Further Evidence on Wage and Productivity Differentials in Brazil

Abstract

This paper discusses the relationship between the elasticities of wages and productivity with respect to human capital. The goal is to search if there is a distortion on the expected relationship between these two variables, given market forces and a selfish behavior by agents, as it is found in some Europeans countries. A general equilibrium, overlapping generation model that can capture the relationship between these two elasticities is presented. Two equations that emerge from this model are estimated, using data from RAIS and IBGE Pesquisa Industrial Annual for 2000. The results indicate that local labor market attenuates income inequality, transferring income from more qualified to less qualified workers, similarly to what happens in European labor markets.

Resumo

Esse trabalho discute a relação entre as elasticidades dos salários e da produtividade com respeito ao capital humano dos indivíduos. O seu objetivo é investigar se no Brasil, assim como tem sido apontado em alguns países europeus, há distorções a partir de valores sociais que mudam a relação que essas duas elasticidades deveriam ter, se determinadas apenas a partir da racionalidade egoísta dos agentes e as forças de mercado. Um modelo de equilíbrio geral com gerações justapostas é desenvolvido para explicar a relação entre essas duas elasticidades. Dados da RAIS e da Pesquisa Industrial Anual do IBGE são utilizados para estimar duas equações desse modelo. Os resultados indicam que há transferência de renda dos indivíduos mais qualificados para os menos qualificados, semelhante a que ocorre nos países europeus. Ou seja, apesar do Brasil ter uma alta concentração de renda, o mercado de trabalho contribui para atenuá-la através de valores que afetam a distribuição de ganhos entre os trabalhadores.

JEL: J24; J31

Key words: Productivity; wages; general equilibrium
Palavras chaves: Produtividade; salários; equilíbrio geral

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1. Introduction

Brazil is a country with high personal income inequality. Its Gini Coefficient is one of the highest in the world, according to World Bank and United Nations Development Program (UNDP) statistics, which are regularly published in their yearly publications.[1] This coefficient in Brazil varies for different years and methods of calculation, but it is normally over 0.60, which is considered high for world standards.

There are many causes for this income inequality pointed in the literature. They vary from simple arguments, such as racial attributes and regional inequalities to the most commonly pointed problems, which are the disparities in educational attainment. There is this general idea that education is a major determinant of income inequality in Brazil. Obviously, some studies search for causes of educational inequality relying on other social factors, such as a class replication institutional framework on educational system.[2]

Others point to the high return the local labour market pays to education, as a mechanism to generate the existing high inequality.[3] A study by Psacharopoulos (1994) indicates that the return to education in Brazil is one of the highest in the world. More recent studies on Brazilian labour market have confirmed that such returns are still high.[4] This problem becomes particularly relevant because Barros and Mendonça (1996) have pointed that educational attainment is by far the most important factor determining income inequality, when a decomposition of its variance is made.

Its has been argued in the literature that sometimes the labour market can distort productivity differences generated by differences on educational attainment.[5] Under such argument, it is possible an extra year of education on average increases a worker's productivity by x%, while his wage increases by (x+y)%, where $y \neq 0$. If $y>0$, this labour market transfer income from poorer workers to richer workers. On the other way around, if $y<0$ this labour market transfer income from richer workers to the poorer ones.

Most of the arguments justifying such distortions generated by labour markets rely on social values to justify them. A society may have social values in favour of equality, which justify transference from rich workers to poorer ones. In the same way, the social values may promote income inequality through transferences from poorer workers to rich ones.

Despite the frequent blame of high returns to education as a major source of income inequality in Brazil, the possibility of existing distortion of such returns by social values were never verified. All studies that emphasize this problem always take for granted that markets pay relative wages that reflect productivity differentials, although the possibility of distortions are mentioned in the world literature.[6]

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[1] In World Bank (2002) and UNDP (2002), Brazil states the fourth highest Gini.
[2] See for example Ferreira (2000) for this approach.
[3] See Barros, Henriques and Mendonça (2000).
[4] See for example Barros (2001) and Ueda and Hoffmann (2002).
[5] See for example Katz and Autor (1999).
[6] See for example Krueger and Lindahal (1999) for such hypothesis on the Swedish labour market.

Trying to contribute to fill up a lack in the literature on Brazilian labour market, this paper focus on this possibility of distortions of productivity differentials on wages inequalities. The paper is organized as follows. Next section analyze some world data to support the hypothesis that return to education is a relevant variable determining income concentration. Section 3 introduces a simple general equilibrium model that can capture the two alternative hypotheses that are object of test and gives a formal support for most of the hypotheses raised to justify differences in return to education found in the literature. Section 4 discusses the method to test the two alternative hypotheses and brings the results of the empirical tests. Section 5 analyzes the potential distortion on the results that may arise from limitations on the dataset used on estimations and section 6 summarizes the major conclusions reached throughout the paper.

2. Inequality and return to education

The relationship between income inequality and the return to education is quite obvious. As long as a non-null share of income of most individuals accrues to them as a consequence of their working activities, the higher this return to education, the higher will be income inequality among these individuals, as the inequality on this particular share of income will increase.

Of course this relationship may be theoretically reversed if there is a negative correlation between other incomes and educational attainments. If individuals with low education tend to have a relatively higher income that do not accrues to him/her from work, higher returns to education could actually be distributive, if the share of income accruing from work is relatively lower. Nevertheless, this does not seem to be the case in most countries, although some rational support to that could be found under some circumstances.

As the direct relationship between income inequality and return to education is not necessarily true, although most researchers assume it exists, this section provide a simple test of this hypotheses, relying on a cross section dataset of countries. More precisely, the Gini coefficient was regressed against the return to education and a constant. Data for Gini coefficient came from World Development Report (2000) and data for Returns of Education from Pscharopoulos (1994). Both sources of data present statistics that are not for the same year for all countries and some of them are for early years in the eighties. Nevertheless, previous studies on these two indexes show that they are quite sluggish on their time evolution. Therefore, previous returns to education consist in a good instrument to more recent returns. Estimations were made by Ordinary Least Squares with correction for heteroskedasticity by the method of White (1980). Table 1 brings the results of this estimation. A more reasonable fit was obtained with a squared function, so that return appears also squared in this table. For the interval of returns to education found in the dataset, an increase in this return also increases the Gini index. Nevertheless, the empirically found relationship is not so strong, as the squared coefficient of determination (R^2) is quite small. In spite of this low R^2, these results support the idea that return to education is a relevant determinant of income distribution and this relationship that underline some of the conclusions of this paper have empirical support.

Table 1
Results of Regression for Gini Index

Variable	Coefficient	Stand Error	T-Statistics	Significance
Constant	28.2661	6.4530	4.3803	0.0000
Return of Education	1.8777	1.0003	1.8772	0.0605
Return of Education Squared	-0.0527	0.0309	-1.7070	0.0878
R^2	0.1387	-	-	-

Note: 52 countries were included in this regression.

3. Relative productivity and return to education

As said before, an important step in understanding Brazilian income inequality is to explain its high rate of return to education. This step demands knowing what determines the rate of return to education. A simple overlapping generation model may unveil the major determinants of such variable. This model is the subject of this section.

3.1. Families

Suppose there are two types of families. Both are composed by two individuals, an adult and a child. Each person in both types of families lives two periods and is one child and one adult. As a consequence, there is no population growth. The parent is responsible for decisions of the family and he/she is the only one working. Therefore, if there are L_u and L_s families in each of these groups and each family supply one unit of labour, the maximum supply of labour in each of these groups will be L_u and L_s, respectively.

Adults of families of type s face a Cobb-Douglas type utility function such as:

$$\ln U_t = \ln v + \alpha \ln C_t + \beta \ln \ell_t + (1-\alpha-\beta)\ln U_{t+1} \quad (1)$$

Where U_{t+i} is the utility function at time (t+i) for i=0 or i=1, C_t is the consumption of the only good produced in the economy, ℓ_t is leisure at time t and v is a constant, which is fixed, at least on the eyes of the utility maximizers. As already said, only the parent works and he/she does not get any utility in his/her own leisure, so that the leisure appearing in the utility function is the one of the child. By normalization, the working time of the parent L_t is set equal to one. The child spends his/her time either accumulating human capital or on leisure. His/her total time is also equal to one and the time accumulating human capital is $(1-\ell_t)$. In equation (1), α and β are parameters, such that $0<\alpha<1$, $0<\beta<1$ and $0<(1-\alpha-\beta)<1$. Families attributing more value to leisure will have higher β.

Equation (1) may be solved recursively forward, yielding:

$$\ln U_t = \frac{1}{\alpha+\beta}\ln v + \alpha\sum_{i=0}^{n}(1-\alpha-\beta)^i \ln C_{t+i} + \\ + \beta\sum_{i=0}^{n}(1-\alpha-\beta)^i \ln \ell_{t+i} + (1-\alpha-\beta)^{n+1}\ln U_{t+n+1} \quad (1')$$

This family type s faces the following budget constraint:

$$C_{t+i} = W_{t+i} \quad (2)$$

Where W_{t+i} is the wage rate at time t+i. Differently from other overlapping generation models, such as the one presented by Galor and Zeira (1993), families do not save and they cannot borrow on the capital markets. If the arbitrage hypothesis embedded in Mincerian Equation is used, it is possible to define:[7]

$$W_{t+i} = W_0 e^{R(1-\ell_{t+i})} \quad (3)$$

Where W_0 is wage for fully unskilled labour and R is the rate of return to education. Substitution of equation (3) in equation (2) yields:

$$C_{t+i} = W_0 e^{R(1-\ell_{t+i})} \quad (2')$$

If one takes natural logarithm of (2′) and substitutes it in equation (1′), a sufficiently large n may yield the following result:

$$\ln U_t = \frac{1}{\alpha+\beta}\ln v + \alpha\sum_{i=0}^{n}(1-\alpha-\beta)^i \ln W_0 + \\ + \beta\sum_{i=0}^{n}(1-\alpha-\beta)^i \ln \ell_{t+i} + \alpha R\sum_{i=0}^{n}(1-\alpha-\beta)^i(1-\ell_{t+i}) \quad (1'')$$

The adult in this type of family maximizes this utility function. First order condition for this problem yields:

$$(1-\ell_{t+i}) = \frac{\alpha R-\beta}{\alpha R} \quad (4)$$

For a given R, a family tends to set the same amount of time to human capital accumulation, so that an economy with many families of type s facing the same problem as this one will have a level of human capital constant over time. The higher is β, the more this type of family values leisure and the lower will be its human capital. In the same way, the more this family values consumption at the expense of leisure, the higher will be its human capital. Obviously, the higher is the rate of return to human capital, the higher will be the human capital of the family.

[7] For a derivation of this arbitrage equilibrium, see Barros (2001).

In this economy, there are L_s families working according to this optimal behaviour. In addition to them, there are L_u families with no access to schooling. In fact it is known that this is not the case in Brazil or in most modern economies. Nevertheless, Brazilian population has access to different quality of schools, which determines different rates of human capital accumulation. Public schools, the ones accessible to most of the population, have very bad quality education, while private and expensive schools offer good quality education. Only the former are available to most of the population, mainly as consequence of the existence of credit constraints to finance the most expensive education.[8] This quality difference in schools is an instrument for one social class to keep social power and relative status, as argued by Ferreira (2000) and as such has a plausible logic to exist. For simplicity, in this model, it will be assumed that there are two social classes, one that have access to education and the other one with no access to any kind of education. It means that individuals in the poorer class use all their time as a child to leisure and all their grown up time to work in the second period of their life. Therefore, their supply of unskilled labour at each period is L_u.

3.2. Firms

There is no capital in this economy and there are two types of firms, one using only unskilled labour and the other one employing only skilled labour. As there is only one good in this economy, both firms produce the same type of good. Therefore, a representative firms would have the two lines of production and would face the following production function:

$$Y_t = A_0 L_{0t}^{\phi} + A_1 \left(HL_{1t}\right)^{\rho} \tag{5}$$

Where Y_t is the output of the only good produced, measured in units of this good, L_{0t} is the unskilled labour employed and L_{1t} is the amount of skilled labour employed. A_0 and A_1 are productivity indexes for plants employing unskilled and skilled labour, respectively. H is the level of skills per capita of the skilled labour, which is a function of the time spent on human capital accumulation. ϕ and ρ are fixed parameters, $0<\phi<1$ and $0<\rho<1$. The proportion of firms in each of these groups was assumed to be one to one. For each firm employing unskilled labour, there is another one employing only skilled labour. This is only a simplifying assumption, which does not affect the results.

The productivity coefficient A_1 is not fixed, but actually is a function of the return to human capital. This function may be defined as:

$$A_1 = A_2 e^{-\delta \frac{\left(R - R^*\right)}{R^*}} \tag{6}$$

Where R^* is the ideologically expected return to human capital. Productivity deviates from a fixed parameter A_2 as a consequence of differences between R from R^*. Effort of workers, such as well analyzed by Akerlof and Yellen (1990), justifies such changes in productivity. Nevertheless, δ may be positive or negative in this model. If

[8] Galor and Zeira (1993) forward a model in which credit constraint justifies differences in human capital accumulation, as the idea forwarded here.

$\delta>0$, social ideology penalizes firms for excessive income wage disparities. Contrary, if $\delta<0$, social ideology penalizes firms for excessive wage equality. If $\delta=0$ productivity of firms are not affected by deviations of wages from the socially optimum. Therefore, this approach changes slightly the one proposed by Akerlof and Yellen (1990) as it moves focus to relative wages and considers productivity as a function of social evaluation of wage dispersion in the firm, instead of a personal evaluation of ones own wage.

As firms take A_1 as fixed, and are able to set L_{0t} and L_{1t} to maximize profits, first order condition for this problem yields:

$$W_{t+i} = \rho A_2 e^{-\delta\frac{(R-R^*)}{R^*}} H^{\rho} L_{1t+i}^{\rho-1} \tag{7}$$

This is the demand of the representative firm for skilled labour. In the same way, the demand for unskilled labour may be defined as:

$$W_{0t+i} = \phi A_0 L_{0t+i}^{\phi-1} \tag{8}$$

From this equation, it may be seen that the higher the amount of L_{0t+i}, the lower will necessarily be the equilibrium wage for unskilled labour. In the same way, the higher is the productivity of this kind of labour A_0, the higher will be the wage of unskilled labour.

3.3. Equilibrium

Equilibrium in the market for unskilled labour is quite simple. It demands only that demand and supply for unskilled labour are equal. This implies that $L_{0t+i}=L_u'$, where $L_u' = (L_u/m_1)$ and m_1 is the number of firms employing unskilled labour. Under such conditions, equation (8) may be rewritten as:

$$W_{0t+i} = \phi A_0 L'^{\phi-1}_u \tag{8'}$$

The market for skilled labour is slightly more complicated. Nevertheless, equilibrium in this market also exist when $L_{1t+i}=L_s'$, $L_s'=(L_s/m_2)$ and m_2 is the number of firms employing skilled labour. Therefore, equation (7) may be rewritten as:

$$W_{t+i} = \rho A_2 e^{-\delta\frac{(R-R^*)}{R^*}} H^{\rho} L'^{\rho-1}_s \tag{7'}$$

This result leaves H and R still undetermined in this market. Although there is not a clear functional relationship between H and $(1-\ell_{t+i})$, it is reasonable to assume that:

$$H = f(1-\ell_{t+i}) = f\left(1-\frac{\beta}{\alpha R}\right) \tag{9}$$

Where $f'>0$ and $f(0)=0$. Substituting this equation on equation (7′) gives a relationship between W_{t+i} and R arising from the demand for skilled labour. This equation may be written as:

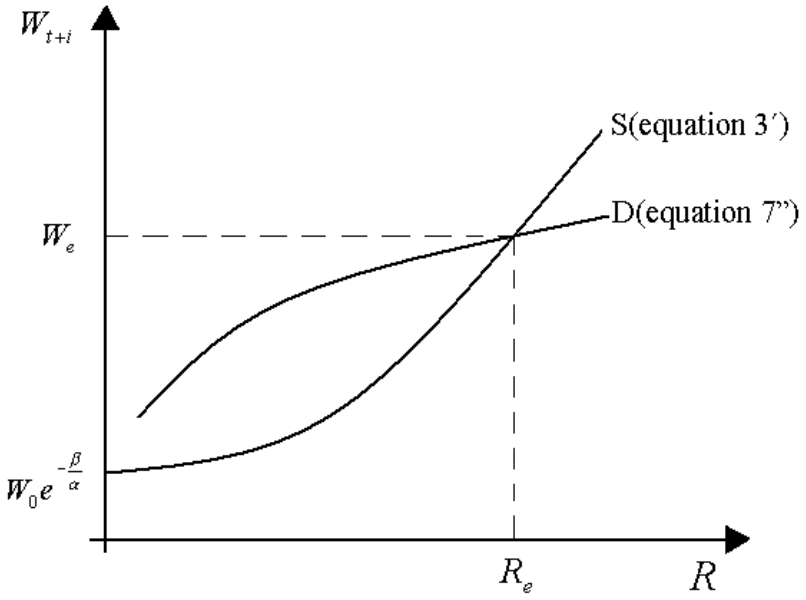
$$W_{t+i} = \rho A_2 e^{-\delta\frac{(R-R^*)}{R^*}}\left[f\left(1-\frac{\beta}{\alpha R}\right)\right]^{\rho} L'^{\rho-1}_{s} \qquad (7'')$$

Substitution of equation (4) in equation (3) yields another relationship between these two variables, but emerging from the supply of labour in this case. This relationship may be written as:

$$W_{t+i} = W_0 e^{R-\frac{\beta}{\alpha}} \qquad (3')$$

An equilibrium market solution for R and W_{t+i} will emerge from this equation and equation (7") together and the fixed value for L_s. Figure 1 draws these two equations in the (R,W_{t+i}) plan.

Figure 1



To simplify, it was assumed that the second derivative of equation (7") is negative, although this is not necessarily true, from the assumptions introduced hitherto. Moving the lines for each of these functions in figure 1 according to the impact of some selected variables and coefficients on the relationships drawn, it is possible to obtain:

$$\frac{\partial R}{\partial \beta} > 0 \qquad \frac{\partial R}{\partial \alpha} < 0 \qquad \frac{\partial R}{\partial L_s} < 0 \qquad \frac{\partial R}{\partial R^*} < 0 \qquad \frac{\partial R}{\partial L_u} > 0$$

These results confirm through a formal model some well-settled conceptions on the determination of the return to education. They are:

i. The higher the value on total utility given to leisure by educated families, the higher will be the return to education.
ii. The higher the value on total utility given to consumption by educated families, the lower will be the return to education, as agents will be more willing to work and make the effort to accumulate human capital.
iii. The higher the share of population with access to education, the lower will be the return to education.
iv. In the same way, the higher the share of population with no access to education, the higher will be the return to education. This certainly is an important source to explain the high rate of return to education in Brazil.
v. The high the value of education on social ideology, the higher will be the equilibrium rate of return to education.

As the model advanced above does not include capital as a factor of production, any explanation for high rate of return to education emerging from capital market was ruled out from its conclusions. Nevertheless, as shown by Galor and Zeira (1993), using an overlapping generation model, the existence of credit constraints may also justify inequality and as a consequence it also determines the rate of return to education. Therefore, although this determinant was ruled out of the model by its simplifying assumptions, it does not mean that this factor should not be taken into account. It absence of the model is justified because it is not relevant for next steps of this paper.

3.4. Productivity and wages

Suppose there is a non-representative firm whose production function may be defined as:

$$y_{nt} = A_2 H_{it}^{\rho} L_{it}^{\rho} \tag{10}$$

Where y_{nt} is its output and the other variables and coefficients are determined as before. The number of workers employed in this firm is m and each one supplies one unit of labour. This firm differs from the representative ones because it does not employ unskilled labour and its productivity does not depend on social values. Average productivity of a particular worker in this firm is:

$$\pi_{mt} = A_2 H_{it}^{\rho} L_{it}^{\rho-1} \tag{11}$$

From this equation it is possible to obtain:

$$\frac{H}{\pi_{mt}} \frac{\Delta \pi_{mt}}{\Delta H_{it}} = \rho \tag{12}$$

Combination of equations (7") and (3´), which generates equilibrium between supply and demand for educated labour, may yield:

$$\frac{H}{W_t} \frac{\Delta W_t}{\Delta H_t} = \frac{R^* \rho}{\delta + R^*} \tag{13}$$

Only if δ=0, the elasticity of wages with respect to human capital is ρ, the same elasticity found in the non-representative firm. Nevertheless, if δ>0,

$$\frac{H}{W_t}\frac{\Delta W_t}{\Delta H_t} = \frac{R^*\rho}{\delta + R^*} < \frac{H}{\pi_{mt}}\frac{\Delta \pi_{mt}}{\Delta H_{it}} \tag{14}$$

and wages in labour market dump productivity differences of such non-representative firm. It means that there is transference of potential income from more qualified workers to less qualified workers. Furthermore, the higher is the moral propensity to equality (the lower is R^*) the higher is this transference from workers with higher labour income to workers with lower labour income.

In the other way around, if society is positive on paying a premium on education (δ<0), the inequality in equation (14) is reverted and the labour market transfers income from less qualified workers to more qualified workers. In this case the elasticity of productivity is higher than the one of wages, both with respect to human capital. Wages increase proportionally more when human capital increases than productivity does. This is the meaning of a labour market amplifying the role differences on education have on wages.

All this developments indicates that the hypothesis that this paper aims to test is the sign of δ. If δ is positive, the amplifying hypothesis is confirmed; otherwise, it is rejected. Next section tests these hypotheses using data from a non-representative firm.

4. Empirical test

The empirical method to test hypotheses on the sign of δ is quite simple. The two equations that determine the market equilibrium, (7′) and (3′) were combined to yield:

$$\ln W_t = B + \frac{\rho R^*}{R^* + \delta}\ln H \tag{15}$$

Where B is a constant, which is a function of R^*, ρ, α, β, A_2 and W_u. In the same way, equation (11), with L_{it}=1, was used to obtain:

$$\ln \pi_{mt} = \ln A_2 + \rho \ln H \tag{16}$$

Both equations were estimated using cross sectional data for economic sectors in the Brazilian economy in the year 2000. Data for sectorial wages were obtained from RAIS (Relação Anual das Informações Sociais), a survey on labour conducted annually by the Brazilian Labour Ministry. This survey presents data for monthly average wages by sector, according to classification of IBGE, Brazilian National Statistics Institute. Data for average schooling for each sector are also provided by RAIS and were used as the measure of human capital. Data for productivity were calculated as output per hours worked in that sector. Output was measured in monetary units, as each sector includes several products. Both output and hours worked come from *Pesquisa Industrial Annual*

(PIA), the Brazilian annual survey of industry conducted by IBGE. All the data refers to the year 2000.

Some sectorial dummies were introduced because either their average wages or productivities were excessively high. Normally this is associated to monopoly powers or abnormal union strength. The sectors in which these happened appear on tables 2 and 3, together with the results of estimations. All estimations were made by ordinary least square with correction for heteroskedasticity by the method of White (1980).

Table 2
Estimation Results for Wages Equation

Variable	Coefficient	Stand Error	T-Statistics	Significance
Constant	8.4321	0.3694	22.8295	0.0000
Natural logarithm of Schooling	0.4392	0.1792	24.5058	0.0143
Dummy for oil and gas Extraction	1.8638	0.0958	19.4619	0.0000
Dummy for oil refining	1.3368	0.0514	26.0156	0.0000
Dummy for paper industry	0.8440	0.0470	17.9544	0.0000
Dummy for iron extraction	1.0468	0.1010	10.3658	0.0000
Dummy for army equipments and ammunitions.	1.1920	0.0544	21.9288	0.0000
R^2	0.2756	-	-	-

Note: 105 sectors were used in this estimation.

Table 3
Estimation Results for Productivity Equation

Variable	Coefficient	Stand Error	T-Statistics	Significance
Constant	9.5929	0.5233	18.3324	0.0000
Natural logarithm of Schooling	0.5231	0.2563	2.0408	0.0413
Dummy for oil and gas Extraction	2.7273	0.1332	20.4693	0.0000
Dummy for oil refining	3.2649	0.0773	42.2622	0.0000
Dummy for paper industry	2.1252	0.0688	30.8777	0.0000
Dummy for iron extraction	2.1683	0.1406	15.4235	0.0000
Dummy for army equipments and ammunitions.	1.9069	0.0819	23.2807	0.0000
R^2	0.3781	-	-	-

A first glance to the results presented in tables 2 and 3 indicates that:

$$\frac{\rho R^*}{R^* + \delta} < \rho \tag{17}$$

This only can be true if $\delta>0$. Therefore, point estimations of these models indicate that the impact of human capital on productivity in Brazilian industry is higher than it is on wages in Brazil. This suggests that, despite the high return to education

found in Brazil, there is transference of income from more educated to less educated workers through labour market in this country.

The two coefficients compared in equation (17) have normal distributions with expected value equal to the estimated parameters and standard deviations that appear on tables 2 and 3. Therefore, the hypothesis that they are equal may be carried through a statistics for mean comparisons. Particularly, the difference of the two coefficients, when divided by a function of their estimated standard deviations, under the null hypothesis that this difference is null, has a t-student distribution. The estimated statistics for this function is t=180.19 and it is distributed as a t-student with more than 98 degrees of freedom.[9] A glance at the t-student distribution indicates that the null hypothesis that the two coefficients are equal is rejected at a p-value of 1%.

Therefore, at a standard p-value found on the literature, the hypotheses $\delta=0$, which is a consequence of the fact that the two coefficients are equal, is rejected. Results strongly support the idea that there is transference from more educated to less educated workers in the Brazilian labour market, similarly to what is suggested to European countries. This indicates that the high returns to education found in Brazilian labour market data is more a consequence of productivity differences than a consequence of concentrating transferences through labour market because of social values. Actually, social values work on the labour market to reduce productivity disparities, which are even wider than they appear on returns to education.

5. Limits of the dataset and comparisons with previous results

This research seeks to shed some light on a crucial concern on the Brazilian income distribution. It focuses on the possibility that Brazilian labour market generates some transference among individuals that may contribute to income concentration. The results obtained indicated that there are such transferences, but similar to what is found on European economies. More qualified workers transfer income to less qualified workers. In this sense, labour market attenuates income concentration.

This result is radically different from what is found by Barros and Silva (2002), using another dataset. This other paper used data from a particular company, for workers who perform the same function, but that could have different productivities and educational attainments. As their output was exactly the same, their productivity could be measured in physical units, not in monetary units, as it was done here. Incentives to have the highest possible productivity justify the potential rise of differences on productivity among workers in their used dataset. Nevertheless, the performance of same activities tend to reduce the potential dispersion of productivity in this case, contrary to what is found here.

[9] The estimated statistics t may be defined as:

$$T=\frac{(\hat{\beta}_1-\hat{\beta}_2)}{\sqrt{\frac{S_1^2}{n_1}+\frac{S_2^2}{n_2}}}=180.19$$

Where the betas with hat are the estimated coefficients and S_1 and S_2 their respective estimated standard deviations. n_1 and n_2 are the size of the two samples.

Different workers may have their output affected by two factors. Firstly, they can have distinct labour intensity. One worker may impinge a faster speed to his/her work, which can be a consequence of either, his/her higher discipline or higher organizational ability. Secondly, they can also diverge on complexity of tasks, as more qualified workers can perform tasks to which the less qualified one does not have the necessary skills. These sources of differences on productivity tend to be a determinant of labour allocation.

Given these potential sources of differences on productivity, it is possible to define labour productivity as a function of these three components, such as:

$$\pi = f(D, O, C) \tag{18}$$

Where π is labour productivity, D is a measure of discipline, O is a measure of organizational skills and C is a measure o complexity of tasks. All the three first derivatives of this function are positive. When two workers perform exactly the same tasks, as they do in the sample of Barros and Silva (2002), they only can diverge in D and O. They cannot diverge on C. Therefore the differences on productivity are restricted to some of its potential. This can explain their lower productivity than wage dispersion in the sample used. As the dataset used here allows for all the three differences, as tasks are different on each sector, differences on productivity were higher and actually overcome those on wages, implying that there are transference from more educated workers to less educated ones, as was seen in the previous sample.

6. Conclusions

This paper discussed the possibility that Brazilian labour market may either magnifies existing productivity differences on relative wages or it may damp such differences as a consequence of social values. The model presented in section 2 shows that both alternatives are real possibilities, given some very simple economic, social and psychological behaviour of individuals.[10] If the first hypothesis is true, this market is increasing income concentration in hands of wealthier people and if the second hypothesis is true this market is attenuating such differences. In a country in which there is almost a political consensus that urge for improvements in its income distribution, this question is crucial.

If labour market damps productivity differentials, the major policies to promote income distribution should focus mainly on improving the access to education for the whole population, specially the offspring of the poorer, as other studies show that someone who has lived in a poor household while young has higher probability to be poor too. More equality on educational access would be the path for better income distribution. Nevertheless, if transferences are in the other way around, policies to reduce such labour market bias could play a prominent role on distributive policies. Changes in ideologies should be the focus and policies such as minimum wages establishment could have a major role on improving income distribution.

[10] Akerlof and Yellen (1990) discusses psychological and social foundations for the relationship between distributive values and effort, which is the underlining hypothesis supporting the economic results found in section 2.

A simple general equilibrium, overlapping generation model was presented in this paper so that the many sources to explain the determination of return to education in a society could be clearly identified. This model incorporated the idea that social values may have a relevant impact on the equilibrium return to education. In addition, it generated two structural equations that could be used to estimate the sign of the ideological bias.

Results from estimation of a wage equation for Brazilian labour market using data from RAIS and a productivity equation also to Brazil, but using data from IBGE and RAIS indicate that labour market attenuates productivity differentials in Brazil, similarly to what is found for most European countries and contrary to what is suggested by some studies on the Brazilian labour market. Social values in Brazil are such that differences in productivity arising from differences in human capital are damped in relative wages.

These results implies that the so much suggested need for improving educational access for the poor as a strategy to reduce income inequality in Brazil is once more supported by detection that the local labour market already does at least part of its share on dampening inequality. A safer and probable more efficient way to promote equality is tackling its true cause, which is deeply related to disparities in educational attainment. Nevertheless, given the relative high return to education in Brazil, it does not mean that some more dampening in productivity differences are not possible.

The model developed in this paper emphasizes two important determinants of the relationship between the elasticities of productivity and wages with respect to education, which are not commonly pointed in the literature. If these two elasticities are defined as e_w and e_π, respectively, from equations (15) and (16), it is possible to obtain:

$$\frac{e_w}{e_\pi} = \frac{R^*}{R^* + \delta} \tag{19}$$

Therefore, this relationship, which has to be reduced in Brazil to diminish income disparities, depends only on R^* and δ, which are the socially fair return to education and the response of productivity to deviations of returns to education from this value, respectively.

As most of the socially determined variables, the socially fair return to education also might be a function of previous social experiences. Obviously, many cultural aspects, such as cultural and even ethnical relations are crucial to determine the value of R^*. Nevertheless, the recent experiences, which are condensed on the previously observed values of the return to education, are important to determine R^*, as social values are strongly subject to hysteresis. Therefore, the higher the observed returns were in the past, the higher tend to be the relationship on equation (19) nowadays.

The response of productivity to deviations of returns to education from the socially fair return, on its turn, also depends on social values. In this case, the relevant ones are those of solidarity among workers and social classes. The higher the solidarity among social classes and the many distinct intellectual social groups, the higher tends to be δ. When the relationship among social classes and groups is one of segregation, this

value is negative and this society tends to concentrate income. Estimations on this paper indicate that this is not the case in Brazil. In spite of having a very segregated society, Brazilian culture and ideology still are such that $\delta>0$.

Nevertheless, if the goal is to reduce income inequality, it is possible to try to reduce segregation and to further increase δ. An example of such policies could be to develop incentives to force poor and rich kids to go to the same schools. Such policies exist in some countries and normally are powerful to reduce income disparities. Brazil still faces tremendous class segregation in its educational system. This surely consists in a barrier to better income distribution, as δ is not as high as it could.

Changing ideology in a society is something very complicated. Sometimes it is necessary much effort to generate very small changes. Nevertheless, the struggle to improve income distribution in Brazil seems to require non-trivial ideological changes in social values. Re-structuring the educational system, not only improving the access it provides for all, but mainly improving the quality of public education, *vis-à-vis* private education, is a major step that can yield some of the necessary results. Studies on minimum wages, such as the one by Barros and Lemos (1997) and Camargo, Neri and Gonzaga (2001) indicate that a better management of the minimum wage policy also may yield some results. Nevertheless, further investigation on these subjects are necessary, including some sociological work, because when values are in question, sociologists have more to say than economists.

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