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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 high inflation, affected earnings inequality in the 1980's and early 90's in Brazil. The evidence shows that the extreme inflation rates, combined with the incomplete indexation coverage existent at the time, had a regressive and significant impact 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 inequality and improve welfare in Brazil.

Keywords: Inequality, Brazil, inflation, indextion

JEL Classification: D31, E31, O11, O54

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1 Introduction and Motivation

We examine the impact that macroeconomic performance, mainly in the role of high inflation, had on earnings inequality in the 1980's and early 90's in regional 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. 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 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, and with data from the 1990's, Romer and Romer (1999) 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[3].

On the other hand, Brazil has been known for its perennial high inequality and also for its chronic high and volatile rates of inflation, especially in

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

[2]The other explanatory variables 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]Complementary to that, Nolan (1987), in a thorough study, uses UK data covering the 1960's and 70's. He acknowledges that his results are "not substantial", but reports that over time the shares of the top quintile decrease relative to the shares of the first and third quintiles of the income distribution when inflation rises.

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 peaks 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 anecdotally debated, however, given the lack of data until late 1970's, the literature on Brazil is, not surprisingly, thin and relatively recent.

Cardoso et al. (1995) investigate the impact of inflation on inequality in the 1980's. Employing time series from metropolitan regions they find that inflation has significant effects in raising inequality in each region separately. 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 the previous study, with or without the presence of regional fixed effects. Also using data from the 1980's, but a different set that includes urban and rural regions, Ferreira and Litchfield (2001) estimate an aggregate time series divided into deciles. They too report regressive effects of inflation on inequality. 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 comes mainly from the Brazilian census bureau and it covers 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 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 biased. Thirdly, there is the possible existence of between-region dependence in the data. This is a matter

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

[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 (2001) report that unemployment is in fact *not* regressive. They highlight the importance of the underground economy in to some extent buffering the prospective regressive effect of higher unemployment on inequality.

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 extreme inflation rates had a regressive impact on inequality. The volatile inflationary environment present in Brazil at the time had a significant and 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. Furthermore, 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 during the hyperinflationary peaks, those at the bottom and even middle of the earnings distribution were not efficiently insulated against the galloping rates of inflation. In addition, this incomplete *indexation* coverage occurred mainly for three reasons: 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 reallocate or substitute cash for financial (indexed) goods[6]. However, in Brazil the poor were financial-goods constrained, with little or no access to, e.g., indexed bank accounts, and therefore *having* to hold the highly taxed cash instead[7]. Second, imperfect wage *indexation* due to lower bargaining power, since in the Brazilian formal labour market at the time indexation was a function of wage levels, with higher wages being *overindexed* and the lower ones severely *underindexed*[8]. Third, the information held by the poor in the very short run was imperfect, making this group even more vulnerable to unexpected high inflation rates. Hence, combining all the factors above, the prospective progressive debtor and creditor channel was offset by the recurrent poor

[6] 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.

[7] See Lucas and Stokey (1987) and Cooley and Hansen (1989) for more on theoretical models with cash-in-advance constraints. Additionally, Bulir (2001) highlights the importance of financial development in reducing the regressive effects of high inflation in a cross-section of countries. 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. They also highlight the importance of financial and credit markets in reducing inequality and poverty.

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

macroeconomic performance existent at the time.

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 much debated 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 *new* empirical issues, which is a significant step forward compared to previous studies in terms of estimation[9].

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 and inequality.

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 census bureau, and also from the Institute of Applied Economic Research (IPEA) files. The IBGE is the most important institution for data collection and dissemination, and is the body that covers the Brazilian territory most thoroughly. The IPEA is an agency of the Brazilian government that, among other things, compiles primary and

[9]For instance, Barros et al. (2000) use pooled data and analysis. However, they do not deal with non-stationarity, nor heterogeneity bias in their dynamic models, nor cross-region dependence in panels.

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 percent 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.

In a country which presented high inflation rates for such a long period of time the way the data is deflated is rather important. The earnings data are deflated by the IBGE's National Index of Consumer Prices (INPC). The INPC covers a basket of goods that families earning between one and eight times the monthly minimum wage, and whose head is employed and living in one of the regions usually purchase[10]. One important prior adjustment is the use of a converter to express all data in Real (R$) mainly because Brazil had many monetary reforms, especially between 1986 and 1994. Some adjustments in the INPC itself are also implemented. These include a correction of 22.25 percent for the inflation incurred in June 1994, a month before the full implementation of the R$. The reason is that the INPC calculated inflation using the price variations of a *virtual*, but not fully implemented R$, which was lower than the price variation incurred by the still existent and widely used Cruzeiro (CR$). Another correction is the need to centre the INPC as if it was measuring inflation starting on the first day of each month, which is the date that most people get their paycheques. Taking into consideration that the information on earnings reported in the questionnaires of the PME is related to the first day of a particular reference month t, earnings are corrected by the deflator of month $t+1$ to allow the inflation incurred in t to be accounted for[11].

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 Co-

[10] This information comes from the IBGE's Family Budget Survey, and Products and Services Specification Survey.

[11] See Corseuil and Foguel (2002) for more details on how to best deflate earnings and income data from Brazil.

efficient of Variation of the earnings distribution, and the respective shares of each quintile in the distribution. These measures of inequality are used for their attractive 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. Furthermore, according to the Relative Income principle, the shares are sufficient to measure inequality[12].

Regarding the inflation rates, we use the variation in the IBGE's regional Consumer Price Indexes (IPCs). 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 and 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 the number of people unemployed and who are currently looking for employment over the labour force, who are at least fifteen years old.

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. The importance of this variable is twofold: first, 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. Second, and in contrast, the minimum wage can be seen as a variable that keeps the earnings of the poor at a minimum level in times of poor macroeconomic performance, with the potential of reducing inequality[13]. The minimum wage data are deflated by the INPC and come from the IPEA files.

Table One 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

[12]For more on inequality measures and their properties, see Sen (1997) or Ray (1999).
[13]For a survey on the economics of the minimum wage, see Brown (1999).

worth mentioning the high means of the Coefficient of Variation (CV) and Gini coefficient of the earnings distribution (1.64 and .54, respectively), and inflation rates (18.50 percent per month) during the period in the first half of the Table. No less important is the fact that the richest twenty percent (Q5) of those in the sample appropriate, on average, an astounding 43 percent of the total earnings (the poorest forty percent (Q12) appropriates a mere 18 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, with Q34 presenting the highest correlation) of the earnings distribution with inflation and, in contrast, the positive correlation between the shares of the fifth quintile of the distribution with the very same inflation rates.

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

As mentioned, the behaviour of inflation in Brazil was notoriously unstable in 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 percent in April 1986) up to something around 80 percent (82.18 percent 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 percent, with an average of 18.50 percent *per month*[14].

Figure One illustrates some important inflationary events that took place during the period. It shows the hyperinflationary period that happened by the years of 1989-90 when inflation reached its peak of around 80 percent *per month,* and then the sudden, but not durable, drop due to the Collor Plan[15]. Another particular feature is the rising inflation rates, especially from 1991 onwards, which culminated with the implementation of the Real Plan in 1994[16]. 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.

[14]To illustrate it further, the annual inflation rate in 1989 was 1,863 percent.

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

[16]The Real Plan was gradually implemented during the first half of 1994 and the Real (R$) itself implemented in July 1994. See Agénor and Montiel (1999) for a textbook treatment.

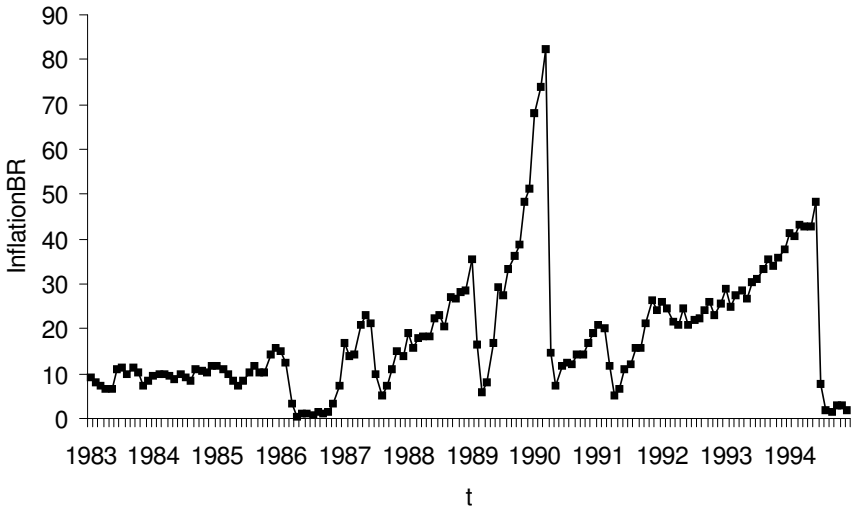

Figure 1: Monthly Inflation Rates in Brazil. Source: IPC, IBGE.

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, which highlights the perverse effects of high inflation on inequality. For instance, both measures of inequality presented increases of 43.71 percent and 9.19 percent between January 1988 and August 1990, and June 1988 and January 1989 respectively. The effects are slightly symmetric though, which shows that when the hyperinflationary periods come to an end inequality also returns to its previous figures. In Figures Two and Three we plot both measures of inequality against inflation to illustrate the above.

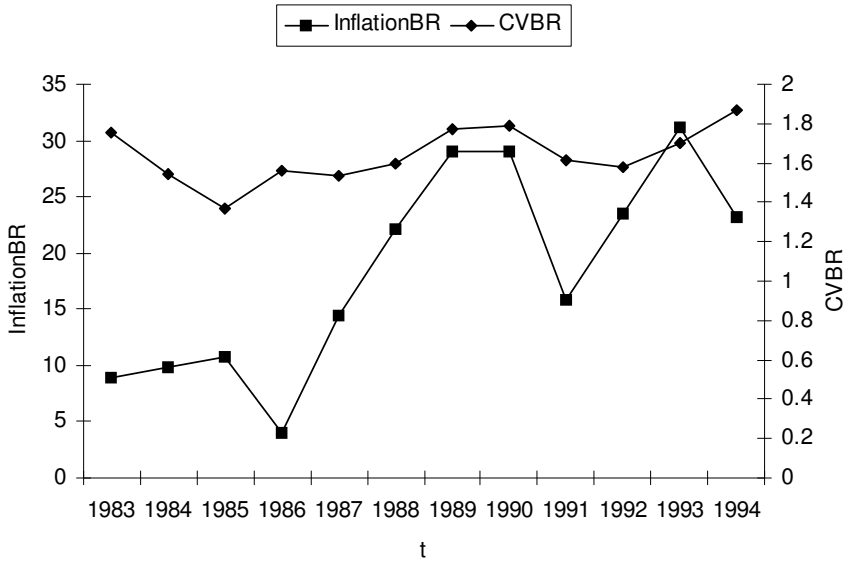

Figure 2: Annual Averages of Inflation and Inequality in Brazil. Source: PME, IPC, IBGE and author's own calculations.

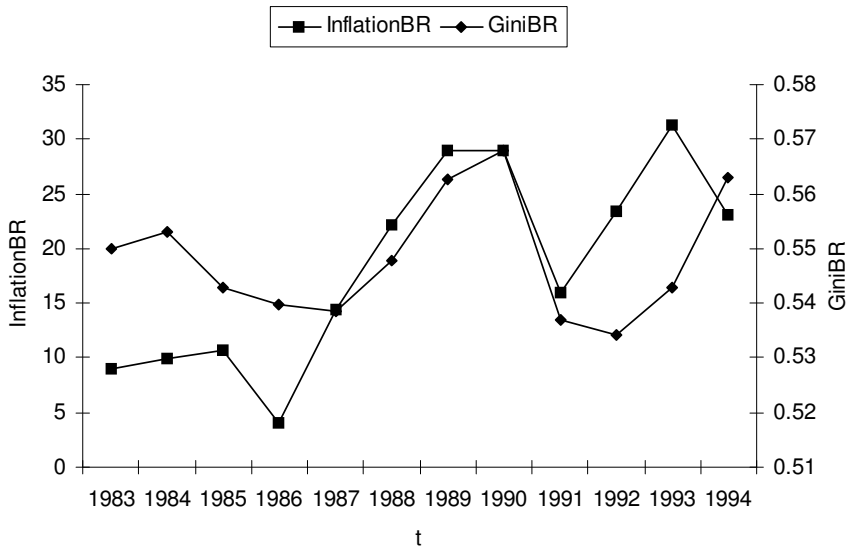

Figure 3: Annual Averages of Inflation and Inequality in Brazil. Source: PME, IPC, IBGE and author's own calculations.

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 fell markedly. For example, the decrease between July 1988 and November 1989 was 24.28 percent. However, after this hyperinflationary peak there was a considerable recovery (to their previous figures) 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 26.61 percent. Figures Four and Five illustrate the above.

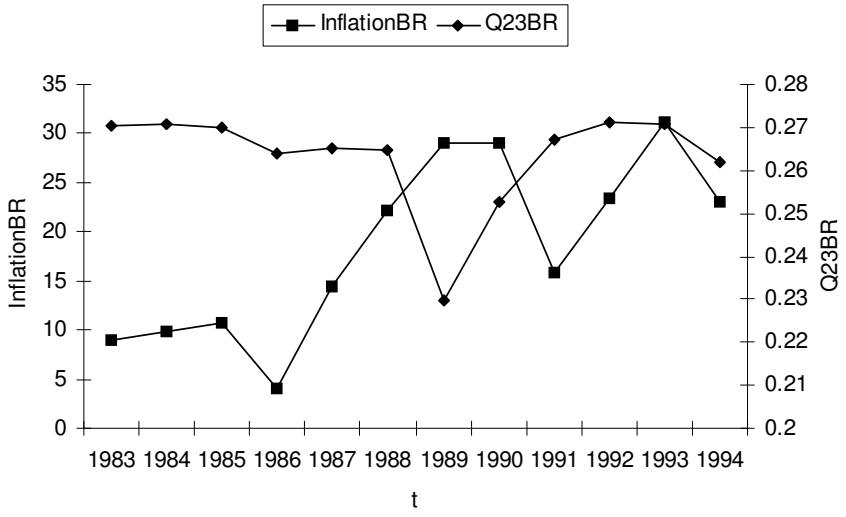

Figure 4: Annual Averages of Inflation and Inequality in Brazil. Source: PME, IPC, IBGE and author's own calculations.

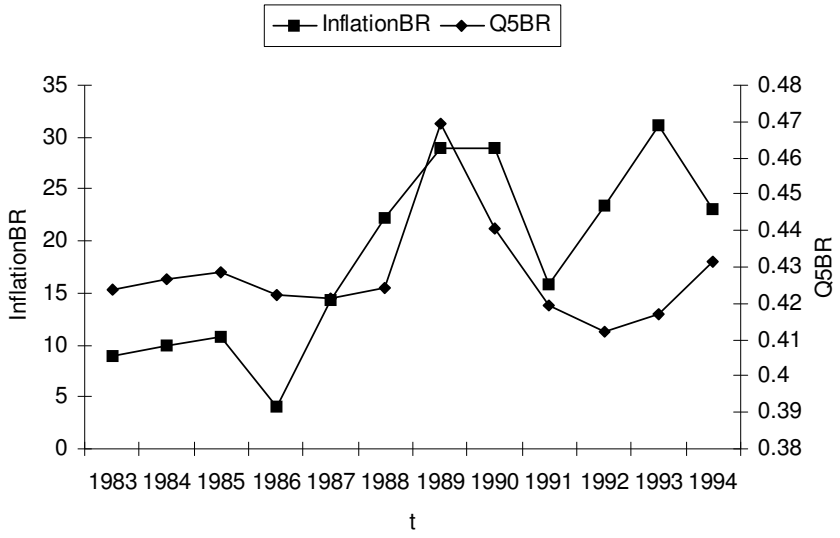

Figure 5: Annual Averages of Inflation and Inequality in Brazil. Source: PME, IPC, IBGE and author's own calculations.

Hence, what can be drawn from the above preliminary descriptive and visual evidence is that high inflation rates considerably widened the earnings distribution during the period. Furthermore, 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 to their previous figures 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[17]. Thirdly, the issue of heterogeneity bias in dynamic $T > N$ panels is dealt with Swamy's (1970) Random Coefficients (RC) estimator, which gives consistent estimates[18]. Finally, since the data present $T > N$, between-region dependence is believed to be through the disturbances, i.e., $E(u_{it}u_{jt}) \neq 0$. This is dealt with Zellner's (1962) Seemingly Unrelated Regressions (SUR) estimator[19] [20].

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 illustrate the regional ADF equations of each variable y and the IPS test, respectively.

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

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

where N accounts for the number of 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.

[17] 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.

[18] The Mean Group (MG) estimator, which consists of a simple average of the time series estimates, proposed by Pesaran and Smith (1995) is an alternative, however it is sensitive to outliers, a problem not faced by the RC estimator. 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).

[19] An alternative to SUR is the estimator proposed by Pesaran (2003), 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.

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

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 proceed to the issue of heterogeneity bias in dynamic models and also to static models[21].

We first estimate benchmark dynamic equations using the one-way Fixed Effects (FE) estimator, which assumes heterogeneous intercepts and homogeneous slopes, as in Equation Three.

$$I_{it} = \alpha_i + \beta I_{it-1} + \gamma INFL_{it} + \delta MW_{it} + u_{it}, \tag{3}$$

where the explained I_{it} is either the Gini or the Coefficient of Variation of the earnings distribution. The explanatory variables include either inflation ($INFL_{it}$) or past inflation, the minimum wage index (MW_{it}), and either the lagged values of the Coefficient of Variation or the Gini coefficient of the earnings distribution (I_{it-1}), and lagged past inflation. We then move to the RC estimator, which assumes the existence of heterogeneous intercepts and slopes[22].

Table Three reports the results of the effects of either inflation or past inflation on the Coefficient of Variation and Gini coefficient of the earnings distribution in a Partial Adjustment Model (PAM) and in an Auto Regressive Distributed Lag (ARDL) model. The results suggest that in all equations and estimators the contemporaneous estimates of inflation and past inflation are

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

[22] 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. See Swamy (1970) or Greene (2003).

positive and statistically significant, and hence the increasing inequality. The estimates of lagged past inflation in the ARDL models are understandably negative[23]. First because better information about past and current economic conditions can be used for protection against inflation. Second, the current levels of *indexation* would account for lagged past inflation and its effects.

Regarding the estimates of the lagged measures of inequality, they are positive and significant, confirming the fact that inequality is persistent over time and generates itself[24]. The estimates of the minimum wage index are negative and significant, which suggests that this policy can reduce inequality. 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. 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[25].

[23]However, all lagged estimates of past inflation are smaller than the current ones. When we calculate the ARDL long-run effect of past inflation they suggest that in the long run its regressive effects on inequality persist. Available upon request.

[24]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 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.

[25]In the PAM specification, when the measure of inequality is the Gini, the estimates are robust in economic terms. Similarly, in the ARDL specification, when the measure of inequality is the Coefficient of Variation, the estimates are robust in economic and statistical terms with respect to those reported in Table Three. Available upon request.

Table 3: Estimates of Inflation and Past Inflation on Inequality

	Dynamic Models	
CV	FE	RC
Inflation	.0116 (7.89)	.0127 (2.61)
Min. Wage	-.0037 (-6.06)	-.0052 (-2.35)
CV (1)	.8820 (83.35)	.8490 (28.61)
Constant		.2570 (4.63)
LR test	82.62	184.78
F test	3438.15	NA
R^2	.9723	.9504
Gini		
Past Infl.	.1009 (23.91)	.1042 (4.89)
Past Infl. (1)	-.0953 (-21.74)	-.0991 (-4.61)
Gini (1)	.9766 (112.17)	.9921 (72.58)
Constant		.3405 (.467)
LR test	7.81	234.14
F test	14095.32	NA
R^2	.9933	.9932

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

In static specifications we first estimate benchmark equations using the Pooled Ordinary Least Squares (POLS) estimator, which assumes homogeneous intercepts and slopes, and then move to the FE estimator. 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 (Q34). At the very other end of the distribution, the richest twenty percent (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 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)
Constant	18.406 (135.18)	
LR test		156.41
R^2	.0145	.1911
Past Infl.	-.02299 (-3.54)	-.02317 (-3.93)
Constant	18.430 (131.38)	
LR test		149.63
R^2	.0161	.1903
Q34		
Inflation	-.04092 (-8.63)	-.04110 (-9.79)
Constant	39.961 (387.64)	
LR test		201.08
R^2	.0861	.2910
Past Infl.	-.03899 (-8.03)	-.03997 (-9.13)
Constant	39.931 (371.49)	
LR test		198.35
R^2	.0777	.2876
Q5		
Inflation	.06234 (6.04)	.06261 (6.78)
Constant	41.631 (185.73)	
LR test		179.89
R^2	.0442	.2384
Past Infl.	.06288 (5.86)	.06315 (6.57)
Constant	41.638 (179.34)	
LR test		174.51
R^2	.0429	.2375

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

When we extend these equations, with unemployment alongside inflation and the minimum wage index, the results 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 those who lose their jobs and earnings first when a recession occurs. The minimum wage is progressive and significant in the FE estimator, which highlights and confirms 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[26]. Table Five reports the results.

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

	Multivariate Static Models	
CV	POLS	FE
Inflation	.0998 (16.64)	.0924 (21.24)
Unemployment	.3204 (8.28)	.0561 (1.67)
Constant	.1259 (49.73)	
LR test		525.30
F test	153.06	189.75
R^2	.2795	.6288
Inflation	.1021(14.70)	.0484 (10.92)
Min. Wage	.0075 (3.38)	-.0287 (-16.80)
Constant	.1350 (45.52)	
LR test		820.84
F test	116.54	297.01
R^2	.2280	.7261
Inflation	.1027 (15.32)	.0504 (11.33)
Unemployment	.3079 (7.57)	.0945 (3.29)
Min. Wage	.0022 (.98)	-.0291 (-17.11)
Constant	.12396 (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.

[26]When the measure of inequality is the Gini, most estimates are robust in terms of economic and statistical significance with respect to those reported in Table Five. Available upon request.

Additionally, we look at the issue of between-region dependence, which is dealt with the SUR estimator. The SUR estimates different regional time series, which are then weighted by the covariance matrix of the disturbances. The equation estimated for each region is as follows;

$$CV_t = \alpha_t + \beta INFL_t + \gamma MW_t + u_{t,} \tag{4}$$

where CV_t is the Coefficient of Variation of the earnings distribution, and $INFL_t$ accounts for either inflation or past inflation and MW_t for 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 seen 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 largest estimates, which indicates that the poorer the region, the more regressive inflation is[27]. When we put together inflation and the minimum wage, the results show that 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[28]. Also worth mentioning is that even in those poor regions of the Northeast, where the index is higher, 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[29].

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

[28]When the measure of inequality is the Gini, all estimates are robust in economic and statistical terms with respect to those reported in Table Six. Available upon request.

[29]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 (2006). 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.

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

	SUR		
CV	REC	SAL	BH
Inflation	.1562 (18.00)	.1245 (10.44)	.0663 (6.40)
Constant	.14517 (76.78)	.15095 (58.34)	.15539 (69.03)
LM test	628.09		
Inflation	.1259 (13.32)	.0689 (6.70)	.0387 (3.46)
Min. Wage	-.0151 (-5.61)	-.0390 (-10.61)	-.0197 (-4.67)
Constant	.16927(36.55)	.19975(40.08)	.17831(33.49)
LM test	333.62		
Past Infl.	.1746 (25.43)	.1503 (14.92)	.0875 (9.09)
Constant	.1416 (95.03)	.1461 (67.07)	.1512 (72.61)
LM test	477.44		
	RJ	SP	PA
Inflation	.1083 (14.84)	.0509 (6.02)	.0323 (3.18)
Constant	.1389 (87.37)	.1333 (72.48)	.1415 (63.85)
LM test	628.09		
Inflation	.0803(10.93)	.0051(.64)	-.0049(-.44)
Min. Wage	-.0203(-6.95)	-.0373(-9.66)	-.0282(-5.69)
Constant	.16227(44.88)	.16682(44.31)	.17069(31.10)
LM test	333.62		
Past Infl.	.1159 (16.55)	.0561 (6.49)	.0363 (3.51)
Constant	.1375 (90.42)	.1324 (70.63)	.1404 (62.62)
LM test	477.44		

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

The economic intuition behind the above empirical evidence is: firstly, chronic high inflation is bad for those who are not at the very top of the distribution; following from that, the middle classes, for being locked in formal employment contracts with imperfect indexation, are the group that lose more with inflation[30]; secondly, the poorer the region, the more regressive

[30]Agénor and Montiel argue that 40 percent of non-agricultural employment in Brazil

inflation tends to be, which highlights the fact that poor regions are very vulnerable to inflation for not presenting the right mechanisms against it. Hence, 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.

Fourthly, in terms of unemployment effects, the evidence confirms the standard assumption that those at the bottom of the distribution present lower turnover costs. Finally, regarding the minimum wage index, the estimates suggest that this policy can help to lower inequality, therefore improving the welfare of the poor instead of harming it. However, the minimum wage is not to be seen as a panacea against the regressiveness of high inflation, since its estimates are smaller than the ones related to inflation. All in all, the evidence presented in this Section backs and confirms that of in Section Two.

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, suggests that extreme 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 shows that the poor and not so poor did not have access to indexed financial goods to protect themselves against accelerating inflation, nor *fully* monthly indexed wages, nor accurate information about unexpected high inflation rates.

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 and not so poor present lower turnover costs, and

was provided by the informal sector in 1985. Those working in this sector of the economy are thus able to *adjust* their wages more flexibly, since they are free of formal employment contracts. Needless to say that the assumption that the poor do not have access to the indexation provided by financial markets holds.

hence lose their formal jobs and earnings first when a recession occurs, and 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 their 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 any way, 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. The review presented in Section One from previous studies on the US, and to a 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 offset by the poor macroeconomic performance, combined with incomplete access to financial (indexed) goods and lower bargaining power regarding earnings *indexation*. The 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, not to mention independent monetary authorities, that actually keep inflation consistently low and under control in the long run.

Moreover, the quality of the results are to a certain extent boosted 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 has been considered before in any other study of the impact of macroeconomic performance on inequality and this can be regarded as a significant step forward in terms of achieving better and more reliable

estimates.

Regarding future work, the use of Brazilian data from 1995 onwards to check whether *low* inflation rates have actually had a progressive impact on inequality, as in developed countries, would naturally complement this study. Another extension is an investigation of the importance of financial development on inequality in Brazil, i.e., whether access to financial 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[31].

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 is considerable. 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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