The Regional Attributes of Financial Processes: Financial Polarisation and Banking Mark-ups in Brazilian Regions

ABSTRACT

This paper investigates the effects of the spatial distribution of financial resources on the determination of regional banking mark-ups. In analysing the relationship between regional financial processes and growth, the local banking mark-up constitutes the link between liquidity conditions stemming from regional financial agglomeration and the interest rates. Estimations by error-correction models for selected Brazilian regions suggests that the polarisation of funding is relevant in explaining mark-ups, showing evidence that the latter dynamics follows an inverted U curve shape that is typical of polarisation processes. Results indicate the importance of analysing regional contexts in finance-growth studies.

Key Words: Regions, Agglomeration, Polarisation, Liquidity Preference, Banking Mark-up

RESUMO

Este artigo investiga os efeitos da distribuição espacial de recursos financeiros na determinação de mark-ups bancários. Ao se analisar a relação entre processos financeiros regionais e crescimento, o mark-up bancário representa a conexão entre as condições de liquidez derivadas da aglomeração financeira regional e a taxa de juros. Estimações com modelos de error-correction para específicos estados brasileiros sugere que a polarisação de funding intra-regional é relevante na explicação dos mark-ups bancários em cada região, com evidências sugerindo que a dinâmica de polarização segue o formato de uma curva U invertida típica de processos de polarização. Resultados reforçam a importância de se analisar contextos regionais em estudos sobre sistema financeiro e crescimento.

Palavras-chave: Regiões, Agglomeração, Polarização Financeira, Liquidez, Mark-up Bancário

JEL Classification: O16, R11, R12, R51

INTRODUCTION

Financial development studies enclose the investigation over the progress of monetary and financial institutions. According to POLLARD (2003), it is now widely accepted that financial systems are crucial to the growth performance of an economy, mainly because they perform functions such as pooling and mobilising of resources, distributing and providing liquidity as well as systemic regulation of different financial designs.

Nonetheless, one of the major downturns in most finance-growth studies is the lack of proper use of regional categories in their analytical framework. The contemporaneous finance-growth literature (LEVINE, 2004) is dominated by the stress on the necessity of free operating markets, including a virtually sterile function for the financial system (ARESTIS *et al.*, 2010). Under this theoretical umbrella, regions are more than relegated: the theoretical assertions reduce regions to micro spaces of market liberalisation, a view that discourages the discussion of historical, geographical, and sectoral specificities of finance (RICHARDSON, 1973; GERTLER, 1984; DOW and RODRIGUEZ-FUENTES, 1997). Despite this relative reduced importance, some works have explored, from different perspectives, the regional institutional character of the financial system (ALESSANDRINI and ZAZZARO, 1999; VALVERDE and FERNANDEZ, 2004; KLAGGE and MARTIN, 2005; HAO, 2006; KOETTER and WEDOW, 2006; and YILDIRIM *et al.*, 2007; ALESSANDRINI *et al.*, 2009). However, most of these studies are not concerned in explaining finance-growth nexus by using regional concepts.

This paper assumes the notion that finance and funding processes are fundamentally determined by regional processes, in the same line of works such as DOW (1993), AMADO (1997) and CROCCO *et al.* (2005, 2010a). The theoretical framework utilised in this paper, however, assumes a deeper regional view, where the availability of finance, investment and growth are *a priori* shaped by the dynamics of regional markets. The financial system operates through spatial agglomerations and depends on local internal and external economies to offer their services. The financial system recognizes the changes in liquidity over different spaces in the territory, setting their mark-ups according to the variation in regional uncertainty and risk.[1] The decisions over the mark-up define the adjustments in interest rates, which in turn determine the degree of changes in regional investment and growth.

It is a general contention of this paper that regional analytical tools must be used to understand financial processes. Therefore, the objective in the following sections is to verify empirically whether polarisation dynamics (KUZNETS, 1955; RICHARDSON, 1980) is a suitable framework to analyse the determination of mark-ups by banks in Brazilian regions. The contribution in this paper not only does it expand the analytical possibilities for finance-growth processes, but it also restores the significance of regional analysis in finance-growth studies. Once this view is accredited, the role of financial agglomerations in regional growth can be reassessed, including new policy designs for the promotion of locally embedded growth and development.

In following such objective, this paper offers an empirical investigation that is also original in the regional economic literature. First, it uses a dataset containing monthly regional balance sheets from banks in Brazil for the period 1994-2007. With these data in hands, the dynamics of the banking *ex-post* mark-up (BROCK and SUAREZ, 2000) can be investigated through an error correction model. This sort of econometric technique is not usually applied to regional studies, mostly because of lack of proper time span in regional datasets. In the case of this paper, the error-correction model is appropriate to investigate the dynamic effects of polarisation, since it can provide evidence about the direction of long-run movements in the levels of polarisation and banking, which allude for the ascending or descending portions of the polarisation curve. Moreover, it can confirm the curve shape by analysing whether the marginal changes decrease or increase over time.

In order to achieve all these objectives, the remainder of this paper is organised in five parts apart from this introduction and a conclusion. The next section introduces the theoretical framework underpinning

[1] This assumption follows from a post-Keynesian model discussed in LIMA and MEIRELLES (2003). The difference here is that the framework assumed in this paper reiterates the significance of regional financial processes in the model.

the relationships assumed in this paper. More specifically, it provides the required arguments to support a regional appreciation of the link between financial polarisation and banking mark-ups. The third section discusses the methodology used to estimate the relationship, while the following part introduces the dataset. The fifth section presents the empirical results.

THEORETICAL BACKGROUND

In order to build a framework to discuss the regional contextualisation of finance and growth with special attention to the effects of regional polarisation on financial mark-ups, this paper relies on the analysis of the development of regional financial agglomerations and its effects on the behaviour of the financial system. These notions are embedded in a post-Keynesian model of the sort discussed by LIMA and MEIRELLES (2003), where banking mark-ups are endogenously determined following changes in the regional rates of profit and real wages. Usual post-Keynesian models envisage the effects of the conflicts over the distribution of income on the accumulation plans of the capitalist class, which in turn affect growth (SCHETTINI, 2010). Moreover, changes in capacity utilisation and mark-ups by firms also affect the adjustment of real wages by workers. In the following, we present an extended version of this sort of model, where long-run adjustments in regional interest rates and wages are conditioned by the changes in regional financial agglomeration.

The regional economy is basically represented by five equations

$$Y = min[Ku_K, L/a_l], \text{ where } L = a_l Y \quad (1)$$

$$g^d = \alpha_0 + \alpha_1 r_p - \alpha_2\left(i_l - \hat{P}\right) + \alpha_3 f\hat{c}c + \alpha_4 f\hat{c}t \quad (2)$$

$$r_p = [1 - Va_l](u) \quad (3)$$

$$(dP/dt)(1/P) = \hat{P} = \phi_1\left[V - V_f\right], \text{ where } V_f = \varphi_0 - \varphi_1 i_l \quad (4)$$

$$g^s = s_p r_p = g^d \quad (5)$$

These functions follow straight from a regional contextualisation of the model in LIMA and MEIRELLES (2003). Equation 1 represents the production function, where *K* is the capital stock in the region and *L* is the regional employment level. The labour-output ratio (a_l) is assumed constant. Equation 2 is the regional investment function, being determined by the rate of profits (r_p), the regional real interest rate ($i_l - \hat{P}$) and the regional financial attributes of concentration ($f\hat{c}c$) and centralisation ($f\hat{c}t$). The distribution of income is represented by equation 3, where income is split between workers (*V* is the actual real wage) and capitalists (r_p), changing whenever the local capacity utilisation (u=*Y*/*K*) changes. Furthermore, inflation is given in equation 4 as a function of the gap between the actual real wage and the real wage desired by firms (V_f). The latter is determined by firms through a mark-up, which follows the changes in local interest rates. Finally, the Cambridge equation is represented by (5), whereby capitalists save a constant proportion (s_p) of their profits.

In equations 1 to 5 below, the peculiarity is in the effects of the regional financial attributes on investment rates. The financial agglomeration is assumed to be determined by two regional attributes: concentration and centralisation. Financial concentration and centralisation are analysed by the concepts of MARSHALL (1890) and CHRISTALLER (1966) through the effects of internal and external economies of scale and scope in the supply of financial services.[2] Increases in financial activity favour the offer of services at lower average costs (KUAH, 2008), while financial centralisation involves economies of scope, inducing the offer of differentiated financial services in the region (PARR and BUDD, 2000). These two attributes are accompanied by external economies of urbanisation and complexity, which contribute to the development of the financial agglomeration.

[2] The application of a Christallerian hierarchical system for the study of regional financial processes is the topic in CROCCO *et al.*, (2005, 2010a, 2010b).

The spur in regional financial agglomerations, via concentration and centralisation, is a process that triggers monetary flows within and between the regions, which in turn contributes for the regional distribution of financial resources (DOW, 1993). These flows are provoked by variations in the liquidity and uncertainty conditions in different local financial markets. Once growth expectations and confidence levels change such conditions, the monetary circulation follows the subsequent appreciation of prices of local financial and productive assets. The resulting distribution of financial resources depends on backward and forward effects stemming from the spur of the regional financial agglomeration. This notion is an extension of the concepts of PERROUX (1949) and MYRDAL (1957) to the analysis of regional financial processes.

PERROUX (1949) considers the heterogeneity of regions as the primary source for the definition of the economy as a system ruled by the exchange of diverse flows (economic, social, demographic etc.). Growth does not occur simultaneously, but instead it manifests through regional growth poles that attain economic flows of variable intensities, expanding and contracting via diverse channels and reaching different final economic outcomes (PERROUX, op. cit., p. 164). Alternatively, there is a discerning literature on growth poles that stress the negative effects of the pole dominance over the polarised regions, such as intensification of central dominance and unequal regional growth. According to AMOS and WINGENDER (1993), authors such as PERROUX (1949), HIRSCHMAN (1958), and HANSEN (1967) have emphasised trickling down (positive) effects of polarisation, while MYRDAL (1957), KALDOR (1957), and DIXON and THIRLWALL (1975) rather focus on backwash (negative) effects. According to POLENSKE (1988), dependency theorists such as BARAN (1957) evoked that, despite regular negative effects, polarisation may still induce structural changes to the economy. However, such changes will only be beneficial to the regions if they are accompanied by underlying social relations of production moving towards the balance of power relations between the polarising and the polarised regions. This position is also emphasised by MYRDAL (1957), for whom the economic processes in low developed regions are trapped in vicious cycles of low income and development due to intense reliance on demand for goods from central places.

In respect to the formal framework, the regional contextualisation of financial processes is represented by four equations:

$$\widehat{fcc} = \frac{dcc}{dt}.\frac{1}{cc} = \gamma_0 + \gamma_1 r_p \quad (6)$$

$$\widehat{fct} = \frac{dct}{dt}.\frac{1}{ct} = \psi_0 + \psi_1 r_p \quad (7)$$

$$\widehat{fpol}_{Myr} = \beta_0 + \beta_1 \widehat{fcc} + \beta_2 \widehat{fct} \quad (8)$$

$$\widehat{fpol}_{Per} = \beta_0 - \beta_1 \widehat{fcc} - \beta_2 \widehat{fct} \quad (9)$$

Together, these equations represent the regional financial agglomeration process. Over the long-run, changes in expectations and distribution of income generate adjustments in the rates of financial concentration and centralisation in the region. This is represented by equations 6 and 7, where the expected rate of profit triggers the concentration of financial services in the region and the complexity of services being supplied.

The rates of polarisation in equations 8 and 9 are designed to encompass the distribution of financial resources as determined by a distributive Perrouxian regime or a polarising Myrdalian regime. A Myrdalian view over polarisation processes is the usual theoretical background of studies on the regional characteristics of financial processes (DOW, 1993; AMADO, 1997; CROCCO *et al.*, 2005, 2010b; CAVALCANTE, 2006). A central region (in comparison to a peripheral) has a higher level of demand for credit because the centre's agents perceive better investment opportunities and benefits from lower liquidity preference (due to increased optimism over higher long term assets' return rates) and lower interest rates (due to lower default rates). DOW (1992) has shown that the central region is characterized by a more stable, self generated growth path, developed financial markets and low propensity to import.

On the other side, the periphery has lower levels of income, follows an unstable growth path that is highly dependent on primary goods and on exports to centre regions. The centre-periphery structure favours the polarisation of resources in central regions, which contributes for the intensification of unequal processes of regional development and growth. Alternatively, in a polarisation regime characterised by a Perrouxian process, regional growth redistributes financial resources towards low-order places in the region, since the regional economic and financial interconnections are stimulated. The outcome of a spur in the regional financial agglomeration is, then, a more balanced regional distribution of financial resources.

Hence, in the Myrdalian regime in equation 8, the enhancement of financial agglomeration in the region, via concentration and centralisation, stimulates polarisation of financial resources in high-order places at the expense of low-order-ones. Equation 9 shows the opposite trend, with the financial atrtributes contributing to a more balanced regional financial activity. In a nationwide financial system, where financial institutions are always looking for better asset prospects, unbalanced regional flows of revolving funds are active determinants of portfolios of financial institutions (CROCCO *et al.*, 2010a). Following an increase in finance, lacking opportunities of funding can disrupt the monetary circulation by a lack of required funding mechanisms available and/or the outflow of resources to other regions (STUDART, 1995). These two disequilibrating factors are directly dealt with by the regional financial agents, through changes in their own liquidity preference along with regulation of regional flows in order to efficiently manage the allocation of the *ex-post* savings created. The outcome of this process is the spatial and time transformation of maturities of assets and the interest rates set by such process. This means that regional financial polarisation plays a role in determining how financial institutions set their mark-ups over borrowing costs (spreads).

In adjusting their portfolios to changing regional economic conditions, financial firms set their spreads according to the difference between the rate they pay to borrow funds and the rates they charge when providing finance (ROUSSEAS, 1985; WRAY, 1990; HEWITSON, 1995). In regional terms, borrowing levels and prices are conditioned by the deposit rate offered at different regions in relation to the base rate set by the Monetary Authority.[3] At the same time, the rates on loans are set according to the banks liquidity preference and the macro and local economic conditions such as default risk and uncertainty (LIMA and MEIRELLES, 2003). In a formal framework, regional interest rates (i_l) are set as

$$i_l = b.c \qquad (10)$$

where $b > 1$ is the regional banking mark-up and c is the borrowing costs faced by banks in the region. This interest rate determination follows an application of Kaleckian mark-up to banks, as suggested originally by ROUSSEAS (1985). HIRAKAWA and BUENO (2009) present evidence of regionally differentiated interest rates charged by banks in Brazil. In the model framework presented in this paper, the novelty is to consider that financial processes affecting the determination of the banking mark-up are intrinsically regional features. Following the suggestions in LIMA and MEIRELLES (2003), the rate of change in banking mark-ups are adjusted endogenously in the long-run through changes in the behaviour of banks towards the changes in profits. In the case of this paper, the assumption of a regional character for financial processes leads to the analysis of how the growth of regional agglomerations and the subsequent polarisation effects affect the adjustment of mark-ups by banks in the region.

When adapting the finance-growth discussion to include the effects of polarisation, the analysis becomes dependent on the changes in the regional internal flow of funds and the hierarchical structure of the regional financial system. Once the region undergoes a stable path of growth, the emergence of financial agglomerations will have, depending on the polarisation regime, fundamental effects on the regional financial mark-ups. By assuming this view, it is straightforward to apply the dynamics of polarisation, as discussed in KUZNETS (1955) and RICHARDSON (1980), to explain regional financial processes. Under a Perrouxian regime of polarisation, a highly polarised region will present, at an initial stage, falling rates of polarisation that will be accompanied by a rise in financial mark-ups. This is because the

[3] Borrowing rates are also conditioned by external market and interbank conditions. However, we focus on the features of local agents in providing liquidity to the financial system in order to stress the importance of regional financial processes.

financial system in the region is initially highly dependent on the monetary flows in the more developed and stable high-order places. While these markets experiment an outflow of resources and a worsening of liquidity conditions, a distributive regime guarantees higher rates of monetary circulation in low-order places which improves local financial conditions. However, these monetary inflows in low-order places and the better conditions in these markets are initially not strong enough to offset the worsening in liquidity at high-order places. Moreover, the dependence structure imposes adjustments in mark-up that are still oriented by conditions in these high-order places. The outcome is a rise in regional financial mark-ups. Nonetheless, regional investment rate prospects improve significantly in the low-order places, given the high elasticity of investment to interest rates in these areas.

With subsequent improvements in distribution of financial resources, liquidity conditions are likely to improve at increasing rates through time in local financial markets, which become more independent of the high-order places. Stable and more reliable conditions in new polarising areas start to be more significant in determining lending prices by financial firms. Subsequent improvements in polarisation enable increases in local economic expectations and sufficient improvement in relative risk. Internal flows of funds are enhanced in low-order regions and monetary leakages reduce. Falling financial mark-up in these uprising places more than offset the rise in financial charges in regions losing monetary flows. These features eventually support a downward adjustment in mark-ups by financial firms in the region. Falling polarisation at subsequent stages are, then, coupled with falling mark-ups, as the local agglomerations provide sufficient developed markets to sustain lower charges on financial services. With the better distribution of financial and economic resources, growth is more equal within the region. The formal representation of the regional rate of change in banking mark-up is then

$$\hat{b} = \omega_0 + \omega_1 \widehat{fpol} \qquad (11)$$

The coefficient ω_1 is positive in case the region is currently under a high level of polarisation (the descending portion of the inverted U curve) or negative if the region presents a low level of polarisation (ascending portion of the curve). This temporal dynamics is the direct result of applying KUZNETS' (1955) inverted U curve to the relationship between mark-ups and polarisation. It is also in line with the discussion over concentrated dispersion of regional economic activity introduced by PERROUX (1949) and RICHARDSON (1980), whereby regional development occurs via the expansion of a regional network through the emergence of localised centres of economic activity. In case financial processes are dominated by a Myrdalian regime, regional growth is accompanied by increasing rates of polarisation and the dynamics explained in the preceding paragraph occurs in reverse. The Myrdalian scenario reflects the financial dominant structure envisaged by DOW (1993), AMADO (1997), and CROCCO *et al.* (2005, 2010b). Growing regional financial attributes are not enough to guarantee a different growth trajectory to places in the region because the highly dependent system structure guarantees that only high-order places will retain the benefits of regional growth. Despite the same alternating pattern in the dynamics of financial mark-ups, the unequal nature of growth is the outcome in the Myrdalian case, which guarantees the enlargement of the disparities between regions.

Alongside these lines, changing liquidity conditions in the region are supposed to lead financial firms to increase then decrease the mark-ups of financial firms, given that the financial structure of the regional network follows a development path ruled by an alternating dynamics, which is typical of the emergence and fall of spatial agglomerations. This paper is set to empirically assess the propriety of using this polarisation dynamics to explain the determination of the financial mark-up. In order to investigate this assumption empirically, the next section introduces the dataset, variables and econometric technique utilised to analyse the formal relationship between regional financial mark-ups and polarisation.

EMPIRICAL METHODOLOGY

The aim in this section is to estimate the rate of change in banks' mark-up as a function of the rate of change in financial polarisation, as represented by equation 11. This function is a regional contextualisation of the model proposed by LIMA and MEIRELLES (2003), where banking mark-up is endogenously adjusted following changes in the rate of profits and prices.

The dynamics in equation 11 are expected to be empirically analysed through an error-correction model (PESARAN *et al.*, 2001; TREECK, 2008). Such model includes both a long-run equilibrium relationship and a short-run component given by lags of the differences on the independent and dependent variables. Thus, regional banking mark-ups dynamics are explained by assuming both a long-run relationship between the mark-up and its determinants and short-run adjustment mechanisms. The coefficient ω_1 refers to the effects of proportional variations in the rate of change in polarisation. It is positive if the rate of change in mark-ups respond positively to changes in polarisation (representing the ascending portion of the inverted U curve), and negative otherwise (representing the descending portion). Underlying this relation, there is also a level relationship between bank regional mark-ups and financial polarisation. This brings the econometric technique close together with the theoretical assumptions.

The most noticeable feature of the econometric model regards the error-correction term, which alludes to the adjustment speed of the long-term equilibrium of the estimated relationship. By assumption, the series of variables must be cointegrated so the model can work, which means that their stochastic trends are correlated. The error-correction model allows the exploration of these dynamic changes *vis-a-vis* the long-run equilibrium between banking mark-ups and polarisation. This means that, for instance, the rates of change in polarisation adjust to the rate of change in banks' regional mark-ups through time until the long-run equilibrium is reached. As such, the error-correction model can elucidate whether the assumption of an inverted U curve is valid for the selected regions in the sample.

In general, error-correction models portray the same structure of auto-regressive distributed lag models (*ARDL*). Therefore, *ARDL* equations are estimated for each region separately as the single equation approach to an error-correction model. Formally, an *ARDL* is given generally by

$$\Delta Y_t = a + b_0 \Delta X_t - b_1 (Y_{t-1} - b_2 X_{t-1}) + e_t \quad (12)$$

The error-correction term is $ec = Y_{t-1} - b_2 X_{t-1}$ and the coefficient b_1 in equation 12 is required to be larger than -1 and less than 0 for the model to be stable. By this *ARDL* approach, we can rewrite equation 11 into 12 so it becomes

$$\Delta b_{mup_t} = a + b_0 \Delta fper_t + b_1 \Delta Z_t - b_2 (BMup_{t-1} - b_3 Fperg_{t-1} - b_3 Z_{t-1}) + e_t \quad (13)$$

where now b_2 is the coefficient of the error-correction term. The term between parentheses contains the error-correction, where *Fperg* is the financial polarisation index and *Z* are the set of control variables. When considering extra lags for adjustment process in the equation, the error-correction model to be estimated by ordinary least squares specifically follows the equilibrium correction form in equation 4 below:

$$\Delta\, lnb_{mup_{t_{r,t}}} = \alpha + \rho\left[(lnBMup)_{r,t-1} + \lambda^{Fpegr}(Fpegr)_{r,t-1} + \lambda^{fint}(Z)_{r,t-1}\right] + \sum_{i=1}^{p} \varphi_{r,i} \Delta(lnBMup)_{r,t-i} + \sum_{j=0}^{q} \psi^{a}_{r,j} \Delta(Fpegr)_{r,t-j} + \sum_{j=0}^{q} \psi^{x}_{r,j} \Delta(Z)_{r,t-j} + \varepsilon_{r,t} \quad (14)$$

Where $\Delta lnBMup$ refers to the rate of change banking mark-up ($\hat{b}$), while $Fpegr\ and\ \Delta Fpegr$ are the level and the rate of change of financial polarisation in region r at time t, respectively. The first term on the right-hand side of the equation is the error-correction term and ρ indicates the rate of adjustment of the regional banking mark-up. The coefficients b_4 to b_6 are obtained by

$$\hat{L}_{fper} = \frac{\hat{\lambda}^{Fpegr}}{\hat{\rho}}, \hat{L}_{inf} = \frac{\hat{\lambda}^{inf}}{\hat{\rho}}, \hat{L}_{Z} = \frac{\hat{\lambda}^{Z}}{\hat{\rho}} \quad (14.1)$$

where $\hat{L}$ represents the estimated long-run coefficients and $\hat{\rho}$ is the estimated coefficient for the error-correction adjustment.

This estimation procedure follows PESARAN, SHIN, and SMITH's (2001) (henceforth *PSS*) *ARDL* method. By using an auto-regressive distributed lag model, these authors propose a unit-root test which consists of providing a non-standard asymptotic distribution for a test statistic, which is valid irrespective of whether the regressors are integrated or not (or mutually cointegrated) (TREECK, 2008, p. 387). Given the *ARDL* model in equation 12, under a F test (F_{PSS}), the null hypothesis of no long-run relationship

between the selected variables is $\rho = \lambda^{Fpegr} = \lambda^{inf} = \lambda^{fint} = \lambda^{ibc} = 0$, where λ are the coefficients of the first lags of the independent and dependent variables. The F_{PSS} test is a bounds-test for which *PSS* have tabulated two sets of critical values that account for regressors containing a unit root or not (stationary). If the F_{PSS} value falls outside the limiting bounds, inferences can be made without assuming any prior integration relationship among the variables.

PSS have also tabulated upper and lower values for a *t* test in which the null hypothesis is $\rho = 0$ (t_{BDM} test). If one rejects the null, long-run estimates can be computed for the regressors from the least square estimators of equation 14. The estimated long-run coefficients in equation 4.1 are super-consistent and follow a limiting normal distribution and the short-run parameters are $\sqrt{T}$-consistent with standard normal distribution.

The *PSS* method helps overcoming problems with the usual tests of the order of integration of variables (Augmented Dickey-Fuller, KPSS, and Philips-Perron tests). The alternative ENGLE and GRANGER (1987) two-step estimation approach to cointegration requires a previous assumption in which all variables are homogeneously integrated of order 1, *I(1)*, and regressors are not mutually cointegrated. The *I(1)* assumption is jeopardized since the power of unit root tests are notoriously low (CAMPBELL and PERRON, 1991), which could force the researcher to drop off theoretically plausible *I(0)* variables when analysing the long run. Following the *PSS* method, we could estimate equation 4 without pre-testing the series for the existence of unit roots.

This estimation strategy follows the one in TREECK (2008). The procedure starts with the initial estimation of the error-correction models for each state, starting with *p=q=12* lags for each region since data correspond to monthly values.[4] After that, lagged changes with statistically insignificant coefficients are dropped. According to TREECK (op.cit.) this model selection procedure automatically determines the short-run dynamics of the model by statistical significance. This is because it is assumed that the estimation already reflects the underlying true relationships' values (the LSE methodological approach).[5] However, in order to allow the lag structure to best fit the equations, lagged changes are dropped until each individual variable reaches the minimum number of 6 lags. This strategy also respects semestral institutional accounting rules affecting the dependent variable.

DATA

The study uses a data set from the Laboratory of Money and Territory Studies (Lemte-Cedeplar) which gathered Brazilian Central Bank's records on monthly balance sheets of banks in diverse regions from 1994 to 2007. The use of monthly data allows a considerable size for the time series, which is a requirement for the consistency of estimators. The dataset contains consolidated regional accounts of the banking system, including commercial and investment banks. The dataset is collected at branches' level and consists of credit operations, deposits, total assets, and number of branches.

Given the limitations in the availability of data, this paper specifically contemplates four Brazilian states. The states of São Paulo, Minas Gerais, Pernambuco, and Ceará are chosen as representative regions to estimate the effects of financial polarisation rates on banking mark-ups. São Paulo and Minas Gerais are regions located in the southeast portion of the country, which carries a higher relative economic importance in the Brazilian regional context. While the state of São Paulo is well known as the national financial and economic centre (CROCCO *et al.*, 2010a), Minas Gerais also incorporates important economic sectors for the country, such as mining and automotive industries (NOGUEIRA *et al.*, 2009). Minas Gerais and São Paulo responded for around 42% of national GDP in 2007 (IBGE, 2010). In contrast, Pernambuco and Ceará can be taken as peripheral regions in Brazil. They are located in the Northeast portion of the country, a region that responded for 13% of national GDP in 2007. Ceará and Pernambuco alone were responsible for 1.89% and 2.38% of national GDP respectively (IBGE, op. cit.). These low developed regions are in high contrast with the dynamism and economic performance of Minas

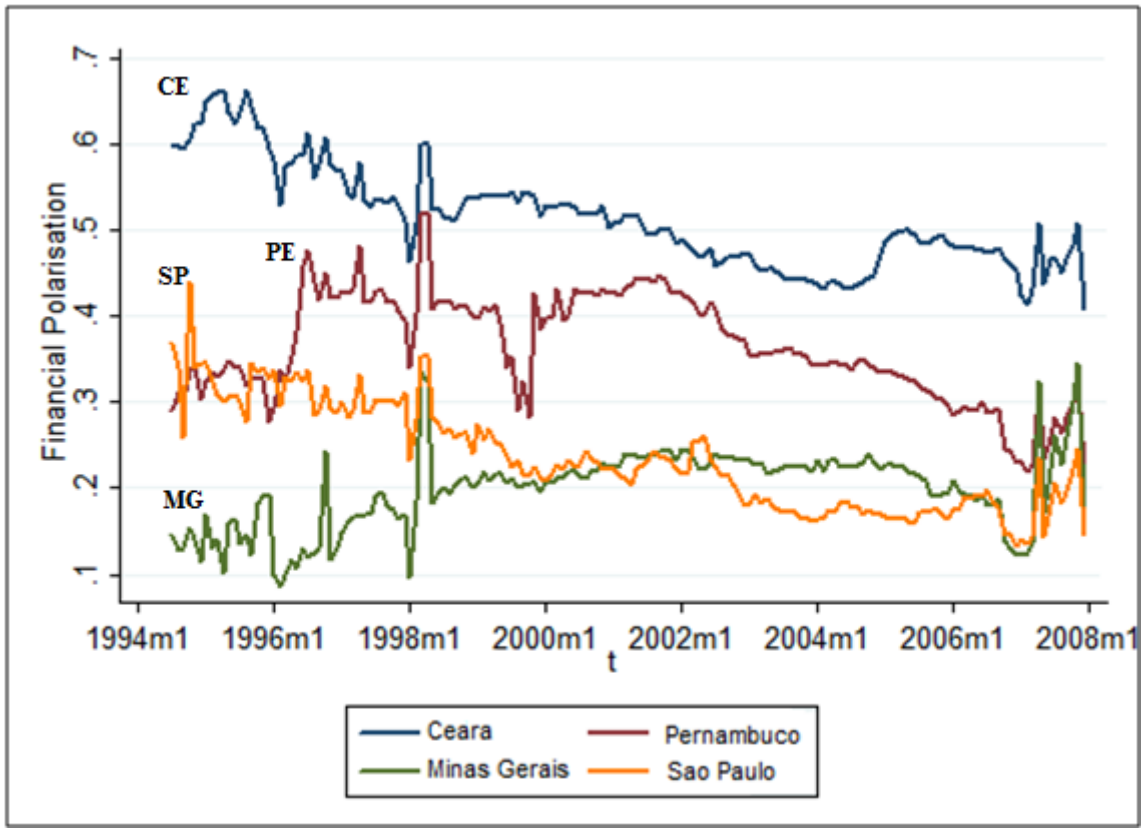
[4] Estimations were performed in the Stata 11 software package.
[5] HOOVER (2006) provides an overall contextualised discussion of the LSE methodological approach.

Gerais and São Paulo. The idea here is to contrast opposing regions and investigate how financial polarisation performs under such different regional economic structures.

In relation to the dependent variable used in the estimations, the *proxy* for the regional banking mark-up ($\hat{b}$) is the average of realized net earnings of banks in the regions. According to BROCK and SUAREZ (2000) the banking spread is basically the difference between the banks' charges on loans and the yields paid to deposit holders, which might include revenues from interest-related financial services, the fees and commissions over the provision of financial services. The available dataset compiles monthly values for banks' net revenues, which is an aggregate variable reflecting relative values for interest- and non-interest-related revenues.

Financial polarisation regional indicators (*FPerg*) are computed for each state separately. The methodology in EZCURRA and PASCUAL (2007) is adopted, with the rates of banks' borrowing (demand and time deposits) and total assets at microregions in each state being used as variables. The volume of deposits is a direct measure of funding possibilities in the region (CROCCO *et al.*, 2005). The regional differences are weighted by the relative sizes of total assets in each microregion. Therefore, the financial polarisation index works as a Gini coefficient, but with a different sensitivity in the weights and an extra component correcting disparities between different group sizes of regions (EZCURRA and PASCUAL, 2007). Results for the polarisation index of each state are depicted in Figure 1.

Figure 1. Financial Polarisation (*Fpegr*) for Brazilian states



Source: Own calculations

The polarisation index performs as expected. In 3 out of 4 states and at different proportions, polarisation indexes have fallen in the period. In April 1994 the Brazilian central government finally succeeded in bringing inflation down by issuing the Plano Real (Plan Real). With lower rates of inflation, the financial institutions lost inflation as their main source of asset revenues. They were then forced to practice more aggressive policies of finance and funding, which rely more intensely on borrowing from regional agents (CROCCO *et al.*, 2010a). This type of strategy reinforced the importance of obtaining short- and long-term deposits from regional borrowers. This can explain the general reduction of localised financial polarisation in the period.

Minas Gerais is the only state where financial polarisation increased in the period. The main reason for this increase can be found in the concentrating aspect of the main economic activity in the state. Minas Gerais is one of the biggest mineral exporters in Brazil, an economic activity that is not usually considered a promoter of balanced regional development (FURTADO, 1969; ANDRADE, 2010). LIMA and SIMÕES (2010) confirm that Minas Gerais showed a slight increase in regional employment from 1995 to 2008, which was rather limited to specific high order places in the state. Increasing income and profits in these few localities can explain the polarisation of funding by banks.

Four controls variables are also included in different specifications of equation 1. The first one is the size of regional financial intermediation measured by IBGE (2010). By including a financial intermediation indicator in the regression, it is expected that the effects of the overall regional agglomeration in each state will be controlled. The financial intermediation index is given by

$$Fintp_j = \frac{added\ value\ of\ finacial\ intermediation_j / total\ added\ value_j}{banks' branches_j\ X\ 1{,}000} \qquad (15)$$

It is weighted by the number of banks in the region since the dependent variable refers to the regional average of banking mark-ups. This is a close indicator for the size of bank support in overall financial agglomeration services in the region (a *proxy* for regional financial attributes). Moreover, the *fintp* time series is shorter than the other ones in the dataset and it only provides yearly values for the index until 2004. Therefore, the data series is interpolated monthly by using the annual rate of growth of the variable. *fintp* is expected to be positively correlated to banking mark-ups, since higher financial intermediation means increased volumes of financial services, better revolving funds and lower uncertainty, which enhances the net revenue prospects obtained by banks.

The second control in the estimations regards the presence of public banks in the region. The objective of the variable is to capture different regional strategies of public and private owned banks. AMADO (2010) points out the different strategies of banking institutions in Brazilian regions. JAYME JR. and CROCCO (2010) indicate that public banks are subjected to credit policies defined by central government. It should also be noted that public banks are less constrained by funding, since they can borrow from sources controlled by the central government, such as federal pension funds (CARVALHO and TEPASSÊ, 2010). Thus, given these features, banks' *ex-post* mark-ups are expected to be lower in regions with a high presence of public banks. The *pubbp* variable is computed as follows

$$Pubbp_j = \frac{Public\ Banks_j}{Total\ Banks_j} \qquad (16)$$

A third control variable, *indprod*, measures the variations in regional industrial production and, as such, is a *proxy* for regional firms' capacity utilisation and growth. A more prominent regional industrial sector demands larger volumes of sophisticated services, including financial instruments, to enable production (JACOBS, 1969). Financial integration between banks and firms is also deepened when industrial production is rising. *Indprod* is expected to be positively correlated to the dependent variable, since a rise in production generates an increase in the volume of financial services being supplied in the region and the *ex-post* revenues generated from it.

Finally, inflation is measured by IBGE (2010) through an index accounting for changes in the INPC (National Index Price for Consumers), a CPI index generally used in Brazil. Unfortunately, data on inflation is restricted to the metropolitan areas of states' capitals. Despite this restriction, the variable is expected to be a good *proxy* for inflation in the region. Since state capitals are natural economic hubs in a region exerting a natural dominance over the regional production system and its flows (LIMA and SIMÕES, 2010), it can be assumed that places in the region present prices that are a function of the distance to the regional centre (ROBERT-NICOUD, 2004; HELPMAN, 1998; KOSFELD *et al.*, 2008). Therefore, prices at these hubs give us an approximate idea of regional prices. A rise in price is supposed to increase mark-ups, since banks adjust their charges according to price changes in order to keep their real gains.

Table 1 below shows the whole set of variables and their descriptive analysis for the estimation period (Apr.1994 to Dec.2007). All variables are deflated to reflect values of Dec.2002. In general, Table 1 shows that the regional averages of banking mark-ups are only slightly different among the states, revolving around 3.8% in the period.[6] Firstly, one can see that standard deviations differ in each state, with São Paulo showing the lowest deviations from the mean. Secondly, the maximum values for the variables in the period are also different among the states, with Minas Gerais and Ceara peaking at 9% while Pernambuco showed the lowest peak (8.1%).

Ceará performs as a financially underdeveloped region, not only with the highest values for polarisation (as showed in Figure 1), but also with the highest values for financial intermediation per thousand banks (*fintp*). Higher ratios of financial intermediation per bank are an indication of weakly-supported concentration of financial activities in the region, or poor distribution of regional financial agglomerations. Hence, Ceará underperforms in such characteristic, while the state of São Paulo shows the lowest indicators.

In relation to the presence of public banks, the indicators are high for peripheral states such as Ceará and Pernambuco. This is a sign of the importance of public banks in Brazil as financial intermediation agents in poorer areas of the country (AMADO, 2010). In São Paulo and Minas Gerais, public banks responded for only 11.4% and 14.4% of total banks in each region, respectively, while in peripheral states the ratios of public banks are well over 30% of total banks.

Table 1. Descriptive Analysis of Model Variables

Variables	Obs	Mean	Std. Dev.	Min	Max
Sao Paulo (SP)					
Mark-up	162	0.0376	0.017	0.009	0.087
Fperg	162	0.235	0.062	0.132	0.439
P	162	0.889	0.244	0.420	1.286
Fintp	126	0.028	0.013	0.019	0.088
Pubbp	162	0.114	0.026	0.084	0.228
Indprod	162	1.033	0.106	0.874	1.325
Minas Gerais (MG)					
Mark-up	162	0.0376	0.019	0.009	0.090
Fperg	162	0.199	0.046	0.087	0.345
P	162	0.914	0.282	0.442	1.435
Fintp	126	0.044	0.025	0.030	0.163
Pubbp	162	0.144	0.011	0.129	0.162
Indprod	162	1.016	0.126	0.822	1.343
Pernambuco (PE)					
Mark-up	162	0.0346	0.020	0.004	0.081
Fperg	162	0.364	0.062	0.219	0.521
P	162	0.891	0.260	0.453	1.347
Fintp	126	0.091	0.040	0.063	0.278
Pubbp	162	0.306	0.017	0.270	0.362
Indprod	162	1.102	0.099	0.922	1.466
Ceara (CE)					
Mark-up	162	0.0384	0.022	0.006	0.090
Fperg	162	0.514	0.059	0.408	0.663
P	162	0.890	0.243	0.483	1.297
Fintp	126	0.165	0.059	0.105	0.452
Pubbp	162	0.499	0.105	0.360	0.620
Indprod	162	1.014	0.104	0.805	1.233

Source: Own Calculations

[6] Figures for median values were more expressive in terms of inter-State differences: banks in São Paulo portray median regional mark-ups around 1.6%, while in Minas Gerais they revolved around 2.2%, in Pernambuco were at 2.5%, and Ceará, 2.7%.

RESULTS

Table 2 brings the underlying long-run relationship coming from fitting equation 3 to monthly data for the period April 1994 to December 2007. Three different empirical specifications in relation to the control variables were used in order to analyse the behaviour of mark-ups. Model specification (1) is the simplest model, an estimation that accounts strictly to the effects of financial polarisation and inflation on *ex-post* banking mark-ups. Model specification (2) includes the regional ratio of public banks (*pubbp*) and the index for industrial production (*indprod*) in the regressions as controls. The last specification (3) adds the ratio of financial intermediation per thousand banks (*fintp*). In this last specification, the number of observation necessarily drops to 126 because the *fintp* series only goes only until December 2004. These different specifications are also helpful in determining the robustness of the original relationship we are testing with different sets of control variables.

The test statistics that follow the results in Table 2 concern the unrestricted model given by equation 4. It is important to note that these test statistics do not show any major problems with the assumptions of the econometric model. However, there is evidence in favour of misspecification in the equations (χ^2_{FF}). This is possibly due to requirements of non-linearity or the omission of some variables in the model, such as important determinants of banking mark-ups like the default rates of regional firms or the term conditions of regional financial operations. Unfortunately, data is unavailable for such variables. Nonetheless, the misspecification test applied to model (3) for the state of São Paulo does not statistically reject the null at a 1% significance level, which is some indication that the model can explain the specified relationships.

The bounds tests proposed by *PSS* are represented by t_{BDM} and F_{PSS} in Table 2. Specifically, t_{BDM} is the t-ratio for testing $\rho = 0$ in equation 4 without a deterministic linear trend. We can find tabulated sets of critical values in PESARAN *et al.,* (2001). We can see that estimations show evidence of the existence of a long-run relationship between *ex-post* mark-ups, financial polarisation, inflation, and the control variables. It should also be noted that specification (2) and (3) for the state of Pernambuco presents values for t_{BDM} that fall within the test critical values, making test results to be undetermined. However, F_{PSS} evidence in this case is strongly favourable to a long-run relationship for the variables in the state.

The Long-run Cointegrating Relationship

In relation to the estimated coefficients, this paper main hypothesis is whether the effects of polarisation and inflation on regional banking mark-ups are significantly different from zero. Table 2 shows evidence in favour of such. Moreover, results also indicate that financial polarisation affects mark-ups positively in the long run in São Paulo, Minas Gerais and Pernambuco, which is further evidence on the regional polarisation character of the relationship estimated. Given the falling financial polarisation trends described in Figure 1, the positive correlation between mark-ups and polarisation is evidence that these regions operate under the low polarisation portion of the inverted U curve. While in the São Paulo and Pernambuco states the better regional distribution of resources lead to a fall in banking mark-up in the period, Minas Gerais presents the opposite behaviour, with a worse distribution actually increasing the banks' regional mark-up.

The state of Ceará portrays a different long-run relationship according to results in Table 2: falling financial polarisation is actually related to rising banking mark-ups. This is evidence in support of the region performing at a very high level of polarisation, or the descending portion of the inverted U curve. Figure 1 confirms that state of Ceará has the highest level of polarisation among the selected regions. In such scenario, falling polarisation raises mark-ups because the levels of polarisation are too high, and lower uncertainty and enhanced revolving funds in low-order places within the region are not strong enough to reduce dependency from financial processes in the high-order region.

In relation to the magnitudes of the polarisation effects, they are larger in less developed regions. In Pernambuco, for instance, a .01 increase in financial polarisation raises regional average *ex-post* mark-ups by 62%, while in Minas Gerais, the same change will only raise mark-ups by 0.8%. This is evidence of a higher polarisation-sensitivity of banks mark-ups at regions with higher levels of polarisation, an indication of the slope of the inverted U curve at poor levels of distribution.

Table 2. Cointegrating Regressions

states	Sao Paulo (SP)			Minas Gerais (MG)		
Model specification	(1)	(2)	(3)	(1)	(2)	(3)
error correction	**-0.07*** **	**-0.08*** **	**-0.14*** **	**-0.06*** **	**-0.11*** **	**-0.20*** **
	(0.01)	(0.01)	(0.03)	(0.01)	(0.02)	(0.04)
fperg	**2.16*** **	**1.23***	**1.31** **	0.27	**0.90***	**0.78***
	(0.68)	(0.73)	(0.51)	(0.95)	(0.55)	(0.48)
p	**0.40** **	-0.06	0.06	**-0.48** **	**-0.72*** **	-0.03
	(0.17)	(0.23)	(0.18)	(0.19)	(0.21)	(0.15)
pub		-0.12	**1.47** **		**6.59*** **	**4.40** **
		(0.69)	(0.67)		(2.19)	(1.96)
Indprod		**0.77*** **	**0.50***		0.72	**-0.96** **
		(0.29)	(0.30)		(0.58)	(0.41)
Fintp			**15.18*** **			**6.50*** **
			(3.56)			(1.93)
Summary Statistics						
$\bar{R}^2$	0.85	0.84	0.90	0.80	0.81	0.89
$\hat{\sigma}$	0.011	0.011	0.009	0.015	0.014	0.013
AIC	-937.82	-925.71	-789.26	-820.59	-844.97	-707.56
t_{BDM}	-4.90***	-5.37***	-4.51**	-4.55**	-5.70***	-5.46***
F_{PSS}	7.23***	5.82***	7.63***	5.93***	9.17***	8.03***
χ^2_{SC}	10.2 [.59]	12.6 [.39]	15.0 [.24]	12.6 [.40]	12.8 [.38]	6.3 [.90]
χ^2_{FF}	6.5 [.00]	8.1 [.00]	2.4 [.07]	16.6 [.00]	21.5 [.00]	5.7 [.00]
χ^2_{N}	6.2 [.04]	8.2 [.02]	7.6 [.02]	2.75 [.25]	2.5 [.28]	1.4 [.49]
χ^2_{H}	0.0 [.99]	8.02 [.89]	2.1 [.15]	0.5 [.47]	0.01 [.92]	0.01 [.92]
χ^2_{arch}	24.6 [.02]	22.3 [.03]	8.3 [.76]	12.8 [.38]	11.3 [.50]	8.8 [.71]
states	Pernambuco (PE)			Ceara (CE)		
Model specification	(1)	(2)	(3)	(1)	(2)	(3)
error correction	**-0.07*** **	**-0.05*** **	**-0.07*** **	**-0.06*** **	**-0.07*** **	**-0.11*** **
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)
fperg	**2.66** **	**5.93** **	**6.20** **	**-4.37*** **	**-3.52*** **	**-4.04*** **
	(1.06)	(2.63)	(2.54)	(0.99)	(0.75)	(0.74)
p	**1.11*** **	**1.92*** **	**2.18*** **	-0.34	**0.42***	0.20
	(0.19)	(0.58)	(0.52)	(0.38)	(0.23)	(0.24)
pub		-5.32	**-10.78***		-0.24	**-0.94*** **
		(5.53)	(5.88)		(0.27)	(0.30)
Indprod		**1.40***	-0.22		-0.47	**0.85***
		(0.88)	(1.29)		(0.49)	(0.53)
Fintp			**7.53** **			**1.68***
			(3.47)			(1.23)
Summary Statistics						
$\bar{R}^2$	0.79	0.83	0.84	0.81	0.81	0.83
$\hat{\sigma}$	0.024	0.021	0.023	0.015	0.015	0.015
AIC	-691.23	-715.41	-559.59	-834.04	-819.66	-667.31
t_{BDM}	-4.68**	-3.44	-3.59	-4.51**	-4.40**	-4.70***
F_{PSS}	9.66***	5.17***	7.73***	6.04***	3.79*	3.65*
χ^2_{SC}	13.8 [.31]	22.4 [.03]	11.8 [.46]	13.5 [.33]	11.3 [.50]	13.5 [.33]
χ^2_{FF}	12.8 [.00]	14.5 [.00]	16.1 [.00]	18.5 [.00]	18.7 [.00]	25.8 [.00]
χ^2_{N}	4.3 [.12]	0.08 [.96]	0.75 [.68]	2.3 [.31]	4.2 [.12]	1.65 [.44]
χ^2_{H}	0.00 [.95]	1.4 [.23]	0.2 [.63]	1.36 [.24]	0.00 [.94]	0.05 [.82]
χ^2_{arch}	11.8 [.45]	26.3 [.01]	8.8 [.71]	4.4 [.97]	7.3 [.84]	9.4 [.67]

Note: Standard errors in parentheses. p-values for statistics in brackets.
*** p<0.01, ** p<0.05, * p<0.1
Source: Own calculations.

Regional inflation has a less marked characteristic among the regions. It should be noted that the inflation variable refers to the metropolitan area of the capitals of each state. In financially underdeveloped regions, such as Pernambuco and Ceará where liquidity is high (CROCCO *et al.*, 2005), a high level of regional polarisation in financial activity is linked to low centralisation of services and a relatively large demand for less complex financial services. In such regions, higher regional shares of elementary financial services have a higher propensity to be positively affected by a rise in inflation at the capital, since they are constituted by simple intermediation services that are usually automatically price-adjusted. Thus, it is likely that an increase in prices in the central place will be positively transmitted to bank mark-ups in low order places at a higher pace.

This relationship presents a different rationale in developed regions, with rising inflation in central places lowering average mark-ups in the region. This may be due to remarkably lower liquidity preference in these regions, which implies in more complex financial services that are likely to be less or non-responsive to regional transmission of prices from high to low order places. This can explain the negative signs found in the regressions for Minas Gerais'. Unfortunately, coefficients are not robust enough for São Paulo, which does not allow a more consistent analysis.

The results for the variable *pubbp* are also noticeable. In general, it is expected from the regional rate of public banks per thousand banks to be negatively related to banking mark-ups, since public banks operate with different credit targets when compared to private banks in Brazil. Public banks also operate in markets that are not covered by private banks in Brazil (AMADO, 2010; CARVALHO and TEPASSÊ, 2010). In fact, this negative relation is the exact result obtained by model (3) in low developed regions. In Pernambuco, a 0.01% rise in the regional concentration of public banks reduces banks mark-ups, in average, by 1.1%. In Ceará, banks' mark-up levels are reduced by 0.9%. However, this relationship does not hold in developed regions. In São Paulo and Minas Gerais, an increase in the ratio of public banks in the region raises the mark-ups of banks. This result ultimately points to the different regional strategies of public banks. CROCCO *et al.* (2010a) discuss how banks, in general, optimize their operation strategies in different regions in Brazil. For these authors, bank revenues in low developed regions are usually linked to the management of liquid and profitable assets, while long-term, illiquid assets are highly concentrated in high order places. Table 2 shows evidence that public banks operate under such strategy in high developed regions. In order to extend loans and financial services at lower mark-ups to peripheral regions, public banks need to rebalance their portfolio liquidity and profitability by offering more complex services at higher mark-ups in central regions.

The index for industrial production and financial intermediation indicates a positive relationship between industrial and financial growth to banking mark-ups. High rates of growth in both variables are likely to increase financial development attributes such as the volume and complexity of financial activity in the regions. These attributes emphasise the role of financial polarisation in determining the mark-ups of banks in the region.

Short-run Dynamic Relationships

In relation to the speed of adjustment of the error-correction term in each state (Table 2), there is indication that post-shock adjustments are faster in financially developed regions, which is an expected result for more integrated and developed regional economies. After an external shock, Minas Gerais and São Paulo present banking mark-ups' short-run adjustment rates around 20% and 14% monthly, respectively, while Pernambuco and Ceará revolved around 7% and 11%, respectively. These results indicate faster speeds of adjustment in developed states. Moreover, from a more thorough look into the dynamics of the model (Table 3), it is possible to see, in the more developed states, that results point to the prominence of few lagged changes in the rates of mark-ups (Δb_{t-1}). Alternatively, in the underdeveloped regions, most of the lagged changes in mark-ups are significant, which is congruent to the adjustment speed being sluggish in low developed states.

Table 3. Dynamic Regional Spreads

States	SP			MG			PE			CE		
Models	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Δb_{t-1}	0.71***	0.60***	0.63***	0.57***	0.52***	0.67***	0.35***	0.53***	0.30***	0.46***	0.39***	0.52***
Δb_{t-2}	-0.10	0.01	0.10	0.11*	0.12**	0.16*	0.30***	0.06	0.26***	0.12**	0.28***	0.15**
Δb_{t-3}	-0.01	-0.07	-0.07	-0.06	0.06	-0.12	-0.18***	-0.05	-0.25***	0.01	-0.24***	-0.05
Δb_{t-4}	0.06	0.01	-0.05	0.24***	0.10	0.13	0.16**	0.20**	0.06	0.06	0.05	0.11
Δb_{t-5}	0.08	0.14*	0.30***	-0.03	0.03	-0.02	0.32***	-0.07	0.44***	0.16**	0.41***	0.22**
Δb_{t-6}				0.10*	0.39***							0.46***
Δb_{t-7}							-0.14**	-0.31***	-0.24***			
Δb_{t-8}						0.23***		0.11*	0.18**		0.10**	
Δb_{t-9}									-0.15*			
Δb_{t-10}			0.12***					-0.13**				
Δb_{t-11}								0.12*				
$\Delta fper_{t}$	-0.04	-0.07	-0.07	0.06	0.05	0.06	-0.14*	-0.05	-0.22*	0.10	0.08	0.05
$\Delta fper_{t-1}$	0.03	0.06	-0.01	-0.09	-0.14*	-0.05	-0.26***	-0.29***	-0.33***	0.19**	0.28**	0.29**
$\Delta fper_{t-2}$	-0.04	-0.01	-0.11	0.07	0.07	0.08	-0.06	-0.22**	-0.33***	0.16*	0.21**	0.27**
$\Delta fper_{t-3}$	-0.12**	-0.07	-0.16**	-0.05	-0.08	0.06	-0.30***	-0.39***	-0.56***	0.13	0.20*	0.17
$\Delta fper_{t-4}$	-0.07	-0.05	-0.20***	-0.08	-0.04	0.10	-0.27***	-0.33***	-0.47***	0.11	0.17*	0.22**
$\Delta fper_{t-5}$	-0.10**	-0.07	-0.06	-0.05	-0.03	0.12*	-0.20**	-0.28***	-0.40***	0.01	0.10	-0.003
$\Delta fper_{t-6}$			-0.15***	-0.16***	-0.17***		-0.24***	-0.13*	-0.38***		0.17*	
$\Delta fper_{t-7}$	-0.10***	-0.11***	-0.15***			0.20***	-0.15*	-0.17**	-0.34***			
$\Delta fper_{t-8}$											0.16**	
$\Delta fper_{t-9}$							-0.17**	-0.20***				
$\Delta fper_{t-10}$							-0.23***	-0.23***				
$\Delta fper_{t-11}$								0.12*				-0.08*
Δp_{t}	-0.02	0.003	-0.006	0.06	0.02	-0.06	0.35	0.52	-0.32	-0.30	0.14	-0.03
Δp_{t-1}	0.02	0.01	0.08	0.23	0.31**	0.50**	-0.31	-0.41*	0.36	0.03	-0.22	0.09
Δp_{t-2}	0.19	0.22	0.18	-0.05	-0.004	-0.45**	1.15***	0.94***	0.26	-0.05	0.09	-0.22
Δp_{t-3}	-0.16	-0.15	0.001	0.08	0.22	0.26	-0.69**	-0.43	-0.77**	-0.07	0.11	-0.02
Δp_{t-4}	-0.90***	-0.85***	-0.84***	0.15	0.22	0.13	0.47*	0.33	0.47	0.75***	0.57***	0.84***
Δp_{t-5}	0.95***	0.74***	1.01***	-1.57***	-1.39***	-1.34***	-1.52***	-1.76***	-1.85***	-2.29***	-2.18***	-2.45***
Δp_{t-6}	-0.36*			1.25***	1.06***		0.73***	0.99***		1.32***	1.41***	0.99***
Δp_{t-7}	0.30*		0.41***									
Δp_{t-8}									0.78**	0.12*		0.45**
Δp_{t-9}	0.42***	0.52***		0.68***		0.51***	0.69***				0.35**	0.54**
Δp_{t-10}							0.57**	1.25***		0.54***		
Δp_{t-11}					0.69***			-0.49**				
Δpub_b_{t}		-0.03	-0.27**		0.52	0.33		0.07	0.02		0.09	0.13
Δpub_b_{t-1}		-0.04	-0.13		-0.93**	-1.82**		-0.25	0.13		0.03	0.18**
Δpub_b_{t-2}		0.04	0.07		-0.89**	-0.95		-0.59**	-0.78		0.01	0.06
Δpub_b_{t-3}		0.04	-0.09		-0.37	-0.32		0.70***	2.08***		-0.04	0.03
Δpub_b_{t-4}		0.05	-0.13		-0.50	0.21		-0.05	-1.16		-0.01	0.11
Δpub_b_{t-5}		0.02	-0.18		0.51	-0.33		0.08	0.17		0.07	0.01
Δpub_b_{t-6}												0.14*
Δpub_b_{t-7}						0.84*			1.54**			
Δpub_b_{t-8}									-1.14*			
Δpub_b_{t-9}					-0.48*			-0.46**				0.13*
Δpub_b_{t-11}					-0.57*	0.88*						
$\Delta indprod_{t}$		-0.03	0.04		0.02	-0.07		0.08**	0.03		0.02	0.04
$\Delta indprod_{t-1}$		-0.06	-0.05		-0.12	-0.03		-0.13**	-0.08		-0.01	-0.10
$\Delta indprod_{t-2}$		-0.05	-0.02		-0.14**	-0.05		-0.07	-0.06		-0.02	-0.13**
$\Delta indprod_{t-3}$		-0.08*	-0.08**		-0.13*	0.001		-0.01	0.03		-0.04	-0.10
$\Delta indprod_{t-4}$		-0.03	-0.01		-0.10	0.003		-0.11**	-0.06		0.03	-0.02
$\Delta indprod_{t-5}$		0.02	0.06		0.08	0.25***		-0.07*	-0.10**		0.09**	0.02
$\Delta indprod_{t-6}$						0.46***		-0.07*				
$\Delta indprod_{t-7}$					-0.10*							
$\Delta indprod_{t-8}$						0.15**						
$\Delta indprod_{t-9}$											0.10**	
$\Delta indprod_{t-10}$						0.143**						
$\Delta indprod_{t-11}$						0.158**						
$\Delta fint_{t}$			9.95***			2.16			0.04			-0.05
$\Delta fint_{t-1}$			0.36			3.11*			0.22			0.36
$\Delta fint_{t-2}$			-1.01			-0.46			0.38			0.06
$\Delta fint_{t-3}$			-2.29			0.38			-4.39**			-0.48
$\Delta fint_{t-4}$			5.11***			-2.22			4.17**			-0.29
$\Delta fint_{t-5}$			5.25***			2.82**			0.28			0.57**
$\Delta fint_{t-6}$												
$\Delta fint_{t-7}$						-2.95**			-4.60***			
$\Delta fint_{t-8}$									3.22**			
$\Delta fint_{t-11}$			-6.90***			-3.37***						
$dummy_{sb}$					-0.02***	-0.02***				0.02***		
$dummy_{sb2}$				0.01*						0.01*		
const	-0.28***	-0.36***	-0.64***	-0.17***	-0.52***	-0.66***	-0.38***	-0.37***	-0.34*	-0.04	-0.09*	-0.22**

Source: Own computations

Nonetheless, the fast adjustments in mark-ups are partially explained by the use of the rate of returns as a dependent variable in the estimation. This variable is likely to be highly sensitive to change in regional financial conditions. Moreover, the fact that the banking system in Brazil operates nationally through branches can also explain the quick adjustments in mark-ups over the regions. Despite the limitations in these results, they can still offer significant inferences on the dynamics of banks' mark-ups over different regions.

In what concerns the dynamics of financial polarisation and the inverted U curve, distinctive results were found. In Table3, short-run results for states of São Paulo, Minas Gerais and Pernambuco show evidence of negative relationship between the rates of change in polarisation and mark-ups. This means that a rise in polarisation rates have decreasing marginal effects on mark-ups through time, an indication of banking mark-ups performing as the imperative conditions of the ascending portion of the inverted U curve. This shape is confirmed by the results for the level relationship in these states (Table 2). More specifically, a fall in the level of polarisation in the states of São Paulo and Pernambuco (Figure 1) in the period resulted in a lower level of mark-ups, with the equilibrium level being reached through increasing marginal rates of change. However, results should be taken with caution, since coefficients are not significant for all lags. Results are more significant in the underdeveloped state of Pernambuco. In Minas Gerais, polarisation has actually increased in the period, which amounts to rising mark-ups at decreasing rates of adjustment.

Alternatively, in the case of the state of Ceará, evidence confirms that not only does the level relationship indicate a negative relation between financial polarisation and banking mark-ups (Table 2), but this relationship adjust positively through time. This is congruent with the descending portion of the inverted U curve, where banks in the region adjust their mark-up under a high dependency of finance and funding processes of high-order places. Table 3 shows that the majority of significant coefficients for the lagged rates of change in polarisation have a positive sign.

CONCLUSIONS

The objective of this paper is to empirically verify the claim over the dominance of a polarisation dynamic for the adjustment in regional banks' mark-up. This claim is supported by a view over finance-growth processes that entail the use of regional analytical tools to understand financial development and growth. The hypothesis is that the emergence of a regional financial agglomeration leads to change i the distribution of monetary resources over the region, which eventually affect the regional behaviour of the financial system. The spatial distribution of liquidity, risk and uncertainty conditions propels the banking system to adjust their charges on financial services being offered locally. Moreover, once polarisation is assumed to affect banking mark-up, then it becomes necessary to investigate whether the adjustment process follows the dynamics discussed by Kuznets (1955).

This paper has empirically tested this assumption in selected regions in Brazil. Results show evidences in favour of the inverted U-shape in all regions. The banking mark-up in the states of São Paulo, Minas Gerais and Pernambuco all dynamically perform as portrayed in the ascending portion of the inverted U curve, while banking mark-up in Ceará mimics the descending portion of the curve. The cointegrating equations also show the significance of the presence of public banks in each state. Results indicate that the increase in the share of public banks in the period decreased (increased) mark-ups in less (more) developed states. This evidence supports the argument of public banks balancing their returns differently through regions. Public banks usually provision credit and financial services to regional agents following specific federal policies. Thus, the mark-ups in less developed states, where the participation of public banks is more significant, are likely to be lower. On the other hand, in developed states, public banks have lower shares of participation in local economies, having to cope with more segmented and restricted markets. This segmentation is likely the increase the cost of funding for all banks, which invariably increases the regional mark-ups.

Despite the limitations in the empirical investigation, especially in relation to the small sample of regions, results are relevant to support the necessity to include regional categories in studies about financial

development and growth. Such claim is mostly important when public policies are discussed. When deciding to finance specific economic sectors in each region, it is fundamental to understand how financial agglomeration and polarisation can support regional finance and funding. The comprehension of the effects of financial agglomeration and polarisation can definitely contribute for the design of more efficient regional and industrial public policies.

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