

Household Income Inequality and Economic Growth in Brazil

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Abstract

This paper investigates the relationship between household income inequality and economic growth in Brazil controlling for a large number explanatory variables, which were divided into three groups: individuals' inherent characteristics, individuals' acquired characteristics and a set of characteristics related to the economic environment of the country.

Using the household income concept to urban areas only, the methodological econometric framework was based upon simultaneous equation models applied in cross-sectional data for Brazilian states with some extensions to different income percentiles.

The results corroborate with some studies, but contradict several others, concerning labor market segmentation, discrimination and access to education and their impacts over inequality, but shows relevant effects about government intervention. It is also found that some of those particular variables affect in different ways the income inequality in each income percentile.

Key words: Household Income Inequality, Economic Growth, Brazil.

JEL: O15, I32, R2

1. Introduction

The relationship between growth and income inequality has been a topic quite discussed and controversial in the economic literature. During the last decades has been available, on one hand, a literature that aims to point the causes of individuals or households income inequality of a certain country, and on the other hand, a literature that deals with factors that explain the differences of income among countries or among regions of a same country. Though, it has arisen in the last recent years, in the extent of economic growth theory, a great development of models in search to explain the reciprocal influence of growth on income inequality. This is the core what will be done here.

Among the several explanatory factors to inequality, it has been evidenced in many empirical studies: the influence of the job market, through some of its characteristics as discrimination and segmentation; the influence of the foreign trade where, in general, act indirectly on the job market, specifically on the remuneration of the qualified labor force relative to the non-qualified labor force; the effect of education – with the adoption of different proxies, especially about the unequal distribution to different levels of income and regional distortions; due to the existence of imperfect competition in the input market, particularly the credit market (for capital financing), that brings in itself incentive problems and moral hazard.

On the other hand, when the characteristics of income inequality in Brazil are considered, to the traditional explanations must be added elements that try to bring about some specificities of inequality in the country. The empirical studies initiated in the sixties and seventies decades up to recently, where the theme of distribution of income and poverty has returned with a great deal of importance in the research agenda, the evidences point out that those explanations need to be

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taken into account in order to assess about the decisive causes of income inequality in Brazil and their relationships with economic growth/development.

The objective of this article is to verify how the relationship between inequality and growth and the explanatory factors are connected to each other, and how they can explain the income inequality in Brazil. Moreover, it is also proposed to investigate how some of the specific characteristics of the income distribution are related, starting from the concept of urban household income for the Brazilian states. A cross-section analysis is made through a simultaneous equations model, relating growth and inequality, with an extension to selected income percentiles. Besides this introduction, the article is divided in seven sections: The second section exposes the theoretical foundations of the relationship between inequality and growth; the third section approaches the characteristics of the Brazilian inequality and its fundamentals; section four states the hypotheses of the empirical model to be adopted; sections five and six present the econometric model and the results; the conclusions are synthesized in section seven.

2. Theoretical Foundations

Growth and inequality does not possess a one way relationship, but a simultaneous a relation of causality where the channels that perpetuate growth act in the sense of promoting the economic distribution of income and wealth. In this sense, in analytical terms, it could start from a given initial distribution of inequality measured in an instant in time and then verify how it develops within a sustained growth process. So, the starting point can be the effect of that initial distribution (inequality) it influenced the growth process, or it can be verified as the growth affects the distribution and, consequently, the inequality. At the current stage of development of any country there always exist a feedback effect between them and, therefore, both ways of causality.

The studies that search to verify that reciprocal effect as a single direction effect are just making an abstraction with respect to the empirical nature of the problem. Starting from the fact that indeed there exist a simultaneity between growth and income inequality, and taking for reference the most recent contributions in light of the theory of economic growth, it can grouped the growth models in at least four types: the) the models of human capital; b) the trade models that appear as the trade opening and its influence on the productive structure, have been affecting the dynamics of the labor market and, therefore in the relative wages of the qualified labor *vis a vis* the non-qualified labor; c) the models of political economy that emphasize the existence of social and political conflicts in the decisions of implementations of government policies that can influence direct and indirectly the distribution of income; d) the restriction models (especially) of credit that, based on the hypotheses of market imperfections, incomplete markets, and in the theories of adverse selection and moral hazard, accentuate how the restricted conditions of capital and wealth create adverse effects on the relationship between inequality and growth.

The models of human capital, either treating the human capital directly as a production factor (Azariadis; Drazen, 1990; Mankiw, Romer; Weil, 1992; Benhabibi; Spiegel, 1994), or taking its indirect effects as externalidades (Romer, 1986, 1990; Lucas, 1988), evidence a positive impact of education on the economic growth. Besides, in those articles the differences in education among countries have been pointed out as decisive to explain the gap among poor and rich countries.

Although the growth theory did not have as main focus of analysis the income inequality, the studies on convergence have been very important in the development of explanatory models of inequality among countries based upon human capital and technological innovation.

According to Ram (apud Menezes-Filho, 2001), education can affect income inequality either positively or negatively. An education expansion starting from low education levels tends to increase the inequality, once it increases the education deviations among the new generation that will receive more education and the old one that would not benefit directly from it. On the other hand, the education expansion may have a reducing impact on the inequality as long as there is a reduction in the differential of wages associated to it along the time. However, this channel acts in consonance with the demand and the offer for the several education groups; the technological biasness (that acts directly on the demand); the international trade; and the patterns of domestic consumption and growth of income.

In some models, the importance of human capital about the inequality rises in an indirect way, once it affects the levels of investment and product, as well as the adjustment possibilities to external shocks (Galor; Zeira, 1993). In other models, in a context of incomplete markets of human capital, where education is a public good, it can create an endogenous stratification between poor and rich that would drive the persistence of income inequality (Durlauf, 1992).

The theory of human capital maybe is the one that has acquired the largest number of followers from the initiated debate in the sixties in Brazil concerning the problem of income inequality which stood in evidence with Langoni's findings (1975). Among the contributed papers, one that deserved special attention is due to Lam and Levinson (1990), where they showed that prize (salary) for the education in Brazil was one of the highest in the world - a burden tax of about 15%.

Recently, many studies have focused on education as a explanatory variable for income inequality, which can be mentioned: Ramos and Reis (1991), Viegas (1996), Menezes-Filho, Fernandes and Picchetti (2000), Menezes-Filho (2001), Barros; Henriques and Mendonça (2000) and more recently Barros et al. (2002). The latter remarks that individuals' education represents the main source of Brazilian income inequality, and it accounts for about 2/3 of the Brazilian income inequality.

The trade models are supported by three main theorems, Heckscher-Ohlin, Stolper-Samuelson and Rybczynski, which are complements to one another by sustaining the hypothesis that the trade opening does have a firm favorable effect on the distribution of income.

The works that tested those three theorems empirically again, especially the first two did not arrive to consensual results. While Of Long and Summers (1991), Dollar (1992) and Krueger (1997) they end for the positive effects of the trade on the growth, Bourguignon and Morrisson (1990), they marked that, for the case of the developing countries, the effect of the trade depends on the protection level about the distribution of the endowment and the abundance of the resources, acting in a negative way in abundant countries in lands and natural resources, as well as the more protectionists went those countries.

Greenaway, Morgan and Wright (1997) summarizing the evidence of the liberalization programs and reform commercial on the growth of a long sample of countries, they affirm that usually (powder-reform) it happens an improvement of the Swinging of Payments in Average Transactions, partly due to an increment of the tax of growth of the exported products, but also in a second moment due to the reduction of the imports. For his/her time, the result of the experiences of the several countries sustains an ambiguous effect on the growth, whose explanations have if focused in three slopes: I draw of the program, implementation of the program and the weak answer of the offer. This last one based in the hypothesis of low elasticity of the offer, and/or in the government's low credibility in driving the reform.

For his/her shift, in the sense of testing empirically, the effects of the commercial opening about the inequality, the results are not also consensual. While Edwards (1997) it presented

evidences that there would not be relationship between opening and inequality, Spilimbergo (apud Barreto; Lima 2003), considering that the endowment stayed constant along the time, for an analysis of data in panel, it approximated to the result that the opening even could cause an increase of the inequality, although it has been found that this would not be the case for more endowed countries in natural resources. In equal way Fischer (2001), using a similar structure (of data in panel), but trying to verify the dynamic effect of the change of the property of the assets, it reaches the conclusion that the capital mobility, (tends critical effect the interest rate), it can revert the positive effects of the trade in lessening the inequality in the long period, especially in countries with larger earth abundance.

Finally, Wood's work (1998) analyzed the experience of two blocks of countries for different periods: Asian east in the decades of 1960 and 1970 and Latin America at the end of the decade of 1980 and beginning of the decade of 1990, observed different results as for the effects of the trade about the inequality. And it concluded that to the commercial opening in the countries of Latin America was accompanied by an increase and no a fall in the salary inequalities.

The models of Political Economy take as presupposition that the effective political regime is democratic which breaks up the idea that the lower the income of the medium voter - that politically can exercise an influence in the public decisions through the vote - the higher the pressure for the government to exercise some type of redistribution politics.

The difference of the models under this mark, as it asserts Ros (2000), it depends on the type of considered government expense: public investment (Alesina and Rodrik, 1994), transfers of the rich for the poor (Person and Tabellini, 1994), and redistribution of the capital for the work (Bertola, 1993).

In any of the cases, there exist some types of compensatory transfer mechanisms that end for increasing the distortions in the economic decisions.

The other models included here as of political economy concern those that accentuate the paper of the inequality in creating instability and partner-political conflicts in the economy. The effect detrimental of the inequality in that matter happens for several reasons. First, because it creates a fort incentive for certain social groups if they engage in rent-seeking activities, or predatory. As, because it motivates an inquietude as for the safety of the property rights and uncertainty concerning the distribution of the resources, including an increase in the expropriation risk. Third, because the inequality of income and wealth can also motivate the poor in criminal activities, with quite significant social costs for the economy and society.

Finally, the inequality excess could drive some polarization type, reducing the possibilities of a consensus as for the implantation of political reforms or even as for the safety in the maintenance of contracts and property rights.

Located among the two divisions above the article of Benabou (1996) analyzes how the redistribution happens in a process voter with imperfection in the credit market. Like this, in a generation context put upon, the author shows that the inequality develops endogenously in response to the credit restrictions and politics, not being affected by the level of the economic development.

The Imperfections in the Market of Credit, Moral Hazard and Incentive has marked in the article of 1981, Stiglitz and Weiss (1981) that presented the bases of the theory of the credit market in a context of adverse selection. In that article, three hypotheses were the focus of the models of credit restriction used in the growth theories. The first was that the lenders could not distinguish among the different risk degrees among the loan takers. The second was that the contracts had a limited responsibility for the loan taker. It is finally, that the analysis limited to involuntary default. Though, this limited responsibility, it can take the one to be reluctant in

increasing the interest rate above a certain level, what creates an incentive problem to the lenders, because this limits the return. From this, it emerges a problem of moral hazard, once the limited responsibility reduces the effort of that takes the loan in avoiding the default.

In fact, as they accentuated Aghion and Bolton (1997), the individuals of low income that are forced to take borrowed to invest, they don't accomplish the necessary effort (great), or at least the effort that the lender would like him to exercise well for the enterprise to be happened, in the measure that the larger loss relapses on the lender, I marry the same is not it.

By similar thinking, Aghion, Caroli and Garcia-Peñalosa (1999) find that when the markets are highly imperfect and the production technology exhibits decreasing returns of the capital, the inequality affects the growth negatively, especially because it has a harmful effect of the agents on the human capital. Besides, that effect is more accentuated as less developed is the credit market and larger the separation between "lenders" and investors, thus, raising the problems of moral hazard and incentive.

Also, providing warranties affect the effort and the return of the loan taker, once those that possess larger wealth obtain cheaper credit and, therefore, larger incentives to accumulate wealth (Ghosh; Mookherjee; Ray, 2000).

3. Characteristics of the Brazilian Inequality

The Brazilian inequality has some particular characteristics that distinguish it from the pattern of the income inequality observed in other countries, even regarding the group of the developing countries. Thus, the identification of those singular characteristics is important to determine the dynamics of the distribution along the time, as well as their decisive factors.

The first characteristic refers to its relative high magnitude, so much regarding wealth degree it interns, as for its relative position to countries in similar socioeconomic conditions. In spite of the country possessing a total income (GDP) superior to almost the totality of the developing countries and even a per capita income that puts it in the group of the countries of medium income, such unequal partition of income ends up creating a large contingent of poor people, either in terms of a relative or absolute measure. From the characteristic that denotes a direct connection between inequality and poverty in the country, it may be derived three inseparable elements as described in Paes de Barros et al (2000) and shared by Rocha (2003).

First, Brazil is not a poor country, but a country with many poor individuals, whose origin of poverty does not rely on the shortage of resources. This means that the country is capable to generate enough wealth to eliminate the poor from the absolute poverty condition. Second, the intensity of the Brazilian poverty is linked to the concentration of income – such inference results from the fact that the per capita income and even the medium income, especially the latter one, are quite superior to the poverty line income. For instance, the per capita incomes of the richest states of the country are comparable to those of high income countries. As a corollary of the two previous elements, the equal distribution would be more than enough to eliminate the poverty.

On the other hand, by comparing the Brazilian inequality to other countries of similar per capita income or even to countries of Latin America, Brazil assumes an undesirable ranking of first place in income inequality. In a more rigorous way, the income inequality in Brazil is superior to other countries with inferior socioeconomic conditions, for instance, the great majority of countries located in the Africa-Subsaharian³.

³ These low income countries are references for World Bank and the United Nations.

The second characteristic standing out of the Brazilian inequality is the persistence along the time for both the individual and the household distribution of income. As Barros; Henriques and Mendonça (2000) state “it is a stability that stays independent of the transformations and cyclical changes of the economy”. This is the result of the insignificant effect that the economic stabilization plans since the 80’s had to lower the inequality. This is true especially for the urban population, regardless the income concept is taken.

The third outstanding characteristic of the Brazilian inequality is that the income inequality in Brazil concentrates on the superior tail of the distribution (Barros; Mendonça and Duarte, 1997). This means that the concentration of income happens particularly in favor of the 10% or even 1% richer of the population. The practical consequence of that characteristic is that the Brazilian inequality has not necessarily been persisting because of a worsening of the poor situation, but as a function of the richest portion of the population.

Together with those three structural characteristics, some others that reflect the own economic environment and of their agents they should be highlighted because they contribute direct or indirectly to the definition of income distribution in the country. Here, it is especially included the way of operation of the labor market in the several discrimination types and segmentation that are really important for the characterization of the Brazilian inequality. From the pioneer work of Camargo and Serrano (1983) approaching gender, until the most recent studies of Barros and Mendonça (1996), Hoffmann (2000), Ramos and Vieira (2000), Leme and Wajnman (2000), all revealed a persistent discriminatory process in the Brazilian labor market.

Segmentation is also a reality in the Brazilian labor market. It can be thought around several dimensions. The main of them have been the space segmentation, with the northern and northeastern poorest regions presenting a medium earning quite inferior relative to the more developed regions.

The segmentation in the labor market by sector is also plenty of empirical evidences. Taking into account the position in the occupation and activity branch, it was verified in several studies, such as, Files (1980), Caccimali (1991), Barros and Mendonça (1996), Ramos and Vieira (2001). Besides these, other recent characteristics of the Brazilian job market are also remarked, (Camargo, 1999) such as: a) the reduction of the industrial job; b) increasing of the workers' medium earnings, regardless the sector of activity; c) rising in the average cost of labor, differentiated by sectors and d) expansion of the non-formal sector of the economy (Cacciamali, 2000).

A more recent thesis in the literature and that has been overspread concerns the influence of the macroeconomic atmosphere in the establishment of the inequality. Among the macroeconomic topics studied as related to the increase of the income inequalities in the country, inflation deserved especial attention. Amongst other studies, it can be mentioned Cardoso (1993); Cardoso, Barros and Urani (1995); Ferreira and Litchfield (1996), Hoffman (1995, 1998), Amadeo and Camargo (2000), reach results not always coincident. Particularly Barros et al. (2000), come to the quite interesting conclusion that inequality is more sensitive to the inflation than poverty, while poverty is more sensitive to unemployment than inequality. Nevertheless, they conclude that the degree of influence of inflation is very small, especially for poverty.

A great number of works appears on the impacts of the Plans of Stabilization over the inequality. In this respect Néri and Considera (1996), for instance, evaluated the impacts of the so called Real Plan (initiated in 1994) on the inequality, found that after the implantation of the Plan, to the opposite, it starts a process of reversion of the direction of the concentration among the deciles of income. So, contrary to what happened before the implantation of the Plan, the lower income deciles present the relative largest earnings.

There are also being some appealing studies verifying the impacts of foreign trade and, more specifically, the trade openness (started by the late 80's), on the inequality and poverty in the country. Focusing on that, Barros, Corseuil and Curry (2000) in a general equilibrium model for the Brazilian economy in 1995 simulate the conditions of trade capital flows from 1985 (in a environment of a closed economy) to evaluate their influence on the inequality of households and individuals. On the other hand, regarding the effects of the trade liberalization on the Brazilian labor market, Arbache (2001) search to answer, based upon the results already available in literature, four characteristics of such effects: i) trade liberalization is associated with the increase of earnings inequality - Stolper-Samuelson effect?, ii) would the trade liberalization be exporting jobs? iii) did the trade liberalization affect the structure and composition of jobs?, iv) does the Heckscher-Ohlin model explain the Brazilian experience?.

For the first inquiry, the answers to the questions pointed to "[...] It can not be concluded that trade is associated with increase in the inequality of earnings [...]" (Arbache, 2001, p.268), as well as that the increase of the trade has taken the some fall of the inequality. The answer to the second inquiry is that there would be a consensus in the literature that "... there was considerable loss of jobs due to trade liberalization" (Arbache, 2001, p. 272). The answer to third question, by the combination of the results in the literature, allows him to affirm that the changes in the composition and structure of jobs in favor of the most qualified workers might have happened due to the increase of imports. And for last question the author comes to the conclusion that the results in the literature, in some extension, "[...] challenge the validity of Heckscher-Ohlin model to Brazil [...]" (Arbache, 2001, p. 278), because the results are mixed up according to what is foreseen by this theory.

4. The Empirical Model

4.1 Nature, Deficiencies and Premises of the Data Set

Differently of other studies, the present paper turns out to analyze the inequality on the urban household income standpoint. That choice is due to the great heterogeneity of the well-being situation among individuals located in the rural and urban areas of a same state, what could generate conflicting results by contrasting inequalities. Besides, as data of PNAD⁴ is taken as reference base for the group of the state, it is computed the household income of the rural sector, which would tend to overestimating the inequality indicators.

It is intention to center specifically to the problem of the inequality among the urban populations of Brazil and, consequently, one of the outstanding characteristics described by the well known Kuznets' curve is neglected, which relates the urban-rural disparities. Due to that, they won't be used in the model the variables that describe the behavior and the dynamics of the agriculture, the productivity differences among the agricultural and non-agricultural sections, as well as it will not be of relevance here the variable that denote the degree of concentration of the earth, as stood out in some articles, for instance, Bourguignon and Morrisson (1998). The chosen period for analysis goes back to the late 90's and early 2000, and the sample gathered only household with positive income.

⁴ National survey by household sample.

4.2 The Theoretical Model

The proposed theoretical model concerns the set of possible explanations for the inequality and, particularly, for the Brazilian inequality and its relationship with economic growth. Such model, in agreement with the selected variables, relates inequality and growth to three groups of variables: i) those that would be linked to the physical characteristics of the population, that is, are attributes of it and have important reflex in its remuneration in the labor market; ii) those that would be linked to the acquired characteristics of the resident population, for instance, the variables that denote the level of instruction of that population, as well as to those representative of its allocation in the labor market; iii) those that would be linked to the own dynamism of the economy where the resident population interferes, such as: local infrastructure, investment, labor force, employment, trade openness and even "quality" of the imports and exports.

The generic theoretical model, in the form of a system of equations is as follows:

$$INEQ = f(GDP, IC, AC, EA) \quad (1)$$

$$GDP = h(INEQ, EA, AC) \quad (2)$$

where,

INEQ = a measure of household income inequality, expressed by the coefficient of variation of income; GDP = gross domestic product of states; EA = vector that describes the economic environment and the dynamics of the state economy in relation to the national economy (group 1).

IC = vector of variables that represents the population residents' inherent characteristics in the state (group 2);

AC = vector of variables that represent the acquired characteristics of the population in the labor market of each state (group 3).

The first group of explanatory variables denotes the economic dynamics of the state and its relationship with the country, which are: Ratio of state GDP to country GDP – rsgc; State investment by employed population – siep; Degree of economic openness – deo; Proportion of industrialized goods relative to imported goods – pii; Proportion of industrialized goods relative to exported goods – pie; Proportion of state budget relative to social expenses – sbse; Proportion of federal transfers to the states – pfts. State infrastructure is given by the proportion of residences provided with sanitation and clean water – san.

The first two variables are self-explanatory. The third variable consists of the state investment accomplished in the period, normalized by the employed population.

The degree of economic openness was calculated in the most conventional way as the sum of total exports and imports of each state in proportion to GDP. The variables pie and pii were calculated as the sum of manufactured and semi-manufactured commodities, exported and imported, relative to the total of all exports and imports goods, respectively, accomplished in each state.

The social expenditure per capita variable was calculated starting from the expense accomplished by the states in the following areas of performance: education and culture, housing and Urbanization, health and sanitation, transportation, social security, labor assistance. Proportion of federal transfers to each state was calculated considering all transfers performed in

the period. Important to say that the transfers included the capital ones. The source of data for both variables is the Ministry of Finance and Federal Treasury Department.

Group 2 of variables include those ones that denote the innate characteristics of the population and whose source of micro data is from PNAD/IBGE⁵. Here are gathered the variables that denote "gender" and "race". Gender is defined as the women's proportion in state – pws; while race is denoted by the proportion of non-white individuals in the state –pnws.

Group 3 contains all those variables that describe the individuals' acquired characteristics such as: individual job qualification, education and the characteristics of the labor market. A proxy for individual job qualification is the age average in each state – aa. For the education variable, it is defined as the proportion of graduated to illiterate individuals either in the labor market or searching for job – educ.

To verify the effect in the labor market segmentation, two categories of variables are specified: the first category measures the proportion of jobs in the industry relative to services – jis; and the second category identifies whether a worker holds a public job or is employed, measured by the ratio between them – pubj. The latter category also include another variable given by, the ratio between workers in the social security system and those who are not – wss.

Other variables related to the labor market are: proportion of the labor force – plf; ratio of employed individual to the labor force –empl; working hours average – wha; proportion of working hours to employed population – whep. Micro data of PNAD/IBGE is the primary source.

The reason to express the variables in the ratio form is just a suitable way to get rid of the scale effects troublesome.

From the selected variables the following simultaneous equation s model has been built up:

$$gdp = f(ineq, deo, sbse, pfts, siep, empl, wha, pii, pie, educ) \quad (3)$$

$$ineq = h(gdp, pubj, pws, pnws, aa, wss, educ, whep, pfts, plf, jis, san, rsgc) \quad (4)$$

where, gdp = gross domestic product;

ineq = coefficient of variation;

grupo1: deo = opening degree;

sbse = per capita social expenses;

pfts = proportion of the federal transfer for the states;

siep = investment for busy population;

empl = proportion of the population of the state occupied;

wha = average of worked hours;

pii = participation of industrialized goods in the total of the imports;

pie = participation of industrialized goods in the total of the exports;

group 2: pws = resident women's proportion;

prpb = proportion of blacks and brown residents;

group 3: pubj = relationship among the employed workers as public employees and the workers that work for bill-own;

aa = medium age of the resident population;

⁵ PNAD stands for national survey at household level, and IBGE stands for brazilian institute of geography and statistics

wss = relationship of the busy workers' proportion with and without signed wallet;

plf = proportion belonging population PEA;

jis = relationship of the proportion among the busy individuals in the industrial sections and of services;

san = proportion of the homes with appropriate sanitation;

whep = reason of the number of hours worked annual for busy population;

rsgc = relative participation of GDP of the State in national GDP

educ = relationship of the busy people's proportion with superior level in relation to illiterate people's proportion;

It is expected that GDP is positively related with the opening degree - deo, as well as, at first with the quality of the imports - pii, and the quality of the exports - pie. It is explained that on the side of the imports the sign will be positive since that indicates some type of technological transfer for the state, however, that sign can move that proportion of industrialized imported goods that has a negative impact on the domestic industry producing that type of commodity and on GDP. On the side of the exports a positive sign is expected, because the industrialized goods join a larger value added to the exported goods by each state.

The variable investment was normalized by the employed population and not in per capita terms, because whichever market people are, formal or informal, that is what indeed contributes for the formation of GDP. Thus, it is expected that the investment for busy population - siep has a positive correlation with GDP.

With this reasoning, it is decided not to use officials' labor statistics for the state, once they just go back to the formal market, underestimating the contribution to the formation of the workers' GDP that act in the informal market. Therefore, it was chosen as variable that denotes job the individuals' proportion, belonging the range 10 years or more), for state - empl. In that case, it is also expected a positive correlation with GDP.

Complementary to the variable used above, that expressed the amount of people that work in each relative state population, a variable was increased that denotes him/it as that busy population works. That variable is given by the average of worked hours - wha - for state that should also have a positive correlation with GDP.

Another variable that is expected to have a positive correlation with GDP is variable proportion of federal transfers for each state. In fact, as larger the relative participation of the states, in the federal transfers, adult should be GDP, once it increases the public saving and, consequently the capacity of investment of the state.

The variable education was disposed as the relationship of the proportions among two education levels that it can one to say exalted, one with positive influence on GDP, the individuals' proportion with superior level, and the other with negative influence on GDP, the illiterate individuals' proportion. In the willing form, the numerator of the ratio - educ - it is the individuals' proportion with superior level, in that way, as larger the larger reason GDP.

Finally, by the way the social per capita variable - for sbse - was defined, it is expected that the larger the social expenses per capita the larger is the income of the population, consequently, the higher the GDP. However, a series of problems regarding the own application of the public politics can distort that pattern, such that the influence of the social public expenses can be negative on GDP. In fact, problems as of focalization of the social politics, corruption and bad administration of the applied resources, it can create inefficiency problems that result in an effect no positive of the point of view joined on GDP. Besides, the possibility that individuals get used to with donations and other public benefits always exists and don't determine to work, a problem of moral hazard, that as one know commits the economic efficiency.

The partial effect of the influence of each variable that describes the innate and acquired characteristics of the population, inserted in the equation 4, it depends on as each isolated factor affects the average and the variance of the distribution of income.

5. The Econometric Model

The definition in the functional way followed the established by the literature about the inequality, particularly, the equations mincerianas of wages, where the dependent variable appears in the form of natural logarithm, while the independent variables in level format. Besides, as since some measures are percentage, for some cases the variable is zero, the logarithm the independent variable would not be applied. Also in the specification of the functional formula the quadratic term was added the variable proxy for experience as suggests by the pertinent theory.

It was arrived to the definition of the relevant variables starting from the priori hypothesis, as suggested by the literature as it is suitable in the theoretical model.

Besides, due to the endogeneity possibility "suggested" by the simultaneity between the dependent variable and some of the variables of the independent ones, the Hausman'test was accomplished. In the specific case it was considered the simultaneity possibility between the $\ln pib$ and $educ$ and among the $\ln pib$ and $pfts$ in the growth equation and among $\ln cofv$ and $educ$ in the inequality equation. The results are in Table 1.

The following variables were object of the Hausman'test for the endogeneity: $educ$, $pfts$, where it was used as instrumental variable for the accomplishment of the test the variables: the proportion of universities for state - $puniv$, the number of per capita universities - $univpc$ for the variable $educ$; the individuals' percentage below the poverty line for state - $plpob$ and proportion of municipality districts "excluded" by state - $excm$ for the variable $pfts$.

For all variables used as instruments, the pertinence was verified to the vector of explanatory variables, as well as the significance of the instrumental variable at 1% level, relative to the lineal projection of the endogenous variable on all exogenous variables and the instrumental variable.

5.1 Hypothesis Testing

Tables 1 and 2 present the test of Heroscedasticity – test of White – and the endogeneity test – test of Hausman.

Tabela 1

Test of White for Growth and Inequality Equations, (3) and (4)

Statistics	Inequality (5)	Growth (6)
F	1.56	0,31
R^2	19.27	15.26

In agreement with Table 1, it is noticed that in both equations the null hypothesis of homocedasticity is not rejected.

Table 2
Test of Hausman for Endogeneity

Variable/Instrument	Residuals	
	Eq. Growth	Eq. Inequality
educ - univpc	0,2465	
pfts - plpob	0,1293	
pfts- excm	0,1155	
educ - puniv		0,4744

According to the results of Table 2 there is no-presence of endogeneity in the model.

5.2 Definition of Estimation Methods

To capture the relationship between growth and inequality, a model was used in the simultaneous system of equations through the Three Stages Least Square (3SLS). The variables *Incoefv* and *Inpib* are endogenous and the variables *pubj*, *pws*, *rpbpp*, *aa*, *aa2*, *wss*, *plf*, *jis*, *san*, *whep*, *rsgc*, *educ*, *pfts* in the first equation; and *deo*, *inpo*, *prtf*, *sbse*, *empl*, *pii*, *pie*, *educ*, *wha*, in the second equation, are pre-determined. The two equations are identified by necessary and sufficient conditions.

6. Empirical Results

The estimated results are found in Table 3 considering 3SLS. It is noticed by the estimates that the model possesses a good fit for the selected variables. In the growth equation just the variables: investment for busy population - *siep*, and proportion of industrialized goods in the exported total - *pie* are not significant, while for the inequality equation all the variables are significant at the level of significance of 1%, except for the variable participation of state GDP in National GDP - *ppre* that is significant to 10%. Besides, all the signs of the coefficients are in agreement with foreseen by the theory, except for the estimate for *siep*, that as referred is not significant.

The first implication of that result is the influence of the economic growth on the Brazilian inequality. On the other hand, it is confirmed as already had been gotten up in the chapter 3, the presence of the characteristics observed in the job market, as well as the influence of current factors of the macroeconomic atmosphere as decisive of that inequality.

The analysis of each individual estimate, as stood out by the theoretical model, needs to be done in consonance the as each explanatory variable affects the two elements that compose the variation coefficient: average and deviation-pattern.

In an analysis of each estimate individually, it is observed that the discrimination for sex - *pws* makes to increase the inequality, while the racial discrimination - *pnws* reduces the inequality. The explanation for that can be thought in the following way. For the variable *pws*, the inequality increases because the effect about the reduction of the average is accompanied by the effect on the increase of the dispersion, which justify the expressive magnitude of that variable. Though, for the variable *pnws*, the effect would be the opposite exactly: the effect about the

Table 3
Estimates of Simultaneous Equations Models, (3) and (4) by 3SLS

Independent Variables	Dependent Variables		"Statistics"
	Lnplib	Lncofv	
c	15,7617* (2,2553)		
deo	1,3181* (0,4539)		
siep	-0,0002 (0,0002)		
pfts	25,0407* (2,7327)	15,2569* (1,2944)	
empl	6,1762* (2,1670)		
wha	0,0520** (0,0265)		
pii	-1,5080* (0,4560)		
pie	0,2557 (0,2276)		
sbse	-0,0021* (0,0011)		
educ	6,3708* (0,6962)	-1,9361* (0,4529)	
lncofv	-0,2838 (0,1818)		
pubj		1,3288* (0,1806)	
pws		5,3355* (0,6149)	
prpb		-1,2939* (0,2524)	
Aa		-1,8243* (0,1208)	
aa ²		0,0329* (0,0022)	
wss		-0,2126* (0,0460)	
plf		3,2207* (0,3412)	
jis		-0,6828* (0,2390)	
san		-0,9604* (0,0769)	
rsgc		-0,6484** (0,3126)	
whep		-0,0229* (0,0026)	
lnplib		-0,1754* (0,0248)	
R ²			Eq.1 0,9690 Eq.2 0,9852
χ^2			Eq.1 863,65 Eq.2 1923,79

Note: Standard error in parenthesis; * significant at 1%; ** significant at 5% e *** significant at 10%.

decrease of the average would be smaller than the effect about the decrease of the dispersion. Besides, that result indicates that the effect reducer of the average is significantly larger in function of the gender than of the race.

The effect of the education - educ - on the inequality it was also negative, reinforcing the theoretical supposition that the increase in the individuals' proportion with relative superior level to the illiterates should take an increase of the average of the largest income than the increase of the dispersion. Although there is a contrary effect when it increases the relative proportion of illiterates the individuals' proportion with superior level: fall of the average, decrease of the dispersion.

In the extent of the segmentation of the labor market, the negative sign of the relationship is emphasized among the employees with and without wallet - wss - as well as of the relationship among the employees' proportion in the industrial section in relation to the employees in the section of services - jis -. In the first case, that might have happened because of the effect of the fall variance to have prevailed under the reduction of the average, while in the second case, exactly the opposite, that is the effect of the increase of the average was superior to an increase of the variance of the income.

As for the relationship of the public employees' proportion to the employees independently there was an increase of the average of incomes, less than proportional to the increase of the dispersion, such that the inequality increased.

The variable plf presented a positive sign, which means that a larger proportion of individuals in the labor force, due to join a larger part of individuals with low income, pull the average upward, however less than proportionally to the increase of the dispersion.

The variable age - aa - presented the expected sign, with the linear estimate presenting negative sign and the estimate to the square a positive sign. This means that until a certain age the dispersion decreases more than proportional to the increase of the average, later the dispersion starts to grow more than the increase of the average. Likewise, it conforms as expected the negative sign of the variables san, whep and rsgc. That last one, reinforcing the evidence that the richest states present smaller inequality.

Finally, it must stand out in the inequality equation the positive sign and the significant magnitude of the coefficient of variable pfts, which can be related to the improper use of the federal transfers, or the appropriation of those resources for a number proportionally larger of individuals with income above the average. This can indicate a behavior of rent-seeking of located groups in the states that appropriate of the transferred public resources. Even by considering that can provoke an increase of the average income; the effect on the dispersion of the income is very larger.

Regarding the growth equation the negative signs of the coefficients: sbse, and pii, can also indicate mixed up effects in the application of the public politics in favor of the rich ones. On a side, it can be having a focalization problem in the application of the public resources in politics social, such that that creates inefficiency problems and incentive. Of other side, it could happen that the import of a larger amount of industrialized products, create difficulties for the national producer in marketing product of similar characteristic to the imported and same that reflects a larger demand of products industrialized that assists a superfluous consumption of the richest layers of the population, without creating any positive internal effect, in technological terms.

The expected signs of the estimates are revealed for the variables deo, wha, empl, rsp and pfts, and those last variables with quite expressive magnitudes.

6.1 Effects on Income Percentiles

It is quite important the verification of how the explanatory factors discussed previously influence the inequality by considering intervals of the income. In fact, it becomes of interest to know, for instance, what explanatory variables influence the inequality in the interval until the first percentile and the interval belonging to the first decile of income, that correspond the ranges of income where concentrate the indigent and the poor of the population, respectively. It is also important to know whether or not the exclusion of the group of the top 5% richer in the sample has some effect on the results of the model compared to the complete sample.

The verification of the influence of the selected explanatory variables is presented for the percentiles 1, 10 and 95 in Table 4 and, 25, 50 and 75 in Table 5.

It is observed that for the first percentile, only the variables educ, pnws, aa, aa², plf, jis, ppre, whep and lnpiib, are statistically significant in the explanation of the inequality of that percentile of the income of the states. In spite of, in the group of the significant variables, the variables ppre and lnpiib they present sign contrary to the verified for the sample completes. In the first case, this indicates, therefore, that the largest relative participation of state GDP in national GDP, has as effect to increase the inequality among the portion more poor of the population (indigent). This can mean that the poor benefit in way different from the "effect wealth" of the state, so that the positive effect on the average of the income of that layer of the population is smaller than the increase of the variance (dispersion).

Result of greater relevance, concerns the change of the sign of the variable lnpiib (to the sample it completes), pointing that the growth elevates the inequality among the poorer 1%. This denotes that for that portion of the population economic growth elevates the average of income less than the dispersion.

As the sample is extended for the percentile tenth, the 10% more poor of the population, the variables selected significant they lose temper. They are significant now: pfts, pws, pnws, aa, aa², san and lnpiib. Though, the signs of the variables aa and aa² and san are inverted, where the variables that denote the medium age of the population describe a parable now in the form of a "U-inverted" one and no more in the form of a "U" and, the variable sanitation that causes a positive effect now on the inequality and no more negative. In the first case, in a first moment as age (average) it grows, the average of the income should be growing less than the variance, maintaining that behavior until a certain age when it starts to happen the inverse. The positive effect of the sanitation on the inequality can reflect that a larger access to the sanitation among the poor causes an increase in the smaller average of incomes than the variance in that percentile one.

Also of great relevance in that percentile is the negative sign of the coefficient of lnpiib. In so being, growth has as effect to elevate the average income more than proportionally the dispersion, just like it happens for the full sample, tends as final effect a fall of the inequality.

For the percentiles 25, 50 and 75, the explanatory power of the model decreases significantly, even considering the existence of a quite few number of significant variables.

Regarding the percentiles 25 and 50, they present as significant the coefficients of the explanatory variables san and plf. The variable san, in both cases, maintains the positive sign, what denotes that that variable contributes to the increase of the inequality. In the percentile 25 it is increased as significant variable, and with the expected sign, the variable wss.

For the percentile 75 the variable san maintains its positive influence on the inequality. However, three another varied pass to be significant: jis, ppre and whep, all maintaining the same negative sign, verified to the sample completes.

Table 4
 Estimates by 3SLS for Selected Percentiles of Income: 1°, 10° e 95°.

	Dependent Variable					
	1° Percentile		10° Percentil e		95° Percentile	
	lnpib	lncov	lnpib	lncov	lnpib	lncov
c	18,126*	21,651**	16,258*	-11,404	17,663*	5,514
	(2,988)	(11,116)	(3,027)	(8,063)	(2,465)	(3,651)
deo	0,897***		0,970***		1,369*	
	(0,499)		(0,513)		(0,498)	
siep	0,0001		-0,0001		-0,0001	
	(0,0002)		(0,0001)		(0,0002)	
empl	5,677**		5,84**		5,033**	
	(2,547)		(2,967)		(2,366)	
wha	0,013		0,039		0,0216	
	(0,028)		(0,033)		(0,0276)	
pii	-1,401*		-1,394*		-1,528*	
	(0,485)		(0,490)		(0,486)	
pie	0,184		0,417***		0,362	
	(0,299)		(0,243)		(0,240)	
sbse	-0,004*		-0,003*		-0,003*	
	(0,001)		(0,001)		(0,001)	
pfts	23,884*	0,283	23,544*	20,272*	22,728*	5,821**
	(2,547)	(7,881)	(2,776)	(5,659)	(2,741)	(2,541)
rsupa	6,801*	-9,008*	6,762*	-0,195	7,146*	-0,338
	(0,703)	(2,762)	(0,759)	(1,981)	(0,723)	(0,890)
lncov	0,134		-0,0403		-0,433	
	(0,1127)		(0,2328)		(0,380)	
pubj		1,329*		0,646		0,716**
		(1,097)		(0,792)		(0,357)
pws		5,351*		6,627*		-0,718
		(3,709)		(2,703)		(1,222)
pnws		-2,632***		-1,796***		-1,241*
		(1,533)		(1,109)		(0,504)
aa		-2,515*		1,156**		-0,232
		(0,725)		(0,524)		(0,238)
aa ²		0,043*		-0,022**		0,003
		(0,013)		(0,009)		(0,004)
wss		0,004		0,118		-0,282*
		(0,279)		(0,203)		(0,093)
plf		8,842*		-0,070		-1,155***
		(2,098)		(1,501)		(0,684)
jis		-3,004**		-1,322		-0,986**
		(1,457)		(1,049)		(0,476)
san		-0,066		0,806*		0,358**
		(0,466)		(0,332)		(0,149)
ppre		3,104***		-0,910		-1,070***
		(1,895)		(1,374)		(0,627)
whep		-0,048*		-0,018		-0,022*
		(0,016)		(0,011)		(0,005)
lnpib		0,332**		-0,400*		-0,008
		(0,151)		(0,109)		(0,049)
R ²	0,9628	0,8452	0,9636	0,6357	0,9671	0,7572
χ^2	748,31	168,17	752,81	58,06	794,57	85,85

Note: Standard error in parenthesis; * significant at 1%; ** significant at 5% e *** significant at 10%.

Table 5
Estimates by 3SLS for Selected Percentiles of Income: 25°, 50°, 75°.

	Dependent Variable					
	25° Percentile		50° Percentil e		75° Percentile	
	lnpib	lncoev	lnpib	lncoefv	lnpib	lncoefv
c	18,846*	-5,344	17,639*	4,228***	16,845*	-1,036
	(2,419)	(3,478)	(2,429)	(2,570)	(2,453)	(2,655)
deo	1,179*		1,088**		1,162**	
	(0,478)		(0,501)		(0,510)	
siep	0,0001		0,0001		-0,00001	
	(0,0001)		(0,0001)		(0,0001)	
empl	5,125**		6,524*		6,276*	
	(2,219)		(2,366)		(2,427)	
wha	0,061**		0,040		0,0273	
	(0,031)		(0,032)		(0,0292)	
pii	-1,746*		-1,621*		-1,542*	
	(0,487)		(0,503)		(0,513)	
pie	0,195		0,195		0,315	
	(0,235)		(0,249)		(0,257)	
sbse	-0,004*		-0,004*		-0,004*	
	(0,001)		(0,001)		(0,001)	
pfts	23,779*	3,362	24,806*	-0,873	23,587*	1,965
	(2,624)	(2,421)	(2,940)	(1,808)	(2,944)	(1,857)
educ	6,01*	-0,221	6,248*	0,111	6,710	0,738
	(0,779)	(0,849)	(0,582)	(0,634)	(0,871)	(0,650)
lncoev	1,004**		0,900		0,164	
	(0,459)		(0,582)		(0,484)	
pubj		0,278		0,049		0,173
		(0,340)		(0,253)		(0,260)
pws		1,181		0,207		0,072
		(1,163)		(0,858)		(0,888)
pnws		-0,589		0,052		0,317
		(0,479)		(0,354)		(0,366)
aa		0,179		0,085		-0,008
		(0,227)		(0,167)		(0,173)
aa ²		-0,003		-0,002		-0,001
		(0,004)		(0,003)		(0,003)
wss		-0,236*		-0,071		-0,103
		(0,088)		(0,065)		(0,067)
plf		1,672*		0,858		0,303
		(0,651)		(0,480)		(0,497)
jis		-0,342		-0,533		-0,656***
		(0,453)		(0,335)		(0,346)
san		0,695*		0,451*		0,485*
		(0,143)		(0,106)		(0,109)
ppre		-0,326		-0,121		-0,868***
		(0,596)		(0,439)		(0,455)
whep		0,005		-0,006		-0,009*
		(0,005)		(0,004)		(0,004)
lnpib		-5,344		-0,033		0,014
		(3,478)		(0,035)		(0,036)
R ²	0,9689	0,6483	0,9633	0,676	0,9644	0,7691
χ^2	852,54	51,10	749,11	62,35	745,96	95,14

Note: Standard error in parenthesis; * significant at 1%; ** significant at 5% e *** significant at 10%.

Finally, as for the extension of the sample to the percentile 95, a larger explanatory power of the model is visualized - as expected - with great part of the significant estimates at least 10% of significance, and with the expected sign - compared with the sample completes - except for the

variables san and plf. That result is quite interesting, because as the largest asymmetries of the medium income of the Brazilian population they happen among the richer 5% in relationship the 10%, 20% or even the poorer 40%, the variables no significant for that percentile one: pws, aa, aa², educ, and lnpiib show a particularity of the disparities of income between the rich ones and the rest of the population.

It can be affirmed that the discrimination for gender is particularly important among the rich ones, so that the dispersion of the income between men and women for that group is larger than the own increase of the medium income, when it is included the richer 5% in the sample. It is worth to observe that that seems to be the case also for the poorer 1%.

Similar reasoning can be applied for the interpretation of the variables that denote age (average), where it is insignificant the effect for percentile 95, but when it is introduced the richest people's incomes a pattern of behavior is demonstrated that elevates the medium income more than proportionally that the variance in a first moment, until a certain age, for later the relationship if it inverts, with the medium income growing less than proportionally to the variance.

Attention must be paid to the result for variable rsupa, which is only significant for the poorer 1%. In spite of, with the introduction of the richer 5% in the sample that relationship becomes again negative and significant. That behavior maybe is explained by the largest number of illiterates in the first percentile and the largest number of individuals with superior level for the group of the richer 5%. This happens because in the first percentile the variance of the income would be small, and smaller than the average that would be also low, while when it is included the richer 5%, it happens a big effect proportionally on the average larger than on the variance.

It is also relevant to verify that the effect of the coefficient of gdp on the inequality is significant only for the first percentile and sample completes. For that road, the introduction of the richer 5% in the sample has an effect proportionally of increasing the average more than the dispersion, tends as final result a fall of the inequality.

Finally, it is worth emphasizing that the results for the equation of gdp for all of the selected quintiles presented, little variation of their estimates, staying the results basically evidenced for the full sample/.

Final Remarks

A first important result was the confirmation of the negative effect of growth on the income inequality, considering both the full sample and the first percentile of income, which contrasts with the result also significant, but positive for the percentile 10.

Particularly, a great discrimination influence was observed by gender and the little relevance of racial discrimination in the inequality. It was verified that the women's proportion in the resident population in each state tends to increase the income inequality; on the contrary, the proportion of non-whites possesses a reducing impact on the inequality. The explanation for that result would lie on the fact that for the variable pws (proportion of women), the inequality increases because, as observed in the sample, the mean reduction is accompanied by an increase in the variance. As a result, the expressive magnitude of the coefficient of that variable. On the other hand, for the variable pnws (proportion of non-whites), the effect would be right the opposite: the mean decrease is smaller than the dispersion decrease. That result indicates that the reducer effect of the mean is significantly larger for gender than for race.

Concerning the variables related to the job market segmentation, the one of larger relevance in the explanation of the inequality was the proportion of workers out of the social security system, which is motivated by an effect caused by the fall of variance to prevail on the reduction of the mean.

In the group of variables that describe the individuals' acquired characteristics stands out a negative effect of education on the inequality. A possible reason for that would be that the increase in the proportion of graduated individuals relative to the illiterates' ones should take a larger increase of the mean income than the dispersion.

In the bundle of variables referring to the economic environment, a striking result points to the proportion of federal transfers to the states that presents negative sign and significant magnitude of the coefficient, indicating a relevant influence on the income inequality in the states.

The importance of the set of results concerning inequality demonstrates that the effect of the explanatory variables on the dependent variable links with the mean and the variance of income. Thus, it is verified that is quite possible that a certain social policy aiming to elevate the average of income may provoke a non expected effect on the dispersion, such that in the end may occur a rise, not a decrease in the inequality. Matching with most results in the literature, economic growth lowers income inequality, as provided by estimations of the full sample.

The extension of results for income ranges indicates that the explanatory variables affect differently the dependent variable for each percentile of income. This is an important result because it reveals, for instance, that in the percentile 95, the non-significant coefficient of variables like: women's proportion, age, education, labor force, there is a particularity of the inequality between rich and poor in the Brazilian states.

This article also allows taking different illations that could help understanding the Brazilian degree of income inequality, either through the full sample or by the sub samples of different percentiles of income, which showed interchangeable sensibilities from the selected variables applied to the models. That certainly enriches some contributions addressed to the elaboration of public policies whose main goal must be the reduction of inequality among all individuals, groups of income and across states.

It is worthwhile pointing out that the estimates here obtained may also be useful in the application of social policies. However, caution is required to implement such policies since the results might lead to distinct effects if applied to different groups of income, which means that a certain policy may induce a greater increase of the variance than the mean what could imply a rise instead of a fall of the inequality.

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