Bank Capital Buffers and Procyclicality in Latin America

Óscar A. Carvallo
Leslie A. Jiménez

Abstract

In this chapter, we conduct an empirical study of fluctuation patters of regulatory capital buffers with respect to the business cycle for the 2001 to 2003 period with data of 18 countries and 456 Latin American and Caribbean banks. We also present results for Argentina, Brazil, Mexico, Panama and Venezuela. Our results show that, although the general intuition sustaining the countercyclical approach of Basel III capital buffers agrees with the data, patterns vary across countries, being determining variables bank size, their forms of organization and levels of competition in the region's banking systems.

Keywords: capital buffers, procyclicality, business cycle, Basel III, Latin America.

JEL classification: G21, G28, E32.

1. INTRODUCTION

The financial crisis experienced by the world economy since 2007 was confronted with combined efforts on several fronts. On the one hand, restructuring and strengthening of the financial regulatory system were undertaken on a global scale. Capital was also injected and most of the major banks were partly nationalized, a process that has now been completely reversed. Massive fiscal

Ó. Carvallo <ocarvallo@cemla.org>, Deputy Manager of Financial Research, and L. Jiménez, Director of Planning, CONSAR (this chapter was developed while she was affiliated with CEMLA).

stimulus programs were introduced simultaneously, while demand was boosted through extremely loose monetary policy around the world.

Reforms that have been implemented in financial regulation include the new proposal for regulatory capital requirements (Basel III), as well as the deep regulatory reforms implemented in the United States (Dodd-Frank Wall Street reform and Consumer Protection Act, July 2010) and the European Union (New European Regulatory Framework approved by the European Commission in September 2010).[1]

Led by the G20, the Basel Committee generated a series of proposals in 2008 that served as a basis, after a long and arduous process of international negotiations, for the new rules announced on September 12, 2010. These regulations, known as Basel III, form part of the international reform package and are aimed at achieving two general goals: *1)* strengthen banks' capital bases, demanding stricter risk assessment, and *2)* contribute to the global economic recovery by introducing standards that reduce the likelihood of a future crisis and increase confidence in the financial system.

It combined both objectives by allowing for a relatively long transition period, placing an upper limit on bank leverage and including countercyclical measures in the proposal. The phase-in equity strengthening arrangement that started on January 1, 2013, and will end on January 1, 2019, aims to contribute to financial stability over the long term, ensuring that banks can accommodate the new requirements while underpinning the economic recovery through bank credit. Although the adjustment in regulatory capital can initially be described as a restrictionary measure that could compromise the recovery phase of the business cycle, it should not in principal affect economic growth given its transitory nature.

The original consultative documents, *Strengthening the Resilience of the Banking Sector* and *International Framework for Liquidity Risk Measurement, Standards and Monitoring* (BCBS, 2009a and 2009b),

---

1 Bill H.R. 4173: "To promote the financial stability of the United States by improving accountability and transparency in the financial system, to end 'too big to fail,' to protect the American taxpayer by ending bailouts, to protect consumers from abusive financial services practices, and for other purposes," United States Congress, July 2010. Jacques de Larosière (2009), *The High-level Group on Financial Supervision in the EU- Report*, Brussels, February 25, 2009.

introduce far-reaching reforms in the following areas: Raising the quality, transparency and consistency of the capital base; enhancing risk coverage and increasing minimum standards; introducing a maximum leverage ratio; reducing procyclicality of capital requirements; establishing a new global liquidity standard, and increasing the supervision of systemically important institutions and markets.

A common vision in all the initiatives is that financial system regulation should take into account the systemic risks deriving from the increasing interconnectedness among financial markets and the greater complexity arising from rapid technological innovation. This new vision, announced as *macrofinancial* regulation, aims to complement traditional *microfinancial* regulation, which, by itself, will be insufficient to address the growing interconnectedness between financial institutions and markets, and between nonfinancial institutions and markets and the financial sector, as well as the presence of shadow financial systems fueled by financial innovation and the evasion of microfinancial regulation. The emphasis on systemic risk and macrofinancial regulation, coupled with associated comprehensive early warning systems, will be an enduring general characteristic of bank and central bank regulation over the coming years.

1.1 Regarding Financial Procyclicality

It is important to ask exactly what is meant by procyclicality. Reinhart et al. (2011), who study the graduation of countries from episodes of external debt default, inflation and banking crises, developed the concept of *graduation from procyclicality.* In the same way, Frankel et al. (2013) study graduation with respect to fiscal procyclicality, while Shin and Shin (2011) analyze the procyclicality of monetary aggregates, particularly, as regards noncore funding. Graduation from procyclicality can be understood as the acquisition by agents (be they countries, banks, or governments) of the capacity to reduce the risk of recurring episodes of crisis, with either monetary, fiscal, financial or external aggregates.

The financial cycle has also become more widely accepted in the literature, understood as "self-reinforcing interactions between perceptions of value, attitudes towards risk and financing constraints" (Borio, 2014), which occurs in cycles that have a lower frequency than the business cycle, as well as the decoupling of money, saving and credit. Likewise, theoretical models such as those of Kiyotaki and

Moore (1997), and Adrian and Boyarchenko (2012) generate credit and leverage cycles. Schularick and Taylor (2009) examine the behavior of credit, money, leverage and the balance sheets of advanced economies' banking systems, in both the period before and after the World War II. They find a structural change in leverage during the latter period, accompanied by an acceleration of credit with respect to GDP and money growth.

The literature reviewed on the graduation from procyclicality and its determinants converges towards two factors: The importance of institutions (contracts and how to make them valid) and the level of financial integration of the economies. For instance, Gavin, Hausmann et al. (1996), as well as Gavin and Perotti (1997), argue that limited access to international capital markets determines the likelihood of countries implementing countercyclical policies. In the case of monetary cyclicity, works such as Shin and Shin (2011) and Adrian and Shin (2010) highlight the role of financial integration in the rise of noncore funding, which ends up being related to credit booms and systemic risk. Cetorelli and Goldberg (2012) find that international banks manage liquidity on a global scale, moving resources across borders in response to local shocks, thereby contributing to the propagation of such shocks. Bruno and Shin (2014) formulate a banking and global liquidity model where global banks interact with their local peers. Leverage cycles arise determined by the transmission of international financial conditions through bank capital flows.

1.2 Basel III and the Regulatory Response to Procyclicality

The precrisis regulatory framework, known as Basel II, was approved only in 2004, and a majority of global banks were still in the process of implementing it when the international financial crisis broke out in 2007. Basel II was never able to legitimately test its regulatory potential. However, the severity of the crisis led to the conviction that this framework was still insufficient to serve as a support for the current international financial system. Some problems that came to light were:

- excess indebtedness among consumers, firms and banks themselves, which in an environment of rampant risk aversion triggered generalized illiquidity and insolvency;

- contagion effects among sectors: The loss of some economic sectors' payment capacity led to a reduction in payment capacity and indebtedness in other sectors, even on a global scale; and
- banks experienced a greater need to raise capital precisely at times when capital markets were closing.

The latter effect, reflected in the so-called procyclicality of bank capital buffers, has a particularly harmful interaction with the business cycle. Capital buffers are banks' holdings of regulatory capital on top of minimum capital requirements. When banks do not accumulate capital reserves during economic upturns they can become trapped with an insufficient level of capital during an economic downturn. Under these circumstances, and to avoid excessive and costly regulatory intervention, banks will have to adjust their capitalization levels. This adjustment tends to take place by reducing assets, mainly loans, or by recomposing risk-weighted assets. Both reactions tend to reduce the supply of bank credit, which accentuates the cycle. Another possible option is to raise new capital, which becomes more costly in recessions. Thus, a negative fluctuation between capital buffers and the business cycle is to be expected. This cyclical behavior of regulatory capital buffers would therefore amplify the effect of GDP shocks (Repullo and Suárez, 2013; Borio and Zhu, 2012).

To reduce those cyclical effects, Basel III requires banks to increase their capital buffers during economic expansions, through: *1)* a mandatory capital buffer of 2.5%, and *2)* a *discretionary countercyclical capital buffer* of 2.5% during periods of economic expansion. While these proposals have been calibrated with data from advanced economies, less evidence has been presented regarding the behavior of capital buffers in emerging countries. This paper aims to help close this gap by studying the behavior of capital buffers in an emerging region, Latin America and the Caribbean.

The empirical study uses bank data from systems of the region and examines the link between capital buffers and the business cycle, while controlling for the factors determining buffers mentioned in the literature. The following section reviews these factors in light of the literature. Section 3 presents the partial adjustment model that serves as a framework for the empirical work. Section 4 shows the data and results of the estimations. The final section gives the conclusions. Our results show that, although the general thinking behind the Basel III proposal for countercyclical capital buffers is based on the data, patterns vary across countries with determining variables being bank size and type, and levels of competition within the region's banking systems.

2. DETERMINANTS OF CAPITAL BUFFERS

To identify links that allow for explaining the behavior of capital buffers have been assessed different indicators on the related banking costs, which, following Fonseca and González (2010), can be classified into three categories: Cost of funding, cost of financial distress and adjustment costs. Market power and regulation, since they condition the size and direction of these costs, also form an important part of the analysis.

With respect to adjustment costs, it is common in the literature the idea that banks maintain sufficient buffers to take advantage of unexpected investment opportunities or be able to withstand the effects of adverse shocks (Berger, 1995), especially if their capital ratio is highly volatile. Larger capital buffers are also associated with high penalties imposed for noncompliance with minimum capital requirements or with significant costs for increasing capital.

As for costs of funding, Fonseca and González (2010) argues that bank shareholders' incentives for increasing capital ratios will depend on the margin between the cost of funding and the cost of capital. Faced with a situation of high leverage shareholders will demand higher returns on capital given the greater risk. In the case of the cost of funding, a situation of higher risk will increase the deposit rate only if there is no market discipline, that is, that the payment of deposits cannot be granted. In this case, the increase in the funding rate will lead shareholders to hold higher capital buffers in order to avoid higher payments for funding; for this reason, a positive relation between the cost of funding and capital buffers is to be expected.

Fonseca and González (2010) follows a methodology proposed by Demirgüc-Kunt and Huizinga (2004) for measuring the cost of deposits, defined as the ratio of interest expenses to interest-bearing debt minus the government interest rate. In contrast, as an approximate measure for the opportunity cost of capital, Ayuso et al. (2004) include return on equity (ROE), with the prediction of a negative relation between ROE and the capital buffer.

Regarding costs of financial distress, Keeley (1990) and Acharya (1996) have placed emphasis on the link between the level of capital maintained by an institution and its risk profile. The results suggest that a decrease in the charter value of banks, as a consequence of changes in competitive conditions, leads to assuming greater risks, and that high market power associated with large charter value reduces the incentives for taking risky decisions in order to maintain said value at high levels. Following the logic that levels of competition influence risk profile and capital buffers, Fonseca and González (2010) included the Lerner index in their analysis as a measure of banks' market power.

As an alternative measure for market power, Boone (2008) introduces a new approximation based on firms' profits. The idea is that the effect of an increase in the level of competition in an industry on a specific firm depends on how efficient it is: The less efficient its operation the greater the impact. If efficiency is defined as the capacity to produce the same number of products at lower costs, then a comparison of the profits of an efficient firm with those of a less efficient one provides information on the level of competition in that industry. The more competitive the market, the stronger the relation between efficiency differences and profit differences.

In general, most international empirical evidence for advanced economies and some emerging ones points towards a negative fluctuation between capital buffers and the business cycle.[2] Some studies, however, record varying cyclical patterns. For instance, Jokipii and Milne (2008) study the systems of the European Union, as well as the so-called recent member states, EU15 and EU25, separately. The authors found that the capital buffers of savings, commercial, and large banks fluctuate negatively, while those of cooperative and smaller banks do so positively. Fonseca and Gonzáles (2010) find differing patterns among advanced and emerging economies, as well as within their respective banking systems. Carvallo et al. (2015), studying the cyclical patterns of capital buffers in Latin America and the Caribbean, found variations between the signs associated to the business cycle across countries when specific bank variables were used.

---

[2] See Ayuso et al. (for Spain, 2004), Lindquist (Norway, 2004), Bikker and Metzemakers (world, 2004), Stoltz and Wedow (Germany, 2006), García Suaza et al. (Colombia, 2012), Tabak (Brazil, 2011) and Shim (United States, 2013).

Finally, Barth, Caprio and Levine (2004) have sought to determine the effects supervision and regulation practices have on banking sector efficiency, fragility and development. They found evidence of the relationship between the performance of banks and this type of indicators.

3. EMPIRICAL MODEL

The estimation through the difference generalized method of moments (*difference* GMM) in dynamic groups, developed by Arellano and Bond (1991), allows for optimally exploiting three questions of importance to this work: *1)* the presence of unobservable bank-specific effects that are eliminated by taking first differences for all the variables; *2)* the autoregressive process in the data, that is, the need to use lagged dependent variables in the model to capture the dynamic nature of capital buffers, and *3)* the possibility of having not strictly exogenous explanatory variables. This therefore solves the problem of likely endogeneity derived from the inclusion of a lagged dependent variable term ($BUF_{i,t}$) in the model.

Nevertheless, the estimator developed by Arellano and Bond (1991) assumes that all the explicative variables are potentially related to individual effects, meaning that, when instruments are available that are not related, the data they could provide in levels on the behavior of relevant variables is lost. One scheme capable of extracting variables' information in levels is presented in Arellano and Bover (1995), which applies a GMM estimator in first differences to the system GMM estimator. Blundell and Bond (1998) present the restrictions that justify employing a system GMM estimator that uses variables in levels as instruments for equations in first differences and provide a more flexible variance-covariance structure. They also demonstrate that there is an efficiency gain in the use of the referred estimator.

Blundell and Bond (1998) characterize the problem of instrument weakness linked to the estimator of Arellano and Bond (1991) and show that this can be avoided by using the system GMM estimator. Taking these factors into account, a two-step system GMM estimator was chosen for this work.

In line with the previous references (Carvallo et al., 2015; Fonseca and González, 2010; Ayuso et al., 2004, and Jokipii and Milne, 2008), this paper proposes a partial adjustment model to explain the effects of the business cycle on bank capital buffers as follows:

$$BUF_{i,t} = \alpha_0 + \alpha_1 BUF_{i,t-1} + \alpha_2 CYCLE_t + \delta X_{i,t} + \eta_i + u_{i,t}. \quad (1)$$

Here, $BUF_{i,t}$ represents the bank's capital buffer i at time t and the associated coefficient α_1 reflects adjustment costs, η_i is associated with specific factors that affect the formation of each bank's capital and $u_{i,t}$ is the independent error term with zero mean. The $CYCLE_t$ variable is a measure of the business cycle at time t, in such way that the sign of coefficient α_2 provides information on whether capital buffer fluctuations are negative or positive with respect to the economic activity indicator.

In order to find the group of specific variables for bank i at time t that correctly describe the behavior of the capital buffer, this paper proposes different $X_{i,t}$ vectors, taking into account the relations described previously.

4. DATA AND EMPIRICAL RESULTS

The results presented in this study were obtained with data from Bankscope for the banks, and from the World Bank for regulatory and financial development databases, and cover the 2001 to 2013 period. In the regional sphere, the results include data on 18 countries and 456 banks. Results are also presented for Argentina, Brazil, Mexico, Panama and Venezuela. This results in an unbalanced set of data because during the period considered some of the banks began operating while others stopped doing so. Annex A presents descriptive statistics of the bank variables used in the estimation. The dependent variable and explicative variables statistics are shown in Table A and, described in Table 1.

Controls for bank size were also included. In accordance with that presented in Ayuso et al. (2004), a binary variable (*SizeCo*) was generated with a value of one for banks whose size is above the 75th percentile in their country in order to test the common hypothesis that large banks tend to hold lower levels of capital since they believe they are *too big to fail*. The significance of the interaction between this variable associated to GDP growth (*GDPG*) is also measured.

Table 1

DEFINITIONS

Variable	Definition[1]	Sources
Capital buffer (BUF)	Amount of banks' capital ratio above the minimum capital requirement (MCR).[2] Bank capital is approximated by the total capital ratio (TCR) variable.	MCR,[3] BM, TCR, Bankscope
Bank size (SIZE)	Calculated based on the natural logarithm of the total Bankscope assets variable.	Bankscope
Profit, return over average asset (ROAA)	As in previous literature,[4] return over equity (ROE) is used, and is taken here as the opportunity cost of capital.	
Loan loss reserve/gross loans (LLRGL)	A measure of the amount of reserves banks maintain to face possible losses in their portfolios and used as an indicator of the risk detected by each institution.	
Business cycle (CYCLE)	The economic growth indicator (GDPG) is used as a reference for the business cycle and its coefficient provides information on the procyclicality looked for.	World Bank
Boone indicator (BOONE)	Calculated as the elasticity of profit to marginal costs. An increase in the Boone indicator implies a deterioration of the competitive conduct of financial intermediaries.	
Overall capital stringency (OCS)	Indicates whether the capital requirement reflects certain elements of risk and reduces some losses in the market value of capital before determining the adequate minimum capital.	
Official supervisory power (OSP)	Indicator of whether supervisory authorities have the power to take specific actions to prevent and correct problems.	
Money and quasi money (MCM)	Includes bills and coins held by the public, checking accounts held by residents of the country, current account deposits, residents' bank deposits, public and private securities held by residents and retirement funds.	

Table 1 (cont.)

Variable	Definition[1]	Sources
Private monitoring index (PMI)	Measures whether there are incentives or capacity for private oversight of firms. High values indicate more private monitoring.	
Overall restrictions on banking activities (ORBA)	Reflects the sum of: *1)* securities' activities, defined as the degree in which banks can participate in securities' subscription, brokerage and operations, and all aspects of the mutual funds industry; *2)* insurance activities, which measures the degree in which banks can participate in the subscription and sale of insurance, and *3)* real estate activities, defined as the degree of participation banks can access in real estate investment, development and management.	
Bank accounting (BACC)	Reflects whether the income statement includes accrued or unpaid interest or principal on nonperforming loans and when banks are required to produce consolidated financial statements.	
Limitations on foreign bank entry/ ownership (LFBEO)	Specifies whether foreign banks can own national banks or if they can enter a country's banking industry.	
Funding with insured deposits (FID)	Measures the degree of moral hazard.	
Foreign-owned banks (FOB)	The extent of foreign ownership in the banking system.	

[1] Supervision and regulation definitions follow Barth et al. (2004).
[2] Defined according to Jokipii and Milne (2008).
[3] MCR was obtained from the World Bank's Bank Regulation and Supervision Surveys for 2000, 2003, 2007 and 2012.
[4] Ayuso et al. (2004); includes return on equity (ROE) with expectations of a negative relations between this and the capital buffer.

The analysis considers commercial, cooperative, savings, real estate, and mortgage banks. In the same way, as in Jokipii and Milne (2008), binary variables were created for the type of specialization to identify deviations by type of bank. The significance of interactions between these binary variables and GDPG are also calculated.

Table 2 presents the results of the estimation of Equation 1, considering all the countries of the region for which information is available and different formulations for the vector $X_{i,t}$, including only those variables that were generally significant. The results of the Arellano-Bond and Hansen tests are presented to verify the validity of the instruments and that there is no serial correlation in the error term.

It can be seen that for each specification, the coefficient describing the relation between the growth of $GPIB_t$ and capital buffers is significant and negative, in such way that there is evidence, considering the five different models, of a negative fluctuation with respect to the business cycle if the 18 countries of the region are considered.

As for adjustment costs denoted by BUF_{t-1}, it shows that such costs are significant in the region, and if we consider the models that contain just one level of lag, the results are comparable to those obtained in Carvallo et al. (2015). The latter argues that this coefficient also provides information on the speed of adjustment, the closer it being to zero, the faster the recovery of capital. It can be said that, taking into account all the countries, access to capital is relatively fast in the region.

The results of the variable $SIZE_t$ are significant and negative for three formulas. In this case, they indicate that bank size is inversely related to the capital buffer, which is consistent with the *too big to fail* hypothesis since the provisions that induce banks to maintain high levels of capital decrease as their size increases.

Coefficients associated $ROAA_t$, that are positive and significant, indicate that when profitability among Latin American banks increases they tend to raise their capital buffer levels. As would be expected, the most profitable banks have a more solid base for the growth of their capital. With respect to LLR_t, which has a positive and significant coefficient in some of the regressions, it indicates a tendency to increase capital buffers when large losses are expected.

The positive and significant coefficients associated to the Boone indicator reflect the fact that in the face of deteriorating competitive conditions, capital buffers increase. According to theory, this is related with a change in bank risk profiles, therefore validating the *charter value* hypothesis.

Estimations for the variables OCS_t and OSP_t, by being negative and significant, show that capital buffers are smaller in the face of more stringent regulation or more powerful regulatory authorities. This behavior might be related to the fact that the more closely monitored institutions are, the more confident they become about their capital and they stop taking precautionary measures beyond the minimum ones. More stringent regulation would therefore be acting as a substitute in the prudential role of buffers.

To identify the specific characteristics of the behavior of capital buffers in the region, the first model shown in Table 2 was estimated taking into account the type of specialization and relative size of a bank within its country of origin, as well as the respective interactions with the business cycle. Table 3 presents the results.

There are two significant results with respect to this new group of models. First, the coefficient of the binary variable for large banks and their respective interaction with the cycle is significant and negative, which provides further evidence of the *too big to fail* hypothesis. Those banks that are relatively large within their national markets tend to hold less capital buffers than the rest. Likewise, the magnitude of the size coefficient interacting with the cycle is greater than the one associated to the remaining banks. Second, the significant and positive result of the binary variable associated with savings banks indicates that these tend to behave positively with the cycle. Said banks also have larger buffers than the other banks, which could be associated with a more conservative profile of this bank group.

To identify specific relations for some countries of the region, estimations were made for Argentina, Brazil, Mexico, Panama and Venezuela, which are shown in Table 4. This group is representative, regarding dimension and heterogeneity, of the region's banking systems. A sample was available for the five countries that was adapted to the methodology and specification adopted for the country environment. It can be seen how the countercyclical behavior detected in the region continues, except in the case of Brazil. With respect to adjustment costs and the speed of access to capital, there are significant differences across countries. Argentina and Mexico for instance exhibit easier access to capital than the rest of the group. In the same way, as for the region as a whole, it can be seen that bank size is a very significant variable for the movement of capital buffers. As for the

Table 2

LATIN AMERICA AND THE CARIBBEAN: RESULTS OF ESTIMATIONS

Variable	*M1_LA*	*M2_LA*	*M3_LA*	*M4_LA*	*M5_LA*
$GPIB_t$	-0.406^c	-0.224^c	-0.092^a	-0.415^c	-0.093^a
	(0.06)	(0.06)	(0.05)	(0.06)	(0.04)
BUF_{t-1}	0.178^c	0.175^c	0.731^c	0.185^c	0.759^c
	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
BUF_{t-2}			0.034^a		0.037^a
			(0.02)		(0.02)
$SIZE_t$	-2.797^c	-2.886^c	−0.121	-2.848^c	−0.156
	(0.21)	(0.25)	(0.13)	(0.19)	(0.14)
$ROAA_t$	0.941^c		0.154	0.862^c	0.121
	(0.10)		(0.10)	(0.11)	(0.10)
LLR_t	0.337^a	0.213	0.253^b	0.228	0.218^c
	(0.15)	(0.21)	(0.08)	(0.16)	(0.06)
$BOONE_t$	35.690^c	37.874^c	14.784^b	33.240^c	13.188^b
	(9.20)	(9.40)	(5.30)	(7.42)	(4.37)
OCS_t	-0.851^b	-0.970^b	−0.325	-0.889^c	−0.082
	(0.32)	(0.35)	(0.18)	(0.26)	(0.17)
OSP_t	0.04	0.121	-0.282^a		
	(0.23)	(0.23)	(0.11)		
CF_t		-0.016^c	-0.005^a	−0.002	-0.006^a
		(0.00)	(0.00)	(0.00)	(0.00)
MCM_t				−0.001	0.034^a
				(0.02)	(0.02)
Constant	54.036^c	41.632^c	2.455	41.799^c	-28.247^b
	(5.97)	(5.42)	(3.80)	(3.41)	(10.83)
N	700	646	525	760	634
j	74	72	75	73	75
Hansen	55.556	60.312	39.017	51.613	42.412
Hansen *p*	0.454	0.228	0.959	0.528	0.91
AR1	−1.364	−1.754	−2.784	−1.675	−1.898
AR1*p*	0.173	0.079	0.005	0.094	0.058
AR2	0.119	0.08	−1.211	0.639	−0.644
AR2*p*	0.905	0.937	0.226	0.523	0.52

Note: Standard errors in parenthesis. $^a p < 0.05$; $^b p < 0.01$; $^c p < 0.001$.

Table 3

**LATIN AMERICA AND THE CARIBBEAN:
RESULTS OF MODEL 1 ESTIMATION**

Variable	*M1_LA*	*M2_LA*	*M3_LA*	*M4_LA*	*M5_LA*
GPIB$_t$	-0.406^{c}	-0.360^{c}	-0.270^{c}	-0.397^{c}	-0.411^{c}
	(0.06)	(0.06)	(0.08)	(0.06)	(0.06)
BUF$_{t-1}$	0.178^{c}	0.189^{c}	0.207^{c}	0.179^{c}	0.183^{c}
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
SIZE$_t$	-2.797^{c}			-2.822^{c}	-2.861^{c}
	(0.21)			(0.21)	(0.22)
ROAA$_t$	0.941^{c}	0.874^{c}	0.889^{c}	0.949^{c}	0.968^{c}
	(0.10)	(0.12)	(0.12)	(0.10)	(0.12)
LLR$_t$	0.337^{a}	0.465^{b}	0.594^{c}	0.329^{a}	0.391^{b}
	(0.15)	(0.14)	(0.15)	(0.15)	(0.15)
BOONE$_t$	35.690^{c}	33.697^{c}	44.021^{c}	35.536^{c}	39.858^{c}
	(9.20)	(9.36)	(9.76)	(9.22)	(9.12)
OCS$_t$	-0.851^{b}	0.463	-0.953^{b}	-0.853^{b}	-0.939^{b}
	(0.32)	(0.33)	(0.32)	(0.32)	(0.32)
OSP$_t$	−0.04	0.3	0.17	0.012	0.049
	(0.23)	(0.22)	(0.22)	(0.23)	(0.23)
SizeCo$_t$		-5.721^{c}			
		(0.59)			
SizeCo$_t$*GPIB			-0.310^{b}		
			(0.10)		
Cooperative banks				−0.013	
				(2.94)	
Savings banks				6.792^{c}	
				(1.16)	
CoopBanks*GPIB					−0.161
SavingsBanks *GPIB					(0.61)
Constant	54.036^{c}	7.27	4.864	53.844^{c}	43.272^{c}
	(5.97)	(3.93)	(2.51)	(6.13)	(4.70)
N	700	700	700	700	700
j	74	74	74	76	76
Hansen	55.556	51.203	56.223	56.789	60.204

Table 3 (cont.)

Variable	*M1_LA*	*M2_LA*	*M3_LA*	*M4_LA*	*M5_LA*
Hansen *p*	0.454	0.62	0.429	0.408	0.293
AR1	−1.364	−1.317	−1.288	−1.367	−1.388
AR1*p*	0.173	0.188	0.198	0.172	0.165
AR2	0.119	−0.224	0.358	0.088	0.159
AR2*p*	0.905	0.823	0.72	0.93	0.874

Note: Standard errors in parenthesis. $^a p < 0.05$; $^b p < 0.01$; $^c p < 0.001$.

Table 4

LATIN AMERICA: RESULTS BY COUNTRY FOR MODEL 1 ESTIMATION

Variable	*Argentina*	*Brazil*	*Mexico*	*Panama*	*Venezuela*
$GPIB_t$	−0.195	0.347^c	-0.110^c	−0.031	−0.044
	(0.17)	(0.01)	(0.02)	(0.02)	(0.03)
BUF_{t-1}	0.525^c	0.205^c	0.668^c	0.282^c	0.279^c
	(0.05)	(0.00)	(0.01)	(0.01)	(0.04)
$SIZE_t$	−1.3	-2.544^c	-1.278^c	-1.658^c	-4.286^c
	(1.16)	(0.08)	(0.18)	(0.09)	(0.44)
$ROAA_t$	−1.976	-0.398^c	0.463^c	0.613^c	1.551^c
	(0.94)	(0.01)	(0.04)	(0.00)	(0.11)
LLR_t	-1.277^a	-0.235^c	0.117^a	1.557^c	0.932^c
	(0.55)	(0.01)	(0.05)	(0.04)	(0.06)
Constant	17.137	46.720^c	21.723^c	26.006^c	58.155^c
	(18.98)	(1.09)	(2.91)	(1.05)	(6.93)
N	41	806	191	214	165
j	13	82	40	76	78
Hansen	3.574	83.479	26.885	32.712	23.395
Hansen *p*	0.827	0.261	0.802	1.000	1.000
AR1	−1.660	−1.725	−1.777	−1.405	−2.495
AR1*p*	0.097	0.085	0.076	0.160	0.013
AR2	−1.332	−1.352	−1.228	0.854	−0.551
AR2*p*	0.183	0.177	0.220	0.393	0.581

Note: Standard errors in parenthesis. $^a p < 0.05$; $^b p < 0.01$; $^c p < 0.001$.

LLR_t and $ROAA_t$ indicators, Brazil exhibits the opposite behavior to the other countries by showing a decrease in capital buffers in response to an increase in profits and expected losses.

Tables 1 to 4 in Annex B show some results of robustness and differentiaton of results. Table B.1 presents the results of replacing the binary variable of relative size within the country with that of size in absolute terms. It is significant that the largest banks tend to have smaller capital buffers, confirming the previous results related to the *too large to fail* hypothesis. Table B.2 shows the interaction between the size variable and $GPIB_t$, which is significant for Brazil, Mexico and Panama. For these countries, not only large banks have a significant negative fluctuation with the cycle, but the sign and the significance also change for the other banks. Table B.3 presents the results of including binary variables by type of bank specialization. It is interesting that in Brazil cooperative banks follow a countercyclical behavior, while in Panama savings banks exhibit a positive fluctuation regarding capital buffers. Table B.4. shows the results of including interactions between the binary variables by type of bank specialization and $GPIB_t$.

5. CONCLUSIONS

In this paper, we conducted an empirical study of regulatory capital buffers' fluctuation patterns with respect to the business cycle for the 2001 to 2013 period using data of 18 countries and 456 Latina American and Caribbean banks. Results are also presented for Argentina, Brazil, Mexico, Panama and Venezuela.

Our results show that, although the general thinking behind the Basel III countercyclical capital buffer proposal is based on data, patterns vary across countries. It can be seen that for each different specification the coefficient describing the relation between $GPIB_t$ and capital buffers is significant and negative, meaning there is evidence, considering the five different models, of a negative fluctuation with respect to the cycle if the 18 countries of the region are taken into account. With respect to adjustment costs associated to the lagged variable BUF_{t-1}, said costs are shown to be significant in the region.

Among the variables that differentiate cyclical patters and the level of buffers are bank size, forms of organization and levels of competitiveness in the region's banking systems. In general, the most profitable and riskiest banks tend to hold more buffers. Savings banks seem to be more prudent in their cyclical behavior and the largest banks have smaller capital buffers. Lower levels of competition are associated to banks with higher buffer levels. More stringent banking regulation in the region seems to serve as a substitute for buffers, while tending to decrease their levels.

Thus, although, in the aggregate, banks of the region present a negative fluctuation with the cycle, which is in line with the proposal of Basel III, there are different patterns when the data is examined and disaggregated in the setting of countries, size and form of organization. This differentiation in the cyclical patterns of capital buffers leads to a more tailored calibration of countercyclical capital buffer requirements, particularly, in their discretionary behavior.

ANNEXES

Annex A

Table A

LATIN AMERICA AND THE CARIBBEAN: DESCRIPTIVE STATISTICS FOR THE VARIABLES EMPLOYED

Country	*Number of banks*	***BUF***		***ROAA***		***GDPG***		***SIZE***		***LLRGL***	
		Mean	*Standard deviation*	*Mean*	*Standard deviation*	*Mean*	*Standard deviation*	*Mean*	*Standard deviation*	*Mean*	*Standard deviation*
Argentina	17	3.285	17.801	−0.710	11.193	4.065	6.075	12.616	2.019	8.473	13.381
Brazil	149	14.812	25.526	1.975	5.284	3.280	2.222	13.709	2.058	6.826	14.764
Chile	30	24.125	39.949	1.049	2.459	4.108	1.926	14.506	2.158	3.087	2.337
Colombia	17	9.027	14.676	1.575	2.712	4.291	1.664	14.080	1.672	6.771	11.742
Costa Rica	10	5.902	6.130	2.310	2.712	4.389	2.559	11.414	2.098	2.194	1.474
Ecuador	20	7.503	14.071	−12.619	52.496	4.550	2.065	11.519	2.155	34.072	59.592
El Salvador	13	17.649	62.141	1.047	1.242	1.778	1.745	13.078	1.571	5.185	9.788
Guatemala	3	5.422	2.921	−1.039	21.288	3.410	1.359	12.427	1.462	7.634	19.517
Guyana	3	13.801	6.710	1.779	0.722	2.342	3.353	12.229	0.653	6.500	5.484
Honduras	7	16.358	29.087	1.186	2.904	3.989	2.259	12.457	1.096	4.288	3.413
Jamaica	9	13.592	13.654	2.127	2.852	−0.020	1.978	13.321	1.319	2.229	1.833
Mexico	45	18.469	46.446	0.039	6.890	2.065	2.739	14.042	2.109	6.292	8.460
Nicaragua	7	5.879	2.777	−5.730	38.444	3.450	2.266	12.450	1.692	7.293	14.453
Panama	47	11.639	15.811	1.280	3.558	7.025	3.283	12.963	1.492	2.200	2.887
Peru	14	5.115	13.507	1.447	4.150	5.732	2.520	13.862	1.811	5.905	3.806
Suriname	3	1.801	3.340	0.904	1.699	4.452	1.509	12.239	1.025	9.766	1.090
Trinidad and Tobago	7	20.702	14.139	2.187	1.306	4.407	5.292	13.990	1.367	1.786	1.543
Venezuela	55	23.489	59.302	3.432	6.580	3.468	7.229	13.418	2.109	6.910	9.107

Annex B

Table B.1

LATIN AMERICA: RESULTS BY COUNTRY FOR MODEL 1 WITH BINARY VARIABLE FOR 25% OF THE LARGEST BANKS

Variable	*Argentina*	*Brazil*	*Mexico*	*Panama*	*Venezuela*
$GPIB_t$	−0.161	0.300[c]	−0.091[c]	−0.048[c]	−0.217[c]
	(0.22)	(0.01)	(0.02)	(0.01)	(0.02)
BUF_{t-1}	0.512[c]	0.235[c]	0.685[c]	0.305[c]	0.229[c]
	(0.06)	(0.00)	(0.00)	(0.01)	(0.02)
$SizeCo_t$	5.881	−6.917[c]	−2.134[c]	−2.594[c]	−6.373[c]
	(5.71)	(0.22)	(0.30)	(0.21)	(0.44)
$ROAA_t$	2.045	−0.338[c]	0.186[c]	0.676[c]	1.985[c]
	(1.00)	(0.01)	(0.03)	(0.00)	(0.13)
LLR_t	−1.447[a]	−0.166[c]	0.136[c]	1.649[c]	1.142[c]
	(0.59)	(0.01)	(0.04)	(0.03)	(0.06)
Constant	−1.91	11.992[c]	3.024[c]	3.900[c]	−2.648[a]
	(6.81)	(0.09)	(0.31)	(0.19)	(1.05)
N	41	806	191	214	165
j	13	82	40	76	78
Hansen	3.317	85.999	27.926	30.190	18.472
Hansen *p*	0.854	0.203	0.759	1.000	1.000
AR1	−1.442	−1.669	−1.804	−1.408	−1.353
AR1*p*	0.149	0.095	0.071	0.159	0.176
AR2	−1.335	−1.298	−1.161	0.858	−0.592
AR2*p*	0.182	0.194	0.246	0.391	0.554

Note: Standard errors in parenthesis. [a]$p < 0.05$; [b]$p < 0.01$; [c]$p < 0.001$.

Table B.2

LATIN AMÉRICA: RESULTS BY COUNTRY FOR MODEL 1 WITH INTERACTION BETWEEN BINARY VARIABLE FOR 25% OF THE LARGEST BANKS AND GDP

Variable	*Argentina*	*Brazil*	*Mexico*	*Panama*	*Venezuela*
$GPIB_t$	−0.854	0.794[c]	−0.061	0.064[b]	−0.274[c]
	(0.66)	(0.01)	(0.04)	(0.02)	(0.05)
BUF_{t-1}	0.508[c]	0.243[c]	0.695[c]	0.315[c]	0.292[c]
	(0.06)	(0.00)	(0.00)	(0.00)	(0.02)
$SizeCo_t$*GPIB	−0.685	−1.417[c]	−0.216[c]	−0.290[c]	0.048
	(0.71)	(0.04)	(0.05)	(0.02)	(0.05)
$ROAA_t$	−2.035	−0.330[c]	0.134[c]	0.657[c]	2.020[c]
	(0.99)	(0.00)	(0.02)	(0.01)	(0.10)
LLR_t	−1.447[a]	−0.150[c]	0.155[c]	1.594[c]	1.137[c]
	(0.60)	(0.01)	(0.04)	(0.04)	(0.09)
Constant	−3.833	9.425[c]	2.145[c]	2.857[c]	−6.488[c]
	(2.99)	(0.11)	(0.24)	(0.26)	(0.71)
N	41	806	191	214	165
j	13	82	40	76	78
Hansen	3.23	92.20	27.25	31.37	18.42
Hansen *p*	0.863	0.100	0.787	1.000	1.000
AR1	−1.321	−1.680	−1.809	−1.434	−1.460
AR1*p*	0.186	0.093	0.070	0.152	0.144
AR2	−1.340	−1.371	−1.153	0.817	−0.744
AR2*p*	0.180	0.170	0.249	0.414	0.457

Note: Standard errors in parenthesis. [a]$p < 0.05$; [b]$p < 0.01$; [c]$p < 0.001$.

Table B.3

LATIN AMERICA: RESULTS BY COUNTRY FOR MODEL 1 WITH SPECIALIZATION BINARY VARIABLE OF COOPERATIVE AND SAVINGS BANKS

Variable	*Argentina*	*Brazil*	*Mexico*	*Panama*	*Venezuela*
$GPIB_t$	−0.223	0.342[c]	−0.132[c]	−0.026[c]	−0.303[c]
	(0.19)	(0.01)	(0.03)	(0.01)	(0.02)
BUF_{t-1}	0.442[c]	0.257[c]	0.677[c]	0.359[c]	0.290[c]
	(0.06)	(0.00)	(0.01)	(0.00)	(0.02)
$ROAA_t$	1.916	−0.304[c]	0.171[c]	0.602[c]	1.974[c]
	(1.27)	(0.01)	(0.04)	(0.00)	(0.07)
LLR_t	−0.876	−0.149[c]	0.307[b]	1.525[c]	1.047[c]
	(0.68)	(0.01)	(0.10)	(0.02)	(0.11)
Cooperative banks	−9.092	−7.544[c]	−0.847		
	(8.36)	(0.75)	(11.20)		
Savings banks			−24.836	1.870[c]	0.704
			(16.79)	(0.11)	(2.86)
Constant	1.663	9.420[c]	1.881[c]	2.145[c]	−5.941[c]
	(3.53)	(0.10)	(0.41)	(0.08)	(0.69)
N	41	806	191	214	165
j	13	82	41	76	78
Hansen	4.699	91.505	25.906	31.633	17.526
Hansen *p*	0.697	0.109	0.839	1.000	1.000
AR1	−1.676	−1.635	−1.783	−1.470	−1.339
AR1*p*	0.094	0.102	0.075	0.142	0.181
AR2	−1.278	−1.309	−1.071	0.888	−0.742
AR2*p*	0.201	0.190	0.284	0.375	0.458

Note: Standard errors in parenthesis. [a]$p < 0.05$; [b]$p < 0.01$; [c]$p < 0.001$.

Table B.4

LATIN AMERICA: RESULTS BY COUNTRY FOR MODEL 1 WITH INTERACTION BETWEEN THE SPECIALIZATION BINARY VARIABLE FOR COOPERATIVE AND SAVINGS BANK AND GDP

Variable	*Argentina*	*Brazil*	*Mexico*	*Panama*	*Venezuela*
$GPIB_t$	−0.224	0.375[c]	−0.168[c]	−0.042[c]	−0.311[c]
	(0.19)	(0.01)	(0.02)	(0.01)	(0.02)
BUF_{t-1}	0.439[c]	0.257[c]	0.693[c]	0.356[c]	0.290[c]
	(0.06)	(0.00)	(0.00)	(0.00)	(0.02)
$ROAA_t$	−1.901	−0.301[c]	0.126[c]	0.606[c]	1.961[c]
	(1.25)	(0.01)	(0.02)	(0.00)	(0.07)
LLR_t	0.906	−0.145[c]	0.139[c]	1.548[c]	1.059[c]
	(0.67)	(0.01)	(0.04)	(0.02)	(0.11)
CoopBanks*GPIB	1.076	−1.496[c]	0.450[c]		
	(0.98)	(0.19)	(0.06)		
SavingsBanks			−0.025	0.212[c]	0.122
*GPIB			(0.06)	(0.04)	(0.24)
Constant	1.805	9.278[c]	2.176[c]	2.269[c]	−5.832[c]
	(3.49)	(0.09)	(0.20)	(0.16)	(0.71)
N	41	806	191	214	165
j	13	82	41	76	78
Hansen	4.681	93.096	27.105	33.314	17.196
Hansen *p*	0.699	0.089	0.793	1.000	1.000
AR1	−1.689	−1.640	−1.808	−1.464	−1.344
AR1*p*	0.091	0.101	0.071	0.143	0.179
AR2	−1.277	−1.311	−1.205	0.891	−0.745
AR2*p*	0.202	0.190	0.228	0.373	0.456

Note: Standard errors in parenthesis. [a]$p < 0.05$; [b]$p < 0.01$; [c]$p < 0.001$.

References

Acharya, S. (1996), "Charter Value, Minimum Bank Capital Requirement and Deposit Insurance Pricing in Equilibrium," *Journal of Banking & Finance,* Vol. 20, No. 2, pp. 351-375.

Adrian, T., and N. Boyarchenko (2012), *Intermediary Leverage Cycles and Financial Stability*, Becker Friedman Institute for Research in Economics Working Paper.

Adrian, T., and H. S. Shin (2010), "Liquidity and Leverage," *Journal of Financial Intermediation,* Vol. 19, No. 3, pp. 418-437.

Arellano, M., and S. Bond (1991), "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations," *The Review of Economic Studies,* Vol. 58, No. 2, pp. 277-297.

Arellano, M., and O. Bover (1995), "Another Look at the Instrumental Variable Estimation of Error-Components Models," *Journal of Econometrics,* Vol. 68, No. 1, pp. 29-51.

Ayuso, J., D. Pérez, and J. Saurina (2004), "Are Capital Buffers Pro-cyclical?: Evidence from Spanish Panel Data," *Journal of Financial Intermediation,* Vol. 13, No. 2, pp. 249-264.

Barth, J. R., G. Caprio, and R. Levine (2004), "Bank Regulation and Supervision: What Works Best?," *Journal of Financial Intermediation,* Vol. 13, No. 2, pp. 205-248.

Basel Committee on Banking Supervision (2009a), *Strengthening the Resilience of the Banking Sector*, consultative document, December.

Basel Committee on Banking Supervision (2009b), *International Framework for Liquidity Risk Measurement, Standards and Monitoring*, consultative document, December.

Berger, A. N. (1995), "The Relationship between Capital and Earnings in Banking," *Journal of Money, Credit and Banking*, pp. 432-456.

Bikker, J., and P. Metzemakers (2004), *Is Bank Capital Procyclical? A Cross-country Analysis*, De Nederlandsche Bank Working Paper, No. 009.

Blundell, R., and S. Bond (1998), "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models," *Journal of Econometrics,* Vol. 87, No. 1, pp. 115-143.

Boone, J. (2008), "A New Way to Measure Competition," *The Economic Journal,* Vol. 118, No. 531, pp. 1245-1261.

Borio, C. (2014), "The Financial Cycle and Macroeconomics: What Have We Learnt?," *Journal of Banking & Finance,* Vol. 45, pp. 182-198.

Borio, C., and H. Zhu (2012), "Capital Regulation, Risk-Taking and Monetary Policy: a Missing Link in the Transmission Mechanism?," *Journal of Financial Stability,* Vol. 8, No. 4, pp. 236-251.

Bruno, V., and H. S. Shin (2014), "Cross-border Banking and Global Liquidity," *The Review of Economic Studies.*

Carvallo, Ó., A. Kasman, and S. Kontbay Busun (2015), "The Latin American Bank Capital Buffers and Business Cycle: Are They Pro-cyclical?," *Journal of International Financial Markets, Institutions and Money,* Vol. 36 , pp. 148-160.

Cetorelli, N., and L.S. Goldberg (2012), "Banking Globalization and Monetary Transmission," *The Journal of Finance,* Vol. 67, No. 5, pp. 1811-1843.

De Larosière, J. (2009), *The High-level Group on Financial Supervision in the EU: Report.* European Commission.

Demirgüç-Kunt, A., and H. Huizinga (2004), "Market Discipline and Deposit Insurance," *Journal of Monetary Economics,* Vol. 51, No. 2, pp. 375-399.

Fonseca, A. R., and F. González (2010), "How Bank Capital Buffers Vary Across Countries: The Influence of Cost of Deposits, Market Power and Bank Regulation," *Journal of Banking & Finance,* Vol. 34, No. 4, pp. 892-902.

Frankel, J. A., C. A. Végh, and G. Vuletin (2013), "On Graduation from Fiscal Procyclicality," *Journal of Development Economics,* Vol. 100, No. 1, pp. 32-47.

García Suaza, A. F., J. E. Gómez González, A. M. Pabón and F. Tenjo Galarza (2012), "The Cyclical Behavior of Bank Capital Buffers in an Emerging Economy: Size Does Matter," *Economic Modelling,* Vol. 29, No. 5, pp. 1612-1617.

Gavin, M., R. Hausmann, R. Perotti, and E. Talvi (1996), *Gestión de la política fiscal en América Latina y el Caribe: volatilidad, propensión a los ciclos y solvencia limitada*, Inter-American Development Bank Working Paper, No. 4033.

Gavin, M., and R. Perotti (1997), "Fiscal Policy in Latin-America," *NBER Macroeconomics Annual*, vol. 12, MIT Press, pp. 11-72.

Jokipii, T., and A. Milne (2008), "The Cyclical Behavior of European Bank Capital Buffers," *Journal of Banking & Finance,* Vol. 32, No. 8, pp. 1440-1451.

Keeley, M. C. (1990), "Deposit Insurance, Risk, and Market Power in Banking," *The American Economic Review,* pp. 1183-1200.

Kiyotaki, N., and J. Moore (1997), "Credit Cycles," *Journal of Political Economy,* Vol. 105, No. 2, pp. 211-248.

Lindquist, K. (2004), "Banks' Buffer Capital: How Important Is Risk," *Journal of International Money and Finance,* Vol. 23, No. 3, pp. 493-513.

Qian, R., C. M. Reinhart, and K. S. Rogoff (2011), "On Graduation from Default, Inflation and Banking Crises: Elusive or Illusion?," *NBER Macroeconomics Annual 2010,* Vol. 25, University of Chicago Press, pp. 1-36.

Repullo, R., and J. Suárez (2013), "The Procyclical Effects of Bank Capital Regulation," *Review of Financial Studies,* Vol. 26, No. 2, pp. 452-490.

Schularick, M., and A. M. Taylor (2009), *Credit Booms Gone Bust: Monetary Policy, Leverage Cycles and Financial Crises, 1870-2008*, NBER Working Paper, No. 15512, pp. 1870-2008.

Shim, J. (2013), "Bank capital Buffer and Portfolio Risk: The Influence of Business Cycle and Revenue Diversification," *Journal of Banking and Finance*, Vol. 37, No. 3, pp. 761-772.

Shin, H. S., and K. Shin (2011), *Procyclicality and Monetary Aggregates*, NBER Working Paper, No. 16836.

Shin, H. S. (2013), *Procyclicality and the Search for Early Warning Indicators.* International Monetary Fund.

Stolz, S., and M. Wedow (2006), "Banks' Regulatory Capital Buffer and the Business Cycle: Evidence for Germany," *Journal of Financial Stability,* Vol. 7, No. 2, pp. 98-110.

Tabak, B. M., A. Noronha, and D. Cajueiro (2011), *Bank Capital Buffers, Lending Growth and Economic Cycle: Empirical Evidence for Brazil,* 2nd BIS CCA Conference on Monetary Policy, Financial Stability and the Business Cycle.