2-1-1990

Wage Inequality and the Distribution of Education: A Study of the Evolution of Regional Differences in Inequality inMetropolitan Brazil

J. G. A. dos Reis

Ricardo Barros

ECONOMIC GROWTH CENTER

YALE UNIVERSITY

Box 1987, Yale Station
New Haven, Connecticut 06520

CENTER DISCUSSION PAPER NO. 606

WAGE INEQUALITY AND THE DISTRIBUTION OF EDUCATION: A STUDY OF THE EVOLUTION OF REGIONAL DIFFERENCES IN INEQUALITY IN METROPOLITAN BRAZIL

Jose Guilherme Almeida dos Reis
IBGE

Richardo Paes de Barros
Yale University

February 1990

Notes: This research was partially supported by The William and Flora Hewlett Foundation and The Ford Foundation.

Center Discussion Papers are preliminary materials circulated to stimulate discussion and critical comments.

We are very grateful to Paul Glewwe, David Lam, Lauro Ramos, T. Paul Schultz, Duncan Thomas and Simone Wajnman for helpful discussions and comments. Critical comments by Jose Luis Carvalho, James Heckman, and Pedro Valls on earlier versions of this paper were particularly helpful and led to substantial changes. Andre Barbosa, Kevin Kim, and Jaime Pontes provided excellent research assistance.

WAGE INEQUALITY AND THE DISTRIBUTION OF EDUCATION: A STUDY OF THE EVOLUTION OF REGIONAL DIFFERENCES IN INEQUALITY IN METROPOLITAN BRAZIL

ABSTRACT

The paper analyzes the evolution of education and wage inequality in metropolitan Brazil from 1976 to 1986. The study is based on data from ten Brazilian Annual Household Surveys (PNADs) for the period 1976-1986. The universe of analysis was limited to prime-age males. The inequality used was Theil's second measure which is analytically convenient to study the determinants of inequality.

It is shown that education can explain almost 50% of the wage inequality in metropolitan Brazil. Large differences in wage inequality are observed across metropolitan regions, the inequality being higher in poor Northeast metropolitan regions. To identify whether the large regional differences in inequality were directly associated to differences in educational levels or to differences in the steepness of the wage-education profiles some simulations were conducted. The simulation results indicate that wage inequality is much smaller in the South-Southeast metropolitan regions than in the Northeast metropolitan regions not because the South and Southeast regions have higher or better distributed levels of education, but because (perhaps as a consequence of a better distribution of education) the wage-education profile is less steep in these regions than in the Northeast regions.

1-Introduction and Summary

The relationship between education and income inequality during the process of economic development has been greatly illuminated by Langoni(1973a) and other studies of the evolution of the Brazilian income distribution since 1960[1]. There exist, however, certain aspects of the Brazilian experience that remain virtually unexplored. An important but frequently overlooked one is the surprisingly large and temporally stable regional differences in income inequality[2]. Since both the distribution of education and the level of development vary greatly across Brazil, regional differences in inequality, like the temporal variations previously studied, offer an additional opportunity to examine the important relationship between income inequality and educational expansion during the development process[3,4].

To investigate the relationship between education and wage inequality, this paper uses information from household surveys on the nine largest Brazilian metropolitan areas. The study itself is divided into two parts. First, we investigate the relationship between the distribution of education and the <u>level</u> of wage inequality in metropolitan Brazil. Secondly, we investigate the extent to which Brazilian regional <u>differences</u> in wage

---

[1]Besides the seminal work done by Langoni(1973a), other important references include Bacha and Taylor(1981), Castello Branco(1979), Fishlow(1972,1973), and Langoni(1971,1973b,1977). Unfortunately, segments of Langoni's(1973a) ingenious and detailed empirical work are hard to follow due to several typographical errors and arithmetic inconsistencies. These problems have already been noticed by Fishlow(1973) and Bacha and Taylor(1981).

[2]Brazilian regional differences in income inequality have not been as extensively studied as temporal variations. Basic references are Langoni(1973a,ch.7), Lodder(1976), and Mata(1979) that discuss the determinants of these regional differences. Additional references include Barros and Rossi(1987), Rossi(1981), and Ramonaval Costa(1977).

[3]Another possibility, pursued by Castello Branco(1979,Chapter 6), ia to use sectoral differences to investigate the relationship between education and income inequality.

[4]See Ram(1989) for a recent review of the issues related to educational expansion and income inequality in less-developed countries.

inequality can be attributed to regional variations in (i) the distribution of education, (ii) the average wages within educational categories, and (iii) the inequality in wages within educational categories.

Ten Brazilian Annual Household Surveys (PNADs) conducted between 1976 and 1986 constitute the empirical base for this investigation. This information permits us to analyze both temporal and regional variations in wage inequality in Brazil. The objective of this paper, however, is limited to an investigation of regional differences only. The temporal patterns of wage inequality in metropolitan Brazil using this same data set were partially analyzed in Almeida Reis and Barros(1989). The temporal dimension of the data set will be used only to assess the temporal robustness of our findings, i.e., we will conduct separate regional analyses for each year and identify which findings are temporally stable. A description and interpretation of these temporarily stable findings will then follow[5].

To measure inequality Theil's(1967) second measure, or simply Theil-L (see also Anand(1983,app.A)), is utilized. This measure is suitable for two important reasons. First, from an ethical point of view it satisfies the Pigou-Dalton principle of transfers and it is also transfer sensitive as defined by Shorrocks and Foster(1987)[6]. As an analytical tool, its convenience derives from its decomposability. It can be written as a function

---

[5]This is not to say that period specific regional phenomena are not important. For example, how regional differences were affected by the recession years in the beginning of the 1980s has actually attract active discussion (see Jatobá(1989)). In this paper we are only interested in "structural" explanations of regional differences in inequality, hence our requirement of stability over time.

[6]For additional information on the implicit ethical judgments associated to this inequality measure see Blackorby and Donaldson(1978) and Barros and Ramos(1989). Loosely speaking the ethical attractivity of the Theil-L derives from its greater sensitivity to changes in the distribution of wages among the poor.

of just three features of the joint distribution of education and wages: (i) the distribution of education, (ii) the average wages within educational categories, and (iii) the inequality in wages within educational categories. Because of this property, the contribution of each these three factors to variations in the overall wage inequality can be readily identified and this greatly simplifies our study of the relationship between wage inequality and the distribution of education.

This paper is organized into seven sections. Section 2 describes the variables used to measure wage and education; the universe of analysis; Theil's second measure and some of its properties; and the methodology used to decompose both levels of inequality and regional variations in inequality.

Section 3 presents our main findings about wage inequality in metropolitan Brazil. We show that the poorer metropolitan areas located in the Northeast of Brazil tend to exhibit higher levels of inequality. The data also reveals that since 1978, regional differences in inequality in metropolitan Brazil have not been significantly reduced.

In section 4 we assess the overall contribution of education to the level of wage inequality in metropolitan Brazil. We show that education accounts for almost 50% of the inequality in wages.

Changes in wage inequality due to changes in the distribution of education can be decomposed into a direct and an indirect component. Given a change in the distribution of education, the direct component is defined as the change in wage inequality that would be obtained if both the average and the inequality of wages within categories were kept constant. Section 5 estimates the direct effect on the level of wage inequality of marginal educational expansion at each education level. We demonstrate that the direct equalizing impact of an educational expansion is decreasing with the level of

education at which expansion occurs. Thus, expansion at the primary school level tends to reduce inequality whereas expansion at the college level tends to increase wage inequality.

Section 6 estimates the proportions of the regional differences in inequality that can be explained by the three factors mentioned above, namely (i) regional differences in the distribution of education, (ii) regional differences in the relative average wages within educational categories, and (iii) regional differences in the inequality in wages within educational categories. The analysis in this section closely parallels the studies of Knight and Sabot(1983) and Mohan and Sabot(1988). We show that standardizing the distribution of education across regions does not reduce regional differences in inequality. These differences are shown to be mainly attributed to regional differences in the slope of the relationship between average wages and education.

Finally, section 7 briefly summarizes our main findings and describes some promising topics for further research.

2-Basic Concepts and Universe of Analysis

2.1-The Choice of a Distribution

The scope of this paper is limited to the investigation of the relationship between the distribution of prime-age males according to their wages and according to their educational levels.

It is certainly true that from a social welfare perspective it would be much more significant to consider the distribution of all individuals according to a more comprehensive notion of income like total family income per adult equivalent. To conduct an investigation by total family income per adult equivalent would require to consider, both explicitly

and simultaneously, family composition and the process of income generation within the family; a task which is beyond the scope of this paper. Even the analysis of the distribution of individual labor income requires the consideration of family structure since individuals labor force participation decisions are not only a function of their own attributes but also a function of the characteristics of other members in their families.

Wages, on the other hand, are strongly related to individual attributes such as education but only marginally to family structure and composition[7]. Therefore, wage distributions can be studied without making reference to family characteristics, especially for prime-age males. By doing so, we are taking a required first step towards understanding changes in the distribution of welfare.

2.2-Measures Used for Income and Education

Two variables are used in this study: education, E, and a measure for wages, W. Labor earnings are standardized for hours worked to proxy wages. Specifically, W is defined as the monthly labor income a worker would obtain if he worked 48 hours a week, i.e.,

$$W = R \cdot 48/H$$

where R is the monthly labor income he receives from his main job and H is the number of hours per week he usually works on this job. This definition

---

[7]This is particularly true for prime-age males. For certain demographic groups like women, though, wages and family structure may be closely linked. For instance, labor market experience of women is known to depend strongly on their marital status, age of marriage, and number of children. Hence, to the extent that experience is an important determinant of wages, wages and family structure will be closely related for women.

assumes that the average and marginal wages are identical. Since certain individuals working 20 hours or less per week are unlikely to satisfy this assumption, they were eliminated from the analysis[8].

With respect to education, the population is segmented into five categories according to the number of completed years of schooling: (a) none, (b) 1 to 4 years, (c) 5 to 8 years, (d) 9 to 11 years, and (e) more than 11 years.

2.3-The Universe of Analysis

This study is based on ten Brazilian Annual Household Surveys (PNADs) covering the period from 1976 to 1986[9]. We limit the analysis to the nine largest Brazilian metropolitan areas. From North to South they are: Belém, Fortaleza, Recife, Salvador, Belo Horizonte, Rio de Janeiro, São Paulo, Curitiba, and Porto Alegre.

Since wages have several determinants besides education (like gender and age) and education is the only determinant considered in this paper we restrict our analysis to males 25 to 50 years old to reduce the bias due to omitted variables.

In these surveys, as in most surveys, wages are recorded for employed persons only. Hence, the universe of analysis excludes persons who are either out of the labor force or unemployed. We also exclude those working twenty hours or less per week in their main occupation. We have also constrained our universe to workers earning positive wages[10].

---

[8]Less than 1% of the observations in the sample were eliminated due to this requirement. See a complete description of the sampling screening in Section 2.3 below.

[9]There are eleven years but only ten surveys. In 1980 the PNAD was not conducted to avoid overlap with the 1980 Demographic Census.

[10]The reason for considering only workers with positive wages is Theil-L's

Taken together, these restrictions generate a universe of analysis that is around 7.5% of the Brazilian population 10 years old or more and around 25% of the labor force in metropolitan Brazil[11]. Table 1 describes the sample screening. The total sample size is around a quarter of a million. It varies, however, from 300 to 6,000 observations depending on the year and the metropolitan area considered (Table 2).

2.4-Measuring and Decomposing Inequality

2.4.1-Decomposable Inequality Measures

Definition 1: We say that $I=\{I_N: N\geq 1\}$ is an **inequality measure** when for every $N\geq 1$,

(i) I_N is a strictly Schur-convex function from $\mathbb{R}^N_{++}$ into $\mathbb{R}_+$,[12]

(ii) $I_N(x_1,\ldots,x_N)=0$ if and only if $x_1=\ldots=x_N$, and

(iii) I_N is homogeneous of degree zero.

Let $\mathcal{P}^N$ denote the set of all disjoint partitions of $\{1,\ldots,N\}$. Let $X^N=(x_1,\ldots,x_N)\in\mathbb{R}^N_{++}$ be a vector of outcomes and $\mathbb{P}^N=\{\mathcal{P}_1,\ldots,\mathcal{P}_m\}\in\mathcal{P}^N$ a partition of $\{1,\ldots,N\}$ into m groups[13] with $\{X_1,\ldots,X_m\}$ being the corresponding partition of X^N. So, $X_i\in\mathbb{R}^{N_i}_{++}$ where N_i is the number of elements in $\mathcal{P}_i$.

---

inability to handle recipient units with zero wages. In the presence of zero wages the geometric mean is zero and Theil-L is not well-defined. Less than 0.2% of the sample was comprised of zero earners.

Since the objective is to understand the relationship between the distributions of wages and education, we also had to eliminate from our final sample all observations without information on labor-income, hours worked, and educational attainment. Less than 0.5% of the sample was lost due to this kind of missing information (Table 1).

[11] Metropolitan Brazil is defined as the union of the nine metropolitan areas included in this study.

[12] This is equivalent to assume that the measure is symmetric and satisfies the Dalton-Pigou principle of transfers. See Dasgupta, Sen and Starrett(1973).

[13] We assume that each group has at least one element, i.e., $\mathcal{P}_i\neq\emptyset$ for $i=1,\ldots,m$.

Furthermore, let $p_i=N_i/N$, $\bar{x}_i$ be the average outcome in $\mathcal{D}_i$, and

$$Iw_i = I_{N_i}(X_i) \qquad i=1,\ldots,m.$$

Let $p=(p_1,\ldots,p_m)$, $\bar{x}=(\bar{x}_1,\ldots,\bar{x}_m)$, and $Iw=(Iw_1,\ldots,Iw_m)$. Notice that by construction there exist functions[14] f_p, f_x, and f_I such that $p=f_p(\mathbb{P}^N)$, $\bar{x}=f_x(\mathbb{P}^N,X^N)$, and $Iw=f_I(\mathbb{P}^N,X^N)$[15].

Definition 2: An inequality measure I is said to be decomposable when for every $N\geq 1$ and $X^N\in\mathbb{R}^N_{++}$, there exists a function H_I such that for every partition $\mathbb{P}^N\in\mathcal{P}^N$

$$I_N(X^N) = H_I(f_p(\mathbb{P}^N), f_x(\mathbb{P}^N,X^N), f_I(\mathbb{P}^N,X^N)) = H_I(p,\bar{x},Iw).^{16}$$

Note that while the number of arguments in I_N is N, H_I has only $3m$ arguments. Hence, as long as m is much smaller than N, H_I leads to a considerable reduction in the dimension of the empirical analysis. As emphasized by Fields(1979) and Kanbur(1988) decomposable inequality measures are a fundamental analytical tool to study the relationship between wage inequality

---

[14]Formally, the domain of f_p is $\bigcup_{N=1}^{\infty}\mathcal{P}^N$ and the domain of f_x and f_I is $\bigcup_{N=1}^{\infty}(\mathcal{P}^N\times\mathbb{R}^N_{++})$.

[15]Actually, a stronger result holds: $\bar{x}_i$ and Iw_i are functions of $\mathcal{D}_i$ and X_i only.

[16]Formally, the domain of H_I is given by

$$\bigcup_{k=1}^{\infty}[0,1]^k\times\mathbb{R}^k_{++}\times\mathcal{R}(I)^k,$$

where $\mathcal{R}(I)$ is the range of I. H_I is the "aggregator" function. Shorrocks(1984) proves that any continuous and decomposable measure can be written as a continuous and strictly increasing function of a member of the Generalized Entropy family.

and its determinants.

Next, define $r_i=\bar{x}_i/\bar{x}_b$ for a given b, $1\leq b\leq m$, and all $i=1,\ldots,m$. Let $r=(r_1,\ldots,r_m)$. It follows from the homogeneity property of I (condition (iii) in Definition 1) that for all decomposable inequality measures

$$H_I(p,\bar{x},Iw) = H_I(p,r,Iw).$$

So, all decomposable inequality measures can be alternatively written as functions of (p,r,Iw). We refer to r as the relative average wages within groups.

2.4.2-THEIL-L

Throughout this paper we use Theil's(1967) second measure to assess inequality. This measure, L, is defined as the logarithm of the ratio between the arithmetic and geometric means[17], i.e.,

$$L_N(x_1,\ldots,x_N) = \ln\left[\frac{1}{N}\cdot\sum_{i=1}^{N} x_i\right] - \frac{1}{N}\cdot\sum_{i=1}^{N}\ln(x_i).$$

It can be easily shown that L is, in fact, an inequality measure, i.e., it satisfies conditions (i) through (iii) of Definition 1 (see Anand(1983,App.A)). Moreover, L is transfer sensitive as defined by Shorrocks and Foster(1987). This means that L is more sensitive to transfers among individuals in the left tail (i.e. among the poor) than among those in the right tail[18]. Theil's second measure, L, is also decomposable. As a function

---

[17]For Log-Normal distributions, it equals to one half of the variance of the logarithms.

[18]See Barros and Ramos(1989) for a comparative analysis of the properties of

of (p,r,Iw) it can be written as

$$H_L(p,r,Iw) = \ln(p\circ r) - p\circ s + p\circ Iw$$

where $\circ$ denotes inner product and

$$s = (\ln(r_1),\ldots,\ln(r_m)).$$

2.4.3-The Contribution of Education to the Inequality in Wages

We define the contribution of education to the overall inequality in wages as the percentage reduction in inequality that would occur if by proportional transfers from better educated to less educated workers the average wages within all educational groups were equalized, but the inequality within groups were preserved. Formally, let X^N be a vector of wages and $\mathcal{P}^N=\{\mathcal{P}_1,\ldots,\mathcal{P}_m\}$ a partition of $\{1,\ldots,N\}$ in m educational categories. Construct a new vector of wages $Z^N=(z_1,\ldots,z_N)$ from X^N as follows

$$z_h = \frac{\bar{x}\circ x_h}{\bar{x}_i} \qquad \text{for all } h\in\mathcal{P}_i,\ i=1,\ldots,m,$$

where $\bar{x}=p\circ\bar{x}$ is the overall mean. Note that Z^N is a redistribution of the same total as in X^N. This redistribution process has two properties: (i) it preserves the inequality <u>within</u> groups, i.e.,

$$I_{N_i}(Z_i) = I_{N_i}(X_i) \equiv Iw_i$$

---

this inequality measure with those in the Atkinson(1970) and Generalized Entropy (Shorrocks(1980)) families.

but (ii) eliminates all the inequality <u>between</u> groups, since $\bar{z}_i=\bar{x}$ for all $i=1,\ldots,m$. This implies that for Z^N all relative average wages are equal to one, i.e., $f_r(\mathbb{P}^N,Z^N)=e\equiv(1,\ldots,1)$. Hence, the inequality associated with Z^N - when a decomposable inequality measure, I, is used - is given by

$$I_N(Z^N) = H_I(p,e,Iw).$$

Therefore,

$$\Delta_I(\mathbb{P}^N,X^N) = 1 - I_N(Z^N)/I_N(X^N) = 1 - H_I(p,e,Iw)/H_I(p,r,Iw)$$

is a measure of the contribution of education to the wage inequality similar to the R^2 commonly used in log-wage regressions. When the inequality measure is the Theil-L, the expression for Δ_L simplifies to

$$\Delta_L = 1 - p\circ Iw/\ell$$

where

$$\ell = \ln(p\circ r)-p\circ s+p\circ Iw.$$

2.4.4-Direct Effects of Marginal Educational Expansions

The <u>direct</u> marginal effect, on the inequality in wages, of expanding education at level i, m_i, is defined as the percentage change in inequality that would occur if 1% of the overall population currently at educational level i-1, were transferred to the educational level i. The relative average wage and the wage inequality within educational categories

are assumed to remain constant[19]. Formally, for a decomposable measure I, this amounts to computing

$$m_i = \frac{1}{H}\cdot\left\{\frac{\partial H}{\partial p_i} - \frac{\partial H}{\partial p_{i-1}}\right\} \quad \text{for all } i=2,\ldots,m.$$

For the Theil-L, m_i will be given by

$$m_i = \frac{1}{\ell}\cdot(\Delta r_i/\bar{r} - \Delta s_i + \Delta Iw_i)$$

where

$$\Delta x_i = x_i - x_{i-1} \quad \text{for } x=r,s,Iw,$$

$$\bar{r} = p\circ r,$$

and as before

$$\ell = \ln(p\circ r) - p\circ s + p\circ Iw.$$

In general, m_i can be positive or negative. Nonetheless, we now demonstrate that if the wage inequality within groups were the same for all groups and the transfer occur between educational groups with average wages below the overall average then educational expansion reduces inequality in wages. The opposite result holds for transfers between educational groups with average wages above the overall average.

Proposition 1: (i) If $\Delta Iw_i=0$ and $r_{i-1} \leq r_i \leq \bar{r}$ then $m_i \leq 0$;

(ii) If $\Delta Iw_i=0$ and $\bar{r} \leq r_{i-1} \leq r_i$ then $m_i \geq 0$;

---

[19]Notice that we are assuming that relative not absolute average wages remain constant. If different types of labor are perfect substitutes, a movement of workers from category i-1 to category i would increase the economy total endowment of labor measured in efficient units. This is expected to decrease absolute wages but since different types of labor are perfect substitutes their relative wages would remain constant.

Proof: By the concavity of the logarithmic function

$$\ln\left[\frac{r_i}{\bar{r}}\right] \leq \ln\left[\frac{r_j}{\bar{r}}\right] + \frac{\bar{r}}{r_j}\cdot\left\{\frac{r_i}{\bar{r}} - \frac{r_j}{\bar{r}}\right\}.$$

So, as long as $r_i \leq r_j \leq \bar{r}$ we obtain

$$\ln\left[\frac{r_i}{\bar{r}}\right] \leq \ln\left[\frac{r_j}{\bar{r}}\right] + \left\{\frac{r_i}{\bar{r}} - \frac{r_j}{\bar{r}}\right\}$$

Hence, if $r_{i-1} \leq r_i \leq \bar{r}$

$$\Delta r_i \leq \bar{r}.\Delta s_i.$$

This fact together with $\Delta Iw_i = 0$ immediately implies that $m_i \leq 0$. Part (ii) of the proposition is proved analogously.

2.4.5-Decomposing Regional Differences in Wage Inequality

When using decomposable inequality measures the overall inequality can be obtained uniquely from (p,r,Iw). Hence, regional differences in inequality can be to regional differences in the triple (p,r,Iw). In this section we describe a procedure to decompose variations in the overall inequality into components due to variations in p, r, and Iw. Let, a be the number of areas in the study[20] and

$$\mathcal{I} = \{I^1, \ldots, I^a\}$$

where

$$I^g = H_I(p^g, r^g, Iw^g) \qquad \text{for } g=1,\ldots,a$$

and p^g, r^g, and Iw^g are, respectively, the distribution of education, the relative average wages within groups, and the inequality in wages within groups in region g. We measure regional differences in inequality by the

---

[20] In this study $a=9$.

standard deviation, σ. Let b, $1 \le b \le a$ be a region chosen as standard. Define

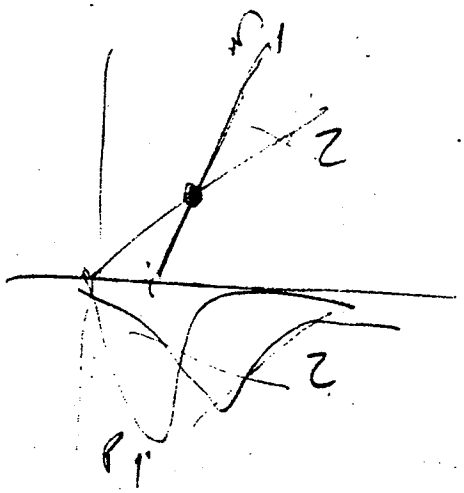
$$Ip^g = H_I(p^b, r^g, Iw^g) \quad \text{for } g=1,\ldots,a$$

$$Ir^g = H_I(p^b, r^b, Iw^g) \quad \text{for } g=1,\ldots,a.$$

and

$$\mathcal{I}p = \{Ip^1,\ldots,Ip^a\}.$$

$$\mathcal{I}r = \{Ir^1,\ldots,Ir^a\}.$$



As a measure of the contribution of variations in the distribution of education we use

$$Cp = \{\sigma(\mathcal{I}) - \sigma(\mathcal{I}p)\}/\sigma(\mathcal{I}).$$

We refer to Cp as the composition effect. Similarly, as a measure of the contribution of variations in relative average wages within groups we use

$$Cr = \{\sigma(\mathcal{I}p) - \sigma(\mathcal{I}r)\}/\sigma(\mathcal{I}).$$

We refer to Cr as the compression effect. Finally, as a measure of the contribution of variations in wage inequality within groups we use

$$CIw = \sigma(\mathcal{I}r)/\sigma(\mathcal{I}).$$

By construction, (i) $Cp+Cr+CIw=1$, (ii) $Cp=0$ if $p^g=p^b$ for all $g=1,\ldots,a$, (ii) $Cr=0$ if $r^g=r^b$ for all $g=1,\ldots,a$, and (iv) $CIw=0$ if $Iw^g=Iw^b$ for all $g=1,\ldots,a$.

3-Inequality in Wages in Metropolitan Brazil: Basic Facts

The level and regional variations in wage inequality for metropolitan Brazil are presented in Table 3 and Figures 1 and 2. Based on this information two empirical regularities can be readily identified.

First, Figure 2 reveals that wage inequality is much higher in labor markets located in the poorer and less-developed North and Northeast regions (Fortaleza, Recife and Bélem) than in labor markets located in the more developed South (São Paulo, Curitiba and Porto Alegre). The remaining areas (Salvador, Belo Horizonte, and Rio de Janeiro) lie between these two groups in all respects. They have intermediate levels of income, development, and inequality[21]. Hence, at least in metropolitan Brazil, inequality seems to be inversely related to the level of income and development[22]. This ranking of Brazilian metropolitan areas by levels of wage inequality is essentially identical to the one obtained by Lodder(1976,Table II.4). Salvador is an exception. In our study this area belongs to the intermediated group (Salvador, Belo Horizonte, and Rio de Janeiro), whereas in Lodder(1976) Salvador is the area with the highest level of inequality[23].

Secondly, Figure 3 shows significant reductions in regional

---

[21] They are also geographically located between the other two groups.

[22] These results are very robust to the choice of inequality measure. The exception is the relative rank improvement of Belem when the coefficient of variation is used. See Tables A1.1, A1.2, and A1.3 in Appendix.

[23] Lodder study is based on the 1970 Demographic Census. Using the Gini coefficient, Lodder(1976) and our results can be compared as follows:

Study	*Belém*	*Fortaleza*	*Recife*	*Salvador*	*Belo Horizonte*	*Rio de Janeiro*	*São Paulo*	*Curitiba*	*Porto Alegre*
Lodder	.56	.59	.58	.59	.55	.54	.54	.51	.52
This	.56	.59	.58	.55	.55	.54	.50	.51	.52

Sources: Lodder(1976,Table II.4) and Table A.2 in appendix.

differences in inequality up to 1978. From 1978 to 1984 this trend has been rather slow. In 1985 regional differences in inequality undergo a sharp increase. It is unknown however which fraction of these changes does not only indicate changes in the quality of the data over time. In the 1970s, the sample was much more concentrated in Rio de Janeiro and São Paulo than after 1981. Table 2 shows that, for 1976, 68.7% of the sample comes from these two metropolitan areas whereas from 1981 on these two areas account for less than 36% of the sample. Since a poorly balanced sample would increase the variance of the estimators across metropolitan areas, it is likely that part of the variations in regional differences in inequality reported in Table 3 only reflect changes in the sampling scheme. Note, however, that in 1978 the sample is more balanced than in 1979 but the regional differences in inequality are larger in 1978.

In section 6 we investigate the extent to which these two empirical regularities can be explained by concomitant regional variations in the distribution of education, **p**, and the relative average wages within educational categories, **r**. Before addressing this question, however, we estimate the overall contribution of education (Section 4) and the direct impact of marginal changes in the distribution of education (Section 5) upon the level of the inequality in wages.

4-The Contribution of Education to Overall Wage Inequality

The existence of a close relationship between wages and education in developing countries is a well established empirical regularity. Numerous studies conducted in several of these countries have identified education as being the most important determinant of income inequality. (See, for instance, Fields(1980, table 4.9) and Altimir and Piñera(1977)). In Brazil

this close relationship between education and income inequality has been confirmed in numerous studies following upon the research of Fishlow(1972) and Langoni(1973). Examples are Velloso(1975), Senna(1976), Castello Branco(1979), Medeiros(1982), Ferreira da Silva(1987), and Lam and Levison(1987,1989).

The relationship between education and wage inequality is stronger in developing than in developed countries. This fact is due to two factors. First, wage differentials by educational level are much greater in developing than in developed countries (Psacharopoulos(1981,1985)) and secondly, education is itself much more unequally distributed in developing countries (see, for example, Lam and Levison(1987) comparison between Brazil and United States).

In this section we verify whether in our universe of analysis education has the same large explanatory power as found in other studies. To estimate the contribution of education to overall wage inequality we use the procedure described in Section 2.4.3. The results can be found in Table 4. Table 4 reveals that, holding constant the distribution of education and the wage inequality within educational categories, the overall wage inequality would be reduced by almost 50% if differences in average wages across educational categories were eliminated.

The contribution of education to wage inequality does vary considerably across areas. It tends to be positively correlated with the level of wage inequality and negatively correlated with the level of development. It is higher in the least developed metropolitan areas located in the Northeast (Fortaleza and Recife), precisely where inequality is the greatest. In São Paulo, Curitiba, and Porto Alegre where wage inequality is smaller, the contribution of education to inequality is also smaller. Belém

is an exception. This area has the third highest level of inequality among all areas analyzed in this study but the smallest contribution of education to inequality.

That education can explain almost 50% of the inequality in wages in metropolitan Brazil is certainly an astonishing result. This result holds up when other measures of inequality are used. Table A2, in the appendix, reveals that very similar results are also obtained using Theil's(1967) first inequality measure[24]. Moreover, similar results are obtained by fitting "human capital" log-wage equations (Velloso(1975) obtains R^2=.50; Senna(1976,Table 1) obtains R^2=.34; Castello Branco(1979,Table 9) obtains R^2=.39 and R^2=.40; Medeiros(1982,Table 4.2) obtains R^2=.45; Ferreira da Silva(1987,Table 4.1,Regression 2) obtains R^2=.38; and Lam and Levison(1989,Table 2) obtains R^2 varying from .37 to .48 depending on the age group is considered)[25].

5-Direct Effects of Marginal Educational Expansion

Educational expansion can have very different direct impacts on wage inequality depending on its nature. For instance, if wage inequality

---

[24]This measure is also decomposable. In this case Δ_T can be obtain via

$$\Delta_T = 1 - p \circ Tw/t,$$

where t denotes the overall Theil and Tw is the vector with the Theils within educational categories. (see Anand(1983)).

[25]Velloso uses the 1970 Demographic Census. His regressions include age and months worked. Education accounts for almost 80% of the explained log-variance.
Senna uses data from the "2/3 Law" for 1970. This data covers only the formal sector.
Castello Branco also uses data from the "2/3 law", but for 1969 and 1973. His regression includes experience in the labor market.
Medeiros's wage equation includes experience in the labor market and a migration dummy. Education accounts for more than 80% of the explained variance. He uses the 1973 PNAD.
Ferreira da Silva uses information from RAIS-1977. His regression includes experience in the labor market and tenure.
Lam and Levison's results are based on PNAD-1985.

within groups does not vary too much by educational level, an expansion at the primary education level would leads to less inequality whereas an expansion at the college level would lead to more inequality. (See Proposition 1 in Section 2.4.4).

In this section we estimate the direct impact on wage inequality of marginal educational expansions at different educational levels. Using the procedure described in Section 2.4.4, we estimate for each educational level by how much, in percentage terms, inequality would increase if 1% of the overall population currently at educational level i-1 were transferred to educational level i. The results are reported in Tables 5a-d and summarized in Figure 3.[26]

Figure 3 clearly demonstrates that the contribution of an educational expansion to reduce wage inequality is monotonically decreasing with the education level at which the expansion occurred. If we take 1% of the overall population from those currently without any formal schooling and permit them to pursue basic primary education (1 to 4 years of schooling), wage inequality will be reduced by 0.3%. On the other hand, if we take the same number of workers (i.e., 1% of the overall population) among those currently with high-school education and permit them to pursue college education, wage inequality will increase by 1.4%. Hence, as far as wage inequality is concerned, priority should be placed at primary education.

Langoni(1973a,Table 4.4) performed related simulations and obtained similar results. For instance, he found that while the large reduction (9%) in illiterates in the labor force during the 1960s[27] led to an increase in

---

[26]As in all other sections, the estimation is done for each year and metropolitan area separately. Figure 3 presents unweighted averages across all years and metropolitan areas.

[27]The proportion of illiterates felt from 39% in 1960 to 30% in 1970.

income inequality of 1.3%, the small increase (1%) in the fraction with college education[28], during this same period, led to an increase in inequality of 4.4%.

We should remember, however, that we are only discussing the direct effect of an educational expansion. Hence, if an expansion in college education were to lead to a large reduction in wages of college educated workers relative to the wages of less educated workers, it is possible that this expansion in college education may lead, in the end, to an overall reduction in wage inequality.

6-Decomposing Regional Differences in Inequality: Composition and Compression Effects

In section 3 we demonstrated the existence of large regional differences in inequality and the lack of a definitive tendency for these regional differences to disappear over time. It remains to be investigated to what extent these regional differences in inequality can be explained by concomitant regional differences in (i) the distribution of education, (ii) the relative average wages within groups, and (iii) the wage inequality within groups.

In this section, we accomplish this goal by estimating for all years from 1976 to 1986 the composition and the compression effects using the procedure introduced in section 2.4.5. This involves a two-step simulation procedure. First, we standardize the distribution of education, p, and so estimate to what extent regional differences in inequality can be directly explained by differences in the distribution of education; the so-called

---

[28]The proportion of the Brazilian labor force with complete or incomplete college education increased from 1.4% in 1960 to 2.5% in 1970.

composition effect. Secondly, we standardize the relative average wages within groups, r, to estimate the indirect effect that changes in the distribution of education may have upon wage inequality through their impact on average wage differentials across educational levels; the so-called compression effect.

Table 6 and Figure 4 present our estimates for the composition and compression effects. For each year, the distribution of education and the relative average wages within groups for Rio de Janeiro were used as the standard[29].

6.1-Composition Effects

Table 6 and Figure 4 demonstrate that standardizing the distribution of education increases rather than reduces regional differences in wage inequality. Therefore, it is not correct to say, for example, that a reason for smaller wage inequality in the South and Southeast metropolitan areas than in the North and Northeast areas is simply a better distribution of education in the South and Southeast areas. In fact, when the distribution of education is standardized the wage inequality in the North and Northeast metropolitan areas increases whereas in the South and Southeast areas the inequality actually decreases, see Table A.6.1 in the Appendix.

6.2-Compression Effects

The results for the compression effect in Table 6 and Figure 4 demonstrate that regional differences in relative average wages within educational categories explain more than 50% of the regional differences in wage inequality. Hence, South and Southeast metropolitan areas have lower

---

[29]Notice that the standardization is done year by year. For each year, the parameters for Rio de Janeiro for that particular year are used as the standard. Rio de Janeiro was chosen as the reference because it is the metropolitan area with the better educated labor force (Tables A.3.1 to A.3.5 in the Appendix).

wage inequality as compared to North and Northeast areas not because of their higher levels of education or because of a better distribution of education per se. The higher wage inequality in the North and Northeast areas is due to a steeper relationship between wage and education, which may certainly be a consequence of a supply shortage of well-educated workers in these areas.

7-Conclusions

This paper analyzes the evolution of the relationship between education and wage inequality in metropolitan Brazil from 1976 to 1986. The study is based on data from ten Brazilian Annual Household Surveys (PNADs) which are available for the period 1976-1986. The universe of analysis was limited to occupied prime-age males. The inequality used was Theil's second measure which is analytically convenient to study the determinants of inequality.

It was shown that education can explain almost 50% of the wage inequality in metropolitan Brazil. This explanatory power is decreasing over time and varies considerably across regions. It tends to be larger in the poor metropolitan regions in the Northeast.

From 1976 to 1985 the wage differentials by educational groups were large and stable. Since this was not a period of fast growth, the evidence of large and stable wage differentials is an evidence against Langoni's hypothesis that Brazilian large wage differentials were due to a very fast growth of the demand for high-skilled labor that would be reduce when this growth slows down. It is important though to observe that despite large wage differentials the average level of education remains stable over the decade.

Large differences in wage inequality are observed across metropolitan regions. The inequality being higher in the poor Northeast metropolitan regions. A decomposition analysis reveals that a large portion

of these differences can be explained by concomitant differences in education. The regions with more inequality are also those with lower levels of education and larger wage differences among educational groups.

To identify whether the large regional differences in inequality were directly associated to differences in educational levels or to differences in the steepness of the wage-education profiles some simulations were conducted. The results indicates that regional differences in the distribution of education are not able to explain much of the differences in wage-inequality. As a matter of fact the differences in wage-inequality are intrinsically associated to differences in the steepness of the wage-education profiles. It has been shown that wage inequality is much smaller in the South-Southeast metropolitan regions than in the Northeast metropolitan regions not because South and Southeast regions have higher or better distributed levels of education, but because (perhaps as a consequence of a better distribution of education) the wage-education profile is less steeper in these regions than in Northeast regions. Therefore a profound understanding of the relationship between the steepness of the wage-education profile and the distribution of education is essential to the design of educational policies with redistributive goals. A study of this relationship is certainly a important topic for further research.

References

Almeida Reis, J. G. and R. Barros (1989) "Educação e Desigualdade de Salários", in Perspectivas da Economia Brasileira - 1989, Chapter 10, Rio de Janeiro: IPEA/INPES.

Altimir, O. and S. Piñera (1977) "Decomposition Analysis of the Inequality of Earnings in Latin American Countries", CEPAL, mimeo.

Anand, S. (1983) Inequality and Poverty in Malaysia: Measurement and Decomposition, Oxford University Press.

Atkinson, A. (1970) "On the Measurement of Inequality", Journal of Economic Theory, 5, 244-263.

Bacha, E. and L. Taylor (1980) "Brazilian Income Distribution in the 1960s: "Facts", Model Results and the Controversy", (ed.), L. Taylor et alli, Models of Growth and Distribution for Brazil, New York: Oxford University Press.

Barros, R. and J. Rossi (1987) "Aspectos da Distribuição de Renda Pessoal no Brasil com Base nos Dados da PNAD/1985", Rio de Janeiro: IPEA/INPES, mimeo.

Barros, R. and L. Ramos (1989) "Medidas de Desigualdade", in Terceira Escola de Séries Temporais e Econometria. ABE/SBE.

Blackorby, C. and D. Donaldson (1978) "Measures of Relative Equality and their Meaning in Terms of Social Welfare", Journal of Economic Theory, 18:??, 59-80.

Castello Branco, R. (1979) Crescimento Acelerado e o Mercado de Trabalho: A Experiência Brasileira, Rio de Janeiro: Editora da Fundação Getúlio Vargas.

Dasgupta, P, A. Sen, and D. Starrett (1973) "Notes on the Measurement of Inequality", Journal of Economic Theory, 6:?, 180-187.

Ferreira da Silva, J. (1987) Diferenciação Salarial na Indústria Brasileira, Rio de Janeiro: Editora da Fundação Getúlio Vargas, Série Teses No. 14.

Fields, G. (1979) "Decomposing LDC Inequality", Oxford Bulletin of Economics and Statistics, 437-459.

_____ (1980) Poverty, Inequality, and Development, Cambridge: Cambridge University Press.

Fishlow, A. (1972) "Brazilian Size Distribution of Income", American Economic Review, 62:2, 391-410.

_____ (1973) "Distribuição de Renda no Brasil - Um novo Exame", Revista Dados, 11:?, 10-80.

Jatobá, J. (1989) "A Dimensão Regional da Pobreza Urbana e os Mercados de Trabalho: O Caso Brasileiro, 1970/83", in G. Sedlacek and R. Barros, (eds.) Mercado de Trabalho e Distribuição de Renda: Uma Coletânea, Rio de Janeiro: IPEA/INPES, Serie Monográfica No. 35.

Kanbur, R. (1984) "The Measurement and Decomposition of Inequality and Poverty" in F. van der Ploeg (ed.) Mathematical Methods in Economics, Academic Press.

Knight, F. and R. Sabot (1983) "Educational Expansion and the Kuznets Effect", American Economic Review, 73:5, 1132-1136.

Lam, D. and D. Levison (1987) "Age, Experience, and Schooling: Decomposing Earnings Inequality in the U.S. and Brazil", Population Studies Center, University of Michigan.

_____ (1989) "Declining Inequality in Schooling in Brazil and Its Effects on Inequality in Earnings", mimeo.

Langoni, C.G. (1971) " Study in Economic Growth: The Brazilian Case", Unpublished Ph.D. Dissertation, University of Chicago.

_____ (1973a) Distribuição de Renda e Desenvolvimento Econômico do

Brazil, Rio de Janeiro: Editora Expressão e Cultura.

_____ (1973b) "Distribuição da Renda: Resumo da Evidência", Revista Dados, 11:??, 81-121.

_____ (1977) "Income Distribution and Economic Development: The Brazilian Case", in Intriligator, M. (ed.) Frontiers of Quantitative Economics, Vol B, Amsterdam: North HollandPublishing Company.

Lodder, C. (1976) Distribuição de Renda nas Áreas Metropolitanas, Rio de Janeiro: IPEA/INPES, Relatório de Pesquisa No. 31.

Mata, M. (1979) Concentração de Renda, Desemprego e Pobreza no Brasil: Análise de uma Amostra de Municípios em 1970, Rio de Janeiro: IPEA/INPES, Relatório de Pesquisa No. 41.

Medeiros, J. (1982) Alcance e Limitações da Teoria do Capital Humano: Diferenças de Ganhos no Brasil em 1973, São Paulo: IPE/USP, Ensaios Econômicos No. 17.

Mohan, A. and R. Sabot (1988) "Educational Expansion and the Inequality of Pay: Colombia 1973/78", Oxford Bulletin of Economics and Statistics, 50:2, ?????

Psacharopoulos, G. (1981) "Returns to Education: An Updated International Comparison", Comparative Education Review, 17:??, ????.

_____ (1985) "Returns to Education: A Further International Updated and Implications", Journal of Human Resources, 20:??, ???.

Ram, R. (1989) "Can Educational Expansion Reduce Income Inequality in Less-Developed Countries?", Economics of Education Review, 8:2, 185-195.

Ramonaval Costa, A. (1977) Distribuição de Renda Pessoal no Brasil em 1970: Uma Análise Cross-Section da Distribuição de Renda por Ocupação, Rio de Janeiro: IBGE

Rossi, J. (1981) "Income Distribution in Brazil: A regional Approach", Journal of Development Economics, 17:2, ????.

Senna, J. (1976) "Escolaridade, Experiência no Trabalho, e Salários no Brasil", Revista Brasileira de Economia, 30:2, 163-93.

Shorrocks, A. (1980) "The Class of Additively Decomposable Inequality Measures", Econometrica, 48:3, 613-25.

_____ and J. Foster (1987) "Transfer Sensitive Inequality Measures", Review of Economic Studies, 54:?, 485-497.

Theil, H. (1967) Economics and Information Theory, Amsterdam: North Holland Publishing Company.

Velloso, J. (1975) "Human Capital and Market Segmentation: An Analysis of the Distribution of Earnings in Brazil", Unpublished Ph.D. Dissertation, Stanford University.

Table 1

Sample Screening

Additional Constraint	Sample Size	Marginal Percentage Reduction
Males	1,688,541	----
Metropolitan Area	582,976	65.5
25 ≤ Age ≤ 50	250,621	57.0
Economically Active	236,925	5.5
Known Education	236,088	0.4
Occupied	228,767	3.1
Known Income	227,611	0.5
Positive Income	227,240	0.2
Known Hours	226,917	0.1
Hours > 20	225,610	0.6

TABLE 2
SAMPLE SIZE

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	TOTAL
BELEM	754	886	1829	1068	1794	2010	1987	2178	2313	1236	16055
FORTALEZA	337	596	1153	483	1733	1905	1955	2055	2116	1149	13482
RECIFE	651	2066	2105	785	2268	2425	2419	2440	2494	1247	18700
SALVADOR	503	793	1568	623	2018	1955	2009	2405	2496	1213	15583
BELO HORIZONTE	1041	2413	2376	1496	3261	3551	3498	3756	3857	2037	27286
RIO DE JANERIO	5346	5667	5819	5796	4344	4499	4491	4472	4634	2341	47409
SAO PAULO	4273	5029	5214	5205	4572	4890	4887	5235	5265	2758	47328
CURITIBA	328	401	1188	528	1926	2048	2022	2156	2328	1190	14115
PORTO ALEGRE	768	2260	2463	950	3161	3470	3461	3484	3604	1831	25452
TOTAL	14001	20111	23715	16934	25077	26753	26729	28181	29107	15002	225610

TABLE 3
INCOME INEQUALITY
THEIL-L

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	0.660	0.651	0.516	0.546	0.464	0.504	0.482	0.497	0.544	0.505	0.537	0.064
FORTALEZA	0.573	0.592	0.593	0.565	0.595	0.535	0.551	0.558	0.632	0.624	0.582	0.030
RECIFE	0.589	0.622	0.631	0.540	0.518	0.522	0.534	0.539	0.609	0.539	0.564	0.041
SALVADOR	0.646	0.446	0.489	0.476	0.480	0.507	0.557	0.545	0.546	0.563	0.526	0.055
BELO HORIZONTE	0.598	0.511	0.464	0.482	0.470	0.482	0.529	0.527	0.535	0.596	0.519	0.046
RIO DE JANEIRO	0.573	0.530	0.483	0.513	0.478	0.476	0.492	0.506	0.549	0.515	0.511	0.030
SAO PAULO	0.455	0.419	0.432	0.405	0.389	0.387	0.411	0.444	0.431	0.440	0.421	0.022
CURITIBA	0.398	0.447	0.473	0.453	0.414	0.448	0.436	0.470	0.478	0.479	0.450	0.026
PORTO ALEGRE	0.488	0.433	0.472	0.455	0.423	0.451	0.454	0.479	0.514	0.460	0.463	0.025
MEAN	0.553	0.517	0.506	0.493	0.470	0.479	0.494	0.507	0.538	0.525	0.508	0.025
STD	0.083	0.083	0.061	0.049	0.058	0.043	0.050	0.036	0.057	0.058	0.050	

TABLE 4

CONTRIBUTION OF EDUCATION
TO OVERALL WAGE INEQUALITY
(THEIL-L)

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	40.6	40.0	40.1	38.0	41.0	42.2	37.3	36.5	39.5	37.0	39.2	1.8
FORTALEZA	52.6	50.6	44.2	52.0	52.4	55.6	53.0	54.9	54.3	50.2	52.0	3.1
RECIFE	54.1	54.6	51.3	50.4	48.6	56.4	51.2	53.9	48.4	50.1	51.9	2.6
SALVADOR	57.4	44.7	42.9	40.8	47.9	51.4	48.5	53.8	48.4	43.7	47.9	4.9
BELO HORIZONTE	26.1	51.8	50.6	50.9	51.2	51.7	51.2	46.9	45.8	45.7	47.2	7.4
RIO DE JANEIRO	40.8	47.8	47.0	48.1	51.1	52.5	48.2	47.6	48.2	46.1	47.7	2.9
SAO PAULO	47.9	43.9	47.2	46.7	44.9	45.3	43.2	45.8	46.0	42.8	45.4	1.6
CURITIBA	46.2	58.5	44.0	45.4	45.6	47.5	46.5	47.4	42.8	36.2	46.0	5.2
PORTO ALEGRE	37.9	44.0	44.1	50.7	47.8	47.7	47.2	43.0	46.5	39.2	44.8	3.8
MEAN	44.8	48.4	45.7	47.0	47.8	50.0	47.4	47.8	46.7	43.4	46.9	1.8
STD	9.1	5.6	3.4	4.6	3.4	4.4	4.5	5.6	3.9	4.9	3.6	

TABLE 5a

THE DIRECT EFFECT OF A MARGINAL EXPANSION IN PRIMARY EDUCATION (1 TO 4 YEARS OF SCHOOLING)

(m_2)

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	-0.191	-0.178	-0.141	-0.093	-0.270	-0.075	-0.118	-0.175	-0.045	-0.138	-0.142	0.062
FORTALEZA	-0.071	-0.332	-0.220	-0.078	-0.279	-0.202	-0.235	-0.184	-0.206	-0.278	-0.209	0.079
RECIFE	-0.219	-0.319	-0.217	-0.334	-0.279	-0.303	-0.295	-0.237	-0.289	-0.215	-0.271	0.043
SALVADOR	-0.557	0.005	-0.319	-0.166	-0.277	-0.371	-0.254	-0.224	-0.350	-0.229	-0.274	0.139
BELO HORIZONTE	-0.094	-0.506	-0.427	-0.338	-0.475	-0.430	-0.489	-0.498	-0.437	-0.340	-0.403	0.118
RIO DE JANEIRO	-0.350	-0.248	-0.275	-0.210	-0.378	-0.256	-0.343	-0.348	-0.364	-0.239	-0.301	0.058
SAO PAULO	-0.488	-0.441	-0.458	-0.511	-0.488	-0.430	-0.442	-0.526	-0.497	-0.506	-0.479	0.032
CURITIBA	-0.836	-0.523	-0.468	-0.386	-0.466	-0.504	-0.428	-0.537	-0.424	-0.296	-0.487	0.134
PORTO ALEGRE	-0.263	-0.265	-0.263	-0.244	-0.322	-0.346	-0.238	-0.362	-0.454	-0.357	-0.311	0.066
MEAN	-0.341	-0.312	-0.310	-0.262	-0.359	-0.324	-0.316	-0.343	-0.341	-0.289	-0.320	0.027
STD	0.233	0.158	0.110	0.134	0.089	0.124	0.113	0.139	0.134	0.099	0.110	

TABLE 5b

THE DIRECT EFFECT OF A MARGINAL EXPANSION IN SECONDARY EDUCATION (5 TO 8 YEARS OF SCHOOLING)

(m_3)

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	-0.105	-0.247	-0.138	-0.237	-0.104	-0.186	-0.184	0.000	-0.202	-0.186	-0.159	0.070
FORTALEZA	-0.260	-0.115	-0.302	-0.193	-0.158	-0.221	-0.178	-0.159	-0.191	-0.143	-0.192	0.053
RECIFE	-0.268	-0.131	-0.162	-0.121	-0.024	-0.072	-0.134	-0.194	-0.144	-0.221	-0.147	0.067
SALVADOR	-0.385	-0.324	-0.256	-0.163	-0.288	-0.273	-0.291	-0.284	-0.212	-0.230	-0.271	0.058
BELO HORIZONTE	0.004	-0.012	-0.192	-0.282	-0.157	-0.247	-0.233	-0.225	-0.223	-0.203	-0.177	0.092
RIO DE JANEIRO	-0.177	-0.194	-0.173	-0.170	-0.277	-0.303	-0.271	-0.320	-0.270	-0.257	-0.241	0.054
SAO PAULO	-0.043	-0.139	-0.143	-0.230	-0.183	-0.188	-0.139	-0.214	-0.171	-0.236	-0.169	0.054
CURITIBA	-0.383	-0.264	-0.396	-0.389	-0.080	-0.185	-0.168	-0.207	-0.128	-0.397	-0.260	0.117
PORTO ALEGRE	-0.094	-0.272	-0.264	-0.363	-0.250	-0.165	-0.235	-0.210	-0.254	-0.245	-0.235	0.067
MEAN	-0.190	-0.189	-0.225	-0.239	-0.169	-0.204	-0.204	-0.201	-0.200	-0.235	-0.206	0.021
STD	0.134	0.092	0.081	0.086	0.086	0.064	0.053	0.085	0.044	0.066	0.044	

TABLE 5c

THE DIRECT EFFECT OF A MARGINAL EXPANSION IN HIGH SCHOOL EDUCATION (9 TO 11 YEARS OF SCHOOLING)

(m_4)

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	0.263	-0.158	-0.035	-0.027	0.018	0.250	0.192	0.063	-0.073	-0.001	0.049	0.134
FORTALEZA	0.382	0.469	0.478	0.603	0.307	0.304	0.308	0.101	0.230	-0.060	0.312	0.182
RECIFE	0.180	0.330	0.657	0.359	-0.032	0.128	0.244	0.120	0.153	-0.054	0.209	0.196
SALVADOR	-0.125	0.482	0.156	-0.013	-0.101	0.154	0.022	-0.095	0.028	-0.121	0.039	0.178
BELO HORIZONTE	-0.357	-0.083	0.351	0.085	0.097	0.073	0.093	0.050	-0.020	-0.065	0.022	0.170
RIO DE JANEIRO	0.022	0.208	0.212	0.103	-0.002	0.059	0.040	-0.042	-0.047	-0.146	0.041	0.106
SAO PAULO	-0.005	0.408	0.215	0.248	0.352	0.042	0.150	0.132	-0.002	-0.074	0.147	0.152
CURITIBA	-0.134	-0.157	0.207	0.142	0.210	-0.040	0.094	-0.081	-0.102	0.217	0.036	0.145
PORTO ALEGRE	-0.341	0.198	0.014	0.025	0.122	-0.009	-0.084	-0.007	0.008	0.169	0.010	0.144
MEAN	-0.013	0.189	0.251	0.170	0.108	0.107	0.118	0.027	0.019	-0.015	0.096	0.086
STD	0.241	0.246	0.205	0.193	0.147	0.108	0.114	0.081	0.101	0.118	0.098	

TABLE 5d

THE DIRECT EFFECT OF A MARGINAL EXPANSION IN COLLEGE EDUCATION (MORE THAN 11 YEARS OF SCHOOLING)

(m_5)

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	0.701	1.205	1.774	1.360	1.713	0.924	0.933	1.274	1.290	1.262	1.244	0.318
FORTALEZA	2.038	1.512	1.102	1.169	1.722	2.120	1.763	1.727	1.782	2.157	1.709	0.344
RECIFE	1.542	1.517	1.284	1.714	2.010	2.385	2.074	1.945	1.946	2.310	1.873	0.336
SALVADOR	1.639	2.690	2.092	1.052	1.559	1.483	1.708	1.620	1.276	1.355	1.647	0.436
BELO HORIZONTE	0.967	1.927	1.702	1.740	1.747	1.761	1.532	1.227	1.345	1.583	1.553	0.278
RIO DE JANEIRO	1.722	1.902	1.554	1.633	1.706	1.531	1.290	1.463	1.398	1.326	1.553	0.183
SAO PAULO	1.820	1.354	1.517	1.639	1.236	1.535	1.181	1.396	1.426	1.676	1.478	0.189
CURITIBA	1.379	1.168	1.000	1.322	0.977	1.425	1.002	1.151	0.992	0.575	1.099	0.237
PORTO ALEGRE	0.863	1.129	1.103	1.230	1.233	1.294	1.274	0.945	1.127	0.853	1.105	0.157
MEAN	1.408	1.601	1.459	1.429	1.545	1.606	1.417	1.416	1.398	1.455	1.473	0.076
STD	0.438	0.474	0.344	0.242	0.309	0.410	0.357	0.292	0.282	0.526	0.255	

Table 6

The Composition and Compression Effects

Year	Composition	Compression
1976	-.108	.253
1977	-.000	.398
1978	-.049	.492
1979	-.224	.469
1981	-.069	.621
1982	-.279	.860
1983	-.200	.800
1984	-.278	.778
1985	-.193	.719
1986	-.172	.690

Wage Inequality by Metropolitan Area

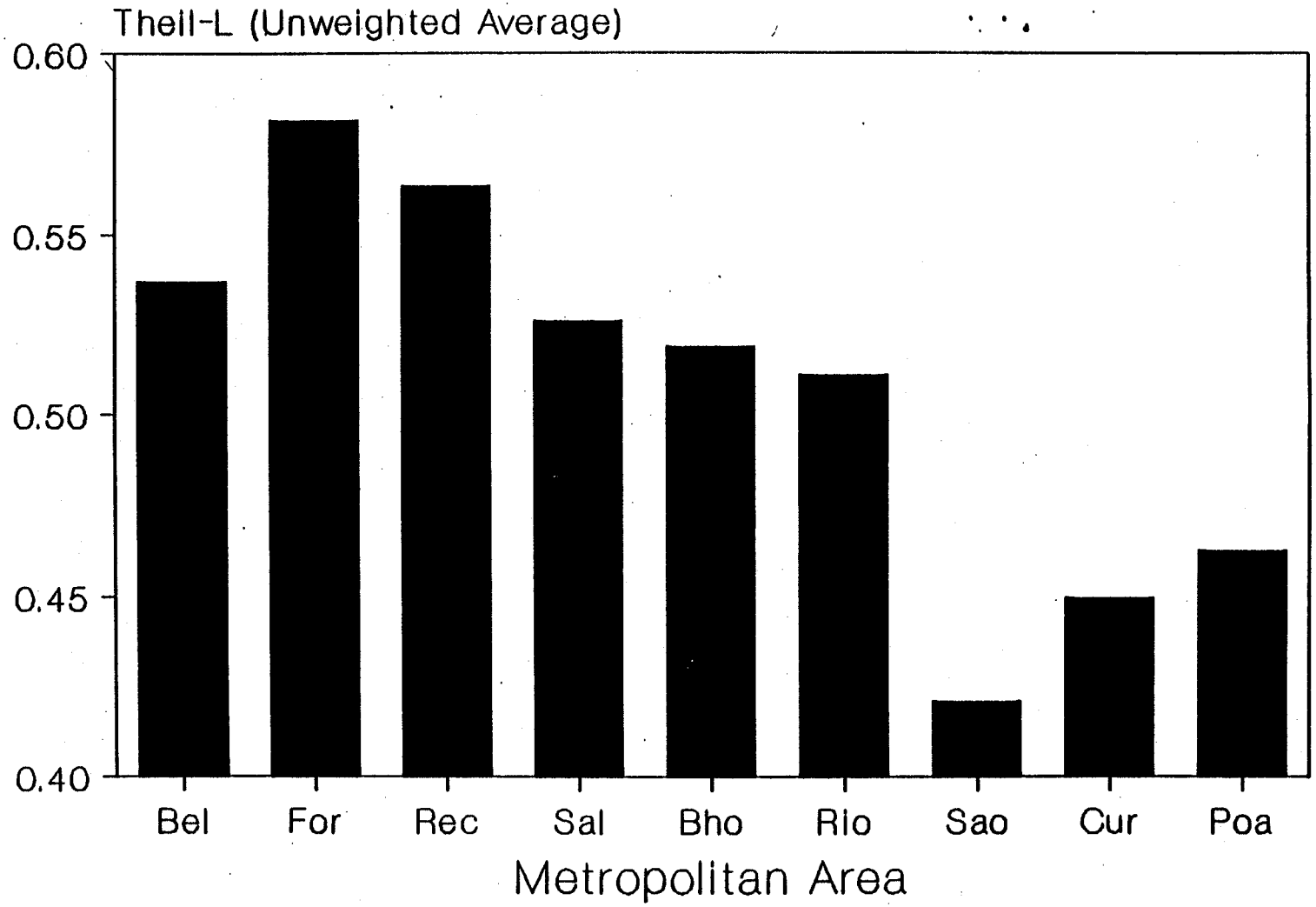


Figure 1

The Evolution of Regional Differences in Wage Inequality

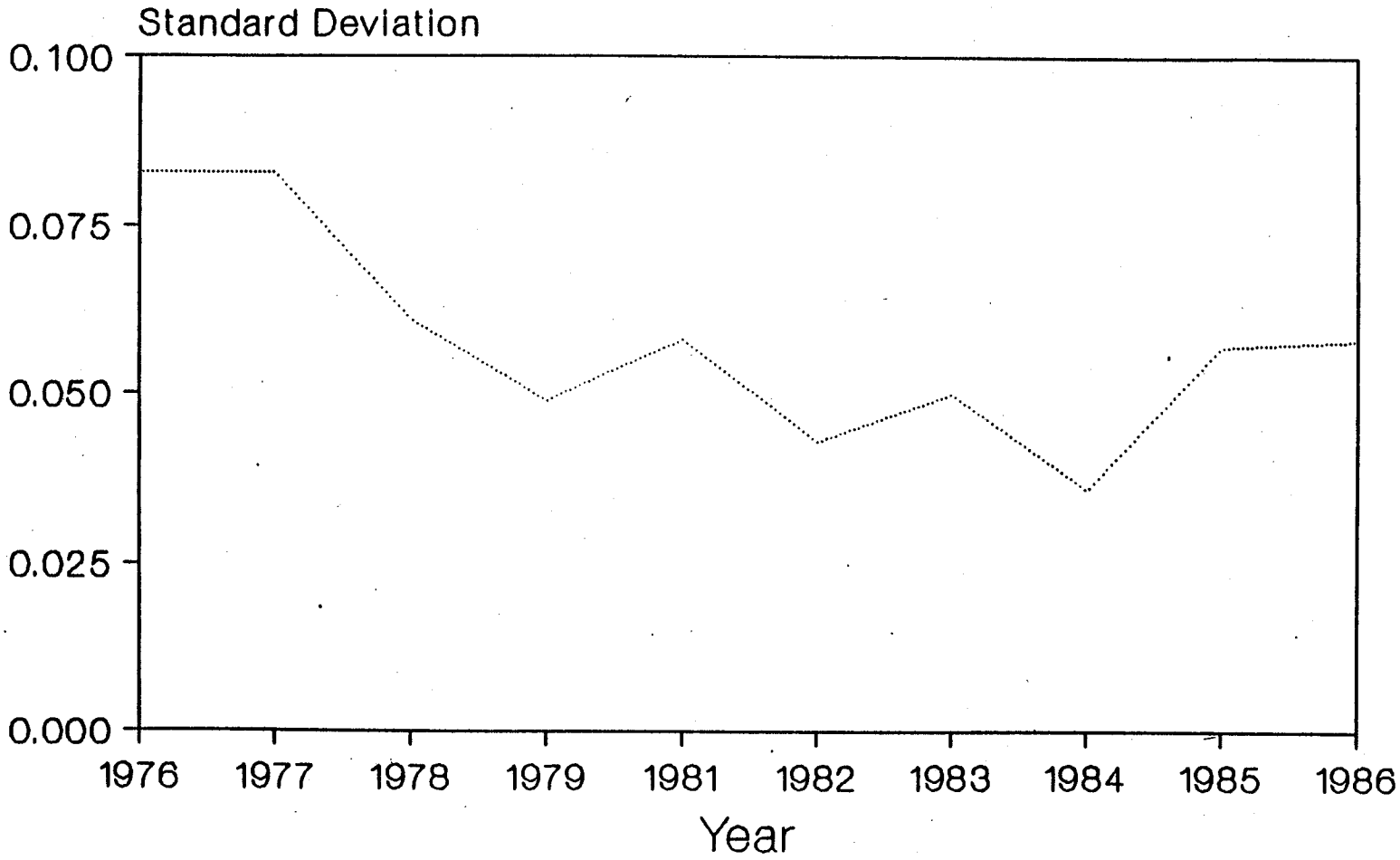


Figure 2

Redistributive Impact of Marginal Expansion on Education by Grade Level

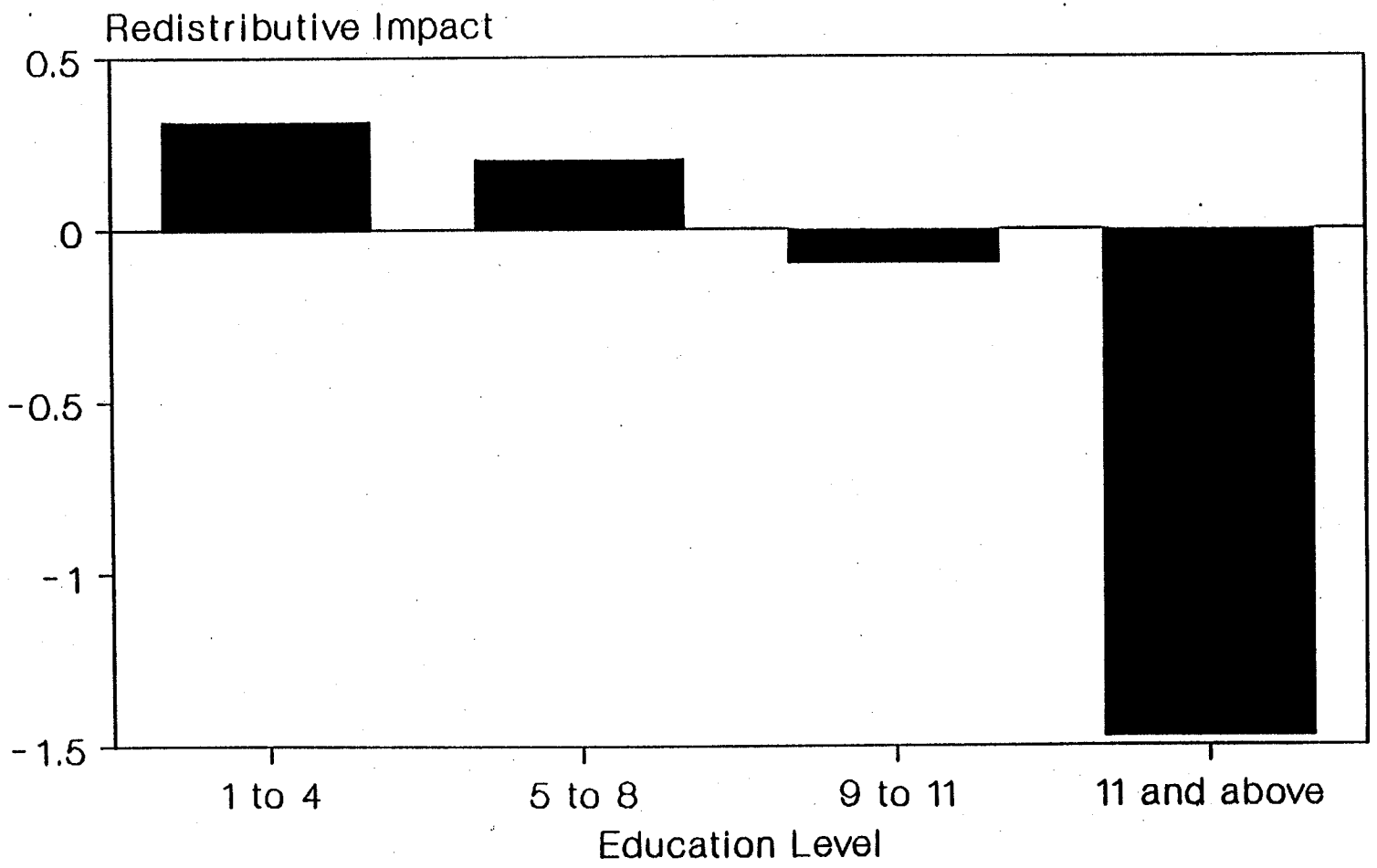


Figure 3

The Composition and Compression Effect

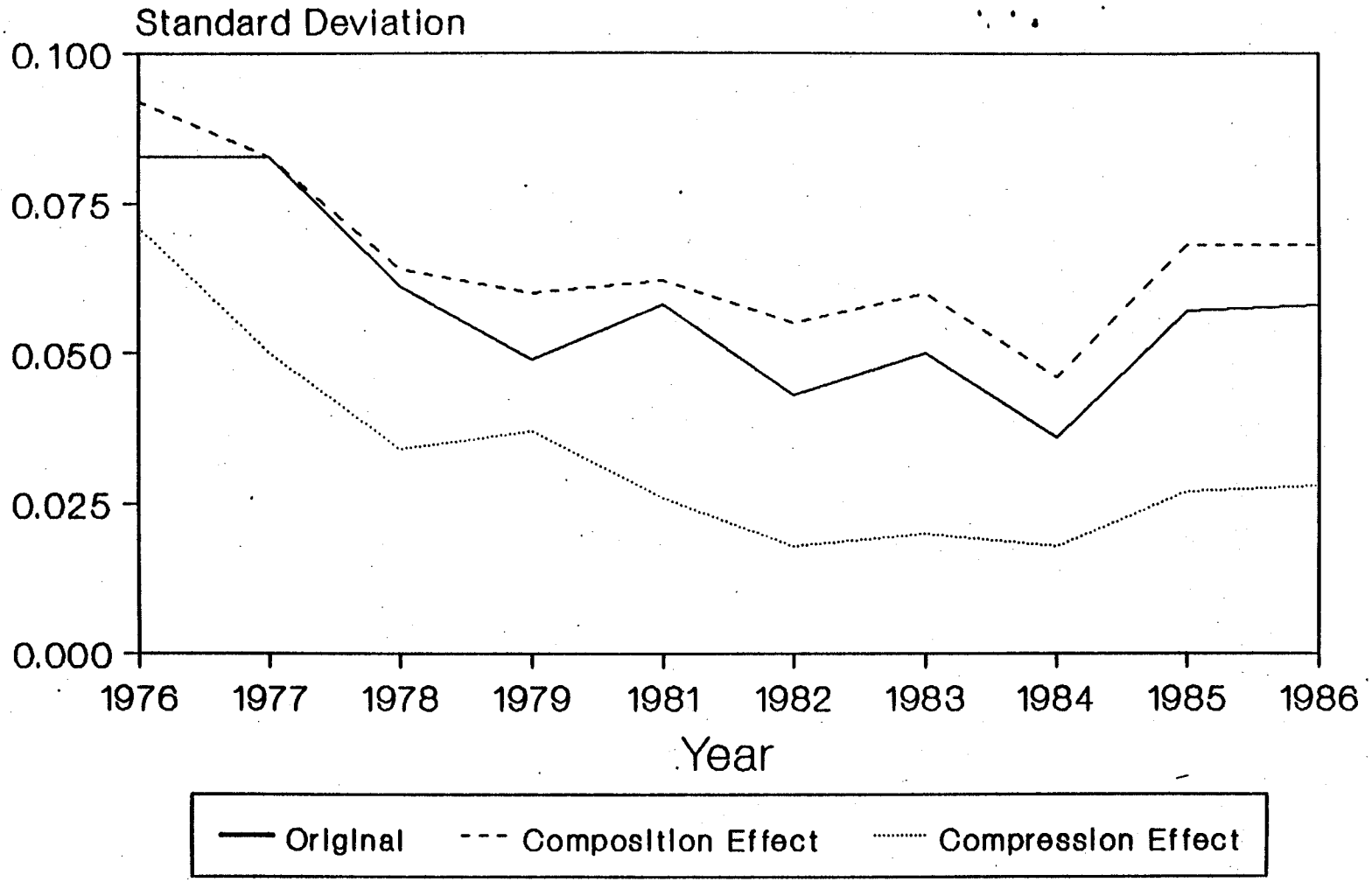


Figure 4

TABLE A1.1
INCOME INEQUALITY
THEIL-T

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	0.707	0.664	0.556	0.575	0.512	0.553	0.524	0.565	0.594	0.541	0.579	0.058
FORTALEZA	0.659	0.635	0.628	0.658	0.699	0.593	0.617	0.618	0.729	0.831	0.667	0.067
RECIFE	0.619	0.692	0.760	0.603	0.589	0.609	0.658	0.601	0.671	0.640	0.644	0.050
SALVADOR	0.614	0.505	0.535	0.489	0.497	0.547	0.637	0.586	0.596	0.620	0.563	0.052
BELO HORIZONTE	0.833	0.461	0.508	0.511	0.512	0.504	0.572	0.548	0.561	0.719	0.573	0.109
RIO DE JANEIRO	0.688	0.695	0.546	0.621	0.532	0.528	0.524	0.548	0.601	0.557	0.584	0.061
SAO PAULO	0.517	0.467	0.484	0.450	0.422	0.426	0.460	0.483	0.466	0.549	0.472	0.037
CURITIBA	0.416	0.436	0.509	0.514	0.468	0.506	0.470	0.538	0.517	0.554	0.493	0.042
PORTO ALEGRE	0.549	0.478	0.504	0.487	0.463	0.508	0.502	0.521	0.563	0.528	0.510	0.029
MEAN	0.622	0.559	0.559	0.545	0.521	0.531	0.552	0.556	0.589	0.616	0.565	0.032
STD	0.114	0.103	0.082	0.067	0.077	0.051	0.069	0.039	0.073	0.096	0.061	

TABLE A1.2
INCOME INEQUALITY
GINI

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	0.604	0.598	0.546	0.556	0.520	0.542	0.530	0.541	0.559	0.540	0.554	0.026
FORTALEZA	0.573	0.575	0.576	0.570	0.582	0.558	0.566	0.567	0.601	0.593	0.576	0.012
RECIFE	0.577	0.593	0.599	0.556	0.549	0.551	0.554	0.556	0.583	0.560	0.568	0.018
SALVADOR	0.599	0.589	0.532	0.523	0.525	0.540	0.563	0.556	0.558	0.563	0.547	0.025
BELO HORIZONTE	0.585	0.545	0.521	0.530	0.523	0.528	0.549	0.544	0.550	0.578	0.545	0.021
RIO DE JANEIRO	0.575	0.556	0.531	0.546	0.527	0.527	0.533	0.539	0.557	0.543	0.543	0.015
SAO PAULO	0.517	0.498	0.505	0.489	0.479	0.478	0.490	0.507	0.500	0.505	0.497	0.012
CURITIBA	0.485	0.509	0.523	0.513	0.496	0.516	0.506	0.518	0.525	0.527	0.512	0.013
PORTO ALEGRE	0.528	0.506	0.523	0.514	0.500	0.516	0.516	0.526	0.540	0.516	0.519	0.011
MEAN	0.560	0.543	0.540	0.533	0.522	0.528	0.534	0.539	0.553	0.547	0.540	0.011
STD	0.038	0.037	0.028	0.024	0.029	0.022	0.025	0.018	0.028	0.027	0.025	

TABLE A1.3
INCOME INEQUALITY
COEFICIENT OF VARIATION

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	1.632	1.484	1.373	1.414	1.312	1.375	1.354	1.423	1.461	1.328	1.416	0.089
FORTALEZA	1.662	1.467	1.484	1.622	1.768	1.399	1.475	1.487	1.708	2.805	1.688	0.399
RECIFE	1.431	1.655	2.023	1.490	1.462	1.559	2.121	1.495	1.583	1.682	1.650	0.225
SALVADOR	1.903	1.310	1.350	1.206	1.232	1.384	1.779	1.458	1.486	1.635	1.474	0.220
BELO HORIZONTE	2.742	1.514	1.303	1.270	1.299	1.250	1.455	1.363	1.367	2.287	1.585	0.482
RIO DE JANEIRO	1.862	2.361	1.408	1.770	1.361	1.376	1.311	1.372	1.541	1.416	1.578	0.314
SAO PAULO	1.402	1.274	1.326	1.248	1.157	1.229	1.344	1.292	1.255	2.081	1.361	0.248
CURITIBA	1.171	1.127	1.428	1.411	1.333	1.357	1.230	1.253	1.362	1.589	1.326	0.129
PORTO ALEGRE	1.755	1.271	1.295	1.255	1.223	1.392	1.346	1.349	1.509	1.576	1.397	0.159
MEAN	1.729	1.496	1.443	1.410	1.350	1.369	1.491	1.388	1.475	1.822	1.497	0.148
STD	0.421	0.341	0.213	0.180	0.170	0.089	0.267	0.080	0.127	0.451	0.124	

TABLE A2
CONTRIBUTION OF EDUCATION TO
OVERALL WAGE INEQUALITY
(THEIL-T)

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	37.0	30.5	38.4	34.5	40.6	41.0	34.8	36.2	35.3	36.6	36.5	2.9
FORTALEZA	57.4	55.0	41.4	56.2	52.5	55.8	52.7	54.6	54.3	56.4	53.6	4.3
RECIFE	54.0	54.1	50.2	51.5	47.5	59.6	57.3	55.4	51.7	51.5	53.3	3.4
SALVADOR	51.4	48.7	44.0	34.7	47.8	52.2	46.4	55.5	46.0	35.6	46.2	6.4
BELO HORIZONTE	49.0	41.4	51.6	50.4	54.3	53.0	51.9	46.4	45.3	47.6	49.1	3.8
RIO DE JANEIRO	30.0	52.1	48.2	49.5	54.2	53.4	48.4	47.9	51.0	44.8	48.0	6.6
SAO PAULO	49.6	44.1	48.0	48.7	48.0	47.6	43.5	48.3	47.8	45.3	47.1	1.9
CURITIBA	40.3	54.0	39.3	44.7	42.0	41.7	45.7	51.2	37.6	21.5	41.8	8.4
PORTO ALEGRE	22.0	43.6	41.4	51.2	49.7	47.0	45.6	39.3	48.5	38.1	42.6	8.0
MEAN	43.4	47.1	44.7	46.8	48.5	50.1	47.4	48.3	46.4	41.9	46.5	2.4
STD	11.2	7.6	4.6	7.1	4.6	5.9	6.0	6.5	6.0	9.7	5.2	

TABLE A3.1
DISTRIBUTION OF EDUCATION
FRACTION OF POPULATION WITH NO FORMAL EDUCATION
(p_1)

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	0.064	0.048	0.078	0.058	0.055	0.042	0.043	0.041	0.042	0.043	0.051	0.012
FORTALEZA	0.156	0.159	0.210	0.183	0.185	0.210	0.209	0.201	0.190	0.177	0.188	0.019
RECIFE	0.160	0.191	0.192	0.166	0.147	0.168	0.159	0.143	0.144	0.101	0.157	0.025
SALVADOR	0.080	0.069	0.109	0.102	0.091	0.093	0.072	0.075	0.080	0.064	0.083	0.014
BELO HORIZONTE	0.065	0.099	0.095	0.087	0.072	0.083	0.066	0.059	0.056	0.054	0.074	0.016
RIO DE JANEIRO	0.079	0.063	0.082	0.080	0.061	0.065	0.067	0.059	0.058	0.052	0.067	0.010
SAO PAULO	0.076	0.087	0.098	0.078	0.072	0.086	0.065	0.074	0.075	0.062	0.077	0.010
CURITIBA	0.079	0.081	0.071	0.080	0.070	0.071	0.056	0.048	0.049	0.060	0.067	0.013
PORTO ALEGRE	0.052	0.051	0.072	0.046	0.057	0.053	0.050	0.046	0.053	0.048	0.053	0.007
MEAN	0.090	0.094	0.112	0.099	0.090	0.097	0.087	0.083	0.083	0.073	0.091	0.010
STD	0.037	0.046	0.049	0.044	0.043	0.052	0.054	0.051	0.048	0.040	0.045	

TABLE A3.2
DISTRIBUTION OF EDUCATION
FRACTION OF THE POPULATION WITH 1 TO 4 YEARS OF SCHOOLING
(p_2)

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	0.321	0.297	0.318	0.321	0.280	0.308	0.285	0.249	0.247	0.261	0.289	0.028
FORTALEZA	0.357	0.335	0.324	0.318	0.331	0.315	0.297	0.273	0.289	0.280	0.312	0.025
RECIFE	0.324	0.348	0.385	0.400	0.356	0.352	0.343	0.328	0.312	0.342	0.349	0.025
SALVADOR	0.265	0.372	0.282	0.293	0.269	0.285	0.265	0.251	0.225	0.233	0.274	0.039
BELO HORIZONTE	0.504	0.488	0.494	0.482	0.466	0.462	0.460	0.445	0.426	0.431	0.466	0.025
RIO DE JANEIRO	0.327	0.342	0.286	0.252	0.286	0.289	0.274	0.253	0.244	0.242	0.280	0.032
SAO PAULO	0.538	0.537	0.502	0.512	0.486	0.473	0.465	0.438	0.430	0.424	0.480	0.040
CURITIBA	0.421	0.421	0.442	0.419	0.470	0.427	0.423	0.424	0.415	0.389	0.425	0.019
PORTO ALEGRE	0.221	0.246	0.222	0.232	0.257	0.260	0.260	0.252	0.237	0.221	0.241	0.015
MEAN	0.364	0.376	0.362	0.359	0.356	0.352	0.341	0.323	0.314	0.314	0.346	0.021
STD	0.099	0.086	0.094	0.094	0.089	0.077	0.080	0.083	0.082	0.079	0.084	

TABLE A3.3
DISTRIBUTION OF EDUCATION
FRACTION OF THE POPULATION WITH 5 TO 8 YEARS OF SCHOOLING
(p_3)

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	0.368	0.348	0.329	0.327	0.348	0.324	0.331	0.366	0.327	0.316	0.338	0.017
FORTALEZA	0.227	0.271	0.225	0.230	0.222	0.224	0.226	0.234	0.223	0.237	0.232	0.014
RECIFE	0.260	0.229	0.199	0.203	0.229	0.220	0.239	0.237	0.266	0.278	0.237	0.024
SALVADOR	0.304	0.364	0.364	0.323	0.305	0.302	0.332	0.304	0.339	0.341	0.328	0.023
BELO HORIZONTE	0.181	0.177	0.185	0.181	0.191	0.187	0.182	0.198	0.200	0.201	0.189	0.008
RIO DE JANEIRO	0.354	0.338	0.377	0.386	0.344	0.329	0.329	0.347	0.346	0.343	0.349	0.018
SAO PAULO	0.177	0.168	0.177	0.176	0.190	0.176	0.194	0.210	0.205	0.207	0.189	0.014
CURITIBA	0.189	0.202	0.203	0.192	0.186	0.189	0.200	0.209	0.212	0.177	0.196	0.011
PORTO ALEGRE	0.447	0.439	0.420	0.421	0.393	0.378	0.385	0.379	0.377	0.403	0.404	0.025
MEAN	0.279	0.282	0.275	0.271	0.268	0.260	0.269	0.276	0.277	0.278	0.273	0.006
STD	0.090	0.090	0.090	0.089	0.076	0.070	0.071	0.069	0.066	0.073	0.077	

TABLE A3.4

DISTRIBUTION OF EDUCATION

FRACTION OF POPULATION WITH 9 TO 11 YEARS OF SCHOOLING

(P_5)

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	0.142	0.173	0.170	0.182	0.198	0.190	0.212	0.221	0.245	0.235	0.197	0.030
FORTALEZA	0.177	0.126	0.141	0.163	0.154	0.154	0.165	0.184	0.192	0.188	0.164	0.020
RECIFE	0.132	0.124	0.129	0.135	0.156	0.151	0.151	0.179	0.169	0.158	0.148	0.017
SALVADOR	0.188	0.132	0.151	0.161	0.199	0.203	0.220	0.240	0.230	0.246	0.197	0.037
BELO HORIZONTE	0.126	0.117	0.116	0.126	0.148	0.148	0.161	0.161	0.184	0.172	0.146	0.023
RIO DE JANEIRO	0.122	0.132	0.127	0.144	0.159	0.163	0.177	0.186	0.195	0.197	0.160	0.027
SAO PAULO	0.086	0.088	0.098	0.107	0.115	0.117	0.130	0.127	0.137	0.152	0.116	0.020
CURITIBA	0.132	0.129	0.127	0.145	0.134	0.160	0.162	0.160	0.168	0.199	0.152	0.022
PORTO ALEGRE	0.118	0.110	0.132	0.151	0.133	0.153	0.141	0.155	0.163	0.176	0.143	0.019
MEAN	0.136	0.126	0.132	0.146	0.155	0.160	0.169	0.179	0.187	0.192	0.158	0.022
STD	0.029	0.021	0.019	0.021	0.027	0.023	0.028	0.032	0.032	0.030	0.024	

TABLE A3.5

DISTRIBUTION OF EDUCATION

FRACTION OF POPULATION WITH MORE THAN 11 YEARS OF SCHOOLING

(P_4)

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	0.106	0.134	0.105	0.113	0.119	0.136	0.129	0.123	0.140	0.146	0.125	0.013
FORTALEZA	0.082	0.110	0.101	0.106	0.108	0.097	0.103	0.109	0.106	0.118	0.104	0.009
RECIFE	0.123	0.109	0.094	0.096	0.112	0.101	0.108	0.114	0.108	0.120	0.108	0.009
SALVADOR	0.162	0.063	0.094	0.120	0.136	0.116	0.112	0.131	0.127	0.116	0.118	0.025
BELO HORIZONTE	0.124	0.120	0.111	0.125	0.124	0.119	0.132	0.137	0.134	0.142	0.127	0.009
RIO DE JANEIRO	0.118	0.123	0.128	0.138	0.150	0.153	0.153	0.156	0.156	0.165	0.144	0.015
SAO PAULO	0.124	0.121	0.125	0.127	0.137	0.148	0.146	0.152	0.154	0.155	0.139	0.013
CURITIBA	0.179	0.168	0.158	0.156	0.140	0.154	0.159	0.159	0.156	0.176	0.160	0.011
PORTO ALEGRE	0.163	0.154	0.154	0.151	0.161	0.156	0.164	0.167	0.170	0.152	0.159	0.006
MEAN	0.131	0.122	0.119	0.126	0.132	0.131	0.134	0.139	0.139	0.143	0.132	0.007
STD	0.029	0.028	0.023	0.019	0.017	0.022	0.022	0.020	0.021	0.020	0.019	

TABLE A.4.1

RELATIVE AVERAGE WAGES BY EDUCATIONAL LEVEL:
AVERAGE WAGE OF WORKERS WITH NO FORMAL EDUCATION RELATIVE
TO THE AVERAGE WAGEOF THOSE WITH 1 TO 4 YEARS OF SCHOOLING
(π_1)

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	0.840	0.702	0.772	0.731	0.735	0.842	0.748	0.807	0.975	0.766	0.792	0.075
FORTALEZA	0.888	0.645	0.616	0.808	0.738	0.763	0.745	0.760	0.659	0.696	0.732	0.077
RECIFE	0.923	0.634	0.659	0.687	0.726	0.741	0.729	0.725	0.733	0.678	0.724	0.075
SALVADOR	0.533	0.734	0.689	0.823	0.769	0.758	0.719	0.830	0.699	0.863	0.742	0.089
BELO HORIZONTE	0.453	0.599	0.619	0.588	0.607	0.600	0.595	0.564	0.604	0.593	0.582	0.045
RIO DE JANEIRO	0.837	0.817	0.703	0.804	0.732	0.740	0.717	0.732	0.673	0.796	0.755	0.052
SAO PAULO	0.661	0.649	0.617	0.630	0.660	0.618	0.631	0.616	0.619	0.594	0.629	0.020
CURITIBA	0.415	0.702	0.827	0.577	0.610	0.770	0.665	0.626	0.629	0.554	0.638	0.109
PORTO ALEGRE	0.879	0.709	0.732	0.818	0.752	0.718	0.792	0.704	0.675	0.715	0.749	0.059
MEAN	0.714	0.688	0.693	0.718	0.703	0.728	0.704	0.707	0.696	0.695	0.705	0.012
STD	0.190	0.061	0.070	0.096	0.058	0.071	0.059	0.084	0.106	0.097	0.066	

TABLE A.4.2

RELATIVE AVERAGE WAGES BY EDUCATIONAL LEVEL:
AVERAGE WAGE OF WORKERS WITH 5 TO 8 YEARS OF EDUCATION RELATIVE
TO THE AVERAGE WAGE OF THOSE WITH 1 TO 4 YEARS OF SCHOOLING
(π_3)

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	1.899	1.732	1.410	1.622	1.246	1.552	1.331	1.501	1.428	1.315	1.504	0.193
FORTALEZA	1.822	1.267	1.428	1.545	1.590	1.542	1.599	1.600	1.599	1.742	1.573	0.145
RECIFE	1.909	1.720	1.488	1.604	1.492	1.584	1.411	1.421	1.369	1.391	1.539	0.162
SALVADOR	1.566	1.453	1.512	1.501	1.551	1.648	1.507	1.662	1.457	1.968	1.582	0.145
BELO HORIZONTE	1.612	1.935	1.610	1.710	1.677	1.752	1.664	1.695	1.674	1.498	1.683	0.107
RIO DE JANEIRO	1.361	1.530	1.396	1.447	1.448	1.416	1.508	1.524	1.579	1.475	1.468	0.064
SAO PAULO	1.801	1.485	1.722	1.504	1.406	1.453	1.494	1.389	1.423	1.346	1.502	0.139
CURITIBA	1.463	2.175	1.694	1.440	1.595	1.514	1.447	1.701	1.554	1.263	1.585	0.232
PORTO ALEGRE	1.839	1.438	1.564	1.688	1.435	1.612	1.699	1.566	1.456	1.410	1.571	0.134
MEAN	1.697	1.637	1.536	1.562	1.493	1.564	1.518	1.562	1.504	1.490	1.556	0.063
STD	0.190	0.267	0.113	0.093	0.120	0.096	0.112	0.107	0.095	0.214	0.059	

TABLE A4.3

RELATIVE AVERAGE WAGES BY EDUCATIONAL LEVEL:

AVERAGE WAGE OF WORKERS WITH 9 TO 11 YEARS OF EDUCATION RELATIVE TO THE AVERAGE WAGE OF THOSE WITH 1 TO 4 YEARS OF SCHOOLING

(r4)

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	4.536	3.104	2.528	2.806	2.152	2.951	2.526	2.415	2.454	2.056	2.753	0.671
FORTALEZA	4.023	2.980	3.278	3.721	3.312	3.173	3.171	3.476	3.264	2.711	3.311	0.348
RECIFE	3.847	3.736	3.912	3.323	2.552	2.956	2.913	2.865	2.907	2.280	3.129	0.528
SALVADOR	3.407	3.211	2.687	2.924	2.731	3.353	3.151	3.429	3.230	3.283	3.140	0.256
BELO HORIZONTE	2.020	2.831	2.942	2.784	2.856	2.848	2.968	2.947	2.906	2.572	2.767	0.272
RIO DE JANEIRO	2.802	3.078	2.826	2.824	2.649	2.719	2.784	2.644	2.862	2.622	2.781	0.128
SAO PAULO	2.495	2.623	2.609	2.514	2.484	2.171	2.371	2.311	2.261	2.009	2.385	0.188
CURITIBA	2.125	3.257	2.937	2.448	2.564	2.485	2.696	2.773	2.657	2.200	2.614	0.318
PORTO ALEGRE	3.060	2.950	3.235	3.546	2.811	2.886	2.958	2.961	2.929	2.736	3.007	0.220
MEAN	3.146	3.086	2.995	2.988	2.679	2.838	2.838	2.869	2.830	2.497	2.876	0.182
STD	0.825	0.294	0.405	0.419	0.298	0.332	0.255	0.376	0.310	0.382	0.276	

TABLE A.4.4

RELATIVE AVERAGE WAGES BY EDUCATIONAL LEVEL:

AVERAGE WAGE OF WORKERS WITH MORE THAN 11YEARS OF EDUCATION RELATIVE TO THE AVERAGE WAGE OF THOSE WITH 1 TO 4 YEARS OF SCHOOLING

(r5)

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	7.501	7.338	6.079	6.118	5.447	5.955	5.100	5.818	6.370	5.287	6.101	0.759
FORTALEZA	8.493	6.772	5.432	7.009	7.489	7.495	7.144	7.381	8.218	7.818	7.325	0.805
RECIFE	8.210	7.426	7.090	6.501	6.370	7.544	6.703	7.177	7.418	6.856	7.130	0.524
SALVADOR	8.597	6.746	6.227	5.321	6.198	7.117	7.697	8.406	7.069	8.333	7.171	1.031
BELO HORIZONTE	3.935	6.122	5.562	5.666	5.760	5.964	6.322	5.767	5.966	6.457	5.752	0.663
RIO DE JANEIRO	6.268	6.790	5.849	6.527	6.230	6.211	6.091	6.397	7.006	6.287	6.366	0.319
SAO PAULO	5.312	4.467	4.780	4.579	4.259	4.155	4.321	4.712	4.646	4.522	4.575	0.311
CURITIBA	3.787	5.787	4.926	4.539	4.491	5.126	4.724	5.288	4.935	3.998	4.760	0.564
PORTO ALEGRE	5.696	5.043	5.504	6.526	5.231	5.846	5.934	5.471	5.970	4.985	5.621	0.449
MEAN	6.422	6.277	5.717	5.865	5.719	6.157	6.004	6.269	6.400	6.060	6.089	0.248
STD	1.773	0.957	0.662	0.843	0.943	1.048	1.057	1.112	1.093	1.393	0.957	

TABLE A.5.1
WAGE INEQUALITY AMONG WORKERS WITH NO FORMAL EDUCATION
(Iw_1)

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	0.299	0.256	0.226	0.193	0.205	0.149	0.164	0.157	0.295	0.214	0.216	0.051
FORTALEZA	0.185	0.208	0.236	0.133	0.208	0.170	0.173	0.144	0.112	0.184	0.175	0.036
RECIFE	0.278	0.158	0.184	0.204	0.188	0.149	0.189	0.158	0.258	0.154	0.192	0.042
SALVADOR	0.144	0.102	0.213	0.244	0.203	0.194	0.189	0.169	0.181	0.243	0.188	0.041
BELO HORIZONTE	0.101	0.150	0.140	0.092	0.114	0.122	0.160	0.161	0.180	0.173	0.139	0.029
RIO DE JANEIRO	0.422	0.210	0.146	0.173	0.183	0.138	0.174	0.206	0.154	0.219	0.202	0.078
SAO PAULO	0.205	0.192	0.149	0.171	0.172	0.123	0.143	0.188	0.164	0.179	0.169	0.023
CURITIBA	0.049	0.159	0.373	0.124	0.114	0.282	0.156	0.180	0.177	0.150	0.176	0.086
PORTO ALEGRE	0.257	0.130	0.159	0.149	0.146	0.095	0.125	0.164	0.204	0.208	0.164	0.045
MEAN	0.215	0.174	0.203	0.165	0.170	0.158	0.164	0.170	0.192	0.191	0.180	0.018
STD	0.107	0.044	0.069	0.043	0.035	0.052	0.020	0.018	0.052	0.029	0.021	

TABLE A.5.2
WAGE INEQUALITY AMONG WORKERS WITH 1 TO 4 YEARS OF SCHOOLING
(Iw_2)

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	0.283	0.372	0.292	0.327	0.242	0.212	0.268	0.192	0.285	0.291	0.276	0.050
FORTALEZA	0.214	0.263	0.375	0.213	0.223	0.216	0.215	0.209	0.248	0.238	0.241	0.048
RECIFE	0.198	0.244	0.292	0.235	0.220	0.165	0.209	0.221	0.265	0.263	0.231	0.035
SALVADOR	0.247	0.266	0.266	0.271	0.228	0.180	0.259	0.172	0.223	0.211	0.232	0.034
BELO HORIZONTE	0.488	0.198	0.211	0.243	0.190	0.223	0.229	0.261	0.265	0.302	0.261	0.082
RIO DE JANEIRO	0.316	0.197	0.215	0.193	0.192	0.198	0.212	0.227	0.218	0.237	0.221	0.035
SAO PAULO	0.205	0.222	0.211	0.206	0.194	0.206	0.210	0.224	0.217	0.245	0.214	0.013
CURITIBA	0.250	0.150	0.254	0.266	0.196	0.200	0.204	0.218	0.251	0.348	0.234	0.051
PORTO ALEGRE	0.206	0.215	0.225	0.166	0.176	0.146	0.161	0.210	0.224	0.241	0.197	0.030
MEAN	0.267	0.236	0.260	0.236	0.207	0.194	0.219	0.215	0.244	0.264	0.234	0.024
STD	0.086	0.059	0.051	0.045	0.021	0.024	0.030	0.023	0.023	0.040	0.022	

TABLE A.5.3
WAGE INEQUALITY AMONG WORKERS WITH 5 TO 8 YEARS OF SCHOOLING
(Iw_3)

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	0.498	0.463	0.350	0.384	0.279	0.309	0.296	0.357	0.341	0.311	0.359	0.068
FORTALEZA	0.311	0.291	0.313	0.288	0.317	0.264	0.297	0.323	0.333	0.374	0.311	0.028
RECIFE	0.322	0.367	0.340	0.326	0.350	0.302	0.272	0.266	0.313	0.277	0.314	0.032
SALVADOR	0.246	0.243	0.284	0.345	0.278	0.267	0.293	0.283	0.294	0.404	0.294	0.046
BELO HORIZONTE	0.577	0.374	0.261	0.270	0.288	0.283	0.300	0.336	0.344	0.350	0.338	0.087
RIO DE JANEIRO	0.338	0.274	0.265	0.271	0.224	0.213	0.262	0.260	0.293	0.291	0.269	0.033
SAO PAULO	0.324	0.258	0.273	0.220	0.221	0.232	0.270	0.239	0.260	0.240	0.254	0.029
CURITIBA	0.284	0.300	0.246	0.211	0.296	0.268	0.270	0.317	0.353	0.244	0.271	0.044
PORTO ALEGRE	0.416	0.243	0.292	0.249	0.222	0.278	0.286	0.307	0.272	0.273	0.284	0.050
MEAN	0.360	0.313	0.292	0.285	0.275	0.268	0.283	0.299	0.311	0.307	0.299	0.025
STD	0.112	0.070	0.034	0.054	0.043	0.029	0.014	0.037	0.032	0.054	0.032	

TABLE A.5.4
WAGE INEQUALITY AMONG WORKERS WITH 9 TO 11 YEARS OF SCHOOLING
(Iw_4)

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	0.493	0.384	0.330	0.352	0.338	0.446	0.417	0.425	0.385	0.379	0.395	0.048
FORTALEZA	0.372	0.523	0.391	0.506	0.429	0.348	0.394	0.318	0.457	0.349	0.409	0.065
RECIFE	0.348	0.405	0.496	0.347	0.317	0.323	0.359	0.344	0.419	0.294	0.365	0.056
SALVADOR	0.288	0.275	0.317	0.284	0.259	0.333	0.349	0.310	0.370	0.366	0.315	0.037
BELO HORIZONTE	0.329	0.254	0.291	0.234	0.266	0.248	0.310	0.312	0.307	0.346	0.290	0.036
RIO DE JANEIRO	0.336	0.364	0.350	0.361	0.278	0.300	0.326	0.306	0.346	0.302	0.327	0.028
SAO PAULO	0.258	0.294	0.266	0.232	0.282	0.215	0.288	0.290	0.254	0.228	0.261	0.027
CURITIBA	0.132	0.165	0.272	0.249	0.314	0.249	0.288	0.256	0.288	0.379	0.259	0.067
PORTO ALEGRE	0.246	0.297	0.268	0.258	0.284	0.293	0.265	0.322	0.338	0.371	0.294	0.037
MEAN	0.311	0.329	0.331	0.314	0.307	0.306	0.333	0.320	0.351	0.335	0.324	0.014
STD	0.093	0.097	0.071	0.084	0.049	0.065	0.048	0.043	0.061	0.048	0.052	

TABLE A.5.5
WAGE INEQUALITY AMONG WORKERS WITH MORE THAN 11 YEARS OF SCHOOLING
(Iw_5)

METROPOLITAN REGION	1976	1977	1978	1979	1981	1982	1983	1984	1985	1986	MEAN	STD
BELEM	0.279	0.303	0.266	0.295	0.258	0.259	0.249	0.301	0.296	0.314	0.282	0.022
FORTALEZA	0.356	0.246	0.346	0.284	0.315	0.220	0.262	0.294	0.322	0.484	0.313	0.070
RECIFE	0.259	0.308	0.294	0.277	0.277	0.265	0.361	0.255	0.368	0.333	0.300	0.039
SALVADOR	0.430	0.252	0.316	0.167	0.249	0.243	0.276	0.272	0.259	0.214	0.268	0.066
BELO HORIZONTE	0.353	0.330	0.269	0.270	0.309	0.255	0.288	0.272	0.309	0.380	0.303	0.039
RIO DE JANEIRO	0.357	0.430	0.300	0.340	0.309	0.266	0.271	0.308	0.340	0.298	0.322	0.046
SAO PAULO	0.262	0.252	0.266	0.263	0.241	0.257	0.249	0.274	0.257	0.338	0.266	0.026
CURITIBA	0.275	0.167	0.266	0.309	0.197	0.258	0.239	0.242	0.239	0.244	0.243	0.038
PORTO ALEGRE	0.180	0.283	0.292	0.235	0.262	0.274	0.268	0.274	0.315	0.272	0.266	0.034
MEAN	0.306	0.286	0.290	0.271	0.269	0.255	0.274	0.277	0.300	0.320	0.285	0.019
STD	0.070	0.068	0.026	0.046	0.037	0.015	0.034	0.020	0.040	0.075	0.025	