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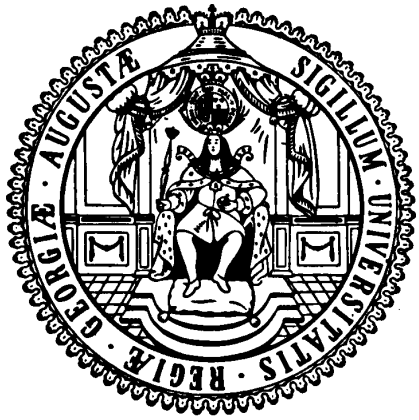

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Inflation and Financial Development: Evidence from Brazil

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Inflation and Financial Development: Evidence from Brazil*

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Abstract

We examine the impact of inflation on financial development in Brazil and the data available permit us to cover the period between 1985 and 2002. The results—based initially on time-series and then on panel time-series data and analysis, and robust for different estimators and financial development measures—suggest that inflation presented deleterious effects on financial development at the time. The main implication of the results is that poor macroeconomic performance, exemplified in Brazil by high rates of inflation, have detrimental effects to financial development, a variable that is important for affecting, e.g. economic growth and income inequality. Therefore, low and stable inflation, and all that it encompasses, is a necessary first step to achieve a deeper and more active financial sector with all its attached benefits.

Keywords: Financial development, inflation, Brazil.

JEL Classification: E31, E44, O11, O54.

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1 Introduction and Motivation

We investigate the role of inflation for financial development in Brazil using data covering the period between 1985 to 2002 and ten economically diverse regions. This period is particularly interesting because it encapsulates two distinct regimes in terms of macroeconomic performance in Brazil. The period between 1985 and 1994 covers the time when the rates of inflation were notoriously high, reaching an astounding 82.18 percent *per month* in March 1990. However, from 1995 onwards macroeconomic performance has consistently improved, with inflation presenting much lower and stable rates since then.

The evidence, based initially on the time-series variation, and then on the relatively novel panel time-series data and analysis, indicates that inflation is detrimental to financial development. The evidence is significant and robust for different data sets, different measures of financial development and different estimators. The main *policy* implication emerging from the results is that the high rates of inflation seen in Brazil in the 1980s and first half of the 1990s had a clear detrimental effect to a variable that is known to play an important role in economic growth and income inequality[1]. Therefore, low and stable inflation is a necessary first step to be pursued in Brazil if it is to have a deeper and more active financial sector with all its attached benefits[2].

What distinguishes this paper from previous studies is that, firstly, we use, as suggested by Fischer (1993) and Besley and Burgess (2003), national data to construct a more disaggregated sub-national data set, which better pinpoints the importance of inflation on financial development in a country so regionally diverse in terms of economic outcomes. Furthermore—to carry out the study, and in addition to the time-series data—we take advantage of

[1] For instance, King and Levine (1993), Levine and Zervos (1998), Beck, Levine, et al. (2000), and Beck and Levine (2004) report that financial development has a positive impact on long-run growth. Moreover, Li, Squire, et al. (1998), Dollar and Kraay (2002), Clark, Xu, et al. (2003), Bonfiglioli (2005), Bittencourt (2006), and Beck, Demirguc-Kunt, et al. (2007) report that financial development reduces inequality.

[2] Singh (2006), Singh and Cerisola (2006), and Santiso (2006) highlight the importance of the much improved macroeconomic performance in Latin America in producing better economic outcomes recently. Moreover, Carvalho and Chamon (2006) suggest that the growth of real income that took place after the reforms of the 1990s in Brazil has been severely underestimated for methodological reasons, which reinforces the role of macroeconomic stability on welfare.

the novel panel time-series analysis, which deals with important empirical issues—non-stationarity, heterogeneity bias and between-region dependence in panels—not discussed in the previous empirical studies, to get better and more informative estimates. Additionally, the use of panel time-series analysis is particularly important because it does not suffer from the usual criticism applied to cross-sectional data and analysis, i.e. that since a period of high inflation is normally followed by a period of low inflation, high inflation's detrimental effects would be cancelled by low inflation[3]. Secondly, we take into consideration the problem of financial repression seen in Brazil during the high-inflation period, and therefore use an extra measure of financial development that to some extent accounts for this problem.

All in all, we attempt to fill in a gap in the literature by exploring national and sub-national data, with time-series and regional variation, from a developing country that provides a *rich* ground to study and better understand the impact of inflation on financial development. Thus, determining what causes financial development in a developing country like Brazil—which has presented historically high inequality and erratic growth rates, and high rates of inflation for a long period of time—is important because financial development can have an incremental effect on growth, and a progressive effect on inequality. On the other hand, inflation—for its nature in Brazil—arises as a natural macroeconomic determinant of financial development.

Theoretical studies related to what is done here include, Moore (1986), Choi, Smith, et al. (1996), and Azariadis and Smith (1996). They highlight the fact that if inflation is high enough, returns on savings are reduced—which leads to a reduction in savings and savers alike, the pool of borrowers is swamped, informational frictions become more severe—and therefore credit becomes scarce in such an economy. In a slightly different strand, Schreft and Smith (1997), Boyd and Smith (1998), Huybens and Smith (1998), and Huybens and Smith (1999), explore the idea that economies with higher rates of inflation do not approach or reach the steady state where their capital stocks would be high, i.e. there are bifurcations and development traps arise in such economies. Furthermore, these economies obviously present less efficient financial markets because of the higher interest rates that follow high rates of inflation. All the same, the Mundell-Tobin effect is reversed in a high-inflation environment.

[3] See Bruno and Easterly (1998).

No less important, Rajan, R. and L. Zingales (2003) highlight a political-economy dimension of economic development in general, i.e. that vested interests or incumbents trying to curtail competition, play an important role in keeping (financial) development relatively low. Moreover, Acemoglu, D., S. Johnson, et al. (2003) argue that distortionary macroeconomic policies, in the role of high inflation in this case, are more likely to be a symptom of weak institutions used by the 'elite' to keep themselves in power[4].

On the empirical side, Haslag and Koo (1999), and Boyd, Levine, et al. (2001), using cross-sectional and panel international data from the 1960s to early 1990s, report that moderate inflation has a negative impact on financial development. Moreover, both studies find evidence of nonlinearities, i.e. after a particular threshold—15 percent per year in Boyd, Levine, et al. (2001)—inflation presents only smaller marginal negative effects on financial development. The intuition is that the damage on financial development is done at rates of inflation lower than the proposed threshold. Moreover, Dehesa, M., P. Druck, et al. (2007) use a panel of 120 countries between 1997 and 2004 to report that lower inflation increases the amount of credit in their sample. Furthermore, Choi, Smith, et al. (1996) use national data from different countries, US, Chile, Korea and Taiwan—and covering the periods between 1958-1993, 1981-1991, 1982-1987 and 1983-1988 respectively—to confirm that inflation presents a negative impact on stock-market development in each country.

All in all, we highlight the importance of a stable macroeconomic environment, with consistent monetary and fiscal policies, which is attainable only by the introduction of stronger institutions, which are not easily manipulated by a small 'elite', so that a deeper and more active financial sector emerges with all its consequences on crucial variables such as growth and inequality[5].

The remainder of this paper has the following structure: Section 2 describes the data set used, and also presents some correlations and regression plots of the main variables. Section 3 explains the empirical strategy used

[4]Furthermore, Crowe (2006) argues that macroeconomic stabilisation took so long to take place in, e.g. Brazil, because the rich have always benefited from high inflation.

[5]Singh (2006) reports that the Brazilian authorities have started to implement sounder federal and regional fiscal rules and also inflation targeting from the late 1990s onwards. Nevertheless, Carstens, A. and L. Jácome (2005) report that Brazil still has one of the least independent central banks in Latin America.

and reports the results. Section 4 concludes the paper: it summarises the importance of the results and their implications in terms of policy, it acknowledges some limitations in terms of data availability, and it suggests future work.

2 The Data

2.1 Description of the Data

The data set used comes from the Brazilian Institute of Geography and Statistics (IBGE), which is the Brazilian Census Bureau, the Brazilian Central Bank (BACEN), and the Institute of Applied Economic Research (IPEA) files. The IPEA is an agency of the Brazilian government that, among other activities, compiles primary and provides secondary data from a variety of national and international sources.

This data set covers the period between 1985 and 2002 and ten regions, from North to South: Pará (PA), Ceará (CE), Pernambuco (PE), Bahia (BA), Distrito Federal (DF), Minas Gerais (MG), Rio de Janeiro (RJ), São Paulo (SP), Paraná (PR) and Rio Grande do Sul (RS). To briefly illustrate the importance of these regions in the national context, they accounted for 74 percent of the total population and 84 percent of the total gross domestic product in 1995. Moreover, in terms of regional variation, this data set includes a relatively rich southern region like São Paulo, and also a region like Pará in the poor north of the country, with a gross domestic product equivalent to just 5 percent of the one produced by São Paulo in 1995.

The data used to construct the measures of financial development are from the BACEN's Monthly Bulletin, and IBGE's National Accounts System. The first annualised monetary aggregate used is m2, and it is defined as money in circulation in the economy plus current account and savings deposits in the financial institutions, or just the liquid liabilities for short. The second monetary aggregate, m3, is defined as m2 plus other financial assets which are more illiquid, but with higher rates of nominal and real returns than the ones in m2. Moreover, credit to the private sector (credit) and personal credit (personal) are defined respectively as credit provided by public and private financial institutions to firms and to individuals, and individuals only respectively. These monetary aggregates are deflated by the IBGE's national index of consumer prices (INPC).

The gross domestic products (GDPs), and financial domestic products (FDPs)—which account for the gross domestic product of the financial sector by region—are calculated at market prices and deflated by the IBGE's GDP implicit deflator.

We can then calculate the ratios $m2/GDP$, $m3/GDP$, $credit/GDP$ and $personal/GDP$ at regional and national levels to obtain $M2$, $M3$, $CREDIT$ and $PERSONAL$ respectively. To calculate these measures at national level we use the information on the national monetary aggregates over the national GDPs. However, to construct the regional proxies for financial development we have to take into account the fact that the data on monetary aggregates are provided only at national level. We therefore use the available national data on monetary aggregates divided by the regional gross domestic products, and multiplied by the percentage participation of each region in the financial domestic product to construct these regional proxies for financial development.

The reason for doing so is that otherwise the most developed regions of the south would not appear as financially developed as they actually are. More specifically, with this weighting, the measures of financial development recapture more accurately the regional variation in financial development present among the different regions of Brazil. For example, the Distrito Federal, where the federal capital Brasília is located, São Paulo and Rio de Janeiro, regain their places among the most financially developed regions after the weighting. Definitions 1 and 2 illustrate the regional (FD_{it}) and national (FD_t) measures of financial development respectively.

$$FD_{it} = (mon.aggregates_t/GDP_{it})FDP_{it,} \tag{1}$$

in which FDP_{it}= FDP_i/FDP_t, and

$$FD_t = mon.aggregates_t/GDP_t. \tag{2}$$

Furthermore, the reason for using $M3$ in addition to $M2$ is because during the high-inflation period Brazil presented the problem of financial repression—the government kept the basic nominal interest rates artificially low, generating with that negative real interest rates—and therefore a low $M2$[6]. Additionally, the measure $PERSONAL$ captures credit being allo-

[6] Agénor and Montiel (1999), and Easterly (2002), cover the issue of financial repression

cated to individuals who might lack the collateral available to, e.g. firms, and captured by $CREDIT$. We therefore believe that these extra measures provide a more accurate view of financial development in Brazil at the time for, firstly, broadening the usual $M2$ to account for assets that, although less liquid, would not suffer as much from financial repression and high inflation for having higher rates of returns, not to mention higher levels of indexation; and secondly, for narrowing $CREDIT$ to account for those resources being allocated at a more individual level. All in all, $M2$ and $M3$ measure the overall size or how deep a financial sector is, and $CREDIT$ and $PERSONAL$ measure how active in channeling savings to investors the financial sector is[7].

That said, the data on the rates of inflation ($INFL$) come from the IBGE's regional consumer price indexes (IPCs) and the national INPC. The IPCs cover the already mentioned ten regions. This regional information is then compiled and aggregated by the IBGE, using the resident population in each region as weight, to form the national INPC itself[8].

The macroeconomic control variables used are the regional government expenditure over the regional GDPs (GOV), and the regional financial domestic product (FDP), which accounts for the gross domestic product of the financial sector in each region. GOV encapsulates all expenditure on current public services provided, including education and health, by regional governments. The expenditure by the regional governments is deflated by the IBGE's INPC and the data come from the IPEA files.

2.2 Behaviour of the Data

The rates of inflation were notoriously high during the 1980s and first half of the 1990s in Brazil. The two most visible hyperinflationary bursts happened in 1989-1990—1,863 percent in 1989, and 82 percent in March 1990—and then again in 1994, 2,489 percent in 1993. However, after July 1994, with the implementation of the Real Plan, inflation has been consistently stable and much lower than previously[9].

in developing countries in general.

[7]For more on financial development measures, see Thorsten Beck, A. D.-K. a. R. L. (2001).

[8]For more on these price indexes, see Corseuil and Foguel (2002).

[9]The Real Plan was gradually implemented during the first half of 1994. The Real (R$) itself was introduced in July 1994. See Agénor and Montiel (1999).

About financial development, it can be said that all measures presented sharp reductions right before, during and after the first hyperinflationary burst of 1989-1990—and then again, although less sharply than before—during and after the second burst of hyperinflation in 1993-1994. On the other hand, after the stabilisation of 1994-1995, all measures have experienced a constant increase in size. Figure 1 illustrates the above using the national time-series variation in the data.

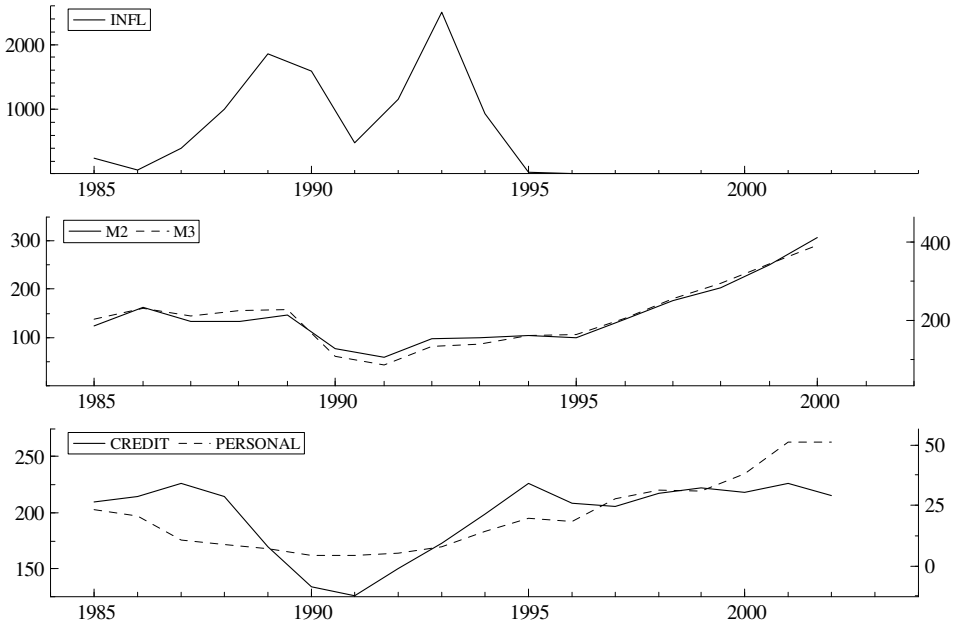

Figure 1: Inflation and Financial Development, 1985-2002. Source: IBGE, BACEN, IPEA and author's own calculations. *INFL* accounts for inflation and the measures of financial development are *M2*, *M3*, private credit (*CREDIT*) and personal credit (*PERSONAL*).

Moreover, Table 1 provides the correlations between the measures of financial development and inflation using the national time-series variation in the data. Firstly, it is seen that all measures of financial development are positively correlated with each other and all correlations are statistically significant at the 5 percent level. Secondly, all measures are negatively correlated with inflation, with $CREDIT$, $PERSONAL$ and $M3$ being significant at the 5 percent level, and $M2$ being significant at the 10 percent level. It is worth mentioning that $CREDIT$ and $PERSONAL$ present sizeable negative correlations with the rates of inflation. This highlights the importance of inflation in affecting those measures that provide funds to be invested in long-gestation projects such as education and physical capital, and, e.g. self-employment activities that in general take place in the short run in developing countries. No less important is the effect of inflation on $M3$, a measure more associated with the provision of indexed assets and that by its nature would provide some insulation against high inflation during a crisis.

Table 1: Correlation Matrix, Financial Development and Inflation, 1985-2002.

Variables	M2	M3	CREDIT	PERSONAL	INFL
M2	1				
M3	.983*	1			
CREDIT	.596*	.691*	1		
PERSONAL	.857*	.853*	.648*	1	
INFL	-.481**	-.505*	-.635*	-.664*	1

Source: BACEN, IBGE, IPEA and author's own calculations. * significant at the 5 percent level, and ** significant at the 10 percent level.

Additionally, we run univariate OLS time-series regressions based on the national data to further investigate the statistical and economic relationship seen between inflation and financial development. Figure 2 shows how the four measures of financial development fared against inflation, and the clear and statistically significant results from these regressions are that inflation presents a clear negative effect on all measures of financial development. Moreover, it is important to mention the effect of inflation on $M3$, since it presents larger estimates than $M2$—which highlights that a measure that, in

principle, would not suffer as much from high inflation and financial repression for encapsulating assets which present higher nominal and real returns than the ones provided by $M2$ and less imposed restrictions—is in fact affected by the high rates of inflation seen at the time. This is particularly worrying because during crisis—in which a process of financial adaptation would take place for those with access to financial assets—$M3$ would be the monetary aggregate presenting the public assets with more indexation, i.e. a reduction in $M3$ would deprive the general public of an important tool against high inflation[10].

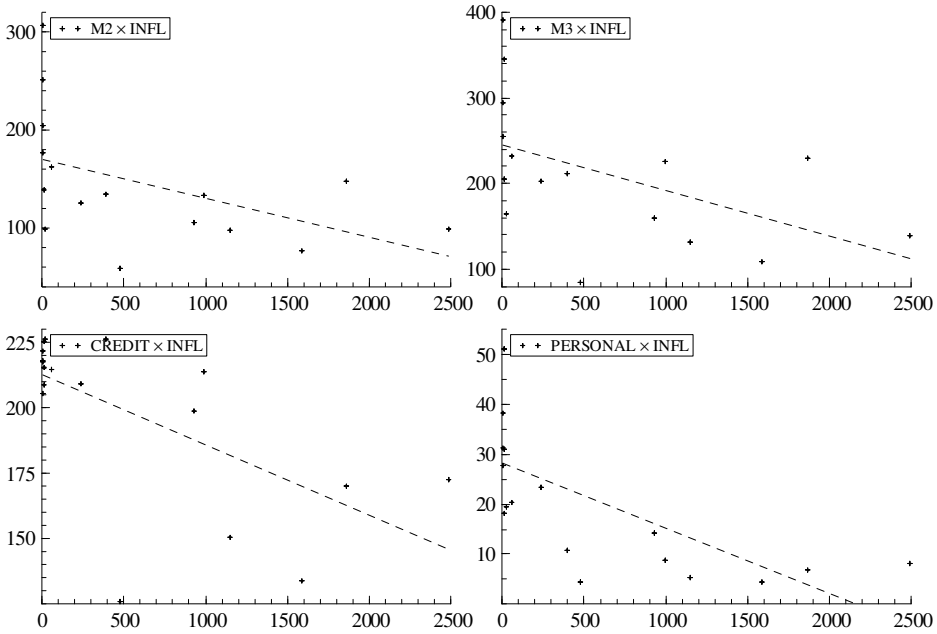

Figure 2: OLS Regression Lines, Financial Development and Inflation, 1985-2002. Source: BACEN, IBGE, IPEA and author's own calculations. *INFL* accounts for inflation and the measures of financial development are *M2*, *M3*, private credit (*CREDIT*) and personal credit (*PERSONAL*). All estimates are statistically significant at the 5 percent level.

[10]For more on financial adaptation and velocity of money, see Erosa, A. and G. Ventura (2002), and Moore (1986).

In summary, firstly, the above preliminary visual evidence briefly illustrates the behaviour of the national time-series data during the period, particularly the fact that during the hyperinflationary periods the measures of financial development presented considerable reductions. This shows that macroeconomic uncertainty, caused mainly by high rates of inflation, is detrimental to financial development. More intuitively, the high inflation seen between 1985 and 1994 created a clear sense of uncertainty in terms of expectations of a drastic disinflationary policy that would come at some point with all its costs[11]. This uncertainty, combined with the restrictive stabilisation plans themselves, played a central role in reducing the amount of financial resources available in the economy at the time.

On the other hand, the shorter visual evidence covering the period between 1995 and 2002 suggests that financial development presented a clear increase at the time, which points to the importance of a stable macroeconomic environment for a deeper and more active financial sector, and hence for higher savings and credit in the economy. However, since the series are shorter, this effect is still not being picked up by the initial correlation nor regression analyses.

Secondly—and complementary to the above—the statistical correlations among the variables indicate a significant negative statistical relationship between inflation and financial development. Furthermore, the univariate OLS time-series regressions to a large extent confirm the visual and descriptive evidence presented, and suggest that a negative economic relationship exists between inflation and financial development in Brazil.

3 Empirical Strategy and Results

3.1 Strategy

The data set we explore in this Section presents time-series combined with panel variation. The time series consists of $T = 18$ years, and the panel of $N = 10$ regions covering the period between 1985 and 2002. Therefore

[11] For instance, the Collor Plan implemented in 1990 was not only a stabilisation attempt based on restrictive monetary policies, but it also confiscated a huge fraction of financial assets in the economy. Furthermore, the Cruzado Plan implemented in 1986 relied heavily on interventionist price controls to curb high inflation. It is therefore thought that both plans only added to the macroeconomic uncertainty at the time. See Agénor and Montiel (1999) or Kiguel and Liviatan (1992) for more on these plans.

the empirical strategy used is based on the relatively novel panel time-series $T \succ N$ analysis. This sort of analysis allows us to deal with issues such as non-stationarity, heterogeneous bias and between-region dependence in panels.

For non-stationarity in the regional time series we use the Im, Pesaran and Shin [IPS (2003)] test, which allows for heterogeneous parameters and serial correlation[12]. The IPS test is based on an Augmented Dickey-Fuller (ADF) regression for each region of each variable, which are then averaged. The moments of the mean E and variance var of the average $\bar{t}$ to be plugged into the IPS test are taken from IPS (2003) and in this case are -1.349 and .565 respectively. Equations 3 and 4 illustrate the regional ADF equations of a particular variable y and the IPS test respectively.

$$\Delta y_{it} = \alpha_i + \beta_i y_{it-1} + \sum_{j=1}^{k} \gamma_{ij} \Delta y_{i,t-j} + \delta_i t + u_{it}, \tag{3}$$

$$IPS = \frac{\sqrt{N}(\bar{t} - E(\bar{t}))}{\sqrt{var(\bar{t})}}, \tag{4}$$

in which α_i is the heterogeneous intercept, $\delta_i t$ the time trend and N the number of regions.

When dynamic models are estimated, the Fixed-Effects (FE) estimator provides consistent estimates when $T \to \infty$ and N is fixed, but only when the slopes are *homogeneous*. When *heterogeneous* slopes are present, the estimates provided by the FE estimator become inconsistent, even for large T. Basically, the x_s will not be independent of the lagged y. The indiscriminate use of the FE estimator in this case is to be seen with caution, since it contains a heterogeneity bias problem, and this bias might be severe. However, the Random Coefficients (RC) estimator proposed by Swamy (1970), which allows for heterogeneous intercepts and slopes, gives consistent estimates of the expected values. The RC, which can also be interpreted as a Generalised Least Squares (GLS) estimator, consists of a weighted average of $\hat{\alpha}_i$ and $\hat{\beta}_i$, and the weight contains a modified variance-covariance matrix of the heterogeneous α_i and β_i[13]. Equation 5 illustrates the dynamic heterogeneous

[12] An alternative to IPS (2003) is the test by Levin, Lin and Chu (2002). However, this test assumes parameter *homogeneity*, and therefore does not consider a possible heterogeneity bias present in the data.

[13] An alternative to the RC-GLS is the Mean Group estimator (MG), which consists of

equation estimated.

$$FD_{it} = \alpha_i + \beta_i INFL_{it} + \gamma_i GOV_{it} + \delta_i FDP_{it} + \epsilon FD_{it-1} + u_{it}, \quad (5)$$

in which FD_{it} is the particular measure of financial development being estimated, α_i the heterogeneous intercept, $INFL_{it}$ the rates of inflation, and the control variables, i.e. government expenditure (GOV_{it}) and the financial gross domestic product (FDP_{it}), and u_{it} the independent normal error term. The FD_{it-1} term is the first lag of the measure of financial development being used. The use of the first lag of the dependent variable is important, not only because it accounts for the dynamics of financial development over time, but also because it works as a proxy for possible omitted variables.

Moreover, since our data set presents $T \succ N$, between-region dependence is believed to be through the disturbances, i.e. $E(u_{it}u_{jt}) \neq 0$. In this case, the covariance matrix of the residuals of the time-series regressions can be estimated and used as a weight so that the between-region dependence is captured. Therefore the Seemingly Unrelated Regression (SUR-FGLS) estimator is used, and its estimates are based on the regional time series, which are in turn weighted by the covariance matrix of the residuals, and the more correlated the residuals are, the more efficient the SUR-FGLS is[14]. Equation 6 illustrates the dynamic equation estimated.

$$FD_t = \alpha_t + \beta INFL_t + \gamma GOV_t + \delta FDP_t + \epsilon FD_{it-1} + u_t, \quad (6)$$

in which all variables account for the regional time series of each variable.

Given the brief review above, it can be said that we deal with the most important empirical issues facing a data set which presents a long T combined with a shorter N. This is important in itself because dealing with

a simple average of the time-series estimates. However, the MG is sensitive to outliers, a problem not faced by the RC-GLS estimator. A second alternative is the Instrumental Variable estimator, however an instrument uncorrelated with the residuals is uncorrelated with the explanatory variable, and therefore not a valid instrument. See Pesaran and Smith (1995) for more on heterogeneity bias in dynamic panels, or alternatively Smith and Fuertes (2007). Moreover, GMM-type estimators are not an option due to overfitting. See Bond (2002).

[14] An alternative to SUR-FGLS is the Common Effects Estimator (CCE) proposed by Pesaran (2006). However, for CCE to work best N is assumed to be large, and in our data set $N = 10$. Furthemore, Kapoor, M., H. H. Kelejian, et al. (2007) propose a FGLS estimator that also works under the $N \to \infty$ assumption.

these issues implies that we are able to deliver better and more informative estimates. Furthermore, the pooled estimators explore the regional links present in the data to improve efficiency and to reduce collinearity, and the SUR-FGLS estimator accounts for excessive between-region dependence in the data and also disaggregates the analysis so that a more insightful view of the results can be obtained. This distinction is relevant because, as Phillips and Sul (2003) point out, if between-region dependence is large, there is little gain in actually pooling the data, instead of using the time-series variation, as in SUR-FGLS estimator.

All the same, the panel time-series analysis used provides enough tools that cater for different issues, and also avoids the usual criticism that the cross-country analysis of this subject tends to suffer[15].

3.2 Results

The IPS statistics suggest that we can reject the null hypothesis of unit roots in all variables and accept in favour of the alternative that at least *one* region of each variable is stationary[16]. Table 2 reports the results.

Table 2: Panel Unit-Root Tests

Variables	IPS Statistics
M2	-2.58
M3	-2.83
CREDIT	-2.64
PERSONAL	-3.16
INFL	-3.51
GOV	-2.09
FDP	-1.92

The moments of the mean E and variance var of the average $\bar{t}$ are respectively: -1.349 and .565. Source: Im, Pesaran and Shin (2003) and author's own calculations.

[15] See also Clark (1997) for some of the criticism of cross-sectional analysis from an economic point of view.

[16] Pesaran and Smith (1995), and more fundamentally, Phillips and Moon (1999) argue that spurious regressions are less of a problem in dynamic panels. This is because the pooled estimators average over the regions and the noise is severely attenuated, and therefore the estimates are consistent. Furthermore, Kao, Trapani and Urga (2006), and Pesaran and Fuertes (2007) suggest that, under certain conditions, the above result holds even when between-region dependence is present.

The dynamic equations are estimated by the FE and RC-GLS estimators respectively. The first half of Table 3 below reports the estimates provided by the FE estimator. Inflation presents negative effects on financial development, and most estimates are statistically significant. The controls GOV and FDP suggest that regional government expenditure—for including education and health— is conducive to economic development, and an increase in FDP leads to more financial development in the economy. The lags of the financial development measures present positive effects on themselves. The Likelihood Ratio (LR) tests for homogeneity of intercepts suggest that we can not accept the null of homogeneity, confirming the existence of fixed effects.

The second half of the table presents the estimates provided by the RC-GLS estimator. The effects caused by all variables on financial development follow the same pattern, i.e. negative effects of inflation on financial development, and positive effects caused by GOV and FDP. Moreover, $M3$ and $CREDIT$ suffer particularly large effects, stressing the importance of inflation in negatively affecting a measure that is, by definition, more broad than $M2$ and would not be much affected by financial repression—which highlights that inflation severely curtails the provision of better-indexed assets that play a crucial role during crisis—and also reducing the amount of credit in the economy, with all its deleterious effects on longer- and shorter-gestation projects. Furthermore, the LR tests for homogeneity of intercepts and slopes suggest that the coefficients are *heterogeneous*, which makes the RC-GLS the most appropriate estimator in this dynamic framework. Table 3 reports the results.

Table 3: Dynamic Estimates of Inflation on Financial Development, 1985-2002.

	FE			
	M2	M3	CREDIT	PERSONAL
INFL	-.300 (-2.04)	-.424 (-2.03)	-.116 (-.81)	-.044 (-2.73)
GOV	2.083 (2.04)	2.466 (1.70)	2.199 (2.49)	.330 (3.29)
FDP	1.007 (1.61)	1.674 (1.88)	1.724 (2.85)	.032 (.486)
$M2_{t-1}$	.338 (5.76)			
$M3_{t-1}$		.425 (7.18)		
$CREDIT_{t-1}$			.701 (12.91)	
$PERSONAL_{t-1}$				.503 (11.84)
R^2	.89	.90	.93	.89
F test	94.80	102.53	186.65	110.43
LR test	54.89	42.78	12.94	30.68
	RC-GLS			
INFL	-.274 (-1.84)	-.397 (-2.14)	-.186 (-2.83)	-.038 (-1.38)
GOV	1.845 (1.87)	1.749 (1.41)	.853 (.64)	.447 (4.03)
FDP	.775 (1.44)	1.176 (1.66)	.819 (1.97)	.075 (1.38)
$M2_{t-1}$	.436 (4.60)			
$M3_{t-1}$		.493 (5.17)		
$CREDIT_{t-1}$			.419 (4.53)	
$PERSONAL_{t-1}$				.495 (4.93)
R^2	.69	.72	.65	.83
LR test	189.32	235.00	279.70	299.74

T-ratios in parentheses, number of observations: *NT=180*. Source: author's own calculations.

Between-region dependence is dealt with by the SUR-FGLS estimator. The more disaggregated and weighted dynamic time-series equations confirm the results provided above by the pooled estimators. The impact of inflation on $M2$ and $M3$ is negative and significant in almost all regions. Inflation presents larger estimates against $M3$ than $M2$, and the regions most affected by inflation are the ones located in the more developed south, i.e. Distrito Federal (DF), São Paulo (SP), Rio de Janeiro (RJ), Minas Gerais (MG), and Rio Grande do Sul (RS). This is quite intuitive because,

although regional inflation follows the same national trend over time, the richest regions are the ones with more advanced financial sectors, and therefore more prone to be affected by inflation. On the other hand, the poorest regions of the north and northeast do not possess a well-structured financial sector to be affected by inflation. The controls GOV and FDP present the same sort of positive impact as before on financial development, with most estimates being significant. The Lagrange Multiplier (LM) tests suggest that we cannot accept the null of independence across regions[17]. Table 4 reports the results.

[17]The IPS test reported in Table 2 above 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. However, CIPS assumes that $N > 10$ and we have $N = 10$ 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. See Baltagi, Bresson, et al. (2005) for more on panel unit-root tests and between-region dependence.

Table 4: Dynamic SUR-FGLS Estimates of Inflation on Financial Development, 1985-2002.

	SUR-FGLS				
M2	PA	CE	PE	BA	DF
INFL	-.058 (-2.03)	-.289 (-4.74)	-.134 (-2.07)	-.150 (-2.85)	-1.336 (-1.84)
GOV	.512 (2.80)	.244 (.72)	1.061 (2.28)	.757 (1.95)	5.271 (1.57)
FDP	.154 (1.18)	1.001 (3.56)	.838 (3.22)	.495 (2.64)	5.467 (2.49)
$M2_{t-1}$	.908 (10.87)	.790 (8.24)	1.368 (7.47)	.755 (11.33)	.555 (3.79)
LM test	253.94				
M3					
INFL	-.076 (-2.03)	-.384 (-5.24)	-.176 (-2.17)	-.142 (-2.27)	-1.618 (-1.51)
GOV	.768 (3.20)	.631 (1.88)	1.650 (2.88)	1.534 (3.18)	7.584 (1.45)
FDP	.158 (.95)	1.440 (4.36)	1.261 (3.68)	.540 (2.42)	7.291 (2.19)
$M3_{t-1}$	.855 (11.47)	.754 (10.83)	1.400 (8.07)	.739 (12.26)	.676 (4.56)
LM test	221.33				
M2	MG	RJ	SP	PR	RS
INFL	-.247 (-5.06)	-.680 (-8.71)	-.409 (-4.46)	-.178 (-2.06)	-.165 (-5.11)
GOV	-.580 (-2.47)	-1.636 (-3.63)	-.207 (-.31)	1.832 (2.44)	.141 (.37)
FDP	.614 (3.54)	1.666 (5.82)	1.158 (3.34)	.707 (2.52)	.397 (2.05)
$M2_{t-1}$	.857 (9.55)	.802 (14.82)	.875 (8.66)	.639 (4.66)	1.036 (23.07)
LM test	253.94				
M3					
INFL	-.368 (-6.36)	-1.031 (-10.47)	-.571 (-5.46)	-.200 (-1.98)	-.258 (-6.46)
GOV	-1.112 (-3.71)	-2.458 (-4.39)	-.715 (-1.98)	3.135 (3.56)	.372 (.87)
FDP	.923 (4.19)	2.687 (7.18)	1.575 (3.72)	1.012 (3.23)	.855 (3.52)
$M3_{t-1}$	.847 (10.84)	.817 (18.76)	.854 (9.59)	.524 (5.24)	.958 (23.03)
LM test	221.33				

T-ratios in parentheses, number of observations: *NT=180*. Source: author's own calculations.

When the measures used are $CREDIT$ and $PERSONAL$, the impact of inflation on financial development, as we have seen before, is negative and mostly statistically significant. The measure $CREDIT$ suffers larger detrimental effects than $PERSONAL$, and the regions most affected by inflation

are the ones with better developed financial sectors in the more developed south. The controls GOV and FDP confirm their roles of being conducive to financial development, and most estimates are significant. The LM tests reject the null of independence across the regions, therefore suggesting that the SUR-FGLS is an appropriate estimator in this case. Table 5 reports the results.

Table 5: Dynamic SUR-FGLS Estimates of Inflation on Financial Development, 1985-2002.

	SUR-FGLS				
CREDIT	PA	CE	PE	BA	DF
INFL	-.165 (-3.42)	-.150 (-2.19)	-.144 (-2.03)	-.199 (-2.85)	-.122 (-.13)
GOV	.025 (.09)	1.459 (4.92)	1.034 (3.08)	.956 (2.05)	14.244 (2.54)
FDP	.422 (2.03)	1.083 (3.21)	.995 (3.35)	.966 (3.91)	5.723 (1.72)
CREDIT_{t-1}	.362 (2.90)	.603 (6.54)	.264 (2.06)	.185 (1.27)	.686 (4.27)
LM test	187.57				
PERSONAL					
INFL	-.016 (-3.48)	-.038 (-2.80)	-.015 (-1.67)	.000 (.07)	-.239 (-3.52)
GOV	.062 (1.93)	.125 (2.30)	.225 (3.87)	.387 (4.97)	.744 (2.27)
FDP	.033 (1.63)	.136 (2.28)	.073 (2.14)	.012 (.33)	.321 (1.62)
PERSONAL_{t-1}	.616 (9.00)	.877 (9.37)	.762 (8.48)	.677 (7.56)	.509 (5.53)
LM test	176.86				
CREDIT	MG	RJ	SP	PR	RS
INFL	-.224 (-3.99)	-.729 (-7.54)	-.311 (-3.24)	-.368 (-4.01)	-.215 (-3.39)
GOV	.410 (1.40)	-.217 (-.42)	1.379 (1.96)	.671 (1.37)	1.797 (2.78)
FDP	1.227 (5.70)	3.084 (8.34)	1.701 (4.49)	2.032 (5.92)	1.362 (4.53)
CREDIT_{t-1}	.558 (5.69)	.608 (9.58)	.611 (5.93)	.271 (2.63)	.397 (3.72)
LM test	187.57				
PERSONAL					
INFL	-.016 (-1.60)	-.067 (-4.57)	-.051 (-2.16)	-.032 (-2.30)	-.031 (-3.29)
GOV	.204 (3.71)	.142 (1.80)	.249 (1.33)	.198 (2.28)	.041 (.36)
FDP	.069 (1.88)	.170 (3.46)	.122 (1.30)	.074 (1.42)	.128 (2.66)
PERSONAL_{t-1}	.862 (10.06)	.701 (8.70)	.776 (7.77)	.644 (6.50)	.947 (9.90)
LM test	176.86				

T-ratios in parentheses, number of observations: *NT=180*. Source: author's own calculations.

Given the above evidence, we can say that the impact of inflation on a range of financial development measures is negative and statistically significant. Moreover, the pooled evidence, based on different panel estimators, clearly points to the fact that the measures $M3$ and $CREDIT$ are the ones

being affected most by inflation. This is particularly worrying since $M3$ and $CREDIT$ include respectively financial assets that would not be so heavily affected by financial repression, for presenting higher rates of nominal and real returns and less restrictions—and hence higher levels of *indexation*—and therefore important during crisis; and assets that are important for the formation of capital—physical and human—in an economy. For example, using the dynamic RC-GLS estimates of $INFL$ against $M3$, this measure would be reduced in .0040 points *per year* to every one percent increase in inflation, which is considerable given the nature of inflation in Brazil at the time.

Furthermore, the more disaggregated time-series evidence based on SUR-FGLS not only confirms the pooled evidence, but also pinpoints which regions are prone to be more affected by inflation. It is the more financially developed regions which are the ones suffering most with poor macroeconomic performance, therefore depriving the country as a whole of an important engine for economic development. For instance, using the SUR-FGLS estimates of $INFL$ against $CREDIT$ in São Paulo, we can see that this measure would be reduced in .0031 points *per year* to every one percent increase in inflation. On the other hand, it can be said that the poorer regions of the north and the northeast are not so affected by inflation because they already have a rather small financial sector, i.e. there is a smaller marginal negative effect of inflation on financial development in those regions. All the same—although the regional rates of inflation follow a very similar trend over time—the SUR-FGLS estimates provide an insightful analysis into the fact that inflation affects regions with different levels of development differentially.

All in all, the wide body of evidence presented in this Section is economically feasible and statistically sound and it confirms the one presented in Section 2 above, which reinforces the significance of the results.

4 Concluding Remarks

We examined the relationship between inflation and financial development in Brazil from 1985 to 2002. The results—based on different data sets, and on a range of estimators and financial development measures—suggest that inflation clearly reduced financial development in Brazil.

The relevance of understanding the macroeconomic determinants of financial development lies in the fact that a deeper and more active financial sector is of crucial importance for key economic variables—i.e. economic growth and income inequality—high in the agenda of any developing country, and in particular Brazil[18]. Moreover, given the sort of macroeconomic performance seen at the time in Brazil, inflation arises naturally as a proxy for macroeconomic performance and, hence as a factor that is to have an impact on financial development, and its importance is proved by the results shown in Sections 2 and 3 above[19].

The importance of the results presented is mainly because we explore not only the time-series variation, but also the panel time-series dimension present in the data. We carry out a study based on national and subnational data, which, firstly, is believed to more accurately pinpoint the effects of inflation on financial development, and secondly, at least to our knowledge, is believed to be the first time that such a study has been done with Brazilian data.

Furthermore, we employ a range of estimators that deal with the empirical issues present in this sort of $T \succ N$ data to get better and more informative estimates. The panel time-series analysis also, first, avoids the criticism that the cross-sectional analysis usually suffers, e.g. that periods of different macroeconomic performance end up cancelling each other out, and second, highlights the advantages of pooling and SUR-FGLS analysis when the variables are expected to be $I(1)$ and regionally dependent. Moreover, we use financial development measures that, firstly take into account the problem of financial repression, and secondly consider the allocation of credit at a more individual and disaggregated level.

Complementary to the above, the results confirm the theoretical pre-

[18] Schumpeter expertly writes "credit is essentially the creation of purchasing power for the purpose of transferring it to the entrepreneur, but not simply the transfer of existing purchasing power. The creation of purchasing power characterises, in principle, the method by which development is carried out in a system with private property and division of labor", Schumpeter (2005).

[19] Moreover, De Gregorio (1993), Fischer (1993), Barro (1995), Bullard and Keating (1995), Clark (1997), Barro (1998), Bruno and Easterly (1998), and Fischer (2005) confirm the fact that *high* inflation outweighs the Mundell-Tobin effect, and therefore presents a detrimental effect to economic growth. Also, Cardoso, Barros, et al. (1995), Barros, Corseuil, et al. (2000), Ferreira and Litchfield (2001), and Bittencourt (2005) report that the *high* rates of inflation seen in Brazil in the 1980s and first half of the 1990s were significantly regressive on income inequality.

diction, e.g. Choi, Smith, et al. (1996), and Azariadis and Smith (1996) to mention a few, that high rates of inflation are detrimental to financial development, and hence reverse the Mundell-Tobin effect. Furthermore, it also somehow confirms the prediction by Acemoglu, D., S. Johnson, et al. (2003) that a better macroeconomic performance is the result of a better institutional framework that emerges after democratisation takes place. Coincidentally enough, Brazil fully democratised in 1989, macroeconomically stabilised in 1994, and financial development has taken off since 1995.

Therefore, the main *policy* implication of the results is that for a developing country to have a deeper and more active financial sector with all its attached benefits, the rates of inflation have to be low and consistently under control. Poor macroeconomic performance only brings deleterious effects to a developing economy, i.e. high inequality, erratic growth, and most importantly here, a restrictive financial sector. However, for a financial sector to become deeper and more active it is important also to stress the importance of having stronger institutions, which are not easily controlled by a small 'elite'.

A word of caution is necessary though. The data on the monetary aggregates is still only provided at national level by the BACEN. Provision of these sort of data at regional level would certainly bring more flexibility in terms of empirical analysis. Having said that, the proxies we construct capture quite efficiently the regional variation of financial development in Brazil and the absence of regional information cannot be an obstacle to conduct studies in this area. The panel time-series estimates presented in Section 3 mirror the time-series evidence in Section 2. Another interesting development in terms of data would be the provision of data on financial assets at an individual level. These sort of data would not only make it possible to disaggregate the information we have at the moment even further, and to check whether the poor really have access to credit, but also to assess how well or badly the debts are being repaid.

A natural extension would be the use of an extended data set covering only the period from 1994 onwards to investigate how the stable economic environment affected financial development, i.e. can the Mundell-Tobin effect be accepted in Brazil after the stabilisation? Another extension of this work would be an investigation of how inflation and financial development affected economic growth in Brazil during the troubled 1980s and 1990s. The

main question to be asked would be: did financial development compensate for the detrimental effects of inflation to economic growth? Presumably not, because as seen above financial development was significantly reduced during the period of crisis. All in all, the research agenda is rich and the use of sub-national data is promising to be insightful.

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