BIS CCA-004-2011
May 2011

Bank capital buffers, lending growth and economic cycle: empirical evidence for Brazil

Paper prepared for the 2nd BIS CCA Conference on

"Monetary policy, financial stability and the business cycle"

Ottawa, 12–13 May 2011

Authors*: Benjamin Miranda Tabak, Ana Clara Noronha, and Daniel Cajueiro

Affiliation: Central Bank of Brazil, Universidade de Brasília and Universidade de Brasília and National Institute of Science and Technology for Complex Systems, respectively

Email: benjamin.tabak@bcb.gov.br.

* This paper reflects the views of the authors and not necessarily those of the BIS or of central banks participating in the meeting.

Bank capital buffers, lending growth and economic cycle: empirical evidence for Brazil

Benjamin M. Tabak   Ana Clara B. T. F. Noronha
Daniel O. Cajueiro

Abstract

This paper analyzes the relationship between economic cycle and capital buffers held by banks in Brazil. We evaluate the effects of bank capital on bank lending activity and how these effects vary among banks with different ownership structure. We use an unbalanced panel data of Brazilian institutions from 2000 to 2010 to estimate an equation for capital buffers and for loans' growth. Our results reveal that the economic cycle negatively affects the surplus capital. These results have important implications for the discussion of capital regulations and the recent counter-cyclical proposal under Basel III.

Key words: Capital Buffers; Economic Cycle; Pro-Cyclicality; Basel II; Basel III.

JEL: G18, G21, E58

1 Introduction

Banking is one of the most regulated industries in the world, and the rules on bank capital are one of the most relevant aspects of such regulation[1]. In general, bank regulation is justified on the basis of the preservation of financial stability, the presence of market failures and the inability of depositors to monitor banks (Santos, 2000).

Both the 1988 Basel Accord and the proposal for a new capital adequacy (the Basel II Accord), in particular the issue of "pro-cyclicality", has been subject of much investigation (see, among others, Kashyap and Stein (2004), Heid (2007), Jackson (1999), Santos (2000), Borio et al. (2001)). As is well known, by linking capital requirements more closely to risks, hence more closely to economic conditions, the Basel II rules increase the pro-cyclical nature of banks' lending behavior. These studies have focused primarily on the effects of the Basel II framework on the cyclicality of the capital charges and making proposals to dampen this pattern (Gordy and Howels, 2004; Estrella, 2004; Pederzoli and Torricelli, 2005).

Another important branch of the literature on bank regulation focuses on how bank capital ratios affect the response of lending activity to monetary policy and GDP shocks (Gambacorta and Mistrulli, 2004; Furfine, 2001; Kishan and Opiela, 2000; Hancock and Wilcox, 1994; Den Heuvel, 2001; Altunbas et al., 2002; Ehrmann et al., 2003). These studies, for instance, show that regulatory tightening of capital ratios can generate aggregate shocks and, therefore, that prudential capital requirements can influence macroeconomic outcomes.

One of the main lessons of the recent crisis is that bank capital is pro-cyclical and financial regulation that induces counter-cyclical capital buffers may enhance financial stability. There is a large discussion on how these counter-cyclical buffers could be designed and what are the impacts of such rules (Angelini et al., 2011; Drehmann et al., 2010; Ojo, 2010; Fonseca et al., 2010; Blundell-Wignall and Atkinson, 2010; Repullo and Saurina, 2011; Repullo et al., 2010; Jacques, 2010; Berrospide and Edge, 2010).

In order to assess the effects of bank regulation on the economy, more broadly speaking, we analyze (1) the relationship between economic cycle and capital buffers held by banks in Brazil and (2) the effects of such capitalization on bank lending activity. In addition, we test whether these effects and the amount of capital buffers vary among banks with different ownership structure.

We use an unbalanced quarterly panel data of Brazilian institutions from 2000 to 2010. We estimate an equation for capital buffer controlling for other determinants, besides an economic cycle variable. We find a robust and significant

[1] In the verge of the recent crisis concerns regarding regulating liquidity have also been pointed as crucial.

negative relationship between capital and the economy. This result raises some concerns about the pro-cyclicality problem, especially in the debate about the implementation of the Basel III accord in Brazil[2].

Then, we also estimate another regression for loans to explicitly analyze the effect of capital buffers on credit activity. We find highly significant results suggesting that the cushion of capital is negatively associated with loans level and it strengthens the effect of economic cycle and monetary policy on lending behavior.

It is important to highlight that most of the banks, according to their balance sheets, hold capital ratio above the required minimum. In this context, the recent research in this area has focused on analyzing the cyclical behavior of capital buffers. Ayuso et al. (2004) examine the Spanish banks, Lindquist (2004) Norwegian banks, and Stolz and Wedow (2005) German banks, finding evidence of a negative relation between the cycle and the buffer. Using an international bank database, Jokipii and Milne (2008) find a similar negative relation for the 15 countries of the European Union in 2004, but an opposite relation for the 10 countries that joined European Union in 2004.

Therefore, our paper contributes to the literature on bank pro-cyclicality providing recent empirical evidence about the cyclical behavior of capital buffers in Brazil and how they vary among banks with different ownership structure. Furthermore, we also present evidence about the effects of capital buffers on loans' growth and its impact on the credits' response to macroeconomic shocks. To the best of our knowledge this is the first paper in this literature that takes into account explicitly the impact of monetary policy on the capital buffers held by banks as well as that studies exclusively an emerging market case.

The banking system in Brazil is basically composed of domestic institutions (55.7%) and domestic with foreign ownership (34.2%). State-owned banks account for less than 8% of total assets[3]. In addition, it is worth noting that Brazil does not have a well developed corporate bond market and the stock market has been growing fast in the last decade. Due to this fact most firms rely on bank financing and internal sources of funding. Therefore, evaluating the banking system and the capital movement along the economic cycle is crucial.

The rest of the paper is organized as follows. Section 2 summarizes the motivations for this study: the reasons why banks hold an excess of capital; a brief review about the link between capital and lending activity; and the general ideas behind the pro-cyclicality of capital buffers. The theoretical framework and methodology about capital buffers and lending activity are described in section 3, as well as the dataset used in equations. Section 4 shows the econometric results. Finally,

[2]The main proposals in Basel III capital are: a leverage ratio, a capital buffer and dealing with pro-cyclicality through dynamic provisioning (focusing on expected losses).

[3]Financial Stability Report of Central Bank of Brazil - May, 2010

section 5 presents our conclusion.

2 Motivation

2.1 Reasons why banks hold excess capital

Banks maintain excess of capital primarily because of market discipline, supervisory intervention, and adverse shocks. Banks may hold capital buffers to avoid costs related to market discipline (for instance, the cost of deposits) (Lindquist, 2004). When bank liabilities are not totally insured, the depositors demand higher returns to compensate for higher bank risk. Therefore, banks may have incentives to reduce its risk and hence the cost of deposits by increasing its capital level (Fonseca and Gonzalez, 2009).

According to Nier and Baumman (2006), the effectiveness of market discipline depends on banks' support, funding and disclosure. That is, (1) the extent of the government safety net; (2) The degree to which the bank is financed by uninsured liabilities; (3) The observability of the banks' risk choice. Thus, the first one reduces capital buffer and the others factors encourage banks to limit their risk of insolvency (Nier and Baumman, 2006). And this may be achieved by increasing the amount of capital above the minimum required. Hence banks also may hold excess of capital to protect themselves against insolvency.

Banks may keep capital buffers to signal soundness to the market and to satisfy expectations of rating agencies (Jokipii and Milne, 2008; Nier and Baumman, 2006). Hence, excess of capital may serve as an instrument in the competition for unsecured deposits and money market funding (Lindquist, 2004). Therefore, banks care about their relative capital buffer.

Banks maintain a cushion of capital as an insurance against violating the minimum capital requirement (Stolz and Wedow, 2005; Jokipii and Milne, 2008; Lindquist, 2004; Fonseca and Gonzalez, 2009; Stolz and Wedow, 2011). When regulatory requirement changes, banks cannot adjust capital and risk instantaneously. This is because there are adjustment costs related to raise fresh external capital and the drop in banks' common stock values due to changes to equity capital. In addition, this violation results in costs arising from a supervisory intervention, which may be (partially) absorbed by excess of capital.

Capital buffers also act as an insurance for the banks against adverse shocks (Nier and Baumman, 2006). Capital reduces the likelihood of bankruptcy and financial distress costs (Fonseca and Gonzalez, 2009). In particular for poorly capitalized banks, this excess of capital reduces difficulties in raising new capital when capital ratio falls. On the other hand, banks may hold capital to be able to exploit unexpected investment opportunities. So banks can obtain wholesale funds quickly (Jokipii and Milne, 2008; Lindquist, 2004; Fonseca and Gonzalez, 2009).

2.2 Bank capitalization and lending behavior

There are several theories that explain how bank capital could influence the propagation of economic shocks to lending. All these theories suggest the existence of market imperfections that modify the standard results of the Modigliani and Miller (1958) propositions. Specifically, banks face increasing marginal adjustment costs and seek to avoid regulatory costs.

Bank capital can influence the impact of economic shocks on lending in two ways: the "bank lending channel" and the "bank capital channel", in which we are more interested. Both of them are based on adverse selection problems that affect banks' fund-raising: the first relies on imperfections in the market for bank debt (Kishan and Opiela, 2000; Kashyap and Stein, 1995; Bernanke and Blinder, 1988) and the second concentrates on an imperfect market for bank equity (Den Heuvel, 2001).

The lending channel also relies on another two conditions. First, the banking sector as a whole must not be able to completely insulate its lending activities from shocks to reserves, either by switching from deposits to less reserve-intensive forms of finance or by paring its net holdings of bonds. Second, there must be some form of imperfect price adjustment that prevents any monetary policy shock from being neutral (Kashyap and Stein, 1995). Thus, a monetary tightening affects bank lending because the drop in reservable deposits cannot be completely offset by issuing non-reservable liabilities (or liquidating some assets). In this case, bank capital has an important role because it affects banks' external ratings and provides the investors with a signal about their creditworthiness (Kishan and Opiela, 2000).

Gambacorta and Mistrulli (2004) sum up the three hypotheses on which the bank capital channel is based: 1) an imperfect market for bank equity; 2) a maturity mismatching between assets and liabilities that exposes banks to interest rate risk; and 3) a direct influence of regulatory capital requirements on the supply of credit. The mechanism is the following. Since the interest rates on banks' assets are slower to adjust to changes in market interest rates than those on banks' liabilities, banks bear a loss due to the maturity mismatch between assets and liabilities that reduces profits and then capital. If equity is sufficiently low and it is too costly to issue new shares, banks reduce lending, or else they fail to meet regulatory capital requirements.

Bank capitalization may also influence the way the loan supply reacts to output shocks if banks' profits, and thus banks' capital accumulation, depend on the business cycle. In this case, output shocks affect banks capacity to lend if the market for equity is not frictionless and banks have to meet regulatory capital requirements. Other things being equal, well-capitalized banks are in a better position, with respect to low-capitalized banks, to absorb output shocks. Since they hold more capital in excess of the minimum required to meet prudential regulation standards, well-capitalized banks need to adjust lending less during economic downturns in order to avoid regulatory capital shortfalls. Thus, if for institutional reasons banks hold a different amount of capital in excess of regulatory requirements, this may in turn imply cross-sectional differences in lending responses to output shocks (Gambacorta and Mistrulli, 2004).

The bank capital channel and the way banks react to output shocks are closely related to the amount of capital held in excess of regulatory requirements. Gambacorta and Mistrulli (2004) point out that the traditional capital-to-asset ratio does not discriminate among banks with the same level of capital facing different regulatory constraints. By contrast, the capital buffer ratio takes regulatory requirements directly into account.

2.3 Capital buffers along the economic cycle

There is strong empirical evidence that bank capital buffers under Basel I exhibit significant cyclical patterns (Ayuso et al., 2004; Jokipii and Milne, 2008; Lindquist, 2004; Stolz and Wedow, 2005). They increase during economic downturns and decrease during upturns. One reason for this is obvious: demand for loans is pro-cyclical (Stolz and Wedow, 2005; Gambacorta and Mistrulli, 2004).

Since loan losses tend to lag a business cycle, this negative movement of capital buffers may also be evidence for a myopic bank behavior (Jokipii and Milne, 2008; Stolz and Wedow, 2005; Ayuso et al., 2004; Borio et al., 2001; Berger and Udell, 2004). Banks expand their loan portfolio in a boom without building up their capital buffers accordingly. During the following cyclical downturn, the capital accumulation may also be too slow. Hence, banks' capital buffers cannot absorb the materializing credit risks. The banks are forced to increase their capital buffers through a reduction in lending (Koopman et al., 2005; Stolz and Wedow, 2005; Jokipii and Milne, 2008).

It is also argued that portfolio risks actually increase during an economic upturn (Borio et al., 2001). During booms, borrowers are less likely to default than during economic downturn. However, banks are likely to take credit risks during booms when banks expand their loan portfolios. Hence, forward-looking banks build up their capital buffers during booms to be able to accommodate materializing credit risk during recession (i.e. a positive movement) (Jokipii and Milne, 2008; Stolz and Wedow, 2005).

Considering the cyclicality of lending, the capital buffers are likely to reduce the impact of changes in capital charges, even partially (Heid, 2007). In this context, some authors point out that capital buffers will reduce the cyclical effects of Basel II (Nier and Zicchino, 2005).

Under Basel I, Heid (2007) predicts an increase in the capital buffer during an economic downturn due to a reduction in lending. Under Basel II, however, the capital buffer will actually decrease, because the rise in the average risk weights will usually overcompensate the reduction in lending (Heid, 2007; Ayuso et al., 2004). The ongoing discussions on the new accord (Basel III) are focusing on how to produce a stable financial system and new capital requirements that are counter-cyclical may be implemented[4].

Parallel to this approach of bank pro-cyclicality, there is also strong evidence that well-capitalized banks are less constrained in their responses to monetary policy and to other macroeconomic shocks compared with banks with relatively lower levels of capitalization (Kishan and Opiela, 2000; Gambacorta and Mistrulli, 2004; Nier and Zicchino, 2005; Peek and Rosegren, 1995). In particular, credit supply of these banks with higher capital ratio are less pro-cyclical.

3 A model for capital buffer and lending behavior

3.1 Determinants of the surplus capital

Following Ayuso et al. (2004), Lindquist (2004), Fonseca and Gonzalez (2009) we consider three different types of bank capital costs to model capital buffers: costs of funding, costs of failure (financial distress) and adjustment costs.

Holding capital implies direct costs of remunerating the excess of capital, that is the opportunity cost of the capital. Therefore, banks' incentives to hold capital buffers depend on the cost of capital compared to the cost of deposits (Fonseca and Gonzalez, 2009). Ayuso et al. (2004), Jokipii and Milne (2008) use each institutions' return on equity (ROE) to proxy these costs. The expected sign for this variable is negative (Ayuso et al., 2004; Jokipii and Milne, 2008). As noted by Jokipii and Milne (2008), ROE may well exceed the remuneration demanded by shareholders and to this extent is a measure of revenue rather than cost. A high level of earnings substitutes for capital as a buffer against unexpected shocks. Thus, as raising capital through the capital markets is costly, retained earnings are frequently used to increase capital buffers. So the expected sign for ROE may be negative (Jokipii and Milne, 2008; Stolz and Wedow, 2005), but it also may be positive (Nier and Baumman, 2006; Stolz and Wedow, 2005; Rime, 2001).

The bank risk profile also determines the capital buffer, since it is related to the likelihood of costs of failure. Ayuso et al. (2004), Jokipii and Milne (2008), Fonseca and Gonzalez (2009) use the non-performing loan ratio to total loans and

[4]See Drehmann et al. (2010) for a discussion on alternative ways to implement counter-cyclical capital requirements.

credits (NPL) to proxy the bank risk. Therefore, these papers suggest a negative relationship between capital buffers and risk.

Banks may face adjustment costs in moving toward their optimal capital ratios. These costs arise both when the bank is raising new external capital and when it is shedding external capital (Estrella, 2004). The main entry costs include those related to the problem of asymmetric information in capital markets. Equity is a form of capital for which monitoring costs are high, and the bank has an informational advantage over public investors as to the value of its own equity (Myers and Majluf, 1984). Accordingly, the issuance of equity could be seen by the potential buyers as a negative signal with regard to the banks' value. On the other hand, an important cost of shedding equity comes from pressure from regulators, supervisors and market participants to maintain clearly sound levels of capital (Estrella, 2004).

There are several reasons to expect a negative relationship between the banks' size and its capital level. The main reasons are: diversification effect, too-big-to-fail hypothesis, advantages in the access to capital (Brown and Davis, 2008; Berger and Udell, 2004), and if there are economies of scale in screening and monitoring borrowers, then large banks may substitute excess of capital with these activities (Jokipii and Milne, 2008; Lindquist, 2004; Stolz and Wedow, 2005; Nier and Baumman, 2006).

Finally, it is important to consider the ownership structure in the modeling of the buffer. There are some factors to believe that foreign banks hold less capital buffer than domestic banks, and within these type of banks, state-owned banks hold less surplus than private institutions. It is because state-owned and private banks decide in a different manner loan supply. The reason for this is that state-owned banks are often funding politics executers and also because it is easier for them to raise new capital. In addition, one may take into account the political influence factor that encourages such a banks to sustain credit levels which are not compatible to the economic rationality and the efficient management. Hence this negatively affects the amount of excess of capital held by the bank.

3.2 Methodology

We use an unbalanced quarterly panel data of 134 banks, from 2000 to 2010. Overall, we have 3,395 observations. We define capital buffer ($BUF_{i,t}$) as the difference between economic capital and regulatory capital divided by the regulatory capital[5].

[5]Let K_{it} and K_{it}^r be the capital held by banks and minimum regulatory capital. The buffer is defined as $BUF = \frac{K_{it}-K_{it}^r}{K_{it}^r}$.

Following previous literature (Ayuso et al., 2004; Stolz and Wedow, 2005; Jokipii and Milne, 2008; Fonseca and Gonzalez, 2009), we test for a dynamic specification for the BUF. However, we find that a static specification is preferred in our case. Therefore, we estimate the model using Feasible Generalized Least Squares (FGLS).

The baseline specification is:

$$\begin{aligned} \Delta BUF_{i,t} &= \alpha + \beta_1 ROE_{i,t-1} + \beta_2 NPL_{i,t-1} + \beta_3 SIZE_{i,t-1} \\ &+ \beta_4 GAP_{t-1} + \varepsilon_{i,t}, \\ & i = 1,...,N,\ \ t = 1,...,T \end{aligned} \tag{1}$$

We define bank explanatory variables to capture the three types of costs related to capital buffers. All explanatory variables are lagged, which seeks to avoid possible endogeneity of the banking variables. Direct costs of remunerating the excess of capital are proxied by each institutions' *ROE* (return on equity). The expected sign for this variable is negative. Since the expected cost of failure of each institution depends on its risk profile, we use *NLP* (non-performing loans ratio) as a measure of *ex post* realized risk. It implies that its expected sign is negative. We include *SIZE* - the natural logarithm of banks' total assets - to capture the effect of the banks' size on buffer movements.

In order to determine whether the business cycle has an additional effect on the bank capital buffer, we add *GAP* - obtained after applying a standard Hodrick-Prescott filter. We also take into account explicitly the effect of monetary policy in the excess capital by adding in equation 1 the short-term interest rate, the overnight *selic* interest rate, set by the Monetary Policy Committee (Copom). The standard random shock is $\varepsilon_{i,t}$.

3.3 Lending behavior

In order to take into account the bank lending activity in the study of the procyclicality of the capital buffer, we consider the effect of each institutions' capitalization (e.g., the bank capital buffer) on the lending growth. In addition, we use this approach to analyze the mechanisms by which bank capital affects the effects of economic cycle in loan growth.

As reported by Berrospide and Edge (2008), there are many possible values for the magnitude of this impact. Representing one extreme is the possibility that banks target a constant leverage ratio and are very limited in their ability to raise equity to offset declines in capital. On the other hand, there is the possibility that a decline in the leverage ratio that results from a capital loss can be accommodated and that the capital loss can be offset by alternative sources of funding. In this case, capital losses result in no contraction of assets or of lending.

We estimate a regression of the growth rate in loans in which we include, besides the capital buffers, lags of the dependent variable, lags of *GAP* and lags of *SELIC*. Again, using FGLS we estimate the following specification:

$$\Delta LOANS_{i,t} = \alpha + \gamma_1 GAP_{i,t-1} + \gamma_2 \Delta SELIC_{i,t-s} + \gamma_3 \Delta BUF_{i,t-s} + \varepsilon_{i,t}. \quad (2)$$

As in the previous specification all explanatory variables are lagged. We also test a dynamic specification using the difference and system-GMM estimators of (Arellano and Bond, 1991; Blundell and Bond, 1998). However, a static model is preferred for the loans' growth model.

4 Results

4.1 Capital buffer equation

Table 1 presents the results of estimating equation 1. We present in this Table the results for the baseline model using Fixed Effects (first column), Random Effects (second column), Feasible Generalized Least Squares (FGLS) allowing for heteroskedastic panels and common $AR(1)$ coefficient for all panels (third column), and in the last column we present the results for the FGLS model including significant variables only. The FGLS model is preferred as residuals test suggest that we should control for both autocorrelation and heteroskedascity. It is worth mentioning that in all cases the coefficient of the *GAP* is statistically significant, and has the expected negative sign. Therefore, these results imply that when output gap is higher capital buffers are reduced[6]. We also find that the coefficient on *SIZE* is statistically significant and positive. We present a test for joint significance of all variables in the model (F/χ^2).

Place Table 1 About Here

Table 2 presents the model with the inclusion of dummy variables for ownership. We include a dummy for private domestic banks (*PRIVATE* and for foreign banks (*FOREIGN*). In Table 3 we include the interaction between ownership

[6] We also test a dynamic specification using difference-GMM (Arellano and Bond, 1991) and system-GMM (Blundell and Bond, 1998). However, the static models are preferred since the persistence of the buffer changes is low. The low correlation in the last line of the Table also suggests that a static model is preferred (0.134 for the full model and 0.0608 for the model with significant variables only).

dummies and the output gap *GAP*. We have that both *NPL* and *SIZE* are statistically significant and that the interaction of the output gap with the dummy for private domestic banks is significant, which implies that these banks have had an increase in their capital buffers relative to other types of banks (foreign and state-owned) in good times (increasing output gap).

Place Tables 2 and 3 About Here

In Table 4 we include the changes in the domestic short-term interest rate (*SELIC*) in the econometric specification. Our results suggest that increases in the *SELIC* interest rate are followed by increases in capital buffers. The impact of other variables is relatively unchanged - given the magnitude of the coefficients and their respective standard errors we cannot reject that the coefficients are statistically equal. We also include the interaction of changes in the *SELIC* interest rate and ownership dummies to assess whether different types of bank respond differently to changes in monetary policy and we find that there are no systematically differences.

Place Tables 4 and 5 About Here

Negative coefficients for the GAP indicate that the worsening of the real economy implies in higher capital buffers.Therefore, banks would increase their precautionary reserves in bad times, which exacerbates economic fluctuations. Capital regulations that have pro-cyclical elements end up amplifying economic cycles, which may imply in further increase in non-performing loans and a decrease in credit supply, affecting adversely financial stability. Therefore, these results suggest that counter-cyclical capital rules may be warranted to enhance financial stability.

4.2 Loans equation

Table 6 presents the results for the *LOANS* equation. We find that the buffers have a negative impact on loans, with a coefficient of approximately -0.26. Therefore, a one percent increase in capital buffers impact negatively the loan's growth rate in 0.26%. In Table 7 we also include the interaction between the $BUFFER$ and the *GAP* and we see that the interaction is positive and statistically significant.

Place Tables 6 and 7 About Here

Overall these estimates show that capital buffers ($\Delta BUF_{i,t-1}$) are negatively related to loans' growth. Hence, a high bank capitalization is associated with reduced loans. This is consistent with the previous evidence of the negative effect of the business cycle on surplus capital.

In order to test whether the bank capitalization affects the impact of monetary policy and economic cycle on credit activity, we add to equation 2 the interacting variables $GAP_t * BUF_{i,t}$ and $SELIC_t * BUF_{i,t}$. In the first case (see column 2 of table 2), the positive sign and high significance of that variable indicate that the cushion capital intensifies the relation between loans and economic cycle. This results is coherent with other results. For instance, in the economic downturn, besides the direct fall in loans, banks may also reduce their loans as a way to increase their capitalization.

As regards $SELIC_t * BUF_{i,t}$, we also obtain a positive effect. Given a monetary tightening, initially related to a more intensive credit activity (positive $SELIC_t$), in the next period we expect a fall in loans (negative $\Delta SELIC_{t-1}$). Hence, the capital buffer strengthens the impact on loans of this change in Selic interest rate (Table 8).

In order to study whether the effect of capital buffer on lending behavior varies among banks with different ownership structure, we add the interacting variable $FOREIGN_i * BUFi,t$ and $PRIVATE_i * BUF_{i,t}$, with a negative sign in the latter case. This result can be seen as evidence that surplus capital has a weaker impact on lending activity in private domestic banks (see Table 9).

Place Tables 8 and 9 About Here

Overall, our empirical results imply that increases in capital buffers in economic downturns may be amplified, which entails in pro-cyclicality.

5 Conclusion

This paper analyzes the determinants of bank capital buffers, in particular the relationship between capital and the economic cycle, and its effects on lending activity using a panel data of 134 banks in Brazil between 2000 and 2010. We apply the Feasible Generalized Least Squares estimator to control for both autocorrelation and heterokedasticity. We focus primarily on whether the capital buffer depends on the business cycle.

Taken together, our results indicate that in economic downturn, banks raise the amount of capital buffers and lower loans' growth. In addition, we find that capitalization is negatively related to the loans level. That is, we explicitly verify the role of lending activity in the negative movement of the excess bank capital.

In economic downturn, banks have in our sample period increased capital buffers and, under the new accord Pillar 1, capital requirements have been increased as banks exposures are downgraded, whether by external rating agencies or in internal rating systems. This suggests that capital management is especially challenging under the new accord because it will lead to higher capital requirements precisely at the time (trough the business cycle) when most banks are seeking to reduce their capital levels.Furthermore, by taking into account the effect of monetary policy on credit activity, it turns out that bank capitalization positively affects loans level.

Finally, these results indicate that bank capital is relevant for the propagation of different kinds of shocks to lending, particularly owing to the existence of regulatory capital constraints. As highlighted by Gambacorta and Mistrulli (2004), this implies that when evaluating different schemes of regulation on bank capital, one has to consider not only microeconomic effects on banks' soundness but also the macroeconomic consequences of those same schemes.

6 Acknowledgements

The authors are grateful to financial support from CNPQ foundation. The opinions expressed in this paper are those of the authors and do not necessarily reflect those of the Banco Central do Brasil or its members.

References

Altunbas, Y., Fazylow, O. and Molyneux, P. (2002). Evidence on the bank lending channel in europe, *Journal of Banking and Finance* (26): 2093–2110.

Angelini, P., Clerc, L., Crdia, V., Gambacorta, L., Gerali, A., Locarno, A., Motto, R., Roeger, W., Heuvel, S. V. D. and Vlcek, J. (2011). Basel III: Long-term impact on economic performance and fluctuations, *BIS Working Papers 338*, Bank for International Settlements.

Arellano, M. and Bond, S. (1991). Some test of specification for panel data: Monte carlo evidence and application to employment equations, *Review of Economic Studies* (58): 227–297.

Ayuso, J., Perez, D. and Saurina, J. (2004). Are capital buffers pro-cyclical? evidence from spanish panel data, *Journal of Financial Intermediation* (13): 249–264.

Berger, A. N. and Udell, G. (2004). The institutional memory hypothesis and the procyclicality of banking lending behaviour, *Journal of Financial Intermediation* (13): 458–495.

Bernanke, B. and Blinder, A. S. (1988). Is it money or credit, or both or neither? credit, money and aggregate demand, *American Economic Review* (78): 435–439.

Berrospide, J. and Edge, R. (2008). Linkages between the financial and real sectors: Some lessons from the subprime crisis, *Federal Reserve Board Working Paper* .

Berrospide, J. and Edge, R. M. (2010). The effects of bank capital on lending: What do we know, and what does it mean?, *CAMA Working Papers 2010-26*, Australian National University, Centre for Applied Macroeconomic Analysis.

Blundell, R. and Bond, S. (1998). Initial conditions and moment restriction in dynamic panel data models, *Journal of Econometrics* (87): 115–143.

Blundell-Wignall, A. and Atkinson, P. (2010). Thinking beyond Basel III: Necessary solutions for capital and liquidity, *OECD Journal: Financial Market Trends* **2010**(1): 2.

Borio, C., Furfine, C. and Lowe, P. (2001). Procyclicality of the financial system and financial stability: Issues and policy options, *BIS Working Paper* (1).

Brown, C. and Davis, K. (2008). Capital management in mutual financial institutions, *Journal of Banking and Finance* (33): 443–455.

Den Heuvel, S. J. V. (2001). The bank capital channel of monetary policy, *Mimeo. University of Penssylvania* .

Drehmann, M., Borio, C., Gambacorta, L., Jiminez, G. and Trucharte, C. (2010). Countercyclical capital buffers: exploring options, *BIS Working Papers 317*, Bank for International Settlements.

Ehrmann, M., Gambacorta, L., Pages, J. M., Sevestre, P., in I Angeloni, A. ., Kashyap, A. and Mojon, B. (2003). Financial systems and the role of banks in monetary policy transmission in the euro area., *Cambridge University Press* pp. 235–269.

Estrella, A. (2004). The cyclical behaviour of optimal bank capital, *Journal of Banking and Finance* (28): 1469–1498.

Fonseca, A. R. and Gonzalez, F. (2009). How bank capital buffers vary across countries: The influence of cost of deposits, market power and bank regulation, *Journal of Banking and Finance* .

Fonseca, A. R., Gonzalez, F. and da Silva, L. P. (2010). Cyclical effects of bank capital buffers with imperfect credit markets: international evidence, *Working papers series*, Central Bank of Brazil, Research Department.

Furfine, C. (2001). Bank capital allocation: The impact of capital requirements, regulatory monitoring, and economic conditions, *Journal of Financial Service Research* (20): 33–56.

Gambacorta, L. and Mistrulli, P. (2004). Does bank capital affect lending behaviour?, *Journal of Financial Intermediation* (13): 436–457.

Gordy, M. and Howels, B. (2004). Procyclicality in Basel II: Can we treat the desease without killing the patient?, *Journal of Financial Intermediation* (15): 395–417.

Hancock, D. and Wilcox, J. (1994). Banck capital and credit crunch: the roles of risk-weighted and unweighted capital regulations, *Journal of the America Real Estate and Urban Economics Association* **22**: 59–94.

Heid, F. (2007). The cyclical effects of the Basel II capital requirements, *Journal of Banking and Finance* (31): 3885–3900.

Jackson, P. (1999). Capital requirements and bank regulation:the impact of the Basel accord, *Basel Committee on Banking Supervision - Working Paper* (1).

Jacques, K. T. (2010). Procyclicality, bank lending, and the macroeconomic implications of a revised Basel accord, *The Financial Review* **45**(4): 915–930.

Jokipii, T. and Milne, A. (2008). The cyclical behaviour of european bank capital buffers, *Journal of Banking and Finance* (32): 1440–1451.

Kashyap, A. and Stein, J. (2004). Cyclical implications of the Basel II capital standards, *Economic Perspectives - Federal Reserve Bank of Chicago* (28): 18–31.

Kashyap, A. and Stein, J. C. (1995). The impact of monetary policy on bank balance sheets, *Carnegie-Rochester Conference Series Public Policy* (42): 151–195.

Kishan, R. and Opiela, T. (2000). Bank size, bank capital and the lending channel, *Journal of Money, Credit and Banking* **32**(1): 121–141.

Koopman, S., Lucas, A. and Klaassen, P. (2005). Empirical credit cycles and capital buffer formation, *Journal of Banking and Finance* (29): 3159–3179.

Lindquist, K. (2004). Banks buffer capital: How important is risk?, *Journal of International Money and Finance* (23): 493–513.

Modigliani, F. and Miller, M. (1958). The cost of capital, corporation finance, and the theory of investment, *The America Economic Review* **3**(48): 261–297.

Myers, S. and Majluf, N. (1984). Corporate financing and investment decisions when firms have information that investors do not have, *Journal of Financial Economics* (13): 187–221.

Nier, E. and Baumman, U. (2006). Market discipline, disclosure and moral hazard in banking, *Journal of Financial Intermediation* (15): 332–361.

Nier, E. and Zicchino, L. (2005). Bank weakness and loan supply, *Bank of England Financial Stability Review* (December 2005): 85–93.

Ojo, M. (2010). Measures aimed at mitigating pro cyclical effects of the capital requirements framework: counter cyclical capital buffer proposals, *MPRA Paper 24610*, University Library of Munich, Germany.

Pederzoli, C. and Torricelli, C. (2005). Capital requirements and business cycle regimes: Forward-looking modelling of default probabilities, *Journal of Banking and Finance* (29): 3121–3140.

Peek, J. and Rosegren, E. (1995). The capital crunch: Neither a borrower or a lender be, *Journal of Money, Credit and Banking* **27**(3): 625–638.

Repullo, R. and Saurina, J. (2011). The countercyclical capital buffer of Basel III: A critical assessment, *CEPR Discussion Papers 8304*, C.E.P.R. Discussion Papers.

Repullo, R., Saurina, J. and Trucharte, C. (2010). Mitigating the pro-cyclicality of Basel II, *Economic Policy* **25**: 659–702.

Rime, B. (2001). Capital requirements and bank behaviour: empirical evidence for switzerland, *Journal of Banking and Finance* (25): 789–805.

Santos, J. (2000). Bank capital regulation in contemporary banking theory, *Financial Markets, Institutions and Instruments* (10): 41–84.

Stolz, S. and Wedow, M. (2005). Banks' regulatory capital buffer and the business cycle: Evidence for german saving and cooperative banks, *Discussion Paper Series 2: Banking and Financial Studies* pp. 249–264.

Stolz, S. and Wedow, M. (2011). Banks' regulatory capital buffer and the business cycle: Evidence for germany, *Journal of Financial Stability* **7**(2): 98–110.

VARIABLES	(1) OLS FE	(2) OLS RE	(3) FGLS-AR1	(4) FGLS-AR1
GAP_{t-1}	-9.604*	-9.759*	-0.954**	-1.064***
	(5.673)	(5.325)	(0.408)	(0.365)
ROE_{t-1}	0.00116	0.00162	0.00268	
	(0.00172)	(0.00281)	(0.0118)	
NPL_{t-1}	5.886	3.780**	0.241	
	(4.612)	(1.855)	(0.170)	
$SIZE_{t-1}$	0.137*	0.0903	0.00641*	0.00513*
	(0.0723)	(0.0887)	(0.00336)	(0.00282)
Constant	-3.231*	-2.172	-0.162**	-0.123*
	(1.643)	(2.016)	(0.0763)	(0.0629)
Observations	3,397	3,397	3,395	3,395
Number of banks	134	134	132	132
F/χ^2	.0043***	.0002***	.0284**	.0032***
$AR(1)$			0.134	0.0608

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1: The dependent variable is the (ΔBUF_t). We present the results for four different specifications: FE (Fixed Effects), RE (Random Effects), FGLS (FGLS regression allowing for heteroskedastic panels and common $AR(1)$ coefficient for all panels), FGLS (FGLS regression allowing for heteroskedastic panels and common $AR(1)$ coefficient for all panels) excluding non significant variables. we present p-values for F/χ^2 tests. We also present the value of the common $AR(1)$ for all panels.

VARIABLES	(1) OLS FE	(2) OLS RE	(3) FGLS-AR1	(4) FGLS-AR1
GAP_{t-1}	-9.606*	-9.740*	-0.949**	-1.010***
	(5.674)	(5.319)	(0.410)	(0.355)
ROE_{t-1}	0.00117	0.00104	0.00312	
	(0.00172)	(0.00397)	(0.0118)	
NPL_{t-1}	5.886	3.782**	0.254	
	(4.612)	(1.854)	(0.176)	
$SIZE_{t-1}$	0.136*	0.0973	0.00559	
	(0.0723)	(0.0985)	(0.00362)	
FOREIGN	0	-0.0112	0.0146	
	(0)	(0.218)	(0.0206)	
PRIVATE	-0.137	0.155	0.000533	
	(0.194)	(0.182)	(0.0184)	
Constant	-3.131*	-2.400	-0.148*	-0.00865
	(1.647)	(2.247)	(0.0854)	(0.00578)
Observations	3,397	3,397	3,395	3,395
Number of bank	134	134	132	132
F/χ^2	.0081***	.0004***	.0745*	.0213**
$AR(1)$			0.137	0.0710

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2: The dependent variable is the (ΔBUF_t). We present the results for four different specifications: FE (Fixed Effects), RE (Random Effects), FGLS (FGLS regression allowing for heteroskedastic panels and common $AR(1)$ coefficient for all panels), FGLS (FGLS regression allowing for heteroskedastic panels and common $AR(1)$ coefficient for all panels) excluding non significant variables. we present p-values for F/χ^2 tests. We also present the value of the common $AR(1)$ for all panels.

VARIABLES	(1) OLS FE	(2) OLS RE	(3) FGLS-AR1	(4) FGLS-AR1
GAP_{t-1}	-1.397	-1.408	-1.434**	-2.230**
	(1.164)	(1.024)	(0.667)	(0.928)
ROE_{t-1}	0.000281	0.000327	0.00359	
	(0.00180)	(0.00404)	(0.0123)	
NPL_{t-1}	5.769	3.757**	0.310*	0.330**
	(4.590)	(1.864)	(0.162)	(0.168)
$SIZE_{t-1}$	0.130*	0.0971	0.00754**	0.00879***
	(0.0740)	(0.0987)	(0.00329)	(0.00329)
FOREIGN	0	-0.0474	0.0162	
	(0)	(0.226)	(0.0273)	
PRIVATE	-0.144	0.167	0.00388	
	(0.235)	(0.183)	(0.0151)	
$GAP_{t-1} \times PRIVATE$	3.728*	3.257*	1.608**	2.374**
	(2.187)	(1.745)	(0.807)	(1.026)
$GAP_{t-1} \times FOREIGN$	-31.61*	-31.22*	-1.493	
	(17.01)	(16.02)	(1.629)	
Constant	-2.985*	-2.387	-0.195**	-0.220***
	(1.679)	(2.250)	(0.0784)	(0.0743)
Observations	3,397	3,397	3,395	3,395
Number of banks	134	134	132	132
F/χ^2	.0015***	.0001***	.0241**	.0099***
$AR(1)$			0.133	0.0478

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3: The dependent variable is the (ΔBUF_t). We present the results for four different specifications: FE (Fixed Effects), RE (Random Effects), FGLS (FGLS regression allowing for heteroskedastic panels and common $AR(1)$ coefficient for all panels), FGLS (FGLS regression allowing for heteroskedastic panels and common $AR(1)$ coefficient for all panels) excluding non significant variables. we present p-values for F/χ^2 tests. We also present the value of the common $AR(1)$ for all panels.

VARIABLES	(1) OLS FE	(2) OLS RE	(3) FGLS-AR1	(4) FGLS-AR1
GAP_{t-1}	-1.308	-1.625	-2.019***	-2.821***
	(1.905)	(1.955)	(0.703)	(0.963)
ROE_{t-1}	0.000285	0.000363	0.00395	
	(0.00182)	(0.00406)	(0.0123)	
NPL_{t-1}	5.770	3.721**	0.306*	0.332**
	(4.581)	(1.843)	(0.162)	(0.168)
$SIZE_{t-1}$	0.129*	0.0956	0.00784**	0.00905***
	(0.0775)	(0.0974)	(0.00329)	(0.00329)
FOREIGN	0	-0.0459	0.0152	
	(0)	(0.221)	(0.0273)	
PRIVATE	-0.143	0.167	0.00405	
	(0.236)	(0.182)	(0.0151)	
$GAP_{t-1} \times PRIVATE$	3.727*	3.260*	1.582**	2.392**
	(2.185)	(1.742)	(0.806)	(1.026)
$GAP_{t-1} \times FOREIGN$	-31.62*	-31.19*	-1.561	
	(17.04)	(16.03)	(1.628)	
$\Delta SELIC_{t-1}$	-0.0734	0.175	0.499***	0.474**
	(1.507)	(1.443)	(0.192)	(0.208)
Constant	-2.974*	-2.353	-0.200**	-0.225***
	(1.754)	(2.219)	(0.0783)	(0.0743)
Observations	3,397	3,397	3,395	3,395
Number of banks	134	134	132	132
F/χ^2	.0014***	.0002***	.0037***	.0008***
$AR(1)$			0.132	0.0486

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4: The dependent variable is the (ΔBUF_t). We present the results for four different specifications: FE (Fixed Effects), RE (Random Effects), FGLS (FGLS regression allowing for heteroskedastic panels and common $AR(1)$ coefficient for all panels), FGLS (FGLS regression allowing for heteroskedastic panels and common $AR(1)$ coefficient for all panels) excluding non significant variables. we present p-values for F/χ^2 tests. We also present the value of the common $AR(1)$ for all panels.

VARIABLES	(1) OLS FE	(2) OLS RE	(3) FGLS-AR1	(4) FGLS-AR1
GAP_{t-1}	-1.086	-1.667	-1.939**	-2.821***
	(1.898)	(1.333)	(0.797)	(0.963)
ROE_{t-1}	0.000347	0.000384	0.00370	
	(0.00191)	(0.00407)	(0.0124)	
NPL_{t-1}	5.781	3.712**	0.304*	0.332**
	(4.576)	(1.837)	(0.163)	(0.168)
$SIZE_{t-1}$	0.133*	0.0957	0.00770**	0.00905***
	(0.0745)	(0.0968)	(0.00329)	(0.00329)
FOREIGN	0	-0.0475	0.0168	
	(0)	(0.219)	(0.0278)	
PRIVATE	-0.126	0.169	0.00415	
	(0.230)	(0.181)	(0.0151)	
$GAP_{t-1} \times PRIVATE$	2.305	2.517	1.422	2.392**
	(2.529)	(2.198)	(0.958)	(1.026)
$GAP_{t-1} \times FOREIGN$	-29.87*	-29.79*	-2.365	
	(15.30)	(15.43)	(1.946)	
$\Delta SELIC_{t-1}$	-0.258	0.208	0.438	0.474**
	(0.909)	(0.707)	(0.370)	(0.208)
$\Delta SELIC_{t-1} \times PRIVATE$	1.191	0.628	0.0871	
	(0.985)	(0.914)	(0.438)	
$\Delta SELIC_{t-1} \times FOREIGN$	-1.489	-1.192	0.698	
	(5.435)	(4.482)	(0.824)	
Constant	-3.069*	-2.354	-0.197**	-0.225***
	(1.679)	(2.205)	(0.0783)	(0.0743)
Observations	3,397	3,397	3,395	3,395
Number of banks	134	134	132	132
F/χ^2	.0004***	.0002***	.007***	.0014***
$AR(1)$			0.130	0.0507

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5: The dependent variable is the (ΔBUF_t). We present the results for four different specifications: FE (Fixed Effects), RE (Random Effects), FGLS (FGLS regression allowing for heteroskedastic panels and common $AR(1)$ coefficient for all panels), FGLS (FGLS regression allowing for heteroskedastic panels and common $AR(1)$ coefficient for all panels) excluding non significant variables. we present p-values for F/χ^2 tests. We also present the value of the common $AR(1)$ for all panels.

VARIABLES	(1) OLS FE	(2) OLS RE	(3) FGLS-AR1	(4) FGLS-AR1
GAP_{t-1}	0.456	-5.343	-0.901**	-0.700*
	(0.411)	(3.472)	(0.429)	(0.368)
NPL_{t-1}	-0.833***	4.617**	0.695***	0.697***
	(0.158)	(1.897)	(0.196)	(0.197)
$\Delta SELIC_{t-1}$	-0.457**	0.631	0.180	
	(0.201)	(1.521)	(0.189)	
ΔBUF_{t-1}	-0.00545*	-0.101	-0.259***	-0.261***
	(0.00312)	(0.113)	(0.0184)	(0.0183)
Constant	0.101***	-0.225**	-0.0311***	-0.0320***
	(0.00761)	(0.0962)	(0.00985)	(0.00984)
Observations	3,263	3,263	3,260	3,260
R-squared	0.038			
Number of bank	132	132	129	129
Teste	0***	.1125	0***	0***
χ^2		7.483	209.7	213.5
AR1			0.158	0.161

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

ai ai ai

Table 6: The dependent variable is $(\Delta Loans_t)$. We present the results for four different specifications: FE (Fixed Effects), RE (Random Effects), FGLS (FGLS regression allowing for heteroskedastic panels and common $AR(1)$ coefficient for all panels), FGLS (FGLS regression allowing for heteroskedastic panels and common $AR(1)$ coefficient for all panels) excluding non significant variables. we present p-values for F/χ^2 tests. We also present the value of the common $AR(1)$ for all panels.

	(1)	(2)	(3)	(4)
VARIABLES	OLS FE	OLS RE	FGLS-AR1	FGLS-AR1
GAP_{t-1}	0.408	-4.143	-0.710*	-0.561
	(0.403)	(3.211)	(0.417)	(0.359)
NPL_{t-1}	-0.846***	4.971**	0.753***	0.759***
	(0.153)	(1.962)	(0.201)	(0.201)
$\Delta SELIC_{t-1}$	-0.446**	0.294	0.127	
	(0.198)	(1.514)	(0.182)	
ΔBUF_{t-1}	-0.00476	-0.129	-0.285***	-0.286***
	(0.00320)	(0.120)	(0.0183)	(0.0182)
$\Delta BUF_{t-1} \times GAP_{t-1}$	-0.163	5.163	3.964***	4.014***
	(0.187)	(3.204)	(0.942)	(0.940)
Constant	0.101***	-0.227**	-0.0312***	-0.0317***
	(0.00739)	(0.0965)	(0.00987)	(0.00987)
Observations	3,263	3,263	3,260	3,260
R-squared	0.041			
Number of bank	132	132	129	129
Teste	0***	.1488	0***	0***
χ^2		8.139	254.6	256.4
AR1			0.179	0.181

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
ai ai ai

Table 7: The dependent variable is $(\Delta Loans_t)$. We present the results for four different specifications: FE (Fixed Effects), RE (Random Effects), FGLS (FGLS regression allowing for heteroskedastic panels and common $AR(1)$ coefficient for all panels), FGLS (FGLS regression allowing for heteroskedastic panels and common $AR(1)$ coefficient for all panels) excluding non significant variables. we present p-values for F/χ^2 tests. We also present the value of the common $AR(1)$ for all panels.

VARIABLES	(1) OLS FE	(2) OLS RE	(3) FGLS-AR1	(4) FGLS-AR1
GAP_{t-1}	0.425	-4.336	-0.723*	-0.711*
	(0.411)	(3.250)	(0.429)	(0.368)
NPL_{t-1}	-0.841***	4.878**	0.695***	0.698***
	(0.154)	(1.965)	(0.201)	(0.201)
$\Delta SELIC_{t-1}$	-0.437**	-0.106	0.00377	
	(0.199)	(1.408)	(0.192)	
ΔBUF_{t-1}	-0.00573	-0.0935	-0.246***	-0.246***
	(0.00357)	(0.105)	(0.0178)	(0.0178)
$\Delta BUF_{t-1} \times \Delta SELIC_{t-1}$	-0.0695	2.675	1.805***	1.814***
	(0.0648)	(2.199)	(0.511)	(0.502)
Constant	0.101***	-0.231**	-0.0314***	-0.0313***
	(0.00741)	(0.0979)	(0.00996)	(0.00992)
Observations	3,263	3,263	3,260	3,260
R-squared	0.039			
Number of bank	132	132	129	129
Teste	0***	.1816	0***	0***
χ^2		7.570	204.4	203.6
AR1			0.166	0.166

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
ai ai ai

Table 8: The dependent variable is $(\Delta Loans_t)$. We present the results for four different specifications: FE (Fixed Effects), RE (Random Effects), FGLS (FGLS regression allowing for heteroskedastic panels and common $AR(1)$ coefficient for all panels), FGLS (FGLS regression allowing for heteroskedastic panels and common $AR(1)$ coefficient for all panels) excluding non significant variables. we present p-values for F/χ^2 tests. We also present the value of the common $AR(1)$ for all panels.

VARIABLES	(1) OLS FE	(2) OLS RE	(3) FGLS-AR1	(4) FGLS-AR1
GAP_{t-1}	0.471	-5.325	-0.814*	-0.667*
	(0.414)	(3.438)	(0.446)	(0.380)
NPL_{t-1}	-0.843***	4.740**	0.817***	0.799***
	(0.160)	(1.904)	(0.208)	(0.206)
$\Delta SELIC_{t-1}$	-0.472**	0.709	0.146	
	(0.205)	(1.515)	(0.192)	
ΔBUF_{t-1}	0.00354	-0.0530	-0.235***	-0.251***
	(0.0153)	(0.0677)	(0.0570)	(0.0267)
PRIVATE	0.0511	0.00119	-0.00290	
	(0.175)	(0.0293)	(0.0174)	
FOREIGN	0	0.0825	0.0298	
	(0)	(0.191)	(0.0202)	
$\Delta BUF_{t-1} \times PRIVATE$	0.00829	-0.210**	-0.117*	-0.104***
	(0.0235)	(0.105)	(0.0620)	(0.0361)
$\Delta BUF_{t-1} \times FOREIGN$	-0.00933	-0.0447	-0.0195	
	(0.0157)	(0.127)	(0.0643)	
Constant	0.0729	-0.258**	-0.0422**	-0.0368***
	(0.0983)	(0.106)	(0.0177)	(0.0104)
Observations	3,263	3,263	3,260	3,260
R-squared	0.040			
Number of bank	132	132	129	129
Teste	0***	.0629*	0***	0***
χ^2		14.81	306.9	311.6
AR1			0.212	0.218

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
ai ai ai

Table 9: The dependent variable is ($\Delta Loans_t$). We present the results for four different specifications: FE (Fixed Effects), RE (Random Effects), FGLS (FGLS regression allowing for heteroskedastic panels and common $AR(1)$ coefficient for all panels), FGLS (FGLS regression allowing for heteroskedastic panels and common $AR(1)$ coefficient for all panels) excluding non significant variables. we present p-values for F/χ^2 tests. We also present the value of the common $AR(1)$ for all panels.