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## Inflation and unemployment as determinants of inequality in Brazil: The 1980

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# 42

**DISCUSSION PAPER**

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## **INFLATION AND UNEMPLOYMENT AS DETERMINANTS OF INEQUALITY IN BRAZIL: THE 1980**

**Eliana Cardoso  
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Brasília, January 2015

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# SUMMARY

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I. INTRODUCTION

II. BRAZILIAN INCOME DISTRIBUTION

III. THE EMPIRICAL EVIDENCE

IV. CONCLUSIONS

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**INFLATION AND UNEMPLOYMENT AS  
DETERMINANTS OF INEQUALITY IN BRAZIL: THE  
1980**

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## I. INTRODUCTION

Inequality in Brazil has shown extreme oscillations in short periods of time. The benefits from growth in the 60s went disproportionately to the rich and the costs of the 80s stagnation fell disproportionately on the poor. The income of the richest ten percent of the active population divided by the income of the poorest ten percent of the population increased from a factor of 22 in 1960, to 40 in 1970, 41 in 1980, and 80 in 1989. It declined in 1991.<sup>1</sup>

This paper studies the oscillations of income distribution in Brazil during the 80s. Using monthly data for the six largest metropolitan areas, it claims that inequality responded to megainflation and the sharp oscillations in employment. As opposed to what happened in the 60s, education played no role in the change in inequality in the 80s.

Economists agree that behind the vast inequality of income distribution in Brazil lies an extremely unequal education distribution. Barros et alii (1992) show that if all wage differentials by education level were eliminated, the inequality in labor income in Brazil would be reduced by almost 50 percent.<sup>2</sup>

But even if we believe that education plays a major role in explaining inequality, we do not want to attribute the big deterioration of distribution which occurred from 1987 to 1989 to changes in the distribution of education. The poor do not lose their skills so fast, nor do the rich acquire in such a short period of time the education which transforms them into productivity prodigies. On the other hand, recessions and megainflations do play a role in explaining exacerbated income inequality.

Over the past decade, inequality in Brazil has shown only a minor change in trend extreme short-run

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<sup>1</sup>These numbers are calculated from the annual household surveys called *Pesquisa Nacional por Amostra de Domicílios* (PNAD), and do not cover the same universe as the monthly employment surveys called *Pesquisa Mensal de Emprego* (PME), which are used in this paper. The PME show that the income of the richest ten percent of the active population in the metropolitan areas divided by the income of the poorest ten percent of the population after peaking in mid-1990, was declining during 1991. It averaged a factor of 72 during the last quarter of 1991.

<sup>2</sup>See also Barros and Reis (1989), Sedlacek and Barros (1989), and Ramos (1991).



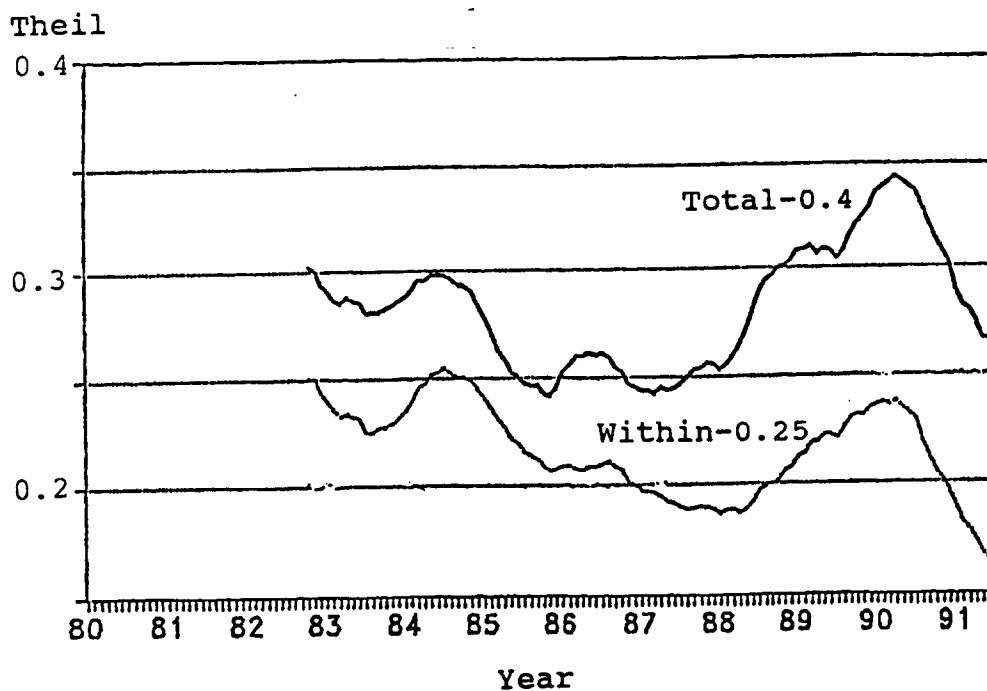
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variations (see Figure 1). The contribution of this paper is use of a decomposition of inequality into two components: inequality within and between groups with the same number of years of schooling. Our objective is to identify macroeconomics as an important explanation for the short-run variations. Specifically we offer two conclusions:

- . inflation promotes increased inequality and
- . unemployment increases inequality

These conclusions do not surprise, but they have not been formally documented before nor has their extreme effect, such as shown in Figure 1, been noted. Needless to say, on the evidence shown here, anyone concerned with inequality would focus on macroeconomic stability as a central policy for increased equality.

Figure 1  
Temporal Evolution of Inequality - Brazil, 1982-1991



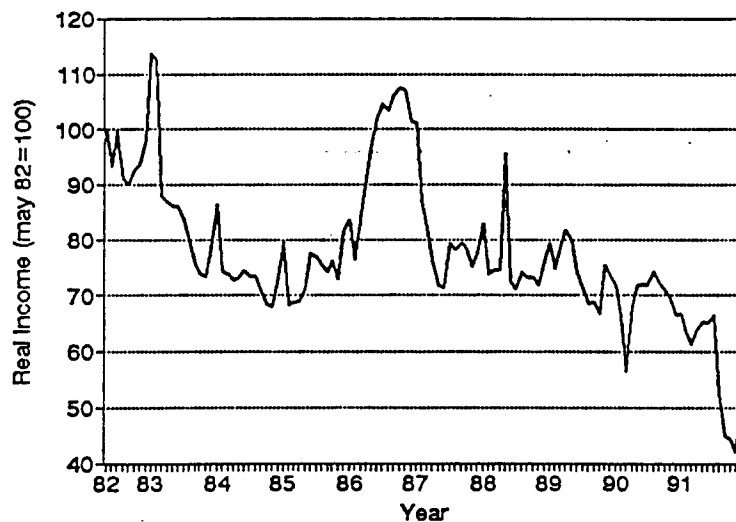
Note: 12-month moving averages for six metropolitan areas.

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A recession worsens the income distribution because of its effect on employment. In a recession, unskilled workers are the first to lose their jobs as firms hoard the trained labor force. In the recovery, unskilled workers get back their jobs and inequality diminishes. One must also take into account the fact that a recession has lasting effects on income distribution. During the recession the middle class groups sell their assets to smooth consumption; assets which they might not be able to earn back during a recovery.

Figure 2 shows the recession of 1983/84 and the decline in real income during 1988/91. Add to the recession all the failed stabilization programs and observe that the poor have little room to cope with the radical policy moves which produce sectoral dislocation of resources and employment.

Figure 2  
Real Income - Brazil, 1982-1991

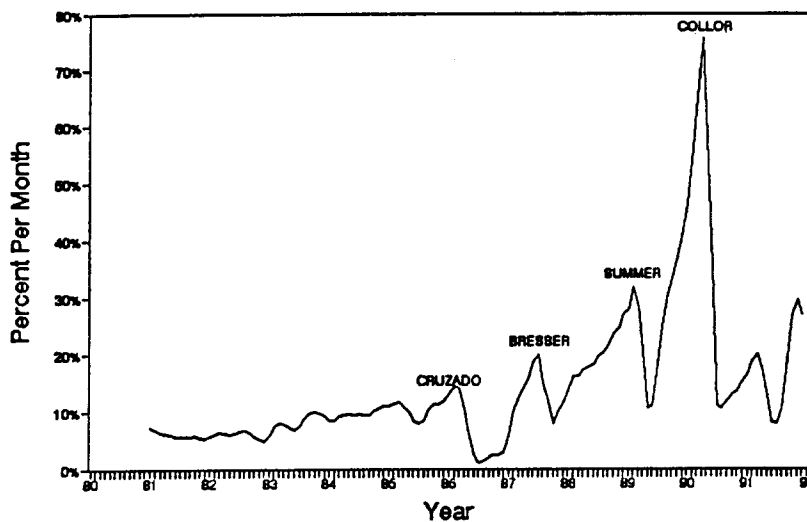


Note: Average for six metropolitan areas.

Figure 3 shows inflation during the 80s. Inflation can increase inequality in three ways. First, if high wages benefit from more perfect indexation, inequality increases. The empirical evidence shows that perfect indexation does not exist and that all labor groups suffer real losses during episodes of high inflation. This paper also shows that in Brazil the group with five to eight years of education lost more than other groups in the 80s.

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Figure 3  
Inflation Rate - Brazil, 1985-1992



Note: 3-month moving average; percent per month.

Second, the inflation tax reduces disposable income. Although the inflation tax does not affect those individuals below the poverty line due to their negligible average cash holdings, it may wipe out the savings of the middle class and increase the number of poor. In this sense it increases poverty and widens inequality of income.<sup>3</sup>

Third, inflation will redistribute assets in favor of the group better able to play the financial markets. Inflation is difficult to predict and nominal interest rates may fail to reflect changing inflation rates. As a result there will be transfers of wealth between creditors and debtors. This will be true of all debtors and creditors linked by indebtedness in the form of bonds, mortgages, sales contracts, and will also be reflected in the stock market. When inflation reaches 1,000 percent, big gains and losses can be made overnight. The middle income groups will certainly lose compared to the groups who have better information, access to expensive technical advice, and flexibility.

The costs of inflation for wage earners also include oscillations in their real income. For individuals who are liquidity constrained, the significant oscillation in their real wages means that they can not smooth consumption or that their real disposable income will

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<sup>3</sup>See Cardoso (1992).

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be eroded if they try to carry cash from one month to the next.

This paper explores the impact of unemployment and inflation on Brazilian inequality in the 80s. The data we use is from **Pesquisa Mensal de Emprego (PME)**, a monthly employment survey conducted by the **Instituto Brasileiro de Geografia e Estatística (IBGE)**.<sup>4</sup> These surveys do not cover money holdings and capital gains. Our measures of inequality only capture inequality in labor earnings and thus the impact of inflation that we can estimate derives only from imperfect indexation. Further information is needed to identify the impact on inequality from the inflation tax and the redistribution of assets.

The paper is organized as follows. Section II sets the background with a summary of what is known about income distribution in Brazil. It also describes the inequality measures used in the paper. Section III contains the empirical evidence which is based on monthly survey data for the six largest metropolitan areas of Brazil between 1982 and 1991. The empirical analysis considers the relationship between inequality in labor income and three variables: the inflation rate, the unemployment rate, and the income differentials by educational level. The methodology and the evidence are summarized in Section IV which spells out our conclusions.

## II. BRAZILIAN INCOME DISTRIBUTION

### Background

In no country has the academic debate on growth versus equality been sharper than in Brazil. In the 70s, the core of the discussion was whether the poor benefitted from growth during the 1965/74 "miracle" and whether they might have done better under different policies.<sup>5</sup> Today the discussion must evaluate the costs of bad macroeconomics in the 80s.

The complexity of statistical problems surrounding income distribution data in Brazil are serious enough to provoke scepticism. There are however a few stylized facts which are widely accepted. They are:

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<sup>4</sup>The universe of analysis and the data is described in the appendix.

<sup>5</sup>See, for instance, Camargo and Giambiagi (1991), Fields (1977), Fishlow (1980), Morley (1982), Pfefferman and Webb (1979), and Taylor et alii (1980).

. Brazil (with a Gini equal to 0.6 in 1990, Table 4) has one of the most unequal income distributions in the world. Social indicators look worse than in any other country with the same income per capita. Table 1 compares economic and social indicators in Brazil with those of Latin American countries with a population of more than 10 million people. Brazil does poorly. Despite the fact that in 1990 it had the highest dollar income per capita in the region, infant mortality was three times that of Chile, the illiteracy ratio was four times that of Argentina, and Brazilians could expect to live four years less than Mexicans.<sup>6</sup>

Table 1  
Economic and Social Indicators  
Latin American Countries with more than 10 million people

Country	Population (Millions) (1990)	GDP per Head (Dollars) (1990)	Gini (Index) (1989)	Population Growth (%) <sup>a</sup>	Life Expectancy (Years) (1990)	Adult Illiteracy Rate (%) <sup>b</sup>	Mean Years In School c	Infant Mortality d
Brazil	150.4	2,680	0.625	2.2	66	19	3.9	60
Mexico	86.2	2,490		2.0	70	13	4.7	40
Argentina	32.3	2,370	0.461	1.3	71	5	8.7	31
Colombia	32.3	1,260	0.515	2.0	69	13	5.7	39
Peru	21.7	1,160		2.3	63	15	6.4	82
Venezuela	19.7	2,560	0.498	2.7	70	12	6.3	35
Chile	13.2	1,940		1.7	72	7	7.5	20
Ecuador	10.3	980		2.4	66			

Notes: <sup>a</sup>Percent per Year between 1980 and 1989,

<sup>b</sup>As a percentage of the total population which is 15 years old or older.

<sup>c</sup>For individuals 25 years old or older.

<sup>d</sup>For 1,000 live births.

Sources: The World Bank, World Development Report 1992, Oxford University Press (1992); Fiszbein and Psacharopoulos (1992); Barros et alii (1992).

. National averages of economic and social indicators hide extreme disparities. Regional inequality is severe.<sup>7</sup> For instance, the interstate range of income in Brazil is 7 to 1.<sup>8</sup> Table 2 shows the range of

<sup>6</sup>For measures of poverty in Brazil see Hoffmann (1989) and Ravillon and Datt (1991).

<sup>7</sup>See, for instance Vinod (1987) and Maddison (1989).

<sup>8</sup>Interstate disparity is 2 to 1 in the United States where Mississippi's per capita income was half of Connecticut's in 1991 (U.S. Department of Commerce, Survey of Current Business, Vol. 72, n.4, Table A, April 1992).

economic and social indicators for the poorest and richest regions and states. Albuquerque (1991) compares the index of human development for Brazilian states with indices of other nations. Rio Grande do Sul is as advanced as Portugal, South Korea, or Argentina, while Paraiba performs as badly as Kenya and more poorly than Bolivia.

Table 2  
Economic and Social Indicators  
Brazil, Poorest and Richest Regions and States, 1988

	GDP per Head Dollars of 1988	Life Expectancy Years	Literacy Ratio Percent
Poorest States:			
Piaui	594	62.6	55.9
Paraiba	718	51.9	63.1
Richest States:			
Sao Paulo	3,503	67.0	90.5
Distrito Federal	4,215	68.9	89.5
Poorest Region: Northeast	1,005	58.8	63.5
Richest Region: Southeast	2,989	67.1	88.2
Brazil	2,241	64.9	81.1

Source: Albuquerque (1991).

Destitution remains predominantly a rural phenomenon even if the gap between the urban and the rural living standards declined in the last 20 years (Table 3). In 1988, rural income was still 60 percent of urban income.

Inequality has roots in history. In the colonial economy, rents from abundant natural resources were monopolized by the state and by large landlords from Portugal. The labor force were slaves. After the abolition of slavery, there was no land reform. Official policy kept labor cheap and uneducated.

. Brazil spends as much as Korea on social programs, but it spends poorly. The Brazilian share of social service expenditure by government in GDP is as high as or even higher than that of other middle-income

developing countries, but Brazilian social welfare indicators are strikingly low.

Table 3  
Indices of Urban-Rural Disparity  
Brazil, 1970/88

Years	Income Index			Human Development Index <sup>a</sup>		
	Urban Income = 100			Urban Index = 100		
	Rural Northeast	Rural South	Rural Brazil	Rural Northeast	Rural South	Rural Brazil
1970	30	53	37	39	71	52
1980	47	70	53	55	83	64
1988	52	78	60	64	84	69

Source: Albuquerque (1991).

Table 4  
Inequality Indices  
12-Month Average for Six Metropolitan Areas  
1981/91

Years	THEIL	GINI
1981	0.68	0.58
1982	0.73	0.59
1983	0.69	0.58
1984	0.69	0.59
1985	0.64	0.58
1986	0.65	0.57
1987	0.63	0.57
1988	0.67	0.57
1989	0.69	0.58
1990	0.73	0.60
1991	0.65	0.56

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The reasons for such an unsatisfactory social performance are twofold: public resources are poorly managed and are not efficiently targeted. The poorest 19 percent of the population (with less than one quarter of a minimum wage per household member) receives six percent of social benefits. An estimated 78 percent of all spending on health is devoted to high-cost curative hospital services and only 22 percent to basic preventive health-care, such as immunization programs, malaria control, and maternal and child health. In education, the government supports free tuition in universities despite the fact that the cost of educating each university student is 18 times higher than government expenditure per student at the primary and secondary level combined.<sup>9</sup>

. From 1960 to 1975 the degree of inequality increased continuously. While Fishlow (1972) emphasized the role of government policy in squeezing real wages, Langoni (1973) stressed non-policy forces inherent in a situation of fast growth with a shortage of educated labor. Despite the political debate which surrounded the two studies, there is no necessary conflict between the two views. The gap between rich and poor increased not only as a result of the increase of the real wage of skilled labor but also because the real wage of unskilled labor fell, in part as a result of the rise in inflation before 1964 and from the mid-60s recession, which validated the incomes policy of imperfect indexation. Along with this explanation, education plays a central role in explaining the worsening in the distribution of income in Brazil between 1960 and 1975.

The education system has a double relationship with the degree of inequality in income. On the one hand and since the level of education is so low, an educational expansion tends to increase the inequality in education and consequently the inequality in income. This is the composition or Kuznets effect. On the other hand, the education expansion was considered to be too slow in comparison to the rate of economic growth and technological change. As a consequence, a relative shortage of educated and skilled workers led to a widening of the wage differential between workers with different years of schooling.

Barros et alii (1992) shows that two thirds of the increase in inequality between 1960 and 1970 can be attributed to education. But the same paper also shows that education has a minor role in explaining what

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<sup>9</sup>The World Bank (1988) and Barros et alii (1992) offer analyses and critiques of social spending in Brazil.



happened in the late 70s and in the first half of the 80s. In this paper we will show that unemployment and inflation generated the extreme oscillations in inequality observed in the 80s.

### Measuring Inequality

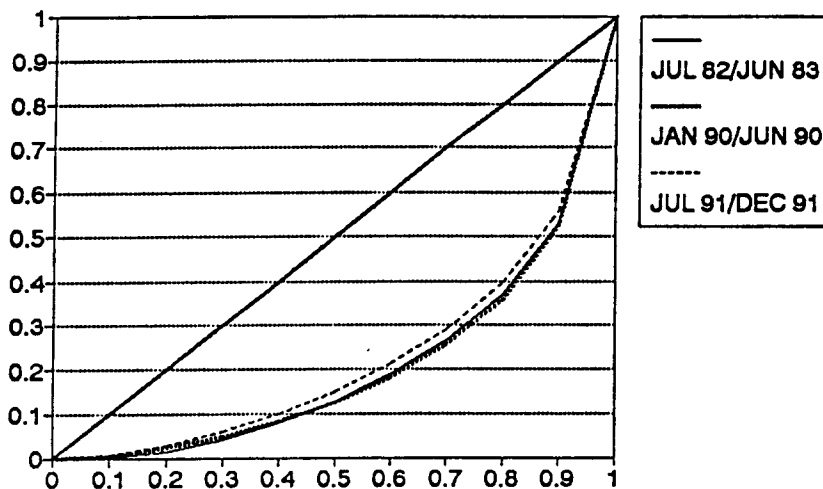
Changes in income inequality are usually described by changes in a scalar measure of inequality such as the Gini or the Theil index. A scalar measure completely ranks a set of income distributions in terms of increasing inequality but alternative scalar measures do not necessarily rank a set of distributions in the same way. We lessen this problem by the use of six different measures.

The Lorenz curve,  $L(p)$ , shows the share of the total income which is appropriated by the poorest  $p$  percent of the population and is defined as:

$$L(p) = (1/\mu) \int_0^p F'(t) dt$$

for  $0 \leq p \leq 1$ .  $F$  is the cumulative distribution of the random variable  $Z$  which represents labor earnings and  $\mu$  is the mean of  $Z$ . Figure 4 illustrates the behavior of the Lorenz curves for residents in Belo Horizonte. The continuous line represents the income distribution in early 80s. In 1990 the Lorenz curve shifts out as inequality increases, and in 1991 it shifts in as inequality decreases.

Figure 4  
Lorenz Curves - Belo Horizonte, 1980-1991



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Based on the Lorenz curve we can estimate a second measure of inequality: the relation between the income share of the richest 10 percent of the population and the income share of the poorest 40 percent. We call this measure the Spread, S:

$$S = [1 - L(0.9)] / L(0.4) \quad (2)$$

We also use the Gini coefficient as a measure of inequality. The Gini coefficient is defined as:

$$G = \int_0^1 (1 - 2L(p)) dp \quad (3)$$

The next inequality measure is the Theil index, T, defined as:

$$T = E [(Z/\mu) \ln(Z/\mu)] \quad (4)$$

where E is the expectation operator, and Z has already been defined as a random variable representing labor earnings.<sup>10</sup>

Inspection of monthly estimates for the Spread, the Gini Coefficient, and the Theil index, from January 1980 to December 1991, indicates the presence of outliers. We consider as outliers any estimate which diverges from the mean by more than two standard deviations. Since outliers can strongly influence our empirical analysis, we discarded them. The identification of outliers was done for each metropolitan area in separate. Having identified an outlier, all inequality measures for that point in time and metropolitan area were discarded.

Next we decompose inequality.<sup>11</sup> The objective of the decomposition is to isolate the contribution of changes associated to education from all other sources of change in inequality. We divide the population in each Metropolitan region in five sub-groups. In each of these sub-groups, all workers have the same level of education according to the number of completed years of schooling: less than one, one to four (elementary school), five to eight, nine to 11, and 12 or more years. Based on this division we compute a measure of

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<sup>10</sup>Monthly estimates for the Spread, the Gini Coefficient and the Theil index, from January 1980 to December 1991, for the six largest metropolitan areas of Brazil are available upon request.

<sup>11</sup>The variables used in the decomposition analysis spread over the period May 1982 and December 1991, because the surveys do not cover information on the level of education of workers before May 1982.

the average income inequality within groups,  $I$ , defined as:

$$I = \sum_{i=1}^5 \alpha_i TW_i \quad (5)$$

where  $TW_i$  is the inequality within sub-group  $i$  as measured by the Theil index;  $(\alpha_i)$  is a system of weights,  $\alpha_i \geq 0$  and  $\sum \alpha_i = 1$ .

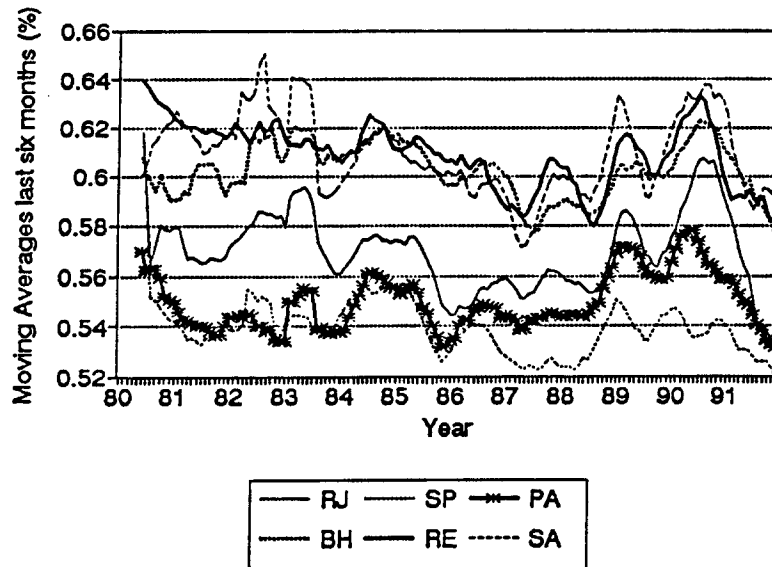
The measure of inequality within groups,  $I$ , can change either because the inequality within groups,  $(TW_i)$ , has changed or because the weights,  $(\alpha_i)$ , have changed. Because we do not want our measure  $I$  to be affected by changes in the distribution of the population by educational level, we define the weight of each subgroup  $i$  as the average of the 1980/1991 shares in total population in each metropolitan area. Therefore, the weights are constant and only variations in  $(TW_i)$  can affect the measure of inequality within groups,  $I$ .

The measure of the inequality between groups,  $B$ , is defined as:

$$B = T - I \quad (6)$$

Figure 5 shows the 12 month moving average of the Gini coefficient for the largest metropolitan areas between January 1980 and December 1991. The degree of inequality is smaller in São Paulo followed by Rio de Janeiro. The extent of inequality is very similar in Belo Horizonte, Salvador, and Recife.

Figure 5  
Gini Coefficients - Brazilian Metropolitan Areas, 1980-1991



Note: 12-month moving averages.

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Despite some regional nuances in the temporal pattern of inequality, all regions followed the same broad pattern which is summarized in Table 4. During the first half of the 80s, the degree of inequality oscillates around a high level. After 1984, inequality first goes down with a trough around mid-1987. It reaches a peak around mid-1990 (with the Gini coefficient exceeding 0.62 in Belo Horizonte, Recife, Rio de Janeiro, and Salvador). After that it declines: at the end of 1991 the degree of inequality was smaller than the minimal level reached during the 80s (the average for the six metropolitan areas was 0.56 in 1991).

The temporal pattern for the other inequality indicators (the Theil index and the Spread) follow a very similar pattern. The appendix shows the high degree of correlation between the different inequality indicators for each metropolitan region.

### III. THE EMPIRICAL EVIDENCE

#### Sources of Inequality

We believe that education has an important role in determining inequality but that it cannot explain the cyclical pattern followed by inequality in the 80s. To determine whether, in fact, education contributed or not to the cyclical pattern of the degree of income inequality in the 80s, we compare the temporal evolution of the Theil index,  $T$ , with the temporal evolution for the average inequality within groups,  $I$ . By construction, the average inequality within groups,  $I$ , is not affected by changes neither in the educational composition of the labor force nor in the wage differentials by educational level. Hence, if  $I$  and  $T$  follow the same pattern we can say that the events affecting the evolution of the inequality in the 80s are unrelated to changes associated with education.

We begin by investigating the temporal evolution of the average inequality within groups,  $I$ , and the inequality between groups,  $B$ . We can do this only after March 1982, when questions on education were introduced in the PME questionnaire. Both  $I$  and  $B$  behave similarly across regions and we can thus concentrate our discussion on the average across regions.<sup>12</sup>

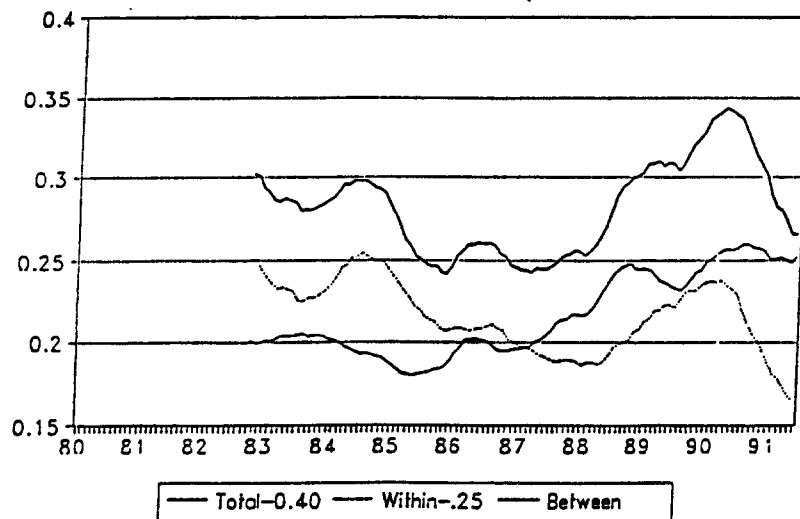
Figure 6 shows the temporal evolution of the average across metropolitan areas of the Theil index  $T$ , of the

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<sup>12</sup>Monthly estimates of the two components of the Theil measure for each of the six metropolitan areas are available upon request.

index of inequality within groups, I, and of the index of inequality between groups, B. Both the Theil index and the index for inequality within groups display the same cyclical pattern. In addition, the index for inequality within groups shows a decreasing trend. On the other hand, the index of inequality between groups, B, displays almost no cyclical pattern and a clear increasing trend.

Figure 6  
Inequality Within and Between Educational Groups - Brazil, 1982-1991



Note: 12-month moving averages for six metropolitan areas.

In summary, the temporal pattern of the overall inequality can be decomposed into three components: 1) a complete cycle from mid-1984 to the end of 1991 which is perfectly matched by the temporal evolution of the inequality within group; 2) a decreasing trend in inequality caused by a decline in the Theil within groups; and 3) an upward trend in inequality caused by an increase in the inequality between groups. As a result, from mid-1982 to the end of 1991, the overall inequality go through a complete cycle with a slightly decreasing trend.

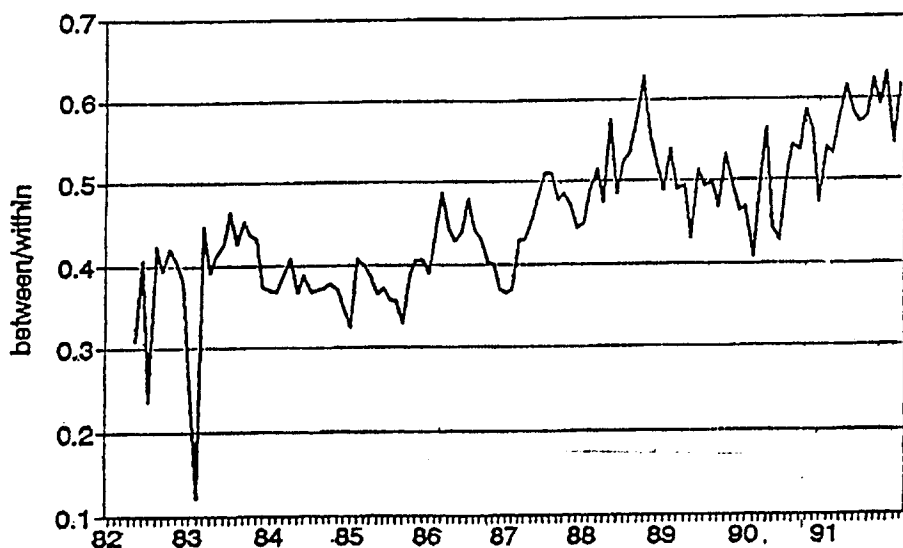
A consequence of the opposite trends in inequality within groups and inequality between groups is an increase in the power of explanation of education to account for the level of inequality at a point in time. We can measure the "explanatory power of education" by the ratio between the indices of inequality between and within groups, B/I. Figure 7 shows that this ratio

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increases over the period. Therefore, over the 80s, even though education does not explain the variations in inequality during the period, the static relationship between education and the level of the overall inequality in 1991 is even stronger than in 1982.

Figure 7

Ratio of Inequality Within/Between Educational Groups - Brazil, 1982-1991



Note: Average for six metropolitan areas.

We also use an alternative procedure to investigate the relative contribution of education to the cyclical fluctuations in inequality. We first identify four periods, which are characterized by relatively big or small inequality: July 1982 to June 1983 (big); July 1986 to June 1987 (small); January 1990 to June 1990 (big); July 1991 to December 1991 (small). Then we decompose the change in overall inequality between each of these periods in two components: a change in inequality within groups and a change in inequality between groups. Table 5 shows that the decline in inequality between 1982/83 and 1986/87 is almost entirely explained by a decline in inequality within groups. The increase in inequality between 1986/87 and 1990 is explained by an increase in inequality in both indices of inequality. Finally, the decline in inequality between 1990 and 1991 is fully explained by the variation in inequality within groups.

Table 5  
 Decomposing the Variation in Inequality  
 Average of all Metropolitan Areas

From	To	$\Delta T$	$1/\Delta T$	B/T
July 82-June 83	July 86-June 87	-0.053	0.94	0.06
July 86-June 87	Jan. 90-June 90	0.102	0.50	0.50
Jan. 90-June 90	July 91-Dec. 91	-0.095	1.02	-0.02

Estimates by metropolitan area (in the appendix) corroborate that for all areas the within component contributes more than the index for inequality between groups to the decline in inequality from 1982/83 to 1986/87 and from 1990 to 1991. The results for the period in which inequality increases are mixed. In Belo Horizonte and Recife the between component accounts for the major part of the increase in inequality; in Salvador both components account equally for the change in inequality; in Rio de Janeiro the within component accounts for the major part of the change in the overall level of inequality.

Having argued that the cyclical pattern followed by the level of the income inequality in Brazil is unrelated to changes associated with education, we turn to the analysis of unemployment and inflation.

#### Unemployment and Inflation as Determinants of Inequality

We first describe the evolution of inflation and unemployment in the 80s.

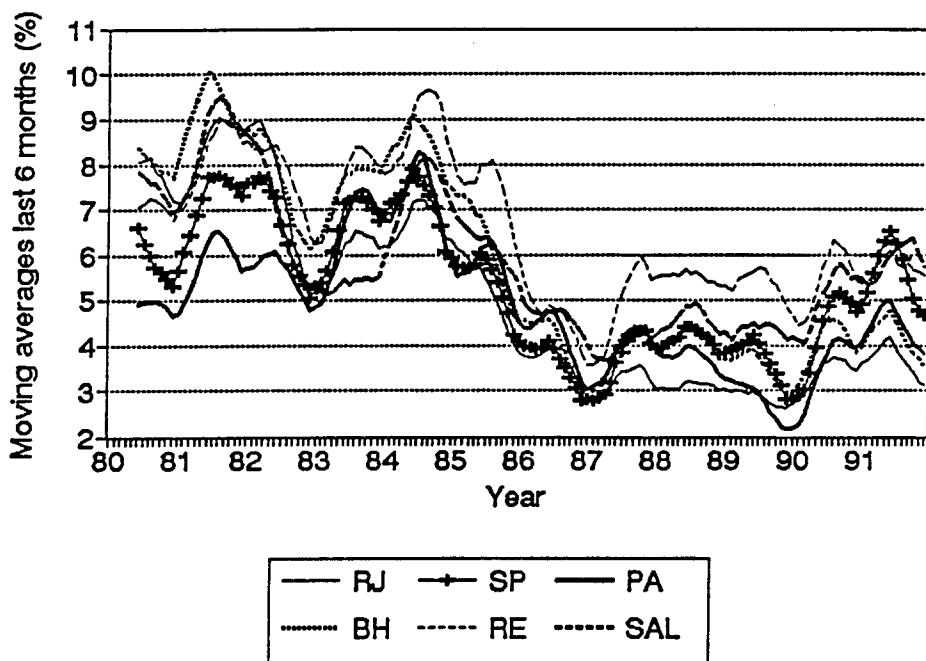
The inflation rates calculated from regional price indices are practically the same in all metropolitan areas. Between 1981 to mid-1983, the inflation rate was relatively stable at approximately six percent per month. From mid-1983 to the beginning of 1986, inflation doubles, it disappears in March 1986 with the Cruzado Plan and returns at full speed in 1987 when it

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accelerates fast reaching 40 percent per month in 1989. Inflation declines in 1990 to 15 percent per month.

The evolution of the unemployment rate between 1980 and 1991 by metropolitan area is shown in Figure 8.<sup>13</sup> Recife has the highest unemployment rates and Rio de Janeiro the lowest. In all metropolitan areas the unemployment rates decline over the period. The decline is larger in Belo Horizonte and smaller in São Paulo. Overall the oscillation of unemployment during the period follows a similar pattern in all metropolitan areas.

Figure 8  
Unemployment Area in Largest Metropolitan Areas - Brazil, 1980-1991



Note: 12-month moving averages.

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<sup>13</sup>A individual is defined as unemployed if he is ten or more years old, is not occupied at the time of the interview but was actively looking for a job in the week prior to the interview. The monthly estimates of unemployment by metropolitan area are available upon request.



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From 1980 to 1985 the unemployment rate goes through two small cycles. It peaks at approximately nine percent in the third quarter of 1981, declines to six percent in the third quarter of 1982, increases to almost eight percent in mid-1984. From mid-1984 to the end of 1986 there is a sharp decline in unemployment to less than four percent. Finally, from 1987 to the 1991, the unemployment rate shows a slight increasing trend.

The short-run fluctuations in unemployment in the first half of the 80s and the sharp decline from 1985 to 1987 match quite closely similar variations in inequality. Hence, variations in the unemployment rate are promising explanations for the variations in inequality which occur before 1988. After 1988, the unemployment rate become stable but the degree of inequality reveals sharp fluctuations. On the other hand, the inflation rate was stable in the first half of the 80s, but fluctuated sharply in the second half of the 80s and beginning of the 90s, matching the fluctuations in the level of inequality. Over the period 1980 to 1991, the combined behavior of unemployment and inflation can explain the oscillations of the degree of inequality.<sup>14</sup>

We now look at the results of the regression analysis. We have run two sets of regressions. In the first set we look at unemployment and inflation as determinants of inequality. In the second set we look at impact of unemployment and inflation on the real income of each educational group.

In the first set, in each regression, our dependent variable is one of our inequality indices. We run each regression separately for each metropolitan area and inequality index. In each regression we use the raw monthly estimates for the inequality index. In the second set, in each regression, our dependent variable is the logarithm of the real income of one of the six educational groups. Again, we run each regression

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<sup>14</sup>The period of fast increase in inflation (January 1987 to March 1990) coincides with the period of sharp increase in the inequality between educational groups (there is a strong correlation between the inequality between groups and the rate of inflation). One could argue that high rates of inflation increases the differentials in average wages between educational groups because the more educated groups are able to protect themselves better through more complete indexation. This conclusion is not warranted because the decline in inflation in 1990 does not reduce inequality between groups. It does however reduce inequality within groups.

separately for each metropolitan area. The independent variables are the level of the unemployment rate and the level of the inflation rate. We use the raw estimate of the unemployment rate. For the rate of inflation we use the average inflation of the previous year.<sup>15</sup>

Table 6 presents the coefficient of determination,  $R^2$ , of the 18 regressions where the independent variable is a measure of inequality. The coefficient of determination of the regressions of real income are in Table 9.

Table 6  
Coefficient of Determination,  $R^2$   
Regressions of Inequality on Unemployment and Inflation

Metropolitan	Dependent Variable			Number of Observations
	Gini	Spread	Theil	
Porto Alegre	0.35	0.33	0.16	131
São Paulo	0.11	0.15	0.06	129
Rio de Janeiro	0.33	0.32	0.32	126
Belo Horizonte	0.34	0.37	0.32	126
Salvador	0.30	0.24	0.37	117
Recife	0.37	0.60	0.28	127

Note: metropolitan areas ordered from South to North.

Table 6 shows that, except for São Paulo, variations in unemployment and inflation can explain approximately one third of all variation in the level of inequality. This is an impressive result given that our dependent variable is the raw monthly estimate of inequality which include quite erratic variations and we have not used any dummies to capture changes in government wage policies.

Table 7 shows the estimated coefficients on unemployment in the regressions of inequality. All coefficients are positive and almost all of them have t-statistics above two. Therefore they corroborate the hypothesis that inequality increases with unemployment.

<sup>15</sup>Our search indicates that results are not sensitive to the use of raw monthly unemployment rates, or 3-month, 6-month, or 12-month moving average. On the other hand, results did improve when we used the last year average inflation rate instead of the current inflation rate.

The regressions of real income of each educational group show that unemployment affects all groups negatively. Unemployment reduces the real income of the group with less than one year of education more strongly than the income of other groups, in São Paulo, Rio de Janeiro, Belo Horizonte, and Salvador. Unemployment does not affect the real income of the group with more than 12 years of education in Rio de Janeiro and Belo Horizonte.<sup>16</sup>

Table 7  
Coefficient on Unemployment in Regressions of Inequality

Metropolitan Area	Dependent Variable		
	Gini	Spread	Theil
Porto Alegre	0.13 (2.0)	6.11 (3.2)	0.28 (1.2)
São Paulo	0.23 (3.8)	7.86 (4.8)	0.39 (2.3)
Rio de Janeiro	0.48 (6.8)	16.70 (7.2)	1.28 (6.2)
Belo Horizonte	0.41 (7.1)	22.31 (8.4)	0.87 (4.8)
Salvador	0.50 (4.6)	27.52 (5.4)	1.46 (4.4)
Recife	0.63 (8.4)	52.33 (12.9)	1.59 (6.3)

Note: metropolitan areas ordered from South to North.

<sup>16</sup>Katz and Ravenga (1989) argue that the education-related wage differential is less likely to grow in very tight labor markets, i.e., unemployment increases inequality between educational groups. Our evidence does not support this hypothesis. Unemployment does increase inequality within groups but does not affect inequality between groups. The coefficient on unemployment of regressions of inequality between groups has actually a negative coefficient (but t-statistics are small). See table A.3 in the appendix.

Table 8 shows the estimated coefficients on inflation and their t-statistics of the regressions of inequality. Except for inequality within groups in São

Table 8  
Coefficient on Inflation in Regressions of Inequality

Metropolitan Area	Dependent Variable		
	Gini	Spread	Theil
Porto Alegre	0.10 (8.0)	2.79 (7.8)	0.20 (4.8)
São Paulo	0.02 (1.8)	0.41 (1.3)	0.07 (2.3)
Rio de Janeiro	0.13 (6.9)	3.62 (6.0)	0.39 (7.1)
Belo Horizonte	0.08 (6.4)	2.85 (4.6)	0.31 (7.4)
Salvador	0.11 (6.3)	3.40 (4.1)	0.41 (7.7)
Recife	0.06 (4.1)	0.10 (0.1)	0.23 (4.9)



Table 9  
Coefficient of Determination,  $R^2$   
Regressions of Real Incomes on Unemployment and Inflation  
Number of observations in each regression: 116

The Dependent Variable is the Logarithm of the Real Income of  
the Group with the following years of education

Metropolitan Area	less than 1	1 to 4	5 to 8	9 to 11	12 or more
Porto Alegre	0.22	0.31	0.37	0.19	0.23
São Paulo	0.25	0.30	0.26	0.25	0.20
Rio de Janeiro	0.26	0.14	0.33	0.20	0.07
Belo Horizonte	0.31	0.35	0.36	0.27	0.13
Salvador	0.35	0.44	0.44	0.39	0.27
Recife	0.07	0.34	0.33	0.31	0.13

Note: metropolitan areas ordered from South to North.

Paulo and Recife (where the t-statistics are small), all other coefficients are positive and have large t-statistics. They corroborate the hypothesis that inflation has an adverse effect on distribution.

These results are supported by regressions for the real income by education differentials in Table 10. These regressions show that inflation adversely affects the real income of all educational groups but it affects particularly the real income of the group in the middle (five to eight years of education, column three in Table 10).

Table 10  
Coefficient on Unemployment in Regressions of Real Incomes

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The Dependent Variable is the Logarithm of the Real Income of  
the Group with the following years of education

Metropolitan Area	less than 1	1 to 4	5 to 8	9 to 11	12 or more
Porto Alegre	-2.24 (-1.6)	-1.11 (-1.0)	-0.56 (-0.5)	-5.80 (-4.5)	-1.54 (-1.5)
São Paulo	-3.87 (-3.3)	-3.46 (-3.4)	-2.58 (-2.3)	-2.75 (-2.5)	-3.28 (-3.2)
Rio de Janeiro	-2.29 (-2.3)	-0.66 (-0.5)	1.63 (1.3)	1.22 (0.9)	0.82 (0.6)
Belo Horizonte	-4.11 (-4.8)	-2.95 (-3.6)	2.04 (1.8)	-0.21 (-0.2)	-0.86 (-1.0)
Salvador	-3.74 (-2.1)	-4.12 (-2.3)	-1.88 (-1.0)	-1.96 (-1.0)	-4.50 (-2.9)
Recife	-2.25 (-1.6)	-5.21 (-2.7)	-1.70 (-1.3)	-1.23 (-1.0)	-2.62 (-2.9)

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Note: metropolitan areas ordered from South to North.

Table 11  
Coefficient on Inflation in Regression of Real Incomes

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The Dependent Variable is the Logarithm of the Real Income of  
the Group with the following years of education

Metropolitan Area	less than 1	1 to 4	5 to 8	9 to 11	12 or more
Porto Alegre	-1.33 (-5.5)	-1.34 (-6.8)	-1.52 (-7.6)	-0.97 (-4.2)	-1.04 (-5.6)
São Paulo	-1.11 (-5.7)	-1.14 (-6.7)	-1.16 (-6.3)	-1.09 (-6.0)	-0.83 (-4.9)
Rio de Janeiro	-0.99 (-6.2)	-0.81 (-4.1)	-1.23 (-6.1)	-0.92 (-4.2)	-0.50 (-2.8)
Belo Horizonte	-1.16 (-6.6)	-1.31 (-7.7)	-1.48 (-6.4)	-1.09 (-6.0)	-0.69 (-4.1)
Salvador	-1.78 (-7.1)	-2.16 (-9.4)	-2.50 (-9.5)	-2.14 (-8.4)	-1.23 (6.2)
Recife	-0.68 (-2.7)	-1.56 (-7.5)	-1.65 (-7.5)	-1.47 (-7.0)	-0.84 (-3.9)

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Note: metropolitan areas ordered from South to North.

Regressions of relative earnings, not reported in this paper, show that unemployment reduces earnings of the two groups which have less than five years of schooling relative to earnings of any of the three groups with more than five years of schooling. They also show that inflation reduces earnings of the group with five to eight years of schooling relative to any of the other groups. Moreover, although inflation reduces real earnings of the group which has more than 12 years of schooling it increases earnings of this group relative to all other groups. This supports the view that the better educated groups are able to obtain more perfect indexation than other groups.

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#### IV. CONCLUSIONS

Using monthly data for the six largest metropolitan areas of Brazil, this paper shows that education cannot explain the evolution of inequality in the 80s which increased with unemployment and inflation. Despite regional features in the temporal pattern of inequality, inequality in all regions remained relatively high and stable over the first half of the 80s and moved cyclically thereafter. Inequality reached a bottom in the middle of 1987, peaked in the middle of 1990, and declined in 1991.

We divide the population into five groups. The active labor force in each group has the same level of education. We measure the inequality within and between groups, and we decompose the temporal pattern of inequality in the 80s into three components: a complete cycle from the middle of 1984 to the end of 1991 which is perfectly matched by the evolution of the within group component of the inequality; a decreasing trend in inequality within groups; and an upward trend in inequality between groups.

Having shown that the cyclical pattern followed by the level of the income inequality is unrelated to changes associated to education, we argue that the opposite trends of the two components of inequality increase the power of differentials in education to explain the level of inequality in 1991 relative to 1982. (The ratio between the index of inequality between groups divided by the index of inequality within groups rises over the period.)

Moreover, we show that variations in unemployment and inflation can explain approximately one third of all variation in the level of inequality in all metropolitan areas, except São Paulo. Furthermore inflation reduces the real incomes of all educational groups but affects more strongly the group in the middle (with five to eight years of education).

Our results support the hypothesis that unemployment increases inequality and that inflation widens inequality by pushing the middle income groups to poverty.

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## APPENDIX

### DATA SOURCES AND DESCRIPTION

Here we describe the data and the universe we used.

Information on the Consumer Price Index in each metropolitan area were obtained from the Instituto Brasileiro de Geografia e Estatística (IBGE, the Brazilian Census Bureau). The consumer Price indices for São Paulo, Rio de Janeiro, and Belo Horizonte are also published in Fundação Getúlio Vargas, *Conjuntura Econômica*, Rio de Janeiro, various issues.

Information on labor income, the unemployment rate, the income differentials by educational level were obtained from the *Pesquisa Mensal de Emprego* (PME), a monthly employment survey conducted by the Instituto Brasileiro de Geografia e Estatística (IBGE). The survey exists since 1980 for the six largest Brazilian metropolitan areas. Ordered from South to North they are: Porto Alegre, São Paulo, Rio de Janeiro, Belo Horizonte, Salvador, and Recife. In 1982, the PME was evaluated and revised, leading to several improvements, in particular the inclusion of questions on the education level of workers.

Each month, approximately 10,000 workers, 10 or more years old, are interviewed in each metropolitan area. The PME asks each sampled individual 19 questions about his/her individual characteristics and the nature of his/her position in the labor market. For each individual in the sample we use the information on whether the individual was occupied or not at the time of the interview. For those who were occupied we also use the information on the labor income actually received in the previous month in his/her primary occupation, and his/her education level. For those who were not occupied we use the information on whether or not they were actively looking for a job during the week prior to the interview.

The analysis is conducted separately for each metropolitan area. For each month between January of 1980 and December of 1991 and each metropolitan area, we compute the unemployment rate, and different measures of income inequality. The universe of analysis is the occupied population 10 or more years old, and the concept of earnings is labor earnings actually received in the previous month in the primary occupation.



Tabela A.1  
Correlation Among Inequality Indices

Region	Theil-Gini	Gini-Spread	Theil-Spread
Porto Alegre	0.84	0.97	0.76
São Paulo	0.77	0.98	0.68
Rio de Janeiro	0.90	0.98	0.84
Belo Horizonte	0.85	0.95	0.73
Salvador	0.92	0.94	0.83
Recife	0.91	0.84	0.65

Note: metropolitan areas ordered from South to North.

Tabela A.2  
Decomposing the Variation in Inequality

São Paulo

from	to	$\Delta T$	$\Delta I/\Delta T$	$\Delta B/\Delta T$
Jul 82/Jun 83	Jul 86/Jun 87	-0.017	0.62	0.38
Jul 86/Jun 87	Jan 90/Jun 90	0.007	-1.46	2.46
Jan 90/Jun 90	Jul 91/Dec 91	-0.028	0.95	0.05

Rio de Janeiro

from	to	$\Delta T$	$\Delta I/\Delta T$	$\Delta B/\Delta T$
Jul 82/Jun 83	Jul 86/Jun 87	-0.091	0.93	0.07
Jul 86/Jun 87	Jan 90/Jun 90	0.129	0.96	0.04
Jan 90/Jun 90	Jul 91/Dec 91	-0.172	1.03	0.10

Belo Horizonte

from	to	$\Delta T$	$\Delta I/\Delta T$	$\Delta B/\Delta T$
Jul 82/Jun 83	Jul 86/Jun 87	-0.041	0.74	0.26
Jul 86/Jun 87	Jan 90/Jun 90	0.085	0.19	0.81
Jan 90/Jun 90	Jul 91/Dec 91	-0.113	0.82	0.18

Salvador

from	to	$\Delta T$	$\Delta I/\Delta T$	$\Delta B/\Delta T$
Jul 82/Jun 83	Jul 86/Jun 87	-0.042	1.16	-0.16
Jul 86/Jun 87	Jan 90/Jun 90	0.164	0.54	0.46
Jan 90/Jun 90	Jul 91/Dec 91	-0.063	2.01	-1.01

Recife

from	to	$\Delta T$	$\Delta I/\Delta T$	$B/\Delta T$
Jul 82/Jun 83	Jul 86/Jun 87	-0.077	1.03	-0.03
Jul 86/Jun 87	Jan 90/Jun 90	0.123	0.28	0.72
Jan 90/Jun 90	Jul 91/Dec 91	-0.097	0.62	0.38

Table A.3  
Regressions of Inequality Within and Between Groups

Metropolitan Area	Number of Observations	Inequality Within Groups			Inequality Between Groups		
		R <sup>2</sup>	Coefficient on Unemployment	Coefficient on Inflation	R <sup>2</sup>	Coefficient on Unemployment	Coefficient on Inflation
Porto Alegre	115	0.08	0.67 (3.0)	0.04 (0.9)	0.36	-0.44 (-2.7)	0.17 (5.6)
São Paulo	113	0.08	0.43 (2.6)	-0.03 (1.0)	0.20	-0.01 (-0.1)	0.10 (5.1)
Rio de Janeiro	110	0.28	1.69 (6.3)	0.21 (4.3)	0.27	-0.06 (-0.3)	0.18 (5.4)
Belo Horizonte	113	0.18	1.18 (5.0)	0.07 (1.5)	0.38	-0.05 (-0.3)	0.23 (7.4)
Salvador	110	0.13	1.35 (3.6)	0.12 (2.3)	0.31	-0.11 (-0.4)	0.30 (6.8)
Recife	112	0.27	1.60 (5.9)	-0.04 (-0.8)	0.34	-0.08 (-0.4)	0.28 (7.2)

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