2011		2013	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Log(hourly earnings)	1.5618	1.0321	2.0169	0.0024	2.1265	0.0024
Education	5.3683	4.5681	9.3044	0.0100	9.4422	0.0098
Experience	21.7005	15.1049	21.8506	0.0378	22.4048	0.0372
Educ.*Exp.	155.1243	136.6790	209.8815	0.4035	218.3518	0.4040
Northeast	0.3272	0.4692	0.2487	0.0011	0.2523	0.0011
South	0.1555	0.3624	0.1856	0.0010	0.1793	0.0010
North	0.0976	0.2968	0.1242	0.0009	0.1274	0.0009
Centre East	0.0962	0.2948	0.1056	0.0008	0.1016	0.0008

Source: PNAD'S (2003,2011 e 2013).

Notes: Earnings are in constant 2013 consumer prices.

Different of Arabsheibani, Carneiro and Henley (2003) I had included men and woman workers and addition a dummy variable for gender to try avoid a selection vies and possibility compare differences of returns human capital variable gap between men and woman workers.

Throughout the period there is a real salary increase, schooling and years of experience. The real salary increased by 36.15% in the period. Schooling was 4.07 years old. The experience and interaction between schooling and experience also increased between 2003 and 2013. This result contrasts with what happened in the previous decade as shown by Justo (2006).

### 4. Empirical Results

Key results (coefficients  $a_1, \dots, a_4$ ) for earnings function estimates for 2003, 2011 and 2013<sup>2</sup> are presented in Table 2, 3 and 4. For each year the table shows simultaneous quantile regression estimates for the 10th, 25th, 50th, 75th and 90th quantiles. The reported coefficients suggest considerable variation in the education-earnings and experience-earnings profiles at the different points in the earnings distribution. I shall discuss rates of return to education and experience shortly.

The education-experience interaction coefficient is negatively signed and statistically significant (at 1%) at the 10th, 25 th and positively sample mean and for the 75th and 90th conditional quantiles for all period. This result suggests that in all period 2003-2013s for those at the very bottom of the earnings distribution formal education appears to have acted as a signal for innate ability rather than provided human capital unlike for it lies from the middle to the top of the distribution. Experience-earnings profiles appear to converge, albeit slowly, after initial. Similar results were meted for Arabsheibani, Carneiro and Henley (2003) for 1988-1998 periods.

Returning to discussion of schooling and experience returns, by Table 2, 3 and 4 é possible observes some regularity. First, with respect to return, notes that it increasing in long of distribution and stability over the years. The differences between quantile (0.1) and (0.9) oscillate by (5.07%) in 2003 and (6.86%)<sup>3</sup> in 2013. Other regularity is the increasing of return of education for quantile (0.9) in all period. This result suggest that a despite of increasing of people with more schooling there are rise the return for this group indicating um increasing in relative demand for workers with this profile. However, the return to those at the top of the distribution is much lower than in the previous decade as shown by Justo (2006). This indicates that education has been contributing to the reduction of inequality over time.

2 President Lula's warrant expired in 2010. But in that year there is no PNAD, because it was used in 2011. During that period, there was the international financial crisis.

3 Values calculated by:  $\text{value\%} = 100 * [\exp(\text{coef.}) - 1]$ , with date of Table 2 and 4.

1 The Southeast was the reference region.

**Table 2.** Quantile regression estimates: 2003

Variable	Q10	Q25	Q50	Q75	Q90
Education	0.0781	0.0771	0.0860	0.1054	0.1239
Exper	0.0208	0.0190	0.0211	0.0255	0.0282
Expersq	-0.0002	-0.0001	-0.0001	-0.0001	-0.0000
Educ*exper	0.0002	0.0005	0.0009	0.0008	0.0004
Durb	0.4549	0.2838	0.1901	0.1439	0.1182
Dgender	0.2326	0.2026	0.1863	0.1601	0.1235
Drace	0.1449	0.1444	0.1614	0.1922	0.2388
Dasimer	0.3000	0.2737	0.2673	0.2587	0.2299
Dmigra	-0.0235	-0.0055	0.0164	0.0661	0.1112
Dmetropolitan	0.1378	0.1155	0.1133	0.1271	0.1404
DNortheast	-0.4466	-0.3481	-0.2827	-0.2468	-0.1904
DSouth	-0.0156	-0.0209	-0.0370	-0.0678	-0.0675
DNorth	-0.2226	-0.1639	-0.1165	-0.0790	-0.0306
DCentre East	0.0127	-0.0283	-0.0238	-0.0259	-0.0061
Constant	-0.8037	-0.2919	0.0186	0.2738	0.5776
Pseudo R2	0.1998	0.1884	0.2201	0.2539	0.2586

Source: PNAD (2003).

**Table 3.** Quantile regression estimates: 2011

Variable	Q10	Q25	Q50	Q75	Q90
Educ	0,0828	0,0782	0,0871	0,1072	0,1316
Exper	0,0239	0,0194	0,0192	0,0259	0,0330
Expersq	-0,0002	-0,0002	-0,0001	-0,0001	-0,0001
Educ*exper	-0,0006	-0,0001	0,0004	0,0005	0,0001
Durb	0,4691	0,2593	0,1534	0,0990	0,0562
Dgender	0,1797	0,1782	0,1987	0,1912	0,1449
Drace	0,0870	0,0947	0,1252	0,1692	0,2100
Dsector	0,1576	0,1540	0,1890	0,2091	0,2025
Dmigra	0,0215	0,0394	0,0779	0,1387	0,1956
Dmetropolitan	0,1121	0,0852	0,0842	0,1054	0,1302
DNortheast	-0,3215	-0,2634	-0,2334	-0,1981	-0,1556
DSouth	0,0502	0,0454	0,0123	-0,0277	-0,0775
DNorth	-0,1564	-0,1223	-0,0941	-0,0496	0,0004
DCentre East	-0,0014	-0,0065	0,0058	0,0173	0,0211
Constant	-0,3178	0,1578	0,3805	0,5089	0,7303
Pseudo R2	0,1585	0,1394	0,1703	0,2036	0,2043

Source: PNAD (2011).

Note: All coefficients have a p-value of less than 0.01. Equal coefficient tests were performed between the quantiles and for all variables the equality hypothesis was rejected at 1% of significance.

In this paper included a variable that try apprehend the effect of changes undertaken in Brazilian economy between the sectors in 2003-2013 period, especially between agricultural and other sectors. Observed a narrowed in wage gap of agriculture to other sectors in all point of the distribution. In (0.1) quantile the gap favorable to agriculture sector was (34.99%) while in (0.9) quantile were only (25.85%). This pattern repeats in 2011. In 2013 there is narrowed again in all point of the distribution but the fall to

workers in the top is hardest. In (0.9) quantile the worker in agricultural sector received (22.0%) relative to other sectors. This is showed in Table 2, 3 and 4.

Macroeconomic and trade reform occurred in Brazil since the late 1989s have been provoked diverse effects between economy's sectors. In this sense, the narrowed dispersion wage in more qualified workers in agriculture sector relative to other sectors suggest an increasing in relative demand to qualified workers in opposite to prediction's H-O model.

**Table 4.** Quantile regression estimates: 2013

Variable	Q10	Q25	Q50	Q75	Q90
Education	0.0770	0.7438	0.0855	0.1090	0.1320
Exper	0.0194	0.0175	0.0198	0.0260	0.0319
Expersq	-0.0002	-0.0001	-0.0001	-0.0001	-0.0001
Educ*exper	-0.0004	-0.0001	0.0002	0.0002	-0.0002
Durb	0.4639	0.2307	0.1232	0.0561	0.0356
Dgender	0.1558	0.1614	0.1788	0.1799	0.1393
Drace	0.0841	0.0971	0.1321	0.1714	0.2204
Dsector	0.1579	0.1652	0.1953	0.2126	0.1988
Dmigra	0.0051	0.0264	0.0617	0.1291	0.1937
Dmetropolitan	0.1060	0.0776	0.0710	0.1043	0.1419
DNortheast	-0.3314	-0.2679	-0.2391	-0.1891	-0.1115
DSouth	0.0477	0.0433	0.0169	-0.0202	-0.0665
DNorth	-0.1690	-0.1341	-0.0978	-0.0341	0.0264
DCentre East	0.0227	0.0109	0.0234	0.0455	0.0471
Constant	-0.1124	0.3540	0.5371	0.6463	0.8486
Pseudo R2	0.1553	0.1333	0.1647	0.1903	0.1846

Source: PNAD (2013).

Note: All coefficients have a p-value of less than 0.01.

Equal coefficient tests were performed between the quantiles and for all variables the equality hypothesis was rejected at 1% of significance. Durb=1 if urban; Drace=1 if white; Dsector=1 if non agriculture; Dmigra=1 if migrant; Dmetropolitan=1 if metropolitan; Dsoutheast were omitted.

How there are many workers with low levels of education in Brazil relative to others development countries, would wait, according the H-O model, an increasing in relative demand by less qualified workers. However, Kats (1992), Krueger and Summers (1988) have been argument that the innovation and technologic diffusion have been contributed for change the demand profile by qualified work favorable to workers able to coexist with new production's technologies and that the introduction of new technologies is not limited to industries sectors associates with trade international. Other sector including agriculture and service sector also have been benefit, justifying, in part, these results.

Is possible to see the importance of inter-sectors dispersion to quantiles in the bottom of distribution earning considering the different regressors's contributions included in model for the wage differentials. Omitting each group of variable verified the impact in standard deviation of model<sup>4</sup>. Is possible to see<sup>5</sup> in that human capital variable are more important to explain the gap wages, however, if the work is

4 Idem note 2.

5 Idem note 2.

in agriculture sector is relatively more important to (0.1) quantile and relatively less important to higher quantile. Although less important than human capital variable, if the work is in agriculture sector is important to explain the differential wage gap, above all, if work is in the bottom of conditional distribution's this variable.

Other result that reinforces the argument above is the behavioral of workers wage in urban area comparative to worker in rural area. In 2003 the workers in urban area wage practically fall in the distribution varying between the premium of (57.69%) to worker in the top and (14.55%) to worker in the bottom. In 2011 there is stabilization of differences. In 2013, the pattern changes favorable to urban worker in the distribution. To (0.1) quantile the difference was (59.02%) while in (-0.9) quantile is (3.62%). However, due the simultaneous changes occurred in Brazilian economy in this period, is necessary be careful with this results. Arbache (2000) point out the possibility of effects in technologies changes predominates in curt time while the argument of trade effects predominates in long time. Once that H-O model admit demand curves perfectly elastic this is possible, only in long time, then this results not were in opposite with the model.

Although the focus in exposition and exploration of profile and return of human capital, this paper not deep in possible rations of dispersion inter-sectors associated with quantiles in the bottom of earnings distribution. However, how previous argument, in part, these differences can be associates with the relative shortage of qualified workforce in agriculture sector when compared to other sectors.

In respect in disparities regional of wage the results are similar to results of Silveira Neto and Campelo (2003) and Justo (2006). The northeast region present a big wage gap relative the southeast region, but these differences fall in period 2003-2013. However, there is smaller difference between the northeast's people more rich relative to more rich in southeast. In 2003 the northeast's workers in (0.1) quantile received (-36.02%) while the workers in (0.9) quantile (-17.34%). The differences fall in 1995 and in 2013 the respective values are (-28.21%) and (-10.55%).

The Central West region, which is the largest producer and exporter of grains and beef in Brazil, presents wage gains compared to the Southeast region in 2013 in all conditional distribution. This result may be due to the rapid expansion of production and productivity as well as to the increase in the prices of these products in the international market.

There are too a premium to migrate relative a native workers. If the worker is migrant rise the wage at all point of earning distribution and all analyzed years. The premium is higher in the top than at bottom of distribution. In 2003 at (0.9) quantile the premium were about (11.76%) and in 2013 (21.37%). This result suggests a selectivity of migrant<sup>6</sup>.

In table 5 I report the different quantiles of the earnings

distribution for each year, along with various inter-quantile differences. Actual values from each empirical distribution are reported in columns (1), (3) and (6). Between 2003 and 2011 the distribution shifts leftwards – at all reported in the distribution. This indicates real wage growth over time. Columns (2), (4) and (7) report conditional quantiles computed from the regression model estimates, setting years of schooling, experience and the other controls to their average values.

In effect these columns show a hypothetical earnings distribution under conditions in which all individuals capital human variables and others characteristics have identical human capital and other characteristics. The difference between the actual and corresponding conditional distribution shows the inequality arises due to differences in endowed. A comparison of the 90-50 gaps with the 50-10 gaps shows that differences in endowed characteristics are much more important in the top half of the earnings distribution.

Columns (5), (8) and (9) report points on counterfactual distribution that show how earnings would have looked in 2011 and 2013 if average levels of human capital and other characteristics had remained unchanged from the early years. The purpose of this decompose shifts in the predict distribution into a component in the rates of return to schooling, experience and the other characteristics. If all workers had in 2011 had endowed characteristics in 2003 the 90-10 gap would have been (1.8049) rather than (1.6482). If the workers had in 2013 average endowed characteristics in 2003, than the 90-10 gap would have been (1.7466) rather than (1.5835) with the more pronounced differences in 75-25 gap, too. Consequently is possible to see that improved human capital has contributed to widening in earnings over the ten-year period. In the opposite direction results were meted by Arabsheibani, Carneiro e Henley (2003) to period 1988-1998.

Table 6 illustrates earnings growth across the distribution exercise further by showing the changes in the actual distribution and in the conditional distributions between 2003 and 2011, 2011 and 2013 and 2003 and 2013. Between 2002 and 2011 the real positive growth in earnings is lowest at the top of the distribution (column 1), and this is what reduces inequality between these years. Column (2) shows that the same is true in the movement in the conditional distribution. The changes in average levels of endowed characteristics affect more strongly those at the bottom of the distribution. It is observed that wage growth over the course of distribution and over time is partly explained by the improvement in individuals' endowments. When the counterfactual exercise of holding appropriations is made, wage growth is lower, especially for those at the top of the distribution, which has contributed to the reduction of inequalities.

6 To more details about this, see Santos Júnior (2002) and Justo and Silveira Neto (2006, 2008).

**Table 5.** Actual and Conditional Log Hourly Earnings Distributions

	2003		2011			2013			
	(1) Real.	(2) Cond.	(3) Real.	(4) Cond.	(5) Cond. at 2003 means	(6) Real.	(7) Cond.	(8) Cond. at 2003 means	(9) Cond. at 2011 means
Q10	0.4424	1.5243	1.0960	2.0599	1.7171	1.2144	2.2079	1.8419	2.1755
Q25	0.9349	1.9481	1.4053	2.4347	2.1198	1.5123	2.5675	2.2378	2.5431
Q50	1.4519	2.4292	1.8115	2.8380	2.5761	1.9401	2.9638	2.6862	2.9344
Q75	2.1081	2.9240	2.4177	3.2882	3.0450	2.5475	3.3970	3.1347	3.3620
Q90	2.8965	3.4278	3.1697	3.7081	3.5220	3.2872	3.7914	3.5885	3.7627
Q90-Q10	2.4541	1.9035	2.0737	1.6482	1.8049	2.0728	1.5835	1.7466	1.5872
Q75-Q25	1.1732	0.9759	1.0124	0.8535	0.9252	1.0352	0.8295	0.8969	0.8189
Q90-Q50	1.4446	0.9986	1.3582	0.8701	0.9459	1.3471	0.8276	0.9023	0.8283
Q50-Q10	1.0095	0.9049	0.7155	0.7781	0.8590	0.7257	0.7559	0.8443	0.7589

Source: PNAD's (2003, 2011 e 2013).

**Table 6.** Earnings Growth Across the Distribution

	2011-2003			2013-2011			2013-2003		
	(1) Real	(2) (Cond)	(3) Cond. at 2003 means	(4) Real	(5) Cond	(6) Cond. at 2011 means	(7) Real	(8) Cond	(9) Cond. at 2003 means
Q10	0.6536	0.5356	0.3428	0.1184	0.1480	0.0324	0.7720	0.6836	0.3660
Q25	0.4704	0.4866	0.3149	0.1070	0.1328	0.0244	0.5774	0.6194	0.3297
Q50	0.3596	0.4088	0.2619	0.1286	0.1258	0.0294	0.4882	0.5346	0.2776
Q75	0.3096	0.3642	0.2432	0.1298	0.1088	0.0350	0.4394	0.4730	0.2623
Q90	0.2732	0.2803	0.1861	0.1175	0.0833	0.0287	0.3907	0.3636	0.2029

Source: PNAD's (2003, 2011 e 2013).

## 5. Conclusions

This paper, has conducted an empirical investigation of the impact of schooling and experience across the earnings distribution for Brazilian workers over the period of the two governments of Luis Inacio Lula da Silva and part of President Dilma Rousseff's mandates before the crisis provoked by the economic policy that strongly affected the labor market and culminated in the impeachment process, through of quantile regression estimates of human capital. Overall results point to improved forces of competition in the labor market particular. This is particularly so because there appears to have been a shift in the role of educational qualifications from rationing or screening workers into better paid jobs towards education being rewarded because of their inherent association with higher productivity. This appears to be particularly the case in the top and bottom of the distribution and in all years.

With this results then would expect to find string evidence for decrease earnings inequality. This has been a consequence of macroeconomic politic in Brazil. A possible explication is that the absence of improvements in levels of human capital has been occurred and has been contributed for narrowing the wage inequality. Between 2003 and 2013,

period of growth public spending on social policies, there are improvements in the wage but the increasing is higher to workers at the bottom than to top of distribution earnings. Improvements in levels of endowed characteristics and human capital characteristics occurred but were of most benefit to the less well paid. This period appears to have stimulated the acquisition of human capital for the less well paid. Higher rates of return, combined with an increased recognition that educational qualifications are of inherent value rather than of use purely as a signaling device, may well have stimulated increased human capital investment, alongside government and private willingness to pay.

There are indication too point to relative more importance of participation in agriculture sector in the relative unfavorable wage comparative to other economic sectors. This is, to individuals in the top of earnings distribution is less important belong or not in agriculture sector. The wage gap between the workers, in agriculture sector and other sectors, at the higher quantiles narrowing across the ten years analyzed indicating possibilities of technologies changes in this sector after the reforms.

A possible extension this paper would put more controls variable allowing deep the investigation of dispersion of inter-sectors wage, gender and migrate.

## REFERENCES

- [1] ARABSHEIBANI, G. Reza and REES, Hedley. (1998), "On the weak vs version of the screening hypothesis: a re-examination of the P-test for the U.K". *Economics of Education Review*, vol.17.n.2. pp.189-192.
- [2] ARABSHEIBANI, G. Reza; CARNEIRO, G. F.; HENLEY, A. (2003), "Human capital and earnings inequality in Brazil 1988-1998: quantile regression evidence". *World Bank Research Working Paper*, n. 3147, pp.1-20.
- [3] ARABSHEIBANI, G. Reza; CARNEIRO, G. F. and HENLEY. (2003a), "Gender wage differentials in Brazil: trends over a turbulent era". *World Bank Research Working Paper* 3148, pp.1-25.
- [4] ARBACHE, J.S. (1998), "How do economic reforms affect the structure of wages? The case of Brazilian manufacturing: 1984-1986". *Kent Working Paper*, pp.1-37.
- [5] ARBACHE, J.S. (1999), "How do economic reforms affect the dispersion and structure of wages: the case of an industrializing country labor market". *Twelfth World Congress of the International Economic Association*, Buenos Aires.
- [6] ARBACHE, J. Saba. (2000), "Os efeitos da globalização nos salários e o caso do Brasil". *Economia*, v.1, n.1, pp. 59-92.
- [7] ARROW, K. (1973), "Higher education as a filter". *Journal of Public Economics*, n. 2, pp.193-216.
- [8] BUCHINSKY, M. (1994), "Changes I the U.S. wage structure 1963-1987: application of quantile regression". *Econometrica*, v.62, n.2, pp. 405-458.
- [9] BUCHINSKY, M. (1998), "Recent advances in quantile regression models - A practical guideline for empirical research". *Journal of Human Resources*, n.33, p.88-126.
- [10] JUHN, C. (1999), "Wage inequality and demand for skill: evidence from five decades". *Industrial and Labor Relations Review*, 52, pp. 424-443.
- [11] JUSTO, W. R., SILVEIRA NETO, R. da M. (2008) "O que determina a Migração Interestadual no Brasil?: Um Modelo Espacial para o Período 1980-2000. *Revista Econômica do Nordeste*, Fortaleza, v. 39, nº 4, out-dez.
- [12] JUSTO, W. R. (2006), "Capital humano diminui desigualdade? evidências para o Brasil a partir de regressões quantílicas. *Economia e Desenvolvimento*, Recife (PE), v. 5, n. 2, p. 189-220.
- [13] JUSTO, W, R, Políticas sociais e o papel nas disparidades regionais de renda no Brasil: Evidências a partir de regressões quantílicas; (2012) In: *Economia Regional*, Org por SOUZA, E. P.; MARTINS, F. L.; JUSTO, W. R. Fortaleza: Premium.
- [14] JUSTO, W. R.; SILVEIRA NETO, R. M. (2006), "Migração inter-regional no Brasil: evidências a partir de um modelo espacial". *Economia*, v. 7, n. 1, p. 167-183.
- [15] JUSTO, W.R.; ALENCAR, M. O de; ALENCAR, N. dos S. "Retorno à educação no Brasil com uso de regressão quantílica: 2003-2014". (2017). *IGepec*, Toledo, v. 21, n.2, p. 09-23, jul./dez. 2017.
- [16] KATZ, L. and MURPHY, K. M. (1992), "Changes in relative wages, 1963-1987: supply and demand factors". *Quarterly Journal of Economics*, 107, pp. 35-78.
- [17] KOENKER, R. and BASSETT, G. (1978), "Regression quantiles". *Econometrica*, n. 50, pp.43-61.
- [18] KRUEGER, A.B., and SUMMERS, L.H. (1988), 'Efficiency wages and the inter-industry wage structure', *Econometrica*, 56, pp. 259-193.
- [19] LEE, K. H. (1980), "Screening and productivity of education in Malaysia". *Economics Letters*, n.5, pp.189-193.
- [20] MACHADO, J. A.F. and MATA, J. (2001), "Earnings functions in Portugal 1982-1994: evidence from quantile regressions". *Empirical Economics*, v26, n.1, pp. 115-134.
- [21] MACIEL, Vladimir F. (2003), "Abertura Comercial e desconcentração das metrópoles e capitais brasileiras". *Revista de Economia Mackenzie*, Ano 1, n.1, pp. 37-64.
- [22] MURPHY, K. M., WELCHE, F. (1992), "The structure of wages". *Quarterly Journal of Economics*, n.107, pp. 285-326.
- [23] MARTINS, P. S. and PEREIRA, P.T. (2004), "Does education reduce wage inequality? Quantile regression evidences from 16 countries". *Labor Economics* 11, pp. 355-371.
- [24] PSACHAROPOULOS, G. (1979), "On the weak versus strong version of the screening hypothesis". *Economics Letters*, n.4, pp.181-185.
- [25] ROBBINS, D. J., GLIDLING, T. H. (1999), "Trade liberalization and the relative wages for more-skilled workers in Costa Rica". *Review of Development Economics*, 3, pp. 140-154.
- [26] SANTOS JÚNIOR, E. da Rosa. (2002), "Migração e seleção: o caso do Brasil". Dissertação (Mestrado)- Escola de Pós Graduação em Economia – EPGE, Fundação Getúlio Vargas, Rio de Janeiro.
- [27] SILVEIRA NETO, R. da M. e CAMPELO, A. K. (2003), "O Perfil das Disparidades Regionais de Renda no Brasil: Evidências a Partir de Regressões Quantílicas para os anos de 1992 e 2001", *Anais do XXXI Encontro Nacional de Economia*, Porto Seguro.