Empirical Analysis of Macroprudential Policies in Peru: The effects of Dynamics Provisioning and Conditional Reserve Requirements

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Thir Draft: June 06, 2016

Abstract

In the last decade, the banking credit has grown significantly and reaches its maximum annual percentage growth during 2008 when it was five times the GDP growth. In a partial dollarized economy, this could represent a serious risk to financial stability. Therefore, during 2008 the Peruvian Financial Supervision Authority (SBS) implemented the dynamic provisioning scheme whose goal was to mitigate the risk of excessive credit growth on the real economy, and during 2013 the Central Reserve Bank of Peru launched a Conditional Reserve Requirements scheme in foreign currency, in order to limit the risk of currency mismatches on financial stability. Thus, this article tries to assess the effect of dynamic provisioning (implemented in 2008) on credit growth and the effect of conditional reserve requirements (implemented in 2013) on the ratio of dollarization and the non-performing loans ratio for mortgage loans. Using a novel credit register data set over a long period, we have found evidence that supports that dynamic provisioning has a negative effect on commercial loans, mortage dollarization has declined more rapidly after the Conditional Reserve Requirement scheme was implemented, but there is no clear evidence with respect to the mortage non-perfoming loans. Furthermore, in the case of dynamic provisioning, its effect is assymetric.[1]

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[1]The authors would like to thank to Leonardo Gambacorta, Paul Castillo, Huvo Vega de la Cruz and all the participants of CGDFS Working Group for their useful comments and suggestions during all the stages of the project. The usual disclaimer applies.

1 Introduction

This article tries to quantify the effect of dynamic provisioning in an economy with a banking system that operates with two currencies, such as the Peruvian economy, where banks grant loan in domestic and foreign currency. High levels of credit dollarization represent a vulnerability of the banking system as a whole since an abrupt depreciation can produce a deterioration of the quality of bank assets due to the balance sheet effect on the partially dollarized non-financial private sector portfolio of assets and liabilities. Moreover, high levels of credit growth like those observed in 2008, with a maximum growth of 39% in october 2008 that was more than five times the growth of gross domestic product (GDP), could be accompained with more flexible credit conditions, which tend to reduce the asset quality. In this context, macroprudential policies were set up in Peru in order to reduce the procyclical behaviour of credit and the level of credit dollarization.

Dynamic provisioning constitutes one of the instruments of macroprudential policy that was implemented one year before the Central Bank of Peru reduced its interest rate policy to a very low level (1% in 2009). [Jimenez, Ongena, Peydró and Saurina (2008)] explored the effects of overnight rates and the stance of monetary policy on credit risk-taking behavior. Their findings suggest that lower short-term interes rates previous to loan origination, cause a relaxation on bank lending standards, and banks grant loans to riskier clients (with a high default probability), complementing the traditional channels [see Bernanke, Gertler and Gilchrist (1996); Diamond and Rajan (2006)]. In this context, macroprudential policies try to limiting excessive borrowing and balance sheet expansion in order to preserve financial stability, in this sense it can be said that macroprudential policies complement monetary policy.

In Latin America, many countries have also established different instruments of macroprudential policy (see Figure.1). Colombian authorites introduced countercyclical reserve requirements during 2007-2008 to limit liquidity risk, marginal reserve requirements and a dynamic provisioning scheme in order to stabilize credit growth in late 2007, and liquidiy ratios in 2009 to limit liquidity risk (this measure was tightened in the end of 2011). In Mexico, dynamic provisioning was established in 2011, additionally limits on exchange rate risk were established (in 1997) and limits to banks' derivatives position (2001).

Despite the impressive advances regarding policy application and theoretical rationalization of several macroprudential instruments such as Loan to Value (LTV), Debt to Income (DTI) and others, there is not ample research on measuring and quantifying their effects on banking asset dynamics, specifically on credit dynamics.

The goal of this document is to analyze the effects of two types of macroprudential tools, dynamic provisioning and conditional reserve requirements, on credit growth. To do this,

we employ a novel credit register data set over a long period of time (2004-2014), which contains information about loan outstading at a micro level (bank-debtor level). We find that dynamic provisioning exhibits a negative and significant relationship with credit growth of corporate sector, however its magnitude is small, in line with other works such as [Saurina, et al (2013)]. Regarding reserve requirements on FX loans, specifically on FX mortage loans, the evidence shows that its effects on mortage dollarization were negative and statistically significant. But, in the case of the non-performing loans rate, the evidence presents mixed results.

This article is organized as follows: section 2 presents a brief literature review; section 3 shows the recent trends in credit dynamics at an aggregate level; section 4 describes our data set and variables that were used; section 5 documents our empirical strategy and results; and, finally, section 6 presents a brief summary of our findings and points out a future research agenda.

2 Literature Review

The Global Financial Crisis, caused by the collapse of the sub-prime mortage market, puts on the agenda the need to develop the financial regulatory framework from one oriented to screen its individual banking solvency to another with a more macro-perspective, which seeks to alleviate systemic risk. [Hanson, Kashyap and Stein (2010)] stated that a micro-prudential regulation seeks to restore individual capital ratio (when a negative shock danpens it), and it is not concerned with how a bank could achieve it. What 2008's Financial Crisis proved was that it is easier to shrink the balance sheet (sell assets) than increase equity.

According to Hanson et.al, when a negative shock affects not only one bank, but many; shrinking assets leads to fire sales and has a negative impact on other banks' balance sheets, which drives the whole system to a collapse. Therefore, they suggest that a macro-prudential regulation is necessary in order to alleviate the social costs imposed by fire sales and shrinking assets. On the contrary, [Brunnermeier and Sannikov, (2013)] show that endogenous risk and leverage lead to an unstable economy regardless of the level of aggregate risk. Also, they state that macro-prudential policies could reduce the likelihood of crisis episodes, at the cost of welfare reduction. Nevertheless, in light of recent episodes on financial markets, a small loss of welfare due to the application of macroprudential measures could be preferred to large welfare losses related to financial meltdown.

Shin (2010) states that in good times, asset prices tend to rise, leading to an incre-

ment on credit risk. Thus, banks need to attract funding, both domestic and foreign. This provokes a jump in the banking leverage ratio, and banks tend to rely on non-core liabilities, which causes foreign exchange and maturity missmatches. Therefore, when external liquidity becomes scarce, banks contract their balance sheet dramatically and could provoke a negative spiral process of asset prices and net worth.

The recent financial crisis, caused by the collapse of the sub-prime mortage sector in the USA, made evident that prior regulation framework, based on a microprudential approach, failed to maintain the stability of the financial system [Hanson, Kashyap and Stein (2011); Brunnermeier, Crockett, Goodhart, Persuad and Shin (2009); French, et al. (2010)]. The traditional approach to financial regulation was based on banks financing themselves with government-insured deposits, preventing runs [Diamond and Dyvig (1983)] while making banks more prone to take excessive risks. So, prior financial regulation sought to reduce the probability of the deposit insurer bearing losses.

According to [Hanson, Kashyap and Stein], microprudential regulation tried to maintain the capital ratio above a minimun requirement, giving incentives to bank managers to internalize the costs of excessive risk taking. However, the Global Financial Crisis proved that this mechanism was not enough to prevent the collapse of financial markets. Authors argued it was easier to shrink assets than raise equity in order to restore capital ratio requirements due to the debt-overhang hypothesis. According to it, banks cannot raise equity in bad times because its value serves to absorb losses or to repay more senior creditors; on the other hand, in good times debt-overhang is not an issue, but raising new equity is more costly than taking short-term debt. Therefore, a massive balance sheet shrinkage, in response to a common shock, leads to the collapse of credit and financial markets. Thus, a macroprudential approach is needed, whose goal is to maintain the stability not only of an individual bank, but of the whole system. In order to achieve financial stability, its instruments need to prevent shrinking balance sheet effects through time-varying capital requirements, contingent capital, and provide incentives to reduce excessive exposure to short-term liabilities.

In more applied work, [Claessens, Ghosh and Mihet (2014)] explored how effective macroprudential policies have been in many emerging and advanced countries. Using a panel data set, which covers 48 countries and 2 800 banks from 2000 to 2010, and controlling for endogeneity[2]; they found that macropudential measures aimed at restraining borrowers' behavior and limiting banking balance sheet growth, such as Loan to Value (LTV), Debt to Income (DTI) or Reserve Requirements (RRs), have a negative and relevant effect on risky asset growth. On the contrary, measures that encourage banks to build-up liquidity buffers, such as dynamic provisioning, exhibit less relevant effects. The results are the

[2]A country could adopt not only macro-prudential policies to deal with systemic risk.

same if we split the sample between advanced and emerging economies; but measures to limit borrowing are more effective reducing asset growth in advanced economies than measures that reduce avalaible funds.

In line with this work, [Cerutti, Claessens and Laeven (2015)] report a recent IMF survey about usage of macroprudential policies, among 119 countries over the 2000-2013 period, and their effects. They conclude that macroprudential policies are used more in emerging countries, specially foreign exchange related policies, but borrower-based policies are preferred in advanced economies. Also, the effects of borrower-based measures are higher than other macroprudential policies. Dynamic provisioning, used almost exclusively in emerging economies, and counter-cyclical requirements have negative effects on overall credit growth. Additionally, they find evidence of asymmetric effects of macroprudential policies: these measures work better on boom periods than during the bust phase.

On the other hand, [Drehmann and Gambacorta (2012)] explored the effects of Basel III countercyclical capital buffers through a counterfactual exercise, using information from 772 European banks between 1998 and 2009. The methodology calculated the additional capital requirements if the Basel III regime would have been placed since 1986. Then, this additional requirement is put on a lending equation, controlling for macroeconomic factors and banking characteristics, and they find that additional capital buffers could have helped to reduce credit growth during booms (the cumulative reduction in the supply of credit over the period 1986 to 2007 would have been around 18 percent).

For emerging markets, [Bruno and Shim (2014)] analized the effects of macropudential and capital flow policies on credit growth across 12 Asia-Pacific countries between 2004 and 2013. The document examined 177 domestic macroprudential policies, such as LTV or DTI measures, and 152 capital flow management policies. Authors found that banking and bond market flow management policies have a negative impact on banking inflows and bond inflows as well. Additionally, they find some evidence about spillover effects of these policies (for instance, bank inflow controls tend to increase international debt securities before 2007, and bond inflow controls increase cross-border bank lending and domestic bank credit after 2009). Regarding the interaction between monetary and macroprudential policies, authors suggest that macroprudential measures have a stronger effect if they reinforce the stance of monetary policy.

The well known work of [Jimenez, Ongena, Peydró and Saurina (2012)] analized the impact of the Spanish Dynamic Provisioning scheme on credit supply, using a Credit Register database of the Banco de España, in particular commercial and industrial loans (80 percent of total loans) granted to non-financial companies by commercial banks, savings banks and credit cooperatives, more than 100,000 firms and 175 banks in the database in any given year. In Spain, countercyclical provision is based on the comparison of the

average of specific provisions along the last lending cycle with the current specific provision, so in good (bad) times, when non-performing loans are low (high), specific provisions are low (high) in comparison with the average of the cycle provisions producing (drawing down) the dynamic provision funds, together with floor and ceiling values set for general loan loss provisions. To identify the impact on credit supply, authors analized three different samples: from 2000 to 2001; between 2004 and 2006; and from 2008 to 2009. In the first period, they evaluated the introduction of dynamic provisioning in the third quarter of 2000; in the second one, they assess the net loosening in provisioning requirements that occured in the first quarter of 2005 as a result of lowering the ceiling of the dynamic provision fund; finally, in the third period, they analize the lowering of the floor of the dynamic provision funds (in the last quarter of 2008), from 33 to 10 percent. The results suggest that dynamic provisions help smooth credit supply cycles and in bad times have positive effects on firm credit availability, assets, employment and survival.

In the case of Latin American economies, [Chan-Lau (2012)] explored the impact of Dynamic Provisioning on bank solvency and credit procyclicality, using information of 14 large chilean banks between 2004 to 2010. She analizes the solvency of those banks under two scenarios: (i) Chilean provisioning scheme of 2011; (ii) dynamic provisioning as detailed in the work of Saurina (2009). The main conclusion was that the dynamic provisioning scheme builds-up more capital buffers in order to cover loan losses than the current Chilean scheme. Additionally, she shows that credit and output lead the evolution of credit provisioning, therefore credit provisioning could not have any effect on credit evolution.

For the Uruguayan case, [Dassatti and Peydró (2015)] studied the effects of a change in regulation regarding reserve and liquidity requirements on bank risk-taking behavior. Using a credit register database and a difference-in-difference approach, they found that increases in reserve and liquidity requirements for distinc funding sources (deposits, short-term funding and others) reduce loan supply to the non-financial sector. This effect is asymmetric, larger banks are more capable to mitigate the effects of the lending channel. At firm level, higher reserve requirements increase their real costs, although the effect is asymmetric too: firms with better credit rating or with a better network with larger banks are able to reduce those costs.

Regarding the use of Reserve Requirements (RRs) as a macroprudential instrument, with the implementation of the Inflation Targeting scheme many emerging economies have left out of use reserve requirements as a monetary policy instrument. However, these economies have actively used RRs on banking and non-banking liabilities to handle systemic risk. [Tovar, Garcia-Escribano and Vera (2012)] remark the variety of purposes that RRs can achieve: (i) RRs can be used for managing the credit cycle countercyclically; (ii) they can be employed to improve the funding structure of banking system -for

instance, Peruvian scheme of RRs on foreign liabilities with short-term maturity has limited the exposure of banking system to short-term debt-; (iii) they can substitute for traditional monetary policy in order to preserve financial stability -for example, many emerging economies rised their policy rate in a context of large capital inflows, this policy response (whose goal was to increase the cost of credit) could lead to more capital inflows (because the yield of domestic assets could be higher than international) and foster the expansion of loans; thus, RRs can substitute traditional monetary policy instruments-. Their results suggest that the effects of RRs are limited, specifically they mentioned that the effects on credit growth are *"modest and short-lived"*, which implied that RRs need to be recalibrated with certain regularity in order to preserve their effects on credit dynamics.

	Argentina	Brazil	Chile	Colombia	Mexico	Peru
Capital based instruments						
Dynamic Provisioning	No	No	No	Yes (2007)	Yes (2011) (provision on expected losses)	Yes (2008)
Limits on dividend distribution	Yes (2010, 2012 conservation buffer)	No	No	Yes (2008)	No	No
Other capital-based tools	Yes (2004, 2007, 2012 changes in risk weights for specific operations)	Yes (Change of risk weights for some housing loans and some auto and payroll loans)	No	Yes (increase in the LGD of some consumer loans in 2011 and temporary provision for entities with high NPL growth in 2012).	No	Yes (on specific operations 2010, 2012)
Liquidity based instruments						
Countercyclical reserve requirements	(but not countercycli	Yes (2008, 2009, 2011, 2012)	No	Yes (2007)	No	Yes. (2010, 2011)
Liquidity ratios	Yes (2008)	Yes. Liquidity measures and capital flow tax to ease funding problems of banks that lend to firms.	Yes	Yes (2008)	Yes	Yes (1997, 2012)
Asset based instruments						
LTV and DTI limits	Yes (LTV for mortgages)	Yes. Establishment of LTV caps for some housing loans.	No	Yes (1999)	No	Yes
Limits on exchange rate risk	Yes (limits on net foreign currency position of FI)	Yes (2007)	Yes	Yes (2005)	Yes (1997)	Yes (2010-2011)
Limits on derivatives	Yes	Yes (2011)	No	Yes (2007)	Yes (2001)	Yes (2011)

Note: The number in brackets indicates the year of modification or use of macroprudential instrument.

Source: BIS, National Central Banks.

Figure 1: Macro-Prudential Measures in Latin America.

3 Credit Dynamics and the Peruvian Macro-Prudential Toolkit

In the last decade, credit to the private sector has grown steadily in Peru. The average growth rate between 2004 and 2014 was around 15 percent, with a highest growth rate of

39 percent at the end of 2008, as a result of the vigorous growth of economic activity (the average growth rate of GDP was around 6 percent) and the abundant international liquidity, which led international interest rates close to the zero lower bound, and provoked a great capital inflow to emerging markets. Thus, in order to prevent an excessive growth of risky loans, many central banks of emerging economies took different macroprudential measures, seeking to reduce the acceleration of credit growth.

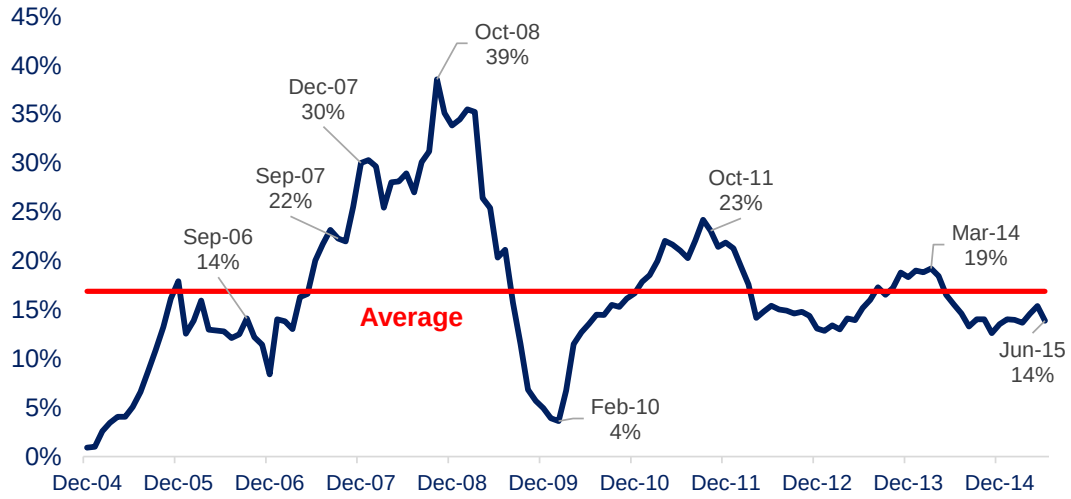

Figure 2: Credit Growth (year over year percent change).

Peruvian authorities (Banking System Supervisor, Treasury and Central Bank) have implemented some macroprudential policies that are oriented to mitigate the following critical issues[3]: (i) the procyclical behavior of credit, (ii) the exchange rate risk and the excessive exchange rate volatility, and (iii) the exposure to short-run capital inflows. To reduce the procyclical behavior of credit, a dynamic provisioning scheme was established at the end of 2008. This scheme saught to diminish the cyclical component of credit and to prevent a missallocation of resources. Dynamic provisioning increased the credit provisions for non-performing loans assymetrically: from 0.3% for unsecured loans to medium enterprises, to 1.5% for revolving consumption loans. These provisions were added to generic provisions. In september 2009, this scheme was deactivated, due to the effects of the international financial crisis on the peruvian economy; but, it was reactivated in october 2010 until november 2014. On the other hand, since january 2013, the Banking Supervisor Authority (SBS) has established more strict and higher capital requirements for consumption loans and mortages.

[3]For a more detailed survey, see: Choy, M., & Chang, G. (2014). Medidas macroprudenciales aplicadas en el Per. Revista Estudios Econmicos, 27, pp 25-50.

In order to cope with higher foreign capital inflows, Peru's Central Bank established

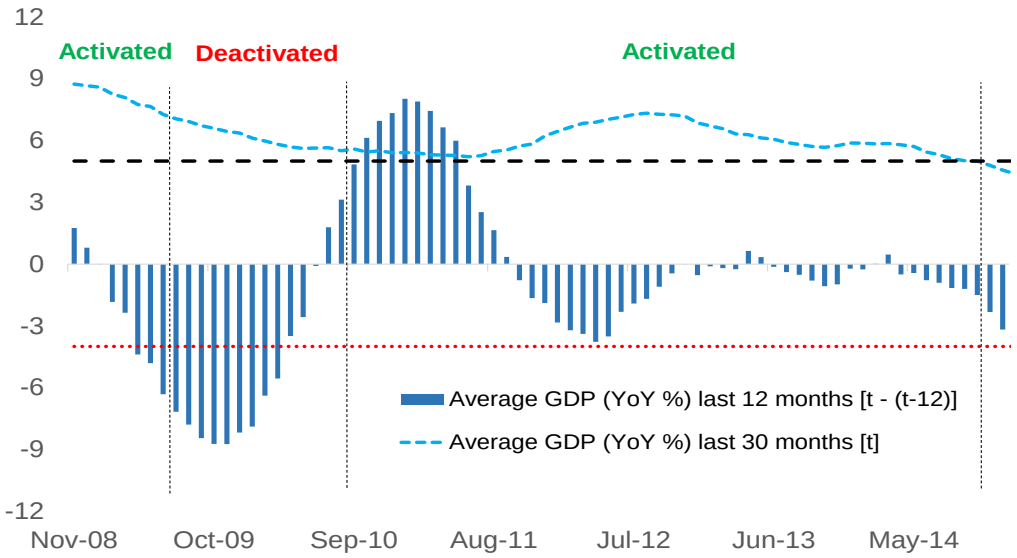

Figure 3: Activation and Deactivation Rule of Dynamic Provisioning

in 2008 a marginal reserve requirement for non-resident deposits in the banking system. This measure required an additional reserve requirement of 120% for liabilities, which exceeds the maximum between the average amount of liabilitites plus S/ 100 millions and 1% of bank net worth, with foreign financial entities. The objective of this policy was to give the right incentives to banking institutions to avoid foreign short-run funding, which proved to revert rapidly in response to external volatility (In the 1998 crisis, the banking system was overexposed to short-run funding. When the international risk aversion went up, the capital outflow was around US$ 1 484 millions -2.5% of GDP, approximately. This led to an abrupt jump of interest rates and exchange rate[4]). Besides, it prevented an accelerated currency appreciation and, therefore, an increase in credit dollarization.
Regarding exchange rate credit risk, the Central Bank implemented the De-Dollarization Program in 2013. This program seeks to accelerate the dedollarization process of credit, through additional reserve requirements in foreign currency conditional to credit evolution. At the begining, the scheme was conditioned on credit growth. There were three limits (10%, 15% and 20%) to total credit in foreign currency[5] growth, if banks exceeded these limits, they faced additional requirements of to 1.5%, 3% and 5%, respectively. In

[4]Castillo, P., Barco D. "Crisis Financiera y Manejo de Reservas", Revista de Estudios Económicos, N 17, June 2009.

[5]It was excluded loans to foreign trade operations.

the case of car loans and mortages, the limits to growth were 10% and 20%, and the associated additional reserve requirements were 0.75% and 1.5%[6]. In the end of 2014, this scheme was adjusted and limits to credito outstanding were set. This new approach demanded a contraction not lower than 10% of total credit stock at september 2013 for total credit outstanding in foreign currency[7] at the end of 2015; in the case of car loans and mortages, the reduction was set to not lower than 15% of these credits at febraury 2013. If banks did not meet this requirements, they would face additional reserve requirements proportional to their total liabilities in foreign currency[8].

Conditional Reserve Requirements in Foreign Currency

Previous Measure: From March 2013 to May 2015

	Targets of Credit Growth*			Additional RR		
	I	II	III	I	II	III
Total Credit excluding foreign trade loans (Sep.13=100)	5,0%	10,0%	15,0%	1,50%	3,0%	5,0%
Mortgage and Car Loans (Feb.13=100)	10,0%	20,0%		0,75%	1,50%	

Since June 2015

	Required Stock*	Additional RR
Total Credit[1/] (Set.13=100)	0,95 times (reduction of 5%)	$\mathbf{0,3} \times \left(\frac{\boldsymbol{C_t}}{\boldsymbol{C_{s13}}} - \mathbf{0,95}\right) \times \boldsymbol{TLiab}$
Mortgage and Car Loans (Feb.13=100)	0,90 times (reduction of 10%)	$\mathbf{0,15} \times \left(\frac{\boldsymbol{CHV_t}}{\boldsymbol{CHV_{f13}}} - \mathbf{0,90}\right) \times \boldsymbol{TLiab}$

Since December 2015

	Required Stock*	Additional RR
Total Credit[1/] (Set.13=100)	0,90 times (reduction of 10%)	$\mathbf{0,3} \times \left(\frac{\boldsymbol{C_t}}{\boldsymbol{C_{s13}}} - \mathbf{0,90}\right) \times \boldsymbol{TLiab}$
Mortgage and Car Loans (Feb.13=100)	0,85 times (reduction of 15%)	$\mathbf{0,15} \times \left(\frac{\boldsymbol{CHV_t}}{\boldsymbol{CHV_{f13}}} - \mathbf{0,85}\right) \times \boldsymbol{TLiab}$

*These targets do not apply if total credit stock in foreign currency is lesser than bank net worth, and if mortgages and car loans are lesser than a fifth of bank net worth.

Figure 4: Conditional Reserve Requirements in Foreign Currency

[6]In both cases, the reserve requirements were applied on deposits in foreign currency.

[7]Excludes loans for foreign trade operations and loans with maturity higher than 3 years and bigger than US$ 10 millions.

[8]Includes deposits, bonds and external liabilities.

Figure 4 shows the evolution of credit growth by currencies. The overall growth rate of credit to the private sector was 9.2%, which was lower than the growth rate registered at the end of 2014 (10.4%). By currency, loans denominated in Soles accelerated their growth, at the end of 2015 the growth rate was 28.0%. On the other hand, credit in foreign currency exhibited more negative growth rates, closing the year with a contraction of 21.0%. We believe that this evolution was partially associated with the implementation of the De-Dollarazation Programand the depreciation of domestic currency.

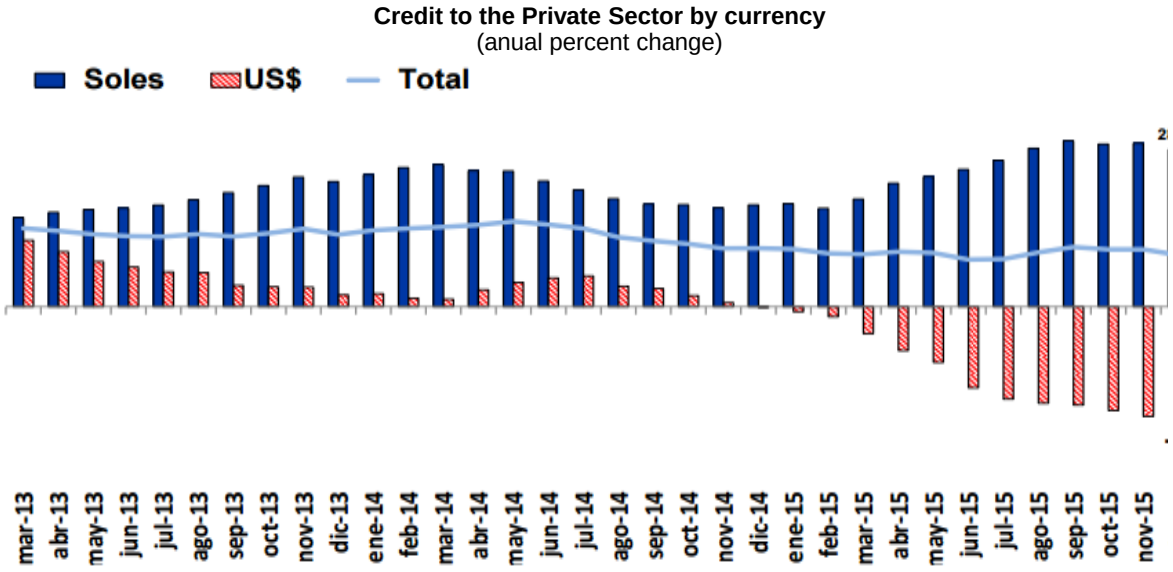

Figure 5: Evolution of Growth rate of Credit to the Private Sector

4 Data

We have employed the Credit Register Data Base, provided by the Peruvian regulatory agency. This data set contains information at a very dissagreggate level of loans outstanding in domestic currency as well as in foreign currency. We used commercial loans and information about bank characteristics, obtained from the public data-base of the national regulatory agency, and macroeconomic controls, such as the interbank interest rate and the exchange rate, obtained from Central Bank's Data Base. Moreover, sample frequency is quarterly, starting on the second quarter of 2004 until the last quarter of 2014. The sample containes 9 banks, which includes the four biggest banks in Peru. The number of debtors was 19639, and the number of bank-debtor relationships was on

average around 6611 (with a maximum of 14892 and a minimum of 568).

Regarding the sample for evaluation of conditional reserve requirements, we have expanded the time dimension up to the third quarter of 2015, in order to have more observations where the measure was active, and we include only banks that lend mortgage. For the lender based regression, the number of lenders (banking and non-bank institutions) included was forty two credit institutions. In the case of lender-debtor based regressions, the numbers of banks was twelve, the number of debtors was 136900, and the number of bank-debtor relationship was 12 118, on average, with a maximun of 46251 and a minimun of 125.

Our dependent variables are real quarterly credit growth, calculated as the first difference of the natural logarithm of outstanding loans, the dollarization ratio of mortgage loans, and the non-perfoming loans rate for mortgages. Total credit stock was calculated using a constant exchange rate and it was deflated using the Consumer Price Index (CPI). Control variables were divided into two groups: bank controls and macroeconomic controls. Bank controls were: size (measured by total assests), leverage ratio, liquidity ratio (loan to deposits). Macroeconomic controls were: the quarterly change of interbank interest rate, the quarterly nominal depreciation, the annualized change of the current account and the annualized change of GDP. Additionally, we control for reserve requirements, both in domestic and foreign currency, that Central Reserve Bank requires to each bank.

It is worth noting that in order to avoid extreme values, we dropped off the observations which the credit growth rate reduced the upper ninety nine quantile and the lower one quantile. The effect on the empirical distribution of credit growth can be noted in Figure 5.

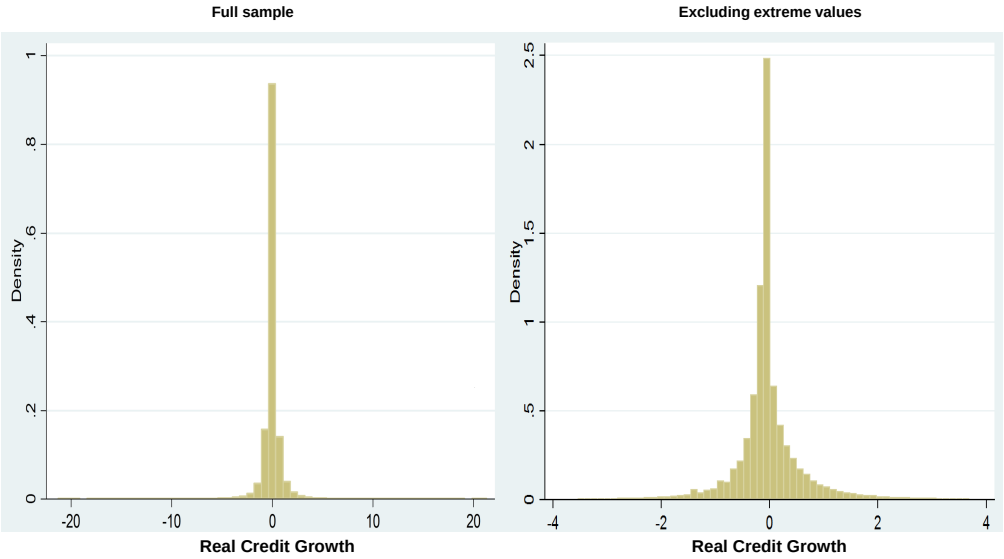

Figure 6: Empirical Distribution of Credit Growth at bank-debtor level.

5 Empirical Strategy and Results

Dynamic Provisioning Effects

In order to quantify the effects of dynamic provisioning on credit growth[9], we will perfom the following base regression equation:

$$Y_{i,b,t} = \sum_{j=0}^{3} X'_{t-j} \times \beta^j + \sum_{j=0}^{3} Z'_{b,t-j} \times \theta^j + MP_{t-1} \times \gamma^1 + u_{i,b,t} \tag{1}$$

Where i, b and t represent debtor, bank and time indexes, respectively.

$Y_{i,b,t}$ is the real credit growth of debtor-i in bank-j at time t. X_s stands for the macro control variables; $Z_{b,s}$ is the matrix of bank controls; and MP_{t-1} expresses the dynamic provisioning scheme at previous time. Moreover, we encode the dynamic provisioning as:

$$MP_t = \begin{cases} 1, & if\ dynamic\ provisioning\ is\ "activated". \\ -1, & if\ dynamic\ provisioning\ is\ "deactivated". \\ 0, & otherwise. \end{cases} \tag{2}$$

[9]We are following the methodology proposed in the BIS CCA CGDFS Working Group Workshop.

As panel data estimation methods usually do, we treat idiosyncratic error ($u_{i,b,t}$) as follows:

$$u_{i,b,t} = \alpha_{i,b} + \varepsilon_{i,b,t} \tag{3}$$

Where $\alpha_{i,b}$ is the non-observable heterogeneity, and $\varepsilon_{i,b,t}$ represents an independent, identically distributed, random disturbance. Also, it is assumed that $\alpha_{i,b}$ is uncorrelated with $\varepsilon_{i,b,t}$.

According to Greene (2014), if the non-observable heterogeneity is uncorrelated with observable regressors, then the random effects estimatior (a feasible GLS estimator) is an efficient and consistent estimator. However, our base equation regression does not take into account individual control, such as debtor wealth or income and other debtor characteristics, so it is difficult to believe that this omitted information is not correlated with macrocontrols or bank controls. Thus, we choose to estimate the models using fixed effects methodology (whitin estimator), which is not an efficient but a consistent estimator.

Whithin estimator (fixed effects methodology) consists in doing a transformation to our dataset. We can substract from (1) the time average. Then, it is possible to re-write (1) as:

$$Y_{i,b,t} - \bar{Y}_{i,b} = \sum_{j=0}^{3} [X_{t-j} - \bar{X}_{i,b}]' \times \beta^j + \sum_{j=0}^{3} [Z_{b,t-j} - \bar{Z}_{i,b}]' \times \theta^j + [MP_{t-1} - \bar{MP}_{i,b}] \times \gamma^1 + \tilde{u}_{i,b,t} \tag{4}$$

Also, we add some dummy variables to control for some time-invariant effects (τ_t), such as seasonality (for instance: after the christmas campaign, many firms diminish their production, therefore they require less funding), and bank-specific effects (γ_b). Additionally, we have corrected for the presence of heterokedasticity, then the variance-covariance matrix was estimated by debtor (cluster). With this, the first two equations we analyze are:

$$\text{Eq.1} \qquad \tilde{Y}_{i,b,t} = \gamma_b + \tau_t + \sum_{j=0}^{3} \tilde{X}'_{t-j} \beta^j + \sum_{j=0}^{3} \tilde{Z}'_{b,t-j} \theta^j + \psi MP_{t-1} + \tilde{u}_{i,b,t} \tag{5}$$

$$\text{Eq.2} \qquad \tilde{Y}_{i,b,t} = \gamma_b + \tau_t + \sum_{j=0}^{3} \tilde{X}'_{t-j} \beta^j + \sum_{j=0}^{3} \tilde{Z}'_{b,t-j} \theta^j + \sum_{j=0}^{3} \psi^j MP_{t-j} + \tilde{u}_{i,b,t} \tag{6}$$

The results (see Appendix, Table.1) show that the first lag of dynamic provisioning has a significant and negative relationship with the growth of commercial loans. So, if the dynamic provisionig scheme was tightened on the previous period, the real credit growth would diminish in 0,006 percent in the current period. Regarding macroeconomic controls, we evaluated the effect of changes of the exchange rate, the interbank rate and the current account on commercial loans. The estimated coefficient for the exchange rate is significant and negative, reflecting that a depreciation of domestic currency reduces the growth of commercial loans, which is fairly probable because many peruvian enterprises

are exposed to exchange rate risk (revenues in domestic currency and liabilities in foreign currency), so depreciation affects their financial position. Besides, we found a significant and positive relationship between the change of the interbank rate and the growth of commercial loans, an unusual and counterintuitive result, inasmuch as a tightening in monetary conditions tends to increase borrowing costs and corporate firms can substitute bank loans.

Furthermore, we get a positive relation between the second lag of capital ratio and our dependent variable, this implies that a well-capitalized bank in the last six months has the ability to borrow more than other banks now. With respect to bank size (logarithm of total assets), we have found it has a negative relationship with credit growth, a possible explanation could be that small banks (which possess lower assets) tend to expand their balance sheet more than big ones because they are in their expansionary phase. Additionally, regarding to liquidity characteristics, we found mixed evidence but not significant at all, in line with [Claessens, et al] who explained that banks with less deposits are riskier than others and will be more willing to expand their balance sheet, but this fact could restrain them to do it as well.

With respect to the effects of reserve requirements, both in domestic and foreign currency, the data shows mixed evidence. On one hand, reserve requirements in domestic currency exhibit a non-significance relation with the credit growth of commercial loans; on the other hand, reserve requirements in foreign currency have a negative and significant effect on the growth of commercial loans.

Then, we evaluated the impact of the dynamic provisioning scheme, splitting tightening periods from easing periods, on the credit growth of commercial loans (Figure.6). Thus, our regression equations were:

Eq.3
$$\tilde{Y}_{i,b,t} = \gamma_b + \tau_t + \sum_{j=0}^{3} \tilde{X}'_{t-j}\beta^j + \sum_{j=0}^{3} \tilde{Z}'_{b,t-j}\theta^j + \psi_{tight} Tightening_{t-1} + \psi_{ease} Easing_{t-1} + \tilde{u}_{i,b,t} \tag{7}$$

Eq.4
$$\tilde{Y}_{i,b,t} = \gamma_b + \tau_t + \sum_{j=0}^{3} \tilde{X}'_{t-j}\beta^j + \sum_{j=0}^{3} \tilde{Z}'_{b,t-j}\theta^j + \sum_{j=0}^{3} \psi^j_{tight} Tightening_{t-j} + \sum_{j=0}^{3} \psi^j_{ease} Easing_{t-j} + \tilde{u}_{i,b,t} \tag{8}$$

Throughout the analysis of these two equations (see Appendix, Table 2), we found similar results in the sign of coefficients and significance for macroeconomic and bank controls. Respect to our main variable (dynamic provisioning), we found that a tightening position in macro-prudential tool tends to reduce credit growth, and an easing position tends to increase credit growth. A similar situation occurs when we analyze the sum of contempo-

raneous and three lags effects of tightening and easing position of our macro-prudential tool. This suggests that dynamic provisioning tends to reduce the procyclicality of credit.

A third set of equations was estimated (see Appendix, Table 3), adding interactions between the macro-prudential variable and the bank characteristic variables.

$$\text{Eq.5} \qquad \tilde{Y}_{i,b,t} = \gamma_b + \tau_t + \sum_{j=0}^{3} \tilde{X}'_{t-j}\beta^j + \sum_{j=0}^{3} \tilde{Z}'_{b,t-j}\theta^j + \psi MP_{t-1} + \sum_{j=0}^{3} [\tilde{Z}'_{b,t-j} \times MP_{t-1}]\phi^j + \tilde{u}_{i,b,t} \tag{9}$$

$$\text{Eq.6} \quad \tilde{Y}_{i,b,t} = \gamma_b + \tau_t + \sum_{j=0}^{3} \tilde{X}'_{t-j}\beta^j + \sum_{j=0}^{3} \tilde{Z}'_{b,t-j}\theta^j + \sum_{j=0}^{3} \psi^j MP_{t-j} + \sum_{j=0}^{3} [\tilde{Z}'_{b,t-j} \times MP_{t-j}]\phi^j + \tilde{u}_{i,b,t} \tag{10}$$

We found similar results regarding the macroeconomic controls: the exchange rate is significant and reduces credit growth, changes in interbank interest rate still have positive effects on credit dynamics (which is counter-intuitive). But, in the case of reserve requirements in foreign currency, the significance of their effects diminishes. Besides, unlike the first regression equation, dynamic provisions have the opposite effect on credit growth and are not significant, only in the second lag the coefficient is negative and significant. Additionally, the coefficients of interactions show that when dynamic provision is activated: banks that are well capitalized (higher bank capital ratio), reduces the growth to commercial loans, and bigger banks (with higher total assets), reduce more the growth of commercial loans. The last result suggests that dynamic provisions help to reduce the growth of commercial loans.

A final set of equations was estimated (see Appendix, Table 4), adding interactions between the macro-prudential dummy variable and the monetary policy stance (interbank rate).

$$\text{Eq.7} \qquad \tilde{Y}_{i,b,t} = \gamma_b + \tau_t + \sum_{j=0}^{3} \tilde{X}'_{t-j}\beta^j + \sum_{j=0}^{3} \tilde{Z}'_{b,t-j}\theta^j + \psi MP_{t-1} + \sum_{j=0}^{3} [\tilde{X}'_{t-j} \times MP_{t-1}]\nu^j + \tilde{u}_{i,b,t} \tag{11}$$

$$\text{Eq.8} \quad \tilde{Y}_{i,b,t} = \gamma_b + \tau_t + \sum_{j=0}^{3} \tilde{X}'_{t-j}\beta^j + \sum_{j=0}^{3} \tilde{Z}'_{b,t-j}\theta^j + \sum_{j=0}^{3} \psi^j MP_{t-j} + \sum_{j=0}^{3} [\tilde{X}'_{t-j} \times MP_{t-j}]\nu^j + \tilde{u}_{i,b,t} \tag{12}$$

We found similar results for the exchange rate but with less significance and for changes in interbank rate, we found a positive relation of its third lag with credit dynamics (which is counter-intuitive) but a negative relation with contemporaneous policy rate. Regarding

banking control variables, the sign and significance for capital ratio and total assets remain the same. Moreover, dynamic provisions have a negative relation with credit growth and it is significant. Besides, we found mixed signs in coefficients of interactions between dynamic provision and policy rate, showing positive relations and negative relations in some cases, so interactions between macro prudential and monetary policy are mixed and more significant than the first set of equations.

Conditional Reserve Requirements Effects

For Conditional Reserve Requiremnts, we encode the dummy variables as following:

$$PdDollar_t = \begin{cases} 1, & if\ De-Dollarization\ Program\ is\ active. \\ 0, & otherwise. \end{cases} \tag{13}$$

The dependent variables we analyzed were: (i) the change in mortage dollarization rate; and (ii) the change of the mortage non-perfoming loans rate. The dollarization rate was calculated at constante exchange rate, and expressed in percentage. The mortage non-perfoming loan rate was calculated considering only clients that have loans in foreign currency, because they are exposed to exchange rate risk.

It can be noted (See Appendix, Table.5) that the contemporaneous effect of conditional reserve requierements has a negative but non-significant effect on the change of the dollarization rate, as it is expected. Domestic currency depreciation shows a positive relation with the change of dollarization, which is unexpected since a depreciation of domestic currency would lead to a substitution between loans denominated in dollars by credit in soles, however this effect is not statistically significant; besides, an increase of the monetary policy rate leads to a rise on dollarization, this implies that an adjusment of monetary policy provokes a substitution between loans granted in soles for credit in dollars; the higher reserve requirements in foreign currency have no significant effects on the change of dollarization rate; finally, improvements on economic activity led to a decrease of dollarization. Besides, bigger banks have a lower dollarization rate.

A similar result can be found if we employed the first lag of the macroprudential dummy variable, however the effect of conditional reserve requirements is statistically significant, the implementation of De-Dollarization Program led deaceleration of dollarization by 1.02 percent points, on average. In the case we include the contemporaneous and lagged effects (up to third lag), the scheme of conditional reserve requirements provokes a significant deaceleratio of the change of dollarization rate by 1.02 percent points, on average.

In the case of the non-perfoming loans rate, the evidence shows that depreciation diminishes the change of this rate, but this effect is not statiscally significant (at least up to

second lag). This result is quite counter-intuitive, because, theoretically, a depreciation in a dollarized economy triggers a negative balance-sheet effect, which worsens the financial position of households with currency mismatches. Besides, an adjustment on monetary conditions has mixed effects on the change of the non-perming loans rate of mortgages in foreign currency, but those effects have no significance. On the contrary, the effect of GDP growth is negative and significant. On the side, the effects of reserve requirements in foreign currency seem to be not significant. Regarding the effect of the De-Dollarization Program, its effects are statiscally non-significant. (See Appendix, Table.6).

6 Conclusions

The relevance of this paper derives of the use of micro data to analyze the impact of some macro-prudential policies such as dynamic provisioning and conditional reserve requirements on commercial credit growth, dollarization and non-perfoming loans rate. Most of literature studies the impact of macro-prudential policies with a theoretical analysis or using aggregate variables. The implementation of dynamic provisioning in Peru carried out a lot of academic debate about their impact on the financial system, and the De-Dollarization Program has not been analyzed in detail.

In this paper, we find that a tightening (easing) dynamic provisioning in Peru reduced (increased) the growth in commercial loans, which indicates that implementation of dynamic provisioning in Peru has contributed in part to reduce the pro-cyclicality of credit, and thus reducing potential adverse effects of an excessive credit expansion. At this point, it is important to notice that banks with higher capital ratios has the ability to expand credit more than other banks, and mitigate the impact of dynamic provisioning. In the case of De-Dollarization Program, the evidence has showed that the program has provided the right incentives to banks to substitute dollar denominated loans and expand credit in domestic currency, especially in sectors with great exposure to exchange rate risk, such as mortages. However, its effect on the change of the non-performing loans rate -an alternative measure of financial vulnerability- is not conclusive.

Additionally, We find a positive relationship between the interbank rate (a proxy of monetary policy interest rate) and credit growth, which is counter-intuitive, and this relation changed when we included interactions between monetary policy rate and dynamic provisioning in our analyses. Therefore, we think a deeper and more advanced study is needed on this point, however the objective of this paper at a first step is the evaluation of the macro-prudential tool on credit growth. Moreover, it was found that depreciation rises significantly the non-performing loan rate in foreign currency, possibly due to the adverse impact of balance-sheet effect on financial position of people with currency missmatches.

Finally, we consider this document as an effort to attract more investigations on the ample range of macro-prudential policies implemented in Peru, which has other goals like mitigate currency risk of non-financial entities on bank asset quality. Especially, we believe that an empirical analysis using a general equilibrium framwork is needed, because all the trade-offs can be take into account.

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8 Appendix

Table 1
Regression Results for Equations 1 and 2.

	Equation 1		Equation 2	
	Coef.	p-value	Coef.	p-value
Macroeconomic controls				
Δ Exchange rate (t)	-0,065 *	0,10	-0,095 **	0,03
(t-1)	-0,203 ***	0,00	-0,204 ***	0,00
(t-2)	-0,148 ***	0,00	-0,099 *	0,07
(t-3)	0,146 ***	0,00	0,140 ***	0,01
Δ Interbank rate (t)	0,002	0,45	-0,001	0,81
(t-1)	0,004	0,14	0,009 **	0,02
(t-2)	0,009 ***	0,00	0,007 **	0,04
(t-3)	0,007 ***	0,00	0,017 ***	0,00
Δ Current Account (t)	-0,000007 ***	0,00	-0,000006 ***	0,00
(t-1)	0,000004 ***	0,01	0,000003 *	0,07
(t-2)	0,000004 **	0,02	0,000004 **	0,03
(t-3)	-0,000001	0,63	0,000000	0,83
Bank controls				
Capital Ratio (t)	0,001	0,51	0,001	0,60
(t-1)	-0,001	0,50	-0,001	0,67
(t-2)	0,005 ***	0,00	0,005 ***	0,00
(t-3)	-0,001	0,18	-0,001	0,28
Liquidity ratio (t)	0,000	0,24	0,000	0,12
(t-1)	0,000	0,41	0,000	0,69
(t-2)	0,000 ***	0,01	0,000 ***	0,01
(t-3)	0,000 **	0,02	0,000 **	0,02
Log (Total assets) (t)	-0,098 ***	0,00	-0,092 ***	0,00
(t-1)	0,090 ***	0,01	0,091 ***	0,01
(t-2)	-0,082 ***	0,01	-0,093 ***	0,00
(t-3)	-0,023	0,32	-0,008	0,73
Deposits to Liabilities (t)	0,000	0,35	0,000	0,43
(t-1)	0,002 ***	0,00	0,002 ***	0,00
(t-2)	-0,002 ***	0,00	-0,002 ***	0,00
(t-3)	0,001 ***	0,00	0,001 ***	0,00
Monetary conditions				
Reserve Requirement PEN (t)	-0,002 **	0,04	-0,003 ***	0,01
(t-1)	0,003 ***	0,01	0,003 ***	0,00
(t-2)	0,003 ***	0,01	0,003 ***	0,00
(t-3)	0,001	0,20	0,001	0,24
Reserve Requirement USD (t)	0,000	0,97	0,000	0,64
(t-1)	-0,002 ***	0,01	-0,002 **	0,03
(t-2)	-0,002 ***	0,01	-0,002 ***	0,00
(t-3)	0,002 ***	0,00	0,002 ***	0,00
Dynamic Provisions				
Prov (t)			-0,011 **	0,03
(t-1)	-0,014 ***	0,00	-0,009	0,06
(t-2)			-0,012 ***	0,01
(t-3)			0,010 ***	0,00
Others:				
Seasonal effects	Yes		Yes	
Constant	1,046 ***	0,00	0,938 ***	0
Number of banks	9		9	
Number of obs.	841 144		841 144	

Table 2
Regression Results for Equations 3 and 4.

	Equation 3		Equation 4	
	Coef.	p-value	Coef.	p-value
Macroeconomic controls				
Δ Exchange rate (t)	-0,069 *	0,08	-0,055	0,22
(t-1)	-0,124 **	0,02	-0,197 ***	0,00
(t-2)	-0,101 **	0,05	-0,095	0,12
(t-3)	0,227 ***	0,00	0,157 ***	0,01
Δ Interbank rate (t)	-0,001	0,82	-0,003	0,54
(t-1)	0,002	0,53	-0,002	0,67
(t-2)	0,010 ***	0,00	0,005	0,15
(t-3)	0,005 **	0,03	0,019 ***	0,00
Δ Current Account (t)	-0,000004 **	0,02	-0,000005 ***	0,01
(t-1)	0,000005 ***	0,00	0,000003 *	0,08
(t-2)	0,000005 ***	0,01	0,000005 ***	0,01
(t-3)	-0,000001	0,60	0,000002	0,31
Bank controls				
Capital Ratio (t)	0,001	0,62	0,001	0,46
(t-1)	0,000	0,88	0,000	0,90
(t-2)	0,005 ***	0,00	0,004 ***	0,01
(t-3)	-0,001	0,42	-0,001	0,39
Liquidity ratio (t)	0,000	0,25	0,000 **	0,02
(t-1)	0,000	0,24	0,000	0,23
(t-2)	0,000 **	0,04	0,000 **	0,02
(t-3)	0,000 *	0,06	0,000 ***	0,00
Log (Total assets) (t)	-0,101 ***	0,00	-0,093 ***	0,00
(t-1)	0,098 ***	0,00	0,099 ***	0,00
(t-2)	-0,080 ***	0,01	-0,075 **	0,02
(t-3)	-0,005	0,82	-0,012	0,64
Deposits to Liabilities (t)	0,000	0,42	-0,001	0,12
(t-1)	0,002 ***	0,00	0,002 ***	0,00
(t-2)	-0,002 ***	0,00	-0,002 ***	0,00
(t-3)	0,001 ***	0,00	0,001 ***	0,01
Monetary conditions				
Reserve Requirement PEN (t)	0,000	0,99	-0,002 *	0,10
(t-1)	0,003 ***	0,00	0,002	0,15
(t-2)	0,004 ***	0,00	0,005 ***	0,00
(t-3)	0,003 ***	0,01	0,004 ***	0,00
Reserve Requirement USD (t)	0,000	0,57	0,000	0,91
(t-1)	-0,002 ***	0,02	-0,001	0,20
(t-2)	-0,002 ***	0,02	-0,002 ***	0,00
(t-3)	0,002 ***	0,00	0,002 ***	0,00
Dynamic Provisions				
Tightening (t)			-0,036 ***	0,00
(t-1)	-0,040 ***	0,00	-0,029 **	0,05
(t-2)			0,004	0,80
(t-3)			0,009	0,58
Easiing (t)			-0,032 ***	0,01
(t-1)	-0,005	0,41	0,001	0,97
(t-2)			0,046 ***	0,01
(t-3)			-0,010	0,58
Others:				
Seasonal effects	Yes		Yes	
Constant	0,798 ***	0	0,752 ***	0,00
Number of banks	9		9	
Number of obs.	841 144		841 144	

Table 3
Regression Results for Equations 5 and 6.

	Equation 5		Equation 6	
	Coef.	p-value	Coef.	p-value
Macroeconomic controls				
Δ Exchange rate (t)	-0,072 *	0,08	-0,122 ***	0,01
(t-1)	-0,247 ***	0,00	-0,233 ***	0,00
(t-2)	-0,191 ***	0,00	-0,136 **	0,02
(t-3)	0,159 ***	0,00	0,155 ***	0,00
Δ Interbank rate (t)	0,002	0,59	0,001	0,79
(t-1)	0,005	0,27	0,006	0,16
(t-2)	0,005	0,17	0,005	0,12
(t-3)	0,013 ***	0,00	0,017 ***	0,00
Δ Current Account (t)	-0,000005 ***	0,01	-0,000004 **	0,02
(t-1)	0,000002	0,23	0,000002	0,27
(t-2)	0,000005 **	0,02	0,000004 **	0,05
(t-3)	0,000001	0,58	0,000001	0,64
Bank controls				
Capital Ratio (t)	0,003 **	0,03	0,002 *	0,06
(t-1)	-0,001	0,36	-0,001	0,49
(t-2)	0,006 ***	0,00	0,005 ***	0,00
(t-3)	-0,001	0,23	-0,001	0,32
Liquidity ratio (t)	0,000	0,21	0,000	0,14
(t-1)	0,000	0,36	0,000	0,61
(t-2)	0,000	0,13	0,000	0,25
(t-3)	0,000 ***	0,04	0,000	0,12
Log (Total assets) (t)	-0,089 ***	0,00	-0,084 ***	0,00
(t-1)	0,098 ***	0,00	0,104 ***	0,00
(t-2)	-0,107 ***	0,00	-0,117 ***	0,00
(t-3)	-0,014	0,56	-0,010	0,66
Deposits to Liabilities (t)	-0,001	0,19	0,000	0,55
(t-1)	0,002 ***	0,00	0,002 ***	0,00
(t-2)	-0,002 ***	0,00	-0,002 ***	0,00
(t-3)	0,001 ***	0,00	0,001 ***	0,00
Monetary conditions				
Reserve Requirement PEN (t)	-0,004 ***	0,00	-0,004 ***	0,00
(t-1)	0,003 ***	0,02	0,003 ***	0,00
(t-2)	0,004 ***	0,00	0,004 ***	0,00
(t-3)	0,001	0,55	0,000	0,78
Reserve Requirement USD (t)	0,000	0,75	0,000	0,65
(t-1)	-0,001 *	0,10	-0,001	0,21
(t-2)	-0,001 **	0,08	-0,001 *	0,06
(t-3)	0,003 ***	0,00	0,003 ***	0,00
Dynamic Provisions				
Prov (t)			0,037	0,46
(t-1)	-0,005	0,89	0,065	0,30
(t-2)			-0,152 ***	0,01
(t-3)			0,009 ***	0,01
Interactions between bank controls and macroprudential policy				
Prov (t) * Capital Ratio (t)	-0,005 ***	0,00	-0,005 ***	0,000
(t-1)	0,002	0,40	0,000	0,803
(t-2)	-0,003 **	0,05	-0,002	0,337
Prov (t) * Liquidity Ratio (t)	0,000	0,38	0,000	0,373
(t-1)	-0,001 ***	0,00	-0,001 ***	0,009
(t-2)	0,001 **	0,02	0,000 *	0,060
Prov (t) * Log (Total assets) (t)	0,003 *	0,06	0,002	0,360
(t-1)	0,000	0,89	-0,002	0,646
(t-2)	0,002	0,36	0,006 **	0,029
Prov (t) * Dep.to.Liabilities (t)	0,000	0,15	0,000	0,807
(t-1)	0,000	0,93	-0,001	0,315
(t-2)	0,000	0,78	0,001 **	0,047
Others:				
Seasonal effects	Yes		Yes	
Constant	1,01419 ***	0,000	0,965 ***	0,00
Number of banks	9		9	
Number of obs.	841 144		841 144	

Table 4
Regression Results for Equations 7 and 8.

	Equation 7		Equation 8	
	Coef.	p-value	Coef.	p-value
Macroeconomic controls				
Δ Exchange rate (t)	-0,120 **	0,04	-0,122 **	0,04
(t-1)	-0,372 ***	0,00	-0,211 **	0,02
(t-2)	-0,312 ***	0,00	-0,224 **	0,02
(t-3)	0,210 **	0,02	0,366 ***	0,00
Δ Interbank rate (t)	0,011	0,20	-0,003	0,78
(t-1)	-0,016 *	0,10	-0,023 **	0,02
(t-2)	-0,012 **	0,06	-0,015 **	0,02
(t-3)	0,010 **	0,06	0,029 ***	0,00
Δ Current Account (t)	0,000000	1,00	0,000	0,20
(t-1)	0,000004	0,13	0,000 *	0,09
(t-2)	0,000002	0,49	0,000	0,23
(t-3)	-0,000004	0,24	0,000	0,62
Bank controls				
Capital Ratio (t)	0,000	0,78	0,001	0,59
(t-1)	0,000	0,96	0,000	0,98
(t-2)	0,004 ***	0,01	0,004 ***	0,01
(t-3)	-0,001	0,23	-0,001	0,37
Liquidity ratio (t)	0,000 **	0,02	0,000 ***	0,00
(t-1)	0,000 *	0,07	0,000 *	0,07
(t-2)	0,000 *	0,09	0,000	0,13
(t-3)	0,000 ***	0,00	0,000 ***	0,00
Log (Total assets) (t)	-0,104 ***	0,00	-0,110 ***	0,00
(t-1)	0,111 ***	0,00	0,128 ***	0,00
(t-2)	-0,095 ***	0,00	-0,088 ***	0,01
(t-3)	-0,026	0,29	-0,025	0,30
Deposits to Liabilities (t)	-0,001 *	0,09	-0,001	0,12
(t-1)	0,002 ***	0,00	0,001 ***	0,01
(t-2)	-0,002 ***	0,00	-0,001 ***	0,00
(t-3)	0,001 ***	0,01	0,001 ***	0,00
Monetary conditions				
Reserve Requirement PEN (t)	-0,004 **	0,02	-0,003 *	0,09
(t-1)	0,002	0,21	0,003 **	0,04
(t-2)	0,006 ***	0,00	0,007 ***	0,00
(t-3)	0,003 ***	0,01	0,003 **	0,03
Reserve Requirement USD (t)	0,000	0,52	-0,001	0,38
(t-1)	-0,001	0,13	-0,001 *	0,06
(t-2)	-0,002 **	0,02	-0,002 ***	0,01
(t-3)	0,002 ***	0,00	0,002 ***	0,00
Dynamic Provisions				
Prov (t)			0,039 ***	0,01
(t-1)	-0,020 **	0,02	-0,056 ***	0,01
(t-2)			-0,051 ***	0,00
(t-3)			0,026 ***	0,00
Interactions between monetary policy and macroprudential policy				
Prov (t) * Interbank rate (t)	-0,092 ***	0,01	0,037 ***	0,00
(t-1)	0,113 ***	0,00	omitted	
(t-2)	-0,025 ***	0,01	***	
Prov (t) * Interbank rate (t-1)	0,040	0,25	0,017	0,46
Prov (t) * Interbank rate (t-2)	0,019	0,80	-0,103	0,24
Prov (t-1) * Interbank rate (t-1)	-0,076 **	0,02	0,048 **	0,04
Prov (t-1) * Interbank rate (t-2)	-0,023	0,76	0,047	0,61
Prov (t-2) * Interbank rate (t)	0,040	0,12	-0,045 ***	0,00
Prov (t-2) * Interbank rate (t-2)	-0,011	0,47	0,026 ***	0,00
Others:				
Seasonal effects	Yes		Yes	
Constant	1,097 **	0,00	0,921 **	0,00
Number of banks	9		9	
Number of obs.	841 144		841 144	

Table 5
Regression Results for Mortage Dollarization Rate.

	Contemporaneous Effect		First Lag Effect		Contemporaneous and Lagged Effects	
	Coef.	P-value	Coef.	P-value	Coef.	P-value
Macroeconomic controls						
Δ Exchange rate (t)	5,885	0,327	7,530	0,135	6,172	0,279
(t-1)	9,132 *	0,082	11,621 **	0,020	8,972	0,108
(t-2)	-2,997	0,459	0,228	0,958	0,918	0,837
(t-2)	10,963 ***	0,001	13,388 ***	0,000	14,374 ***	0,000
Δ Interbank rate (t)	-0,304	0,343	-0,298	0,349	-0,269	0,382
(t-1)	1,290 ***	0,001	1,229 ***	0,001	1,238 ***	0,001
(t-2)	-0,014	0,909	-0,078	0,535	-0,015	0,923
(t-3)	1,253 ***	0,000	1,226 ***	0,000	1,174 ***	0,000
Δ Gross Domestic Product (t)	80,436 ***	0,004	73,872 ***	0,007	28,824	0,318
(t-1)	-120,534 ***	0,003	-108,405 ***	0,007	-69,581 **	0,045
(t-2)	8,243	0,773	21,697	0,442	8,376	0,818
(t-3)	-77,699 **	0,016	-80,796 **	0,019	-60,325 **	0,039
Δ Current Account (t)	0,000	0,619	0,000	0,608	0,000	0,748
(t-1)	0,000	0,426	0,000	0,128	0,000 **	0,049
(t-2)	0,000	0,775	0,000	0,692	0,000	0,553
(t-3)	0,000	0,527	0,000	0,151	0,000 *	0,075
Reserve Requirements						
Foreign Currency (t)	0,033	0,454	0,024 **	0,563	0,018	0,665
(t-1)	0,081 *	0,088	0,072	0,123	0,063	0,198
(t-2)	-0,056	0,208	-0,056	0,184	-0,063	0,144
(t-3)	-0,026	0,433	-0,022	0,472	-0,029	0,347
Bank controls						
Capital Ratio (t)	-0,083	0,109	-0,100 *	0,065	-0,118 **	0,044
(t-1)	0,156 ***	0,006	0,159 ***	0,005	0,170 ***	0,002
(t-2)	-0,036	0,500	-0,020 **	0,699	-0,019	0,729
(t-3)	0,126 **	0,030	0,130 **	0,026	0,121 **	0,039
Liquidity ratio (t)	0,033	0,119	0,031	0,143	0,031	0,147
(t-1)	0,015	0,107	0,014 *	0,099	0,011	0,225
(t-2)	-0,006	0,641	-0,004 ***	0,743	-0,003	0,820
(t-3)	-0,035 **	0,046	-0,035 **	0,046	-0,035 **	0,041
Log (Total assets) (t)	-3,504 ***	0,007	-3,383 ***	0,007	-3,091 ***	0,008
(t-1)	0,292	0,717	0,295	0,639	0,221	0,696
(t-2)	0,374	0,647	0,480 **	0,529	0,436	0,548
(t-3)	2,317	0,115	2,313 *	0,088	2,098	0,112
PdDollar	-0,489	0,447			1,686	0,147
PdDollar (t-1)			-1,016 **	0,051	-2,362 ***	0,004
PdDollar (t-2)					0,785 *	0,098
PdDollar (t-3)					-1,130 *	0,085
Constant	2,964	0,576	0,808	0,869	1,389	0,783

Table 6
Regression Results for Mortage Non-Performing Loan Rate.

	Contemporaneous Effect		First Lag Effect		Contemporaneous and Lagged Effects	
	Coef.	P-value	Coef.	P-value	Coef.	P-value
Macroeconomic controls						
Δ Exchange rate (t)	-0,557	0,769	-2,108	0,514	-4,880 **	0,016
(t-1)	0,889	0,726	-1,214	0,547	-3,310 *	0,070
(t-2)	-16,152	0,252	-18,366	0,384	-36,929 **	0,024
(t-2)	-9,886 *	0,085	-3,989	0,448	-11,343 **	0,038
Δ Interbank rate (t)	0,330	0,300	0,330	0,435	0,852 **	0,017
(t-1)	-0,196	0,611	0,269	0,243	0,025	0,876
(t-2)	-0,272	0,439	0,154	0,350	-0,287	0,205
(t-3)	0,402	0,133	0,405	0,330	0,818 **	0,036
Δ Gross Domestic Product (t)	100,559 **	0,046	60,643	0,384	191,909 **	0,043
(t-1)	-84,464 **	0,046	-55,132	0,381	-195,840 **	0,049
(t-2)	15,452	0,447	-13,543	0,417	29,578	0,189
(t-3)	-68,776 **	0,032	-48,379	0,314	-132,325 **	0,041
Δ Current Account (t)	0,000	0,192	0,000	0,450	0,001 **	0,034
(t-1)	0,000	0,696	0,000	0,311	0,000	0,682
(t-2)	0,000	0,216	0,000	0,244	0,000	0,155
(t-3)	0,000	0,107	0,000	0,432	-0,001 **	0,028
Reserve Requirements						
Foreign Currency (t)	0,031	0,444	-0,014 **	0,081	0,038	0,361
(t-1)	0,061 **	0,050	0,037	0,282	0,072 *	0,053
(t-2)	0,008	0,582	0,009	0,348	0,010	0,562
(t-3)	0,016	0,359	0,005	0,556	0,024	0,428
Bank controls						
Capital Ratio (t)	0,005	0,522	0,005	0,575	0,005	0,523
(t-1)	0,005	0,379	-0,002	0,762	0,005	0,378
(t-2)	0,007	0,466	0,015 **	0,053	0,007	0,466
(t-3)	0,007	0,230	-0,010 **	0,043	0,007	0,230
Liquidity ratio (t)	-0,003	0,252	-0,001	0,390	-0,003	0,250
(t-1)	-0,002	0,500	-0,001	0,712	-0,002	0,500
(t-2)	0,006 **	0,069	0,007 ***	0,004	0,006 *	0,069
(t-3)	0,000	0,881	-0,004	0,126	0,000	0,883
Log (Total assets) (t)	0,321	0,225	0,141	0,418	0,320	0,225
(t-1)	0,104	0,517	0,158	0,381	0,104	0,516
(t-2)	-0,213	0,135	-0,397 **	0,016	-0,213	0,135
(t-3)	-0,214	0,231	0,096	0,489	-0,214	0,232
PdDollar	0,927 *	0,058			1,948 *	0,081
PdDollar (t-1)			0,591	0,390	omitted	
PdDollar (t-2)					-1,214 *	0,099
PdDollar (t-3)					0,685	0,218
Constant	-0,261	0,780	0,419	0,397	0,495	0,633