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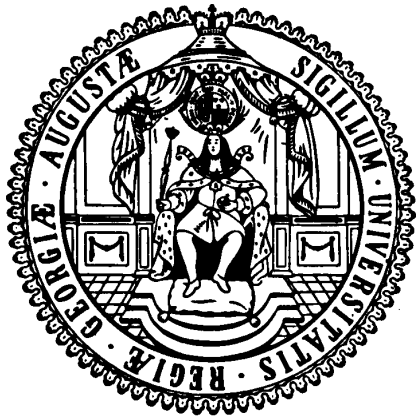

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Macroeconomic Performance and Inequality: Brazil 1983-94

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Macroeconomic Performance and Inequality: Brazil 1983-94[1]

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Abstract

We examine how macroeconomic performance, mainly in the role of inflation, affected earnings inequality during the 1980's and early 90's in regional Brazil. The evidence shows that the high and volatile inflation rates existent at the time, combined with incomplete indexation coverage, had a regressive and significant effect on inequality. The results, based on panel time series T>N data and analysis, are robust for different concepts of inflation, inequality measures, estimators and specifications. Hence, sound macroeconomic policies, which keep inflation low and stable in the long run, are to be a necessary first step of any policy implemented to alleviate high inequality, and improve welfare in Brazil.

Keywords: Inequality, inflation, indexation coverage, minimum wage.

JEL Classification: D31, E31, O11.

1 Introduction and Motivation

We examine the impact that macroeconomic performance, mainly in the role of inflation, had on earnings inequality during the 1980's and early 90's, in regions of Brazil. The importance of this subject in a major *developing* country is, firstly for the distinguishing features in terms of high inequality and poor macroeconomic performance, which are important not only for Brazil itself, but also for other *developing* countries that presented similar economic conditions during roughly the same time. Secondly, the link between macroeconomic performance and inequality in Brazil has been markedly different from what has happened in *developed* countries, where the subject has actually attracted consistent attention for some time.

The first wave of studies on, e.g. the US, covers the post-war period until early 1970's. Metcalf (1969), Schultz (1969), Thurow (1970), Beach (1977), and Blinder and Esaki (1978), employing a range of methods based on aggregate time series data, report that inflation had small, but not always statistically significant, progressive effects on inequality[1]. A second wave of studies that incorporates data from the 1980's, includes Blank and Blinder (1986), and Cutler and Katz (1991). Their results confirm the previous studies, but with even smaller and less precise inflation estimates on inequality. More recently, Romer and Romer (1998), and Blank (2000), also report that inflation remains progressive on inequality and poverty in the US[2]. Thus, it is fair to say that in *developed* countries inflation is believed to be progressive through the debtor and creditor channel, with the poor being the debt holders, and therefore the main beneficiaries of *moderate* rates of inflation that make their debts smaller[3].

On the other side, Brazil has been known for its *historically* high inequality, and also for its chronic high and volatile rates of inflation, especially during the 1980's and early 90's[4]. For the latter, this paper covers a particularly traumatic period in which Brazil experienced not only high and unstable rates of inflation, but also marked periods of *hyperinflation* in the late 1980's and early 90's, and again in the middle of the 90's. The subject of inequality and inflation has been often debated, however, given the lack of data until late 1970's, the literature on Brazil is not surprisingly thin and relatively recent, at least when compared to the US.

Cardoso et al. (1995) investigate the impact of inflation on inequality during the 1980's. Employing time series from metropolitan regions they find that

[1] Schultz (1969) also makes use of Dutch data covering roughly the same period. The same results hold, but with bigger estimates.

[2] The other explanatory variable included in most mentioned studies are either the unemployment or employment rates. Unemployment is reported to be regressive on inequality, and this is for the lower turnover costs that the poor present relative to the rich when a recession occurs.

[3] Nolan (1987), in a thorough study, uses UK data covering the 1960's and 70's, and reports that over time the shares of the top quintile decreases with inflation, relative to the shares of the first and third quintiles of the income distribution.

[4] Other *developing* countries that presented similar patterns of high inequality combined with high inflation during practically the same period were, e.g., Bolivia, Colombia, Indonesia, Mexico, and Peru.

inflation has significant effects in raising inequality in each region *separately*. Also using data from the 1980's, but a different set that include urban and rural regions, Ferreira and Litchfield (1999) estimate an *aggregate* time series divided into deciles. They too report regressive effects of inflation on inequality. Barros et al. (2000) *pool* time series with regional information from 1982 to 98, and consider the existence of fixed effects across regions. Their findings confirm the ones contained in both previous studies, with or without the presence of regional fixed effects. Therefore, these studies on Brazil indicate that, differently from what happens in *developed* countries, inflation rates have regressive effects on inequality, with inflation being regressive for its high and volatile rates, combined with the incomplete *indexation* coverage present at the time[5].

Having said that, the data set we use come mainly from the Brazilian bureau of census, and they cover six major regions over time. This kind of $T > N$ data, which combine a fairly long time series with panel variation, present novel and interesting features in terms of estimation. Firstly, time-series data tend to be non-stationary, and therefore the issue of testing for unit roots in panels is theoretically relevant for estimation and specification purposes. Secondly, there is the question of having heterogeneous dynamic panels. The treatment of heterogeneity is one of the central questions in *panel time series* analysis, since in its presence the estimates might be severely biased. Thirdly, there is the possible existence of between-region dependence in the data. This is a matter that if not taken into account, can lead to the situation of getting little gain in using panel estimators instead of different time series for each region. All these analytical issues are dealt with in this paper.

The evidence shows that chronic high inflation rates had a regressive impact on inequality. The highly volatile inflationary environment present in Brazil at the time, had a clear and significant positive effect on the Gini and Coefficient of Variation, and a negative one on the shares of the first four quintiles of the earnings distribution. The results are robust for different concepts of inflation, estimators and specifications.

This suggests that, despite the fairly sophisticated *indexation* framework existent in the Brazilian economy, especially during the hyperinflationary peaks, the ones at the bottom and middle of the earnings distribution were not efficiently insulated against the galloping rates of inflation. In addition, this incomplete *indexation* coverage occurred mainly because: first, in an economy with cash-in-advance constraints, the existence of inflation acts as a tax on cash (non-indexed) goods, therefore leading people to substitute cash for credit (indexed) goods. However, in Brazil the poor were credit-goods constrained, with little or no access at all to simple, but indexed bank accounts, having to hold cash instead[6]. Second, imperfect wage *indexation* due to lower bargaining power,

[5] Regarding the effects of unemployment rates on inequality in Brazil, Cardoso et al. (1995) and Barros et al. (2000) report that unemployment is regressive, as in the US. However, Ferreira and Litchfield (1999) report that unemployment is actually *not* regressive. They highlight the importance of the underground economy in somehow reducing the prospective regressive effect of higher unemployment on inequality.

[6] See Lucas and Stokey (1987), and to a lesser extent, Cooley and Hansen (1989), for more

since in the Brazilian labour market at the time, indexation was a function of wage levels, with higher wages being *overindexed,* and lower ones being severely *underindexed*[7]. Third, the information held by the poor in the very short run was imperfect, making this group even more vulnerable to high inflation rates. Hence, combining all the factors above, the prospective progressive debtor and creditor channel was clearly offset by the recurrent poor macroeconomic performance existent at the time, combined with the inefficient insulation provided to the ones at the bottom of the distribution[8].

Given that, this paper distinguishes itself from the previous studies for some important reasons. First, it fills in a blank in this literature on Brazil, which can also be mirrored not only to other *developing* countries that presented similar poor macroeconomic conditions, but also to emerging *developing* countries that still do not present credible anti-inflationary institutions. Second, it extends the specifications previously estimated not only with an important and significant anti-inequality variable not included before, but also with a different concept of inflation. Third, it makes use of both time-series and panel variations present in the data. No less important, it takes advantage of the relatively novel *panel time series* analysis that deals with empirical issues not tackled before in the related studies, which is a clear and significant step forward over previous studies in terms of estimation and more reliable estimates. All in all, this paper can also somehow be seen as a robustness check for the previous studies on the subject.

The remainder of the paper has the following structure: Section Two deals with the data set used. Firstly it explains how the variables are obtained and provides some descriptive statistics of the data, and secondly it describes how the variables behaved and interacted with each other during the period. Section Three briefly raises some analytical issues present in the data and how they are dealt with. It also presents and discusses the main empirical results. Finally, Section Four concludes. It summarises the evidence, highlights the differences between *developed* and *developing* countries on the subject, suggests extensions, and raises policy implications that arise from the empirical results in terms of macroeconomic stability or instability, and inequality and welfare.

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on theoretical models with cash-in-advance constraints. Additionally, Bulir (1998) highlights the importance of financial development or better access to credit (financial) goods to counteract the regressive effects of high inflation in a cross-section of countries, and also documents that the ratio of M2/GDP in 1994 in Brazil was .39 and in the US the same ratio was .63. Moreover, Beck et al. (2004) document that the ratio of private credit/GDP in Brazil over the period 1960-99 was .27, and in the US the same ratio was .94. Basically, these studies empirically highlight the importance of financial development in somehow reducing inequality.

[7] See Agénor and Montiel (1999), for more on wage contract indexation issues in Brazil, and also other developing countries during their high inflation periods.

[8] An alternative theoretical treatment is given by Cysne et al. (2005). They show that the rich and the poor present different shopping-time allocations, with the rich presenting better transacting technology, and therefore increasing their shares relative to the poor when inflation accelerates.

2 Description and Behaviour of the Data

2.1 Data Description

The data set comes from the Brazilian Institute of Geography and Statistics (IBGE), which is the Brazilian bureau of census, and also from the Institute of Applied Economic Research (IPEA) files. The IBGE is the most important institution for data collection, production and dissemination, and is the body that covers the Brazilian territory more thoroughly. The IPEA is an agency of the Brazilian government that, among other things, compiles primary and provides secondary data, coming from the IBGE itself, and also other national and international sources.

The data on earnings come from the Monthly Employment Survey (PME) files produced by the IBGE, which is a monthly rotative survey that covers six major regions over time, and approximately 38,500 households drawn from a probabilistic sample. The total resident population in those six regions accounted for 59% of the total Brazilian population in 1996. The six regions covered are, from north to south: Recife, Salvador, Belo Horizonte, Rio de Janeiro, São Paulo, and Porto Alegre. The concept of before tax earnings adopted by the PME includes wages, monetary bonuses and fringe benefits earned by those at work, profits made by those who are self employed and employers, and the monetary value of goods for those earning in kind.

Given that, we use the information of individual earnings from people between fifteen and sixty five years of age to obtain the Gini and the Coefficient of Variation of the earnings distribution, and the respective shares of each quintile in the distribution. These measures of inequality are used for having pleasing properties. The Gini and the Coefficient of Variation are simultaneously consistent with the Anonymity, Population, Relative Income, and Dalton principles, and are therefore Lorenz consistent. Further, according to the Relative Income principle, the shares are sufficient to measure inequality[9].

Regarding the inflation rates, we use the variation in the IBGE's regional Consumer Price Indexes (IPCs), which cover a basket of goods that families earning between one and eight times the monthly minimum wage usually purchase. A second concept of inflation used is the past inflation, which consists of a four-month average of the inflation rates, measured by the regional IPC's. Past inflation is used because it accounts for the known fact that inequality changes slowly over time within regions or countries. An advantage of these regional IPC's is that they cover the Brazilian territory using information from very diverse regions. Although they do not cover the national territory completely, their coverage more than matches the regions surveyed by the PME, which is an advantage for this paper.

The unemployment rates used as a cyclical variable also come from the PME files. Unemployment is calculated by the IBGE following the standard method of people unemployed, and who are actually looking for employment, over the labour force with at least fifteen years of age.

[9] For more on inequality measures and their properties, see Sen (1997).

The *regional* minimum wage index used as an extra variable is the national minimum wage divided by the average earnings of each region covered by the PME[10]. The importance of this variable is that in poorer regions, with lower average earnings, the minimum wage index will be higher, and therefore potentially more harmful for those earning around the index in such regions. This potentially harmful effect is via a prospective loss of employment, which leads to loss of earnings, and therefore higher inequality[11]. The minimum wage data come from the IPEA files.

Table One below provides the descriptive statistics of all national averages of the regional series used for estimation in Section Three, and also the correlations between the inequality measures and inflation rates in Brazil. It is worth mentioning in the first half of the Table, the high means of the Coefficient of Variation (CV) and Gini coefficient of the earnings distribution, and inflation rates during the period. No less important is the fact that the twenty percent richest (Q5) of those in the sample appropriate, on average, an astounding forty three percent of the total earnings (the forty percent poorest appropriates a mere eighteen percent of the total earnings). Additionally, in the second half of the Table we can see the positive correlation between both inequality measures (Coefficient of Variation and Gini) with inflation. Also important to mention is the negative correlation between the shares of the first four quintiles (Q12 and Q34) of the earnings distribution with inflation and, on the contrary, the positive correlation between the shares of the fifth quintile of the distribution with the very same inflation rates.

[10] The minimum wage in Brazil is national in scope.

[11] For more on the economics of the minimum wage, see Brown (1999).

Table 1: Descriptive Statistics and the Correlation Matrix, Brazil 1983-94

Variables	Observations	Mean	Std. Dev.	Min		Max
CV	144	1.642	.211	1.277		2.984
Gini	144	.548	.016	.510		.609
Q12	144	.181	.010	.157		.211
Q34	144	.392	.011	.325		.409
Q5	144	.428	.019	.396		.521
Inflation	144	18.466	14.065	.430		82.180
Unemployment	144	5.220	1.420	2.540		9.770
Min. Wage	144	206.700	42.820	115.030		321.500
Correlations	CV	Gini	Q12	Q34	Q5	Inflation
CV	1					
Gini	.657	1				
Q12	-.157	-.698	1			
Q34	-.298	-.341	.235	1		
Q5	.289	.618	-.754	-.080	1	
Inflation	.270	.276	-.091	-.304	.271	1

Source: PME, IPC, IBGE, IPEA, and author's own calculations.

2.2 Behaviour of the Variables

The behaviour of inflation in Brazil was notoriously unstable during the 1980's, and first half of the 90's. The inflation rates cover a range that goes from a rate of *virtually* zero per cent (.43% in April 1986), up to something around eighty percent (82.18% in March 1990) *per month*. For example, the accumulated inflation rate during the period between January 1983 and December 1994 is a staggering 2,659%, with an average of 18.50% *per month*. Figure One below illustrates some important inflationary events that took place during the period. It shows the hyperinflationary period that happened, particularly by the years of 1989-90, when inflation reached its peak of around eighty percent *per month,* and then the sudden, but not durable, drop due to the Collor Plan[12]. Another particular feature is the rising inflation rates, especially from 1991 onwards, which culminated with the implementation of the Real Plan in 1994[13]. The duration of the price stabilisation after those stabilisation plans is also significant. The drop due to the Real Plan has been not only much deeper, but also more durable than any other before, and inflation has actually been relatively low and stable in Brazil since then.

[12] The stabilisation plan implemented by the then newly elected President Fernando Collor.

[13] The Real Plan was gradually implemented during the first half of 1994, and the Real (R$) itself implemented in July 1994.

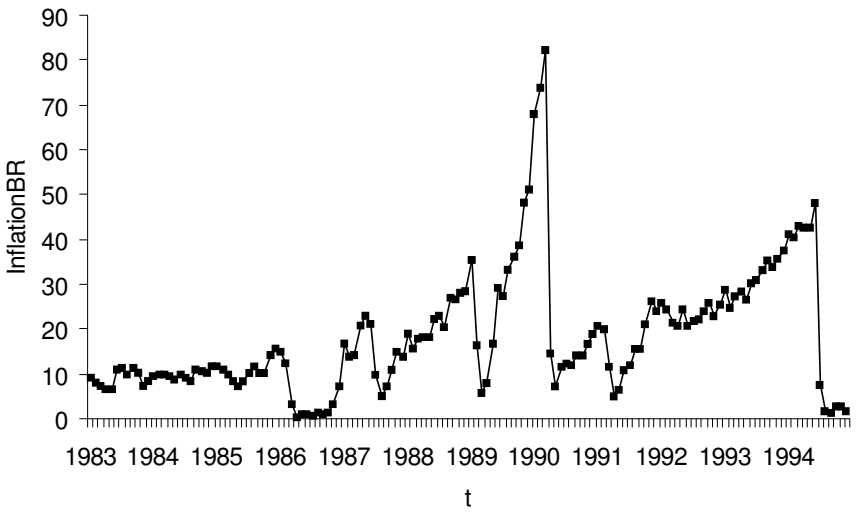

Figure 1: Monthly Inflation Rates in Brazil. Source: IPC, IBGE.

Regarding the behaviour of the Coefficient of Variation (CV) and Gini coefficient of the earnings distribution, combined with inflation, the main feature in the data is that both inequality measures markedly increased during the hyperinflationary periods, highlighting the perverse effects of high inflation on inequality. For instance, both measures of inequality presented increases of 43.71% and 9.19%, between January 1988 and August 1990, and June 1988 and January 1989, respectively. The effects are slightly symmetric though, which points out that when the hyperinflationary periods come to an end, inequality also decreases. In Figures Two and Three we plot both measures of inequality against inflation, which illustrates the above.

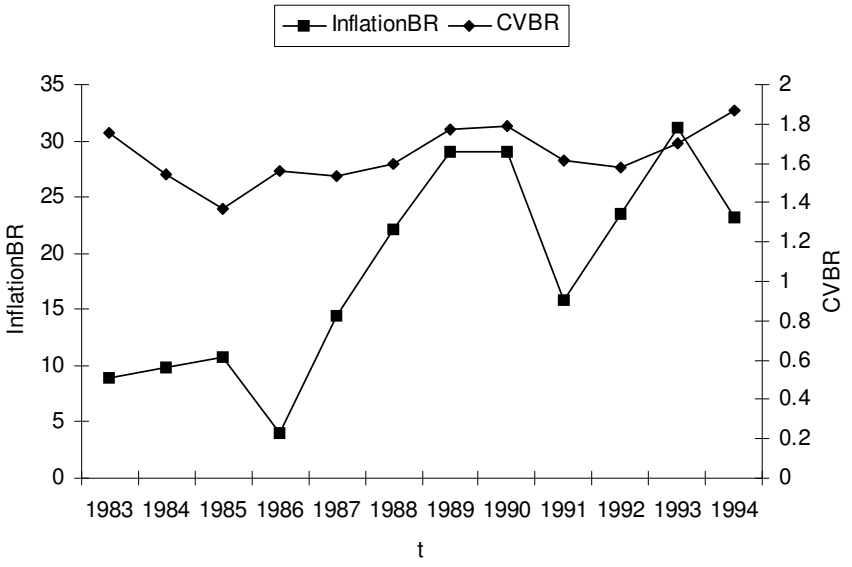

Figure 2: Annual Averages of Inflation and Inequality in Brazil. Source: PME, IPC, IBGE, and author's own calculations.

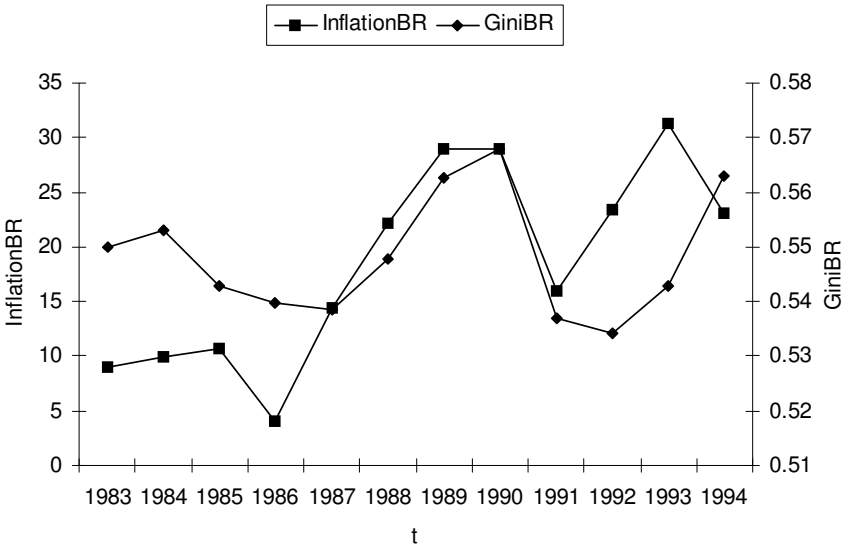

Figure 3: Annual Averages of Inflation and Inequality in Brazil. Source: PME, IPC, IBGE, and author's own calculations.

When we plot the earnings share of the low-middle (Q23), and top fifth (Q5) quintiles against the inflation rates, the data show that during the hyperinflationary peak of 1989-90 the earnings share of the poor and middle classes markedly fell. For example, the decrease between July 1988 and November 1989 was of 24.28%. However, after this hyperinflationary peak, there was a considerable recovery in the shares of the second and third quintiles. With respect to the top fifth quintile, its share increased significantly during the *hyperinflation* of 1989-90, and then dropped when inflation fell. In this case, the increase between April 1988 and November 1989 was of 26.61%. Figures Four and Five illustrate the above.

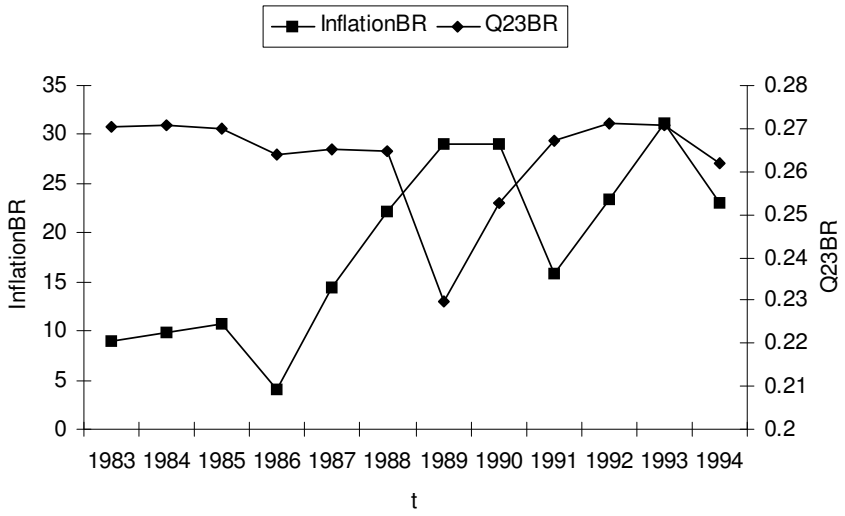

Figure 4: Annual Averages of Inflation and Inequality in Brazil. Source: PME, IPC, IBGE, and author's own calculations.

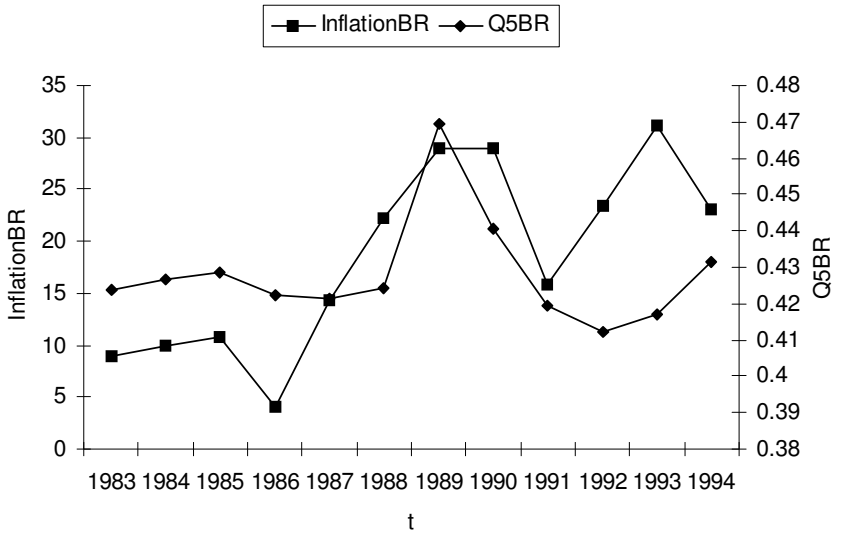

Figure 5: Annual Averages of Inflation and Inequality in Brazil. Source: PME, IPC, IBGE, and author's own calculations.

Hence, what can be drawn from the above preliminary descriptive and eyeball evidence is that high inflation rates considerably widened the earnings distribution during the period. Further, the rich did not lose their earnings through the debtor and creditor channel, but actually gained relative to the poor and middle classes, with high inflation. Moreover, the inequality measures clearly presented the ability to decrease when inflation fell, which suggests that low and stable rates of inflation, at least do not have a regressive effect on inequality.

3 Empirical Strategy and Findings

This Section briefly discusses some analytical issues present in the data and how they are dealt with, and reports and discusses the main results obtained. Firstly, the centred twelve-point moving averages are employed to deal with any possible seasonality, and to smooth the irregular component in the series. This transformed data have information from January 1983 to December 1994 ($T = 132$), covering six major regions of Brazil ($N = 6$). Secondly, for non-stationarity in the regional time series we employ the Im, Pesaran and Shin (IPS 2003) test, which allows for heterogeneous parameters and serial correlation[14]. Thirdly, the issue of heterogeneity bias in dynamic $T > N$ panels is dealt with Swamy's (1970) Random Coefficients (RC) estimator, which gives consistent

[14] An already published alternative to the now well stablished IPS (2003) is the test by Levin, Lin and Chu (2002). However, this test assumes parameter homogeneity, and therefore disconsiders a possible heterogeneity bias present in the data.

estimates[15]. Finally, since the data present $T > N$, between-region dependence is believed to be through the disturbances. This is dealt with Zellner's (1962) Seemingly Unrelated Regressions (SUR) estimator[16] [17].

The IPS test for unit roots is based on an Augmented Dickey-Fuller (ADF) regression for each region of each variable, which are then averaged. The mean E and variance var of the average $\bar{t}$ to be plugged into the IPS test are taken from IPS (2003). Equations One and Two below illustrate the regional ADF equations of each variable y and the IPS test, respectively.

$$\Delta y_{it} = a_i + b_i y_{it-1} + \sum d_{ij} \Delta y_{i,t-j} + \varepsilon_{it}, \tag{1}$$

$$IPS = \frac{\sqrt{N(\bar{t} - E(\bar{t}))}}{\sqrt{var(\bar{t})}}, \tag{2}$$

where N accounts for the regions. The IPS statistics suggest that we can reject the null hypothesis of unit roots in *all* variables, and accept the alternative that at least *one* region of each variable is stationary at 5% level. Table Two reports the results.

Table 2: Panel Unit Root Tests

Variables	IPS Statistics
CV	-2.02
Gini	-4.46
Q12	-3.27
Q34	-3.51
Q5	-2.95
Inflation	-3.98
Unemployment	-5.78
Min. Wage	-2.81

The mean E and variance var of the average $\bar{t}$ are, respectively: -1.504 and 0.683. Source: Im, Pesaran and Shin (2003), and author's own calculations.

Given that all variables are stationary, we can proceed to the issue of heterogeneity bias in dynamic models, and also to static models[18].

[15] The Mean Group (MG) estimator proposed by Pesaran and Smith (1995) is an alternative, however it is sensitive to outliers, a problem not faced by the RC estimator. The MG estimator consists of a simple average of the time series estimates. A second alternative would be the Instrumental Variable estimator, however an instrument uncorrelated with the residuals will be uncorrelated with the explanatory variable, and hence not a valid instrument. For more on the properties of the RC and MG estimators, see Pesaran and Smith (1995).

[16] An alternative to SUR is the estimator proposed by Pesaran (2002), which includes the means of the explained and explanatory variables in the estimated equation. However, N is assumed to be large, and in our data set N=6.

[17] For a more thorough discussion about *panel time series* analysis, see Smith and Fuertes (2004).

[18] For the static models, under certain conditions all panel estimators give unbiased estimates of the expected values. See Zellner (1969).

We first estimate a benchmark equation using the Pooled Ordinary Least Squares (POLS) estimator, which assumes homogeneous intercepts and slopes, as in Equation Three below.

$$y_{it} = \alpha + \beta' x_{it} + u_{it}, \tag{3}$$

where the explained y_{it} is either the Gini, or the Coefficient of Variation, or the quintile shares of the earnings distribution. The explanatory x_{it} includes either inflation or past inflation, unemployment, the minimum wage index, and the lagged values of the Gini coefficient of the earnings distribution, and either lagged inflation or lagged past inflation. We then move to the one-way Fixed Effects (FE) and the RC estimators, which assume the existence of heterogeneous intercepts, and heterogeneous intercepts and slopes, respectively. The RC estimator consists of a weighted average of $\hat{\alpha}_i$ and $\hat{\beta}_i$. The weight is a modified variance-covariance matrix of the heterogeneous α_i and β_i.

Table Three reports the results of the effects of either inflation or past inflation on the Gini coefficient of the earnings distribution in Auto Regressive Distributed Lag (ARDL) models. The results suggest that in all estimators, POLS, FE, and RC, the contemporaneous estimates of inflation and past inflation are positive and statistically significant, hence the increasing inequality. The estimates of lagged inflation and lagged past inflation in the ARDL models are understandably negative, since the methodology used to deflate the levels of earnings, which uses the deflator of month $t + 1$ to allow the inflation incurred in t to be accounted for[19]; better information about past and current economic conditions that can be used for protection against inflation; and current levels of *indexation*, would account for lagged inflation and its effects[20]. Regarding the estimates of the lagged Gini coefficient of the earnings distribution, they are positive and significant, confirming the fact that inequality is persistent over time, and generates itself[21]. The Likelihood Ratio (LR) tests for homogeneity of intercepts and slopes are rejected, indicating that the parameters are heterogeneous and therefore the RC estimator is the most appropriate for these dynamic models, since it deals with the heterogeneity bias nicely. Moreover, the way the RC estimator deals with the heterogeneity bias in such models assumes that the data are stationary, which is the case here.

[19] This is because the information on earnings reported in the questionnaires of the PME is related to the *first day* of a particular reference month t. See Corseuil and Foguel (2002) for more details on how to best deflate earnings and income data from Brazil.

[20] However, all lagged estimates of inflation and past inflation are smaller than the current ones. When we calculate the ARDL long-run effect of inflation they clearly suggest that in the long run the regressive effects of inflation and past inflation persist. Results available upon request.

[21] Corroborating with the fact that, according to the IPS test all variables are stationary, it is important to mention that under $T > N$, a spurious regression is less of a problem in anyway. Phillips and Moon (1999) argue that since these pooled estimators are averaging over the regions, the noise is attenuated, and the estimates are consistent.

Table 3: Estimates of Inflation and Past Inflation on the Gini Coefficient

	Dynamic Models		
Gini	POLS	FE	RC
Inflation	.0767 (13.77)	.0694 (11.80)	.0684 (2.47)
Inflation (1)	-.0698 (-12.42)	-.0610 (-10.06)	-.0599 (-2.13)
Gini (1)	.9967 (282.27)	.9628 (96.78)	.9695 (57.75)
Constant	.0427 (.224)		1.5371 (1.67)
LR1 test		13.87	
LR2 test			161.08
F test	27705.71	10508.10	NA
R^2	.9900	.9901	.9897
Past Infl.	.1035 (25.18)	.1009 (23.91)	.1042 (4.89)
Past Infl. (1)	-.0992 (-24.02)	-.0953 (-21.74)	-.0991 (-4.61)
Gini (1)	.9981 (327.14)	.9766 (112.17)	.9921 (72.58)
Constant	.01400 (.085)		.3405 (.467)
LR1 test		7.81	
LR2 test			234.14
F test	37449.55	14095.32	NA
R^2	.9932	.9933	.9932

T-ratios in parentheses. Source: author's own calculations.

The equations with the earnings quintile shares of the distribution as the explained variables deliver a similar story. The estimates of inflation and past inflation present regressive effects on the shares of the first four earnings quintiles of the distribution (Q12 and Q34). The groups that suffer most with both concepts of inflation are the third and fourth quintiles. At the other very end of the distribution, the twenty percent richest (Q5) is the only group that manage to increase its share when inflation accelerates. All estimates of inflation and past inflation are statistically significant, and the LR tests reject the null of homogeneous intercepts, suggesting the presence of regional fixed effects. Table Four below reports the results.

Table 4: Estimates of Inflation and Past Inflation on the Quintile Shares of the Distribution

	Univariate Static Models	
Q12	POLS	FE
Inflation	-.02142 (-3.42)	-.02159 (-3.79)
Past Infl.	-.02299 (-3.54)	-.02317 (-3.93)
Constant	18.406 (135.18)	
	18.430 (131.38)	
LR test		156.41
		149.63
R^2	.0145	.1911
	.0161	.1903
Q34		
Inflation	-.04092 (-8.63)	-.04110 (-9.79)
Past Infl.	-.03899 (-8.03)	-.03997 (-9.13)
Constant	39.961 (387.64)	
	39.931 (371.49)	
LR test		201.08
		198.35
R^2	.0861	.2910
	.0777	.2876
Q5		
Inflation	.06234 (6.04)	.06261 (6.78)
Past Infl.	.06288 (5.86)	.06315 (6.57)
Constant	41.631 (185.73)	
	41.638 (179.34)	
LR test		179.89
		174.51
R^2	.0442	.2384
	.0429	.2375

T-ratios in parentheses. Source: author's own calculations.

When we extend these univariate equations, the multivariate ones with unemployment and the minimum wage index alongside inflation as explanatory variables, confirm the stability of the above estimates on the Coefficient of Variation of the earnings distribution. In all specifications and estimators, inflation remains regressive and statistically significant. The unemployment rates estimates are significant and, as expected, regressive. This is because the poor are the ones who lose their jobs and earnings first when a recession occurs. The minimum wage is progressive and significant in the FE estimator, which highlights the importance of this particular policy in reducing inequality. The LR tests reject the null of homogeneous intercepts, suggesting the presence of regional fixed effects. Table Five reports the results.

Table 5: Estimates of Macroeconomic Performance on the Coefficient of Variation

	Multivariate Static Models	
CV	POLS	FE
Inflation	.0099 (16.64)	.0092 (21.24)
Unemployment	.0320 (8.28)	.0056 (1.67)
Constant	1.2592 (49.73)	
LR test		525.30
F test	153.06	189.75
R^2	.2795	.6288
Inflation	.0102 (14.70)	.0048 (10.92)
Min. Wage	.0007 (3.38)	-.0028 (-16.80)
Constant	1.3503 (45.52)	
LR test		820.84
F test	116.54	297.01
R^2	.2280	.7261
Inflation	.0102 (15.32)	.0050 (11.33)
Unemployment	.0307 (7.57)	.0094 (3.29)
Min. Wage	.0002 (.98)	-.0029 (-17.11)
Constant	1.2396 (38.53)	
LR test		776.08
F test	102.36	264.5
R^2	.2804	.7299

T-ratios in parentheses. Source: author's own calculations.

Additionally, we look at the issue of between-region dependence, which is dealt with the SUR estimator. The equation estimated for each region is as follows;

$$y_t = \alpha_t + \beta' x_t + u_t, \tag{4}$$

where y_t is the Coefficient of Variation of the earnings distribution, and x_t accounts for either inflation or past inflation, and the minimum wage index. Table Six reports the results. Both concepts of inflation present estimates that are positive and significant in all six regions. An interesting feature present in the estimates of both concepts of inflation is that the poorer metropolitan regions of the Northeast, i.e., Recife (REC) and Salvador (SAL), present the biggest estimates, which indicates that the poorer the region, the more regressive inflation is[22]. When we put together inflation and the minimum wage, the results clearly indicate that again, the minimum wage does not have any regressive effect on inequality. On the contrary, in all regions this policy helps to reduce inequality, although its progressiveness is smaller than the regressiveness of inflation.

[22] Related to that, Guitián (1998) shows in a cross-section of countries that inflation presents stronger regressive effects, the poorer the countries.

Also worth mentioning is that even in those poor regions of the Northeast, the minimum wage does not present any regressive effect. The Lagrange Multiplier (LM) test rejects the null hypothesis that the variance-covariance matrix is diagonal, which suggests that these regions are related to each other through the disturbances, and therefore the SUR estimator is appropriate in this situation[23].

Table 6: Estimates of Inflation, Past Inflation, and the Minimum Wage on the Coefficient of Variation

	SUR		
CV	REC	SAL	BH
Inflation	.0156 (18.00)	.0124 (10.44)	.0066 (6.40)
Constant	1.4517 (76.78)	1.5095 (58.34)	1.5539 (69.03)
LM test	628.09		
Inflation	.0125(13.32)	.0068(6.70)	.0038(3.46)
Min. Wage	-.0015(-5.61)	-.0039(-10.61)	-.0019(-4.67)
Constant	1.6927(36.55)	1.9975(40.08)	1.7831(33.49)
LM test	333.62		
Past Infl.	.0174 (25.43)	.0150 (14.92)	.0087 (9.09)
Constant	1.4165 (95.03)	1.4615(67.07)	1.5124 (72.61)
LM test	477.44		
	RJ	SP	PA
Inflation	.0108 (14.84)	.0050 (6.02)	.0032 (3.18)
Constant	1.3898 (87.37)	1.3330 (72.48)	1.4154 (63.85)
LM test	628.09		
Inflation	.0080(10.93)	.0005(.64)	-.0004(-.44)
Min. Wage	-.0020(-6.95)	-.0037(-9.66)	-.0028(-5.69)
Constant	1.6227(44.88)	1.6682(44.31)	1.7069(31.10)
LM test	333.62		
Past Infl.	.0115 (16.55)	.0056 (6.49)	.0036 (3.51)
Constant	1.3751 (90.42)	1.3242 (70.63)	1.4043 (62.62)
LM test	477.44		

T-ratios in parentheses. Source: author's own calculations.

The clear economic intuition behind the above empirical evidence is that: firstly, chronic high inflation is bad for those who are not at the very top of the

[23] The IPS test reported in Table Two assumes the existence of between region *independence*. An alternative that considers the existence of between region *dependence* is proposed by Pesaran (2003). The cross-section IPS (CIPS) test includes the cross section averages of lagged levels and first differences of the individual series in the ADF regression. However, CIPS assumes that $N > 10$ and we have $N = 6$ in our data set. It is therefore thought that the IPS test in this case is slightly biased but still informative, and the best alternative available.

distribution; secondly, the poorer the region, the more regressive inflation tends to be; thirdly, the policy of earnings *indexation* coverage had not been efficiently implemented in the Brazilian economy to protect, not only the poor, but also the middle classes against high inflation. In terms of unemployment effects, the evidence confirms that those at the bottom of the distribution present lower turnover costs. Regarding the minimum wage index, the estimates suggest that this policy can help to lower inequality, therefore increasing the welfare of the poor, instead of harming it. All in all, the evidence presented in this Section clearly backs and confirms the one presented in Section Two, which clearly indicates that poor macroeconomic performance, exemplified by high inflation rates, is bad for the poor and middle classes, and hence increases inequality[24].

Next Section concludes this paper, it summarises the importance and quality of the results, suggests future work, and raises some public policy issues that arise from the empirical evidence presented.

4 Concluding Remarks

We investigated the impact that macroeconomic performance had on earnings inequality in regional Brazil, in the 1980's and first half of the 90's. The empirical evidence, based on *panel time series* $T > N$ data and analysis, clearly suggests that chronic high and volatile inflation rates had significant effects in raising inequality during the period. The results are robust for different concepts of inflation (current and past inflation), inequality measures (Coefficient of Variation, Gini, and the quintile shares of the earnings distribution), estimators (POLS, FE, RC, and SUR), and specifications (static, dynamic, univariate, and multivariate). The evidence points to the fact that, the poor and not so poor, did not have access to indexed financial (credit) goods, such as simple daily indexed bank accounts to protect themselves against accelerating inflation, nor *fully* monthly indexed wages. The other two variables regressed against inequality alongside inflation, i.e., unemployment rates and the minimum wage index, respectively presented regressive and progressive effects on inequality. These results confirm the fact that the poor present lower turnover costs, and hence lose their jobs and earnings first when a recession occurs, and also that a minimum wage policy can reduce inequality. Still with regards to the minimum wage, it can be said that this policy helps to improve the welfare of those at the bottom of the distribution, without distorting their employment nor earnings opportunities, even in times of poor macroeconomic performance. A word of caution about this policy is needed though. The minimum wage index estimates do not, in anyway, offset the regressive effects of high inflation.

Another important issue raised is the need to differentiate the impact of inflation on inequality in countries that present different economic conditions.

[24] Different univariate and multivariate models, eg, Partial Adjustment Model, and specifications with different explanatory variables, e.g., inflation volatility, were respectively estimated. All results confirm the ones presented above regarding the regressive effects of high inflation on inequality. Results available upon request.

The review presented in Section One from previous studies on the US, and to a much lesser extent the Netherlands and UK, suggests that *moderate* rates of inflation would be beneficial for the poor, since they would benefit from the decreasing amounts of their debts. Any potential loss incurred by the poor for carrying cash balances would be negligible under such an environment too, since it would be offset by gains in having their debts reduced. Slightly higher inflation rates are also associated with an expansive monetary policy, normally used to boost employment in *developed* countries, and which would decrease inequality through lower rates of unemployment in the short run. On the contrary, in a country with galloping and volatile inflation rates such as Brazil, and other *developing* countries in the 1980's and early 90's, any possible gain coming from the debtor and creditor channel was clearly offset by the poor macroeconomic performance, combined with incomplete access to financial (credit or indexed) goods, and lower bargaining power regarding earnings *indexation*. The clear evidence presented in Sections Two and Three from a range of inequality measures, specifications and estimators, highlights the regressive effects of high inflation on inequality, and therefore the importance of having sound monetary and fiscal policies that actually keep inflation consistently low and under control in the very long run.

Moreover, the quality of the results are somehow boasted not only by the inclusion of the minimum wage index in the equations, but also by the novel analytical approach used. The evidence based on *panel time series* $T > N$ data and analysis deals with issues such as non-stationarity in panels, heterogeneity bias in dynamic panels, and between-region dependence. None of these issues have been considered before in any other study of the impact of macroeconomic performance on inequality, and this can be regarded as a clear step forward in terms of achieving better and more reliable estimates from a wide range of estimators.

Regarding future work, an investigation on how poor macroeconomic performance affected inequality over time in a panel of *developing* countries that presented similar unstable economic conditions in the 1980's and 90's would be a natural extension of this work[25]. Another natural extension is an investigation of the importance of financial development on inequality in Brazil, i.e., whether access to financial (credit) goods would really present the poor not only with credit that could be used to invest in human capital, but also with some sort of protection against high inflation[26].

To conclude, first we understand that in such an unequal country like Brazil, the unstable macroeconomic performance, although important, is not the whole story behind the high inequality. Second, however when we take into consideration the high rates of inflation per month existent at the time, the impact of bad macroeconomic performance on inequality are considerable. For instance,

[25] For example, Argentina, Bolivia, Brazil, Israel, Mexico, Peru, Poland, Turkey, and Uruguay.

[26] Galor and Zeira (1993) and Banerjee and Newman (1993), develop theoretical models that highlight the importance of better access to credit markets in lowering inequality through the investment in human capital channel.

taking the inflation estimates from the univariate RC estimator presented in Table Three, and considering a conservative average inflation and past inflation rates of 18.50% *per month*, inequality would increase in 1.26 and 1.92 points *each month,* respectively. When taking the multivariate FE estimates in the equation with inflation and unemployment in Table Five and considering the same average inflation as before, inequality would increase .17 points *each month*. Moreover, applying the same average to the univariate SUR inflation estimates in Table Six for Recife (REC) and Salvador (SAL), the two poorest regions, inequality would increase in .29 and .23 points *each month*, respectively. Therefore, the moral to be drawn is that a stable macroeconomic environment is certainly a *necessary* condition to achieve, at least non-increasing inequality. Thus, the policy of the Brazilian government, which has recently kept inflation under control for some time, is to be praised as a significant and *necessary* first step in the right direction.

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