# Regional income inequalities by income class in Brazil: is inequality higher among rich or poor people?[1]

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## Abstract:

The paper deals with regional inequality of per capita income per income class in Brazil. The paper calculates regional income inequality measures per income class, allowing for the identification of the income classes in which inequality is the highest. The indicators are calculated for the years 1960, 1970, 1980 and 1991. For each income class the speed of convergence is estimated, allowing for the identification of the income classes for which convergence is taking place and at what speed.

## Key Words:

Regional inequality; Convergence; Income Inequality; Brazil.

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## 1 - INTRODUCTION

Being a country with a large territory, with different natural regions, Brazil presents high levels of regional inequality of economic and social conditions. Different studies have covered distinct aspects of this problem, such as the measurement of per capita income dispersion (AZZONI, 1997b, FERREIRA, 1995), the tendency towards convergence or divergence (AZZONI, 1994, 1999, 1997, FERREIRA, 1995, ZINI, 1998), differences in social conditions (HOFFMANN, 1998) . Few studies, however, have dealt with the issue of income inequality among people within the regions, with the possible exception of AZZONI (1997a) and HOFMANN (1997), for Brazil, and FISCH (1984), for the US. More recently, RAVALLION & WODON (1997) and RAVALLION (1998), dealing with poverty programs, considered the possible targeting of households with personal attributes that foster poverty, no matter where they live, instead of targeting poor areas; their findings support the case for anti-poverty programs targeted to poor areas.

This is an important issue, for personal income inequality is higher in poorer regions than in richer ones. Thus, if a policy directed towards reducing regional inequality is devised, without any provision for changing regional income distribution profiles, the final result could be an increase in personal income inequality at the national level. In AZZONI (1997), it is shown that in order to make all states in Brazil have the national personal income distribution, poor people from poor states should be moved to richer states, at the same time that rich people from rich states should migrate to poor states. Moreover, the decomposition of total income inequality in the country indicates that the regional component is small, as compared to the personal component: AZZONI (1997a) finds a 60%/40% relationship; HOFFMANN (1997) finds a 9%/91% proportion. In his study about the social conditions of children in Brazil, HOFFMAN (1998) indicates that the prevalence of malnutrition among children in the poorer regions is greater than in other Brazilian regions, even after considering the effect of poverty.

In this paper I follow the line of analyzing regional inequality of income taking into consideration simultaneous personal income inequality aspects. The idea here is to identify what income classes are responsible for regional income inequality and also for regional income convergence or divergence. The dynamics of regional per capita income inequality over time is guided both by the movement of income and of population over space. The first is determined by entrepreneurs' profitability guided decisions and the latter by the decisions of households seeking better living conditions, income levels included. Thus, the dynamics of income inequality by income class will ultimately depend on what income classes are more prone to migrate in response to wage differentials. In this paper an effort is made to approach this issue, without considering the dynamics of migration by income class. The focus is on the measurement of regional inequality by income class and on the evolution of these inequalities over time.

Different measures of regional per capita income dispersion are presented and their evolution over time analyzed, permitting a first idea of which income classes are more "regionally unequal" and how the inequality within each income class is evolving over time. In a second step, the regional convergence of per capita income by income class is studied, allowing for the identification of the income levels responsible for the movement of income inequality in the country.

The remaining of this paper is organized into four different sections: the second presents the data set to which all measures are applied; the third presents income dispersion by income class and its evolution over time; the fourth deals with income convergence, in the context of the economic growth theory; the fifth section presents the conclusions of the paper.

## 2 - THE DATA BASE ON REGIONAL INEQUALITY BY INCOME CLASS IN BRAZIL

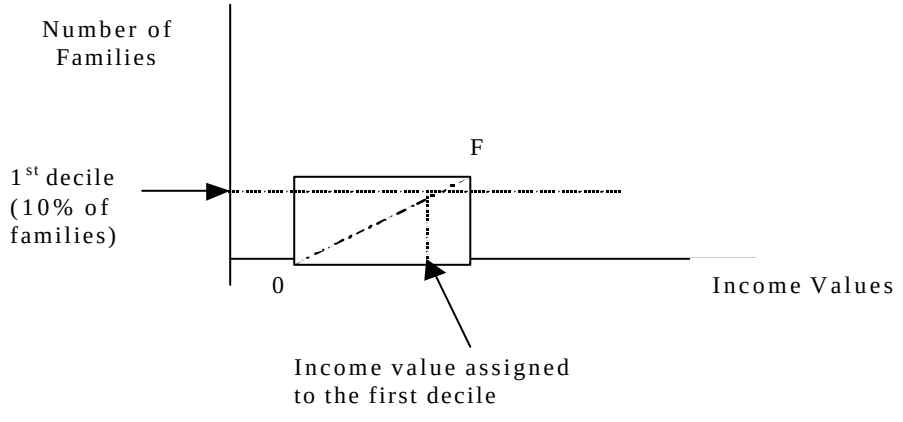
In order to cover the aspects mentioned above, it is necessary to have per capita income data by state[2] over an as long as possible period of time. Unfortunately, the 1960 population census is the first one to present income data in Brazil; after that, data is available for the 1970, 1980 and 1991 population censuses. The 1996 population survey (Contagem Populacional) does not provide income information. The decision was made to deal with 11 income classes: the first 9 deciles, the 5% richer and the 1% richer. For the presentation of the results, those income levels will be noted $D^-$, D, $D^+$, $C^-$, C, $C^+$, $B^-$, B, $B^+$, $A^-$ and A.

The population censuses present different numbers of income classes in each year, making comparisons among them difficult. Thus, before starting calculations, a preparation of census data had to be performed. It was assumed that the distribution of families within each income class was homogeneous, determining a linear accumulated frequency function within each income class. That is, let $F_j$ be the number of families in income class j; starting with zero in j's inferior limit, the accumulated number of families in j's superior limit is F. The procedure is illustrated in Figure 1 below.

Another problem was the standardization of monetary values, for inflation over the 31-year-period was very high. In order to avoid price deflator problems, common to all studies dealing with economies with high inflation, the income distributions obtained were converted into Real Gross Regional Product data. Each income class level in each state was compared to the national income level in each census, producing a set of ratios. Those ratios were applied to real GRP data available from AZZONI (1997b), generating per capita GRP figures for each income class in each state. Thus, the monetary figures used in this study are estimated real per capita GRP values.

**FIGURE 1**

ILLUSTRATION OF THE ESTIMATION PROCEDURE




[2] In this paper, Brazilian states will be considered as regions. In 1995, a total of 26 states formed the Brazilian Federation; in 1960 this number was 24. In order to avoid any bias due to the creation of new states, I have worked with 24 states only, aggregating the states created into the ones they were originated from.

## 3 - REGIONAL DISPERSION BY INCOME CLASS

Using the per capita income values described in section 2, two dispersion measures were calculated for all 11 income classes and 4 observation years: the coefficient of variation and the weighted coefficient of variation[3]. The results are presented in TABLES 1 and 2. The coefficient of variation values for the national average (all income classes) decreases in the period 1960-91 from 0,39 to 0,33, with values of 0,34 in 1970 and 0,32 in 1980. Thus, a decrease in regional inequality is observed over the whole period by this indicator, with a small increase in the period 1980-91; over the period 1970-91, regional inequality remained almost stable in the country. When the weighted coefficient of variation is considered, inequality is generally higher than indicated by the unweighted indicator. Secondly, the levels are more stable, with an increase in the first period and almost stable levels in the later three years. The same increase between 1980 and 1991 is present.

**TABLE 1**

Calculated inequality coefficients

| | Unweighted | | | | Weighted | | | |
|---|---|---|---|---|---|---|---|---|
| | 1960 | 1970 | 1980 | 1991 | 1960 | 1970 | 1980 | 1991 |
| The poorest | 0.36 | 0.35 | 0.33 | 0.31 | 0.25 | 0.39 | 0.45 | 0.40 |
| The lower middle income class | 0.43 | 0.34 | 0.33 | 0.36 | 0.45 | 0.41 | 0.44 | 0.48 |
| The upper middle income class | 0.38 | 0.35 | 0.31 | 0.34 | 0.42 | 0.48 | 0.41 | 0.45 |
| The richest | 0.34 | 0.32 | 0.28 | 0.28 | 0.45 | 0.47 | 0.32 | 0.34 |
| All classes | 0.39 | 0.34 | 0.32 | 0.33 | 0.38 | 0.43 | 0.43 | 0.44 |

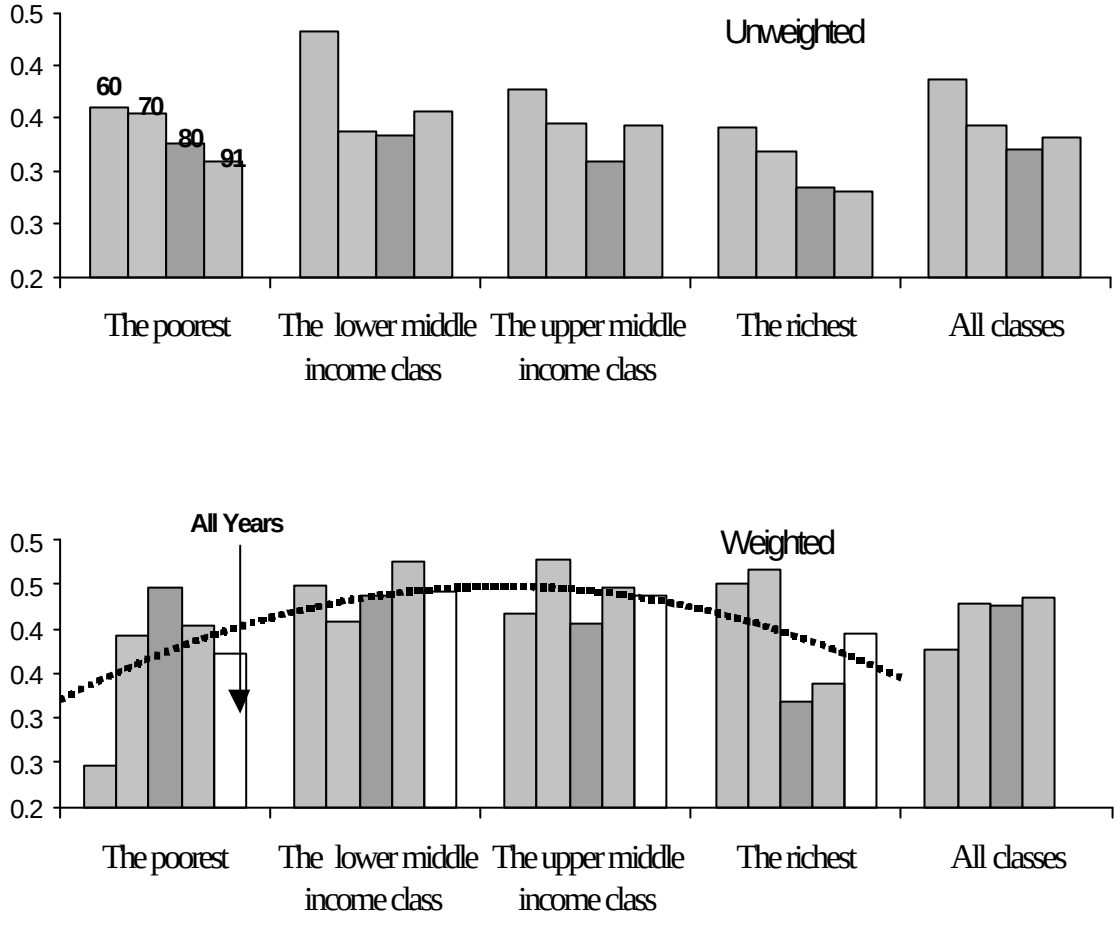
In TABLE 1 and FIGURE 2 the calculated coefficients of variation are presented, with the deciles aggregated into four different income classes: a) the poorest people – classes D-, D and D+, or the 30% lowest income levels; b) the lower middle income class – classes C-, C and C+, or the following 30%; c) the upper middle income class – classes B-, B and B+, and d) the richest people – classes A- and A, or the 5% and 1% plus income classes. The first thing that comes out is the difference in behavior over time of the types of coefficients. For the poorest, the unweighted coefficients indicate a diminution in inequality over time and the weighted indicate an increase. Similar differences occur for the other income groups. This is due to the weighting mechanism, that gives more importance to states with larger population, providing a more meaningful measure of regional inequality. Thus, in this section the analysis will be concentrated in the weighted coefficients. The detailed results by income class are presented in FIGURES 3 and 4. FIGURE 3 shows the absolute values of the weighted coefficients of variation; FIGURE 4 presents the income class coefficient in relation to the average (all classes) coefficient.

Starting with the poorest, it is observed an increase in regional inequality along the whole period analyzed, with the sharpest jump occurring between 1960 and 1970, although the following decade also presented an important increase. Between 1980 and 1991 inequality decreased by 5 points, but still remained above the 1970 level. Compared to the poorest, the lower middle income group exhibits in general higher regional inequality levels. Considering the two extremes of the time period, an increase in inequality is observed, but the middle years present lower levels than the end years. However, there is an evident increasing trend in the last three years of the series. That is, in spite of the drop in the middle years, we may be facing an increasing trend in the inequality among the lower middle income group. The upper middle income group presents a less clear picture of evolution over time, being the most stable income group as far as regional inequality is concerned. Taking the end years, a small increase is observed, but the middle years

[3] With $y_i$ standing for per capita income and $P_i$ for population in state i, and variables without a subscript indicating national figures, the weighted coefficient of variation is given by: $V_w = \frac{\sqrt{\Sigma \left(y_i - y\right)^2 * \frac{P_i}{P}}}{y}$

**FIGURE 2**

Calculated inequality coefficients




present a decrease, with no clear trend observable. The richest income group presents a sharp drop in the last two years, with a slight increase between the first and second years of each sub-period. In the final years, this income group exhibits the lowest inequality levels. As a whole, taking the average for each income group along the four measurement years, an inverted U-shaped curve is observed[4]: the poorest and the richest have the smallest inequality indexes, with the middle income classes with higher inequality levels.

## *4 - REGIONAL INCOME CONVERGENCE BY INCOME CLASS*

The evolution of the coefficient of variation gives an idea of convergence by income class, as displayed in FIGURES 3 and 4. To get a better view of this process, two additional ways for computing regional income convergence will be used: the speed of convergence computed from the weighted coefficient of variation and the one computed from regressions relating the growth in income to the original level of income in each state.

[4] The dotted line in the figure is shown for illustrative purposes only. no statistical meaning is assigned.

FIGURE 3 - Weighted Coefficients of Variation by Income

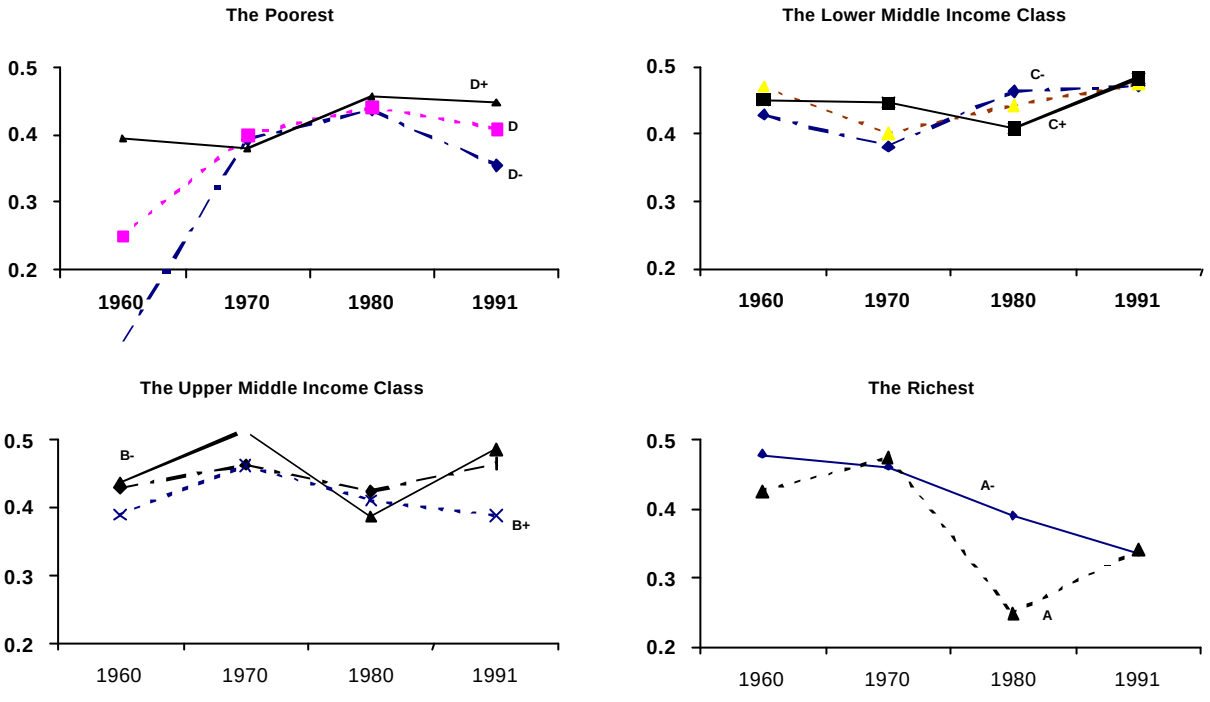
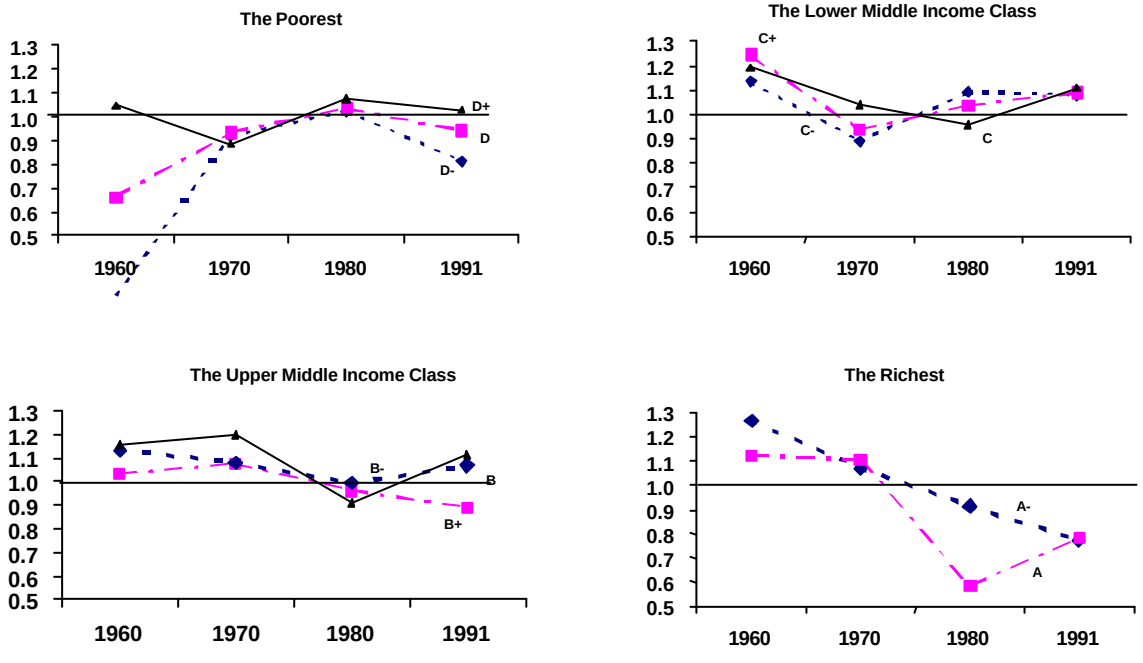



FIGURE 4 - Relative Regional Inequality by Income Class (National Average =




## 4.1 - Coefficient of variation speed of convergence

TAYLOR & WILLIAMSON (1994) have demonstrated that, if there is convergence towards the national average, the speed at which this convergence is taking place is given by

$$V_t = V_{t-1} \cdot \exp(-st), \text{ or } \frac{\ln\left(V_t / V_{t-1}\right)}{t} = -s$$

With V standing for the coefficient of variation and $-s$ the speed of convergence (TAYLOR

& WILLIAMSON, 1994). A negative sign for **s** indicates an increase in inequality, or divergence; a positive sign indicates a decrease in inequality, or convergence; the absolute value indicates the speed at which convergence of divergence is taking place (% per year). This measure was applied to per capita income data by income class, generating the results displayed in TABLE 3 and FIGURE 5.

**TABLE 3**
COEFFICIENT OF VARIATION
SPEED OF CONVERGENCE

| Decile | Unweighted | Weighted |
|---|---|---|
| D- | 0.12% | -1.78% |
| D | 0.18% | -0.67% |
| D+ | 0.30% | -0.17% |
| C- | 0.30% | -0.13% |
| C | 0.27% | -0.01% |
| C+ | 0.22% | -0.10% |
| B- | 0.14% | -0.11% |
| B- | 0.06% | -0.15% |
| B+ | 0.19% | 0.01% |
| A- | 0.39% | 0.48% |
| A | 0.15% | 0.30% |
| All classes | 0.21% | -0.19% |

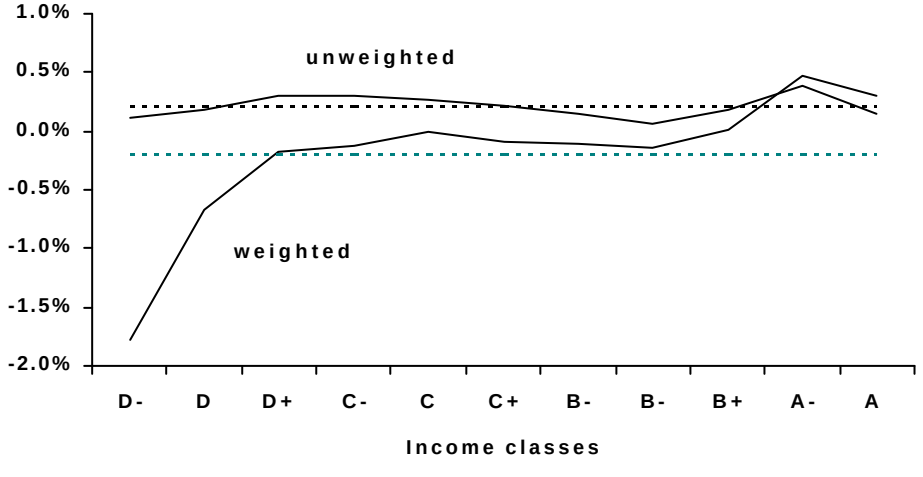
From these results, it is clear that there is a great difference as far as weighted and unweighted coefficients are considered. When no consideration is made for population sizes, all income classes present convergence of per capita income, with an average (all classes) of 0.21%. Considering the quantitative importance of the states, as measured by their population, the results indicate overall divergence, at a speed of –0.19%, with the higher income classes presenting convergence. That is, there is a positive relationship between the income level and the speed of convergence: high income people are becoming more homogeneous across space in Brazil, whilst the 80% poorer are becoming more regionally unequal. In both forms of measuring inequality (weighted and unweighted), the very poor are below average in terms of speed and the very rich are above average; the lower middle income class is above average and the upper middle income class presents lower speeds than the lower middle income class in both cases.

## 4.2 - Beta speed of convergence

Another way of estimating the speed of convergence is through regression analysis. Within the neoclassical growth model, a negative relationship is postulated between the rate of growth in per capita income and the initial level of per capita income in each state. As demonstrated in BARRO & SALA-I-MARTIN (1995), the average rate of growth of per capita income between the initial time t = 0 and any other future time T ≥ 0, with y standing for per capita income, is given by:

$$(1/T).\log[y(T)/y(0)] = x + [(1-e^{-b.t})/T].\log[\hat{y}^*/\hat{y}(0)]$$

**FIGURE 5**
COEFFICIENT OF VARIATION SPEED OF CONVERGENCE



Making $a = x + [(1 - e^{-b.t}) / T].\log \hat{y}*$, one gets β, the coefficient of convergence

$$(1/T).\log[y(T)/y(0)] = a - [(1 - e^{-b.t)} / T].\log y(0)$$

The calculated speeds of convergence for each income class are displayed in TABLE 4 and in FIGURE 6. A total of 72 observations is utilized in each income class, for three periods are considered: 1960-70; 1970-80 and 1980-91. Per capita income growth during the period in each state is regressed against the state's per capita income level at the beginning of the period.

Since this form of measurement considers all three sub-periods and the former includes only the extreme years of the whole period (1960 and 1991), some differences in the results are to be expected. As can be observed in the table and in the figure, the same pattern of variation across income classes is present: lower income classes are below the average speed and the higher income classes are above average. On average, it takes 34 years to reduce regional inequality in the country by the half; in the worst case (income class D), 53 years are needed; in the best case (income class B-), 26 years. The three lower income classes require more than 40 years to half inequality. In the other extreme, the very rich need less than 30 years. As a whole, the period for half convergence is very long, indicating that if no change is imposed to it, the high levels of inequality will prevail in the country for a long time, Especially

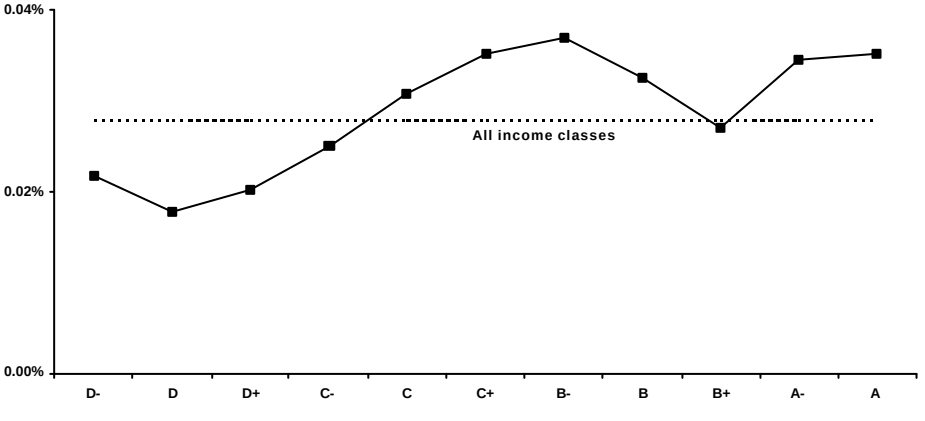
**TABLE 4**

CALCULATED BETA SPEEDS OF CONVERGENCE

| Income Class | Estimated Coefficient | Calculated Speed of Convergence | Years to Half Inequality |
|---|---|---|---|
| D- | -0.016 | 0.023% | 43 |
| D | -0.013 | 0.018% | 53 |
| D+ | -0.015 | 0.021% | 47 |
| C- | -0.018 | 0.026% | 38 |
| C | -0.023 | 0.032% | 31 |
| C+ | -0.026 | 0.036% | 27 |
| B- | -0.027 | 0.038% | 26 |
| B | -0.024 | 0.034% | 29 |
| B+ | -0.020 | 0.028% | 35 |
| A- | -0.025 | 0.036% | 28 |
| A | -0.026 | 0.036% | 27 |
| All Classes | -0.020 | 0.029% | 34 |

**FIGURA 6**

CALCULATED BETA SPEEDS OF CONVERGENCE



among the poorest. For inequality to be reduced to one forth of its level in 1991, almost 70 years are needed on average (107 years in the worst case).

## 5 - CONCLUSIONS

This paper analyses regional inequality in Brazil by income class, in order to find out if there are important differences among them in terms of inequality and of convergence in the period 1960-1991. The results indicate that regional inequality levels are higher among the middle income class, with the extreme income levels presenting less regional inequality: the very rich present less inequality than the very poor.

In terms of its dynamics, the results indicate that the speed of convergence is much lower for low income people than for rich people. Over time, a relatively faster decrease in inequality among the higher income classes is to be observed, with the lower income classes lagging behind. In any case, the calculated speeds of convergence are very low: on average, 34 years are needed to reduce regional inequality by the half; almost 70 years to reduce it to 1/4 of its level in 1991.

Considering these results, it becomes clear that important differences exist between income classes in terms of regional inequality and regional convergence of per capita income in Brazil. It is important to go deeper into this issue, improving the calculations and developing reasonable explanations for them. Those are steps to be followed in the next steps of this investigation.


## Resumo:

Trabalha com a desigualdade regional de renda *per capita* no Brasil por classe de renda. Calcula medidas de desigualdade regional de renda por decil para os anos de 1960, 1970, 1980 e 1991, permitindo-se averiguar quais classes de renda são mais desiguais em termos regionais. Calcula-se também a convergência regional de rendas por decil, buscando averiguar não apenas quais são as classes mais desiguais mas também qual a dinâmica de convergência entre elas.



## Palavras-chave:

Desigualdade regional, convergência, desigualdade de renda; Brasil.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