Macroprudential and Monetary Policy: Loan-Level Evidence from Reserve Requirements

Work in Progress

Cecilia Dassatti Camors* † José-Luis Peydró

November, 2013

Abstract

We analyze the impact of liquidity and reserve requirements on credit supply. For identification, we exploit a change in regulation in Uruguay – an increase of the requirements for short-term funding, especially from (retail and interbank market) non-resident funds – in conjunction with the credit register that follows all loans granted to non-financial firms. Following a difference-in-difference approach, we compare lending to the same firm before and after the policy change among banks with different exposure to the funds targeted by the policies. We find that restrictions to short-term deposits for banks imply a reduction of credit supply; more affected banks increase their exposure into riskier firms; and larger banks mitigate the effects. Our results suggest that foreign short-term capital inflows and liquidity requirements affect credit supply and risk-taking of banks.

*We are extremely grateful to the Central Bank of Uruguay for providing the data for this study. We thank Stephane Bonhomme, Marco Lombardi, Javier Suarez, Rafael Repullo, participants at The French Prudential Supervisory Authority conference on "Risk Taking in Financial Institutions, Regulation and the Real Economy", and seminar participants at the Federal Reserve Board, Central Bank of Uruguay and CEMFI for very helpful comments and suggestions.

†The views expressed in this article are the sole responsibility of their authors and do not compromise the institutional position of the Central Bank of Uruguay.

1 Introduction

According to Bernanke and Blinder's (1988) theory about the *bank lending channel of monetary policy*, imperfections in the banking sector may enable monetary policy to have an effective impact on economic activity through changes on banks' lending behavior. This is a consequence of a violation of Modigliani and Miller Theorem on the banking sector: monetary policy affects economic activity because banks are not indifferent as to the composition of the liability side of their balance sheets. For example, if the funds that are not subject to reserve requirements are also not covered by deposit insurance, banks will face an adverse selection problem that will disable their ability to fully substitute one unit of insured funds with one unit of non-reservable funds, hence their lending behavior can be affected. In particular, a shock to banks' insured deposit base (for example, through higher reserve requirements) cannot be frictionlessly offset with other sources of funding. Although several studies have attempted to test the bank lending channel of monetary policy, they have faced identification problems due to the aggregated data they use.

One lesson we have learned from the recent financial crisis is the increasing reliance of banks on short-term funding. When this is the case, banks don't fully internalize the costs associated with this maturity transformation. Although short-term funding has the advantage of flexibility (that contributes to the ability of a bank to quickly respond to an increase in the demand for loans), it also introduces refinancing risk. This opens the case for macroprudential policies which, by focusing on the common exposures among banks, complement the microprudential dimension of financial regulation.

During the last decades, the monetary authorities of Latin American economies have been very active in the use of reserve requirements with a macroprudential objetive, mainly because of their counter-cyclical role for smoothing the credit cycle and their ability to contain systemic risk. Despite the recent development of the economic debate on macroprudential policies, there is little empirical evidence on their impact (some exceptions will be discussed on Section 2). This paper sheds new light on how monetary policy can influence bank lending and real activity and contributes to the empirical discussion on the effectiveness and use of macroprudential tools to contain imbalances in the banking markets.[1] Following a difference-in-difference approach, we compare lending before and after the introduction of the policy changes among banks with different degrees of exposition to the funds targeted by the policies.

Uruguay offers an excellent setup to study these effects for two main reasons: the policy changes introduced on reserve and liquidity requirements in 2008, and the exhaustive credit registry of all granted loans in the system. On June 2008, the monetary authority of Uruguay introduced the following changes in the regulation associated to the percentage of funds that banks must keep as reserves on the Central

[1] A central bank has mainly two possible means to influence the money supply: it may change the target interest rate or it can change the reserve requirement applied to banks' deposits and hence the money multiplier (when a loan is extended, new money is created in the system through commercial banks, so the total money supply is usually a multiple larger than the money originally issued by the Central Bank).

Bank: an increase in reserve requirements for short-term deposits in both foreign and domestic currencies (10 and 8 percentage points respectively), an increase in the requirements for deposits from the non-financial non-resident sector (5 percentage points), and the introduction of a reserve requirement for funds from foreign banks (the same rate as for funds from non-residents).[2] These changes were implemented under a context of economic prosperity, a strong domestic demand, and threats of inflationary pressures derived from the high prices of the most relevant commodities for the Uruguayan economy. We have access to the Credit Registry of the Central Bank of Uruguay, which is an exhaustive dataset of all the loans granted by each bank. This dataset is complemented with bank balance-sheet information from all the institutions that report to the Central Bank of Uruguay in its role as regulator and supervisor of the banking system.

To study the effects on credit availability, we first match each loan with the relevant bank balance-sheet variables and then aggregate all the different loans between a bank-firm pair in each month in order to construct a measure of total committed lending from January 2007 to December 2008 (the sample starts on January 2007 in order to be able to perform placebo tests). By focusing on firms' borrowing from multiple banks, we follow a difference-in-difference approach which compares lending to the same firm before (May, 2008) and after (July, 2008) the policy change among banks with different degrees of exposition to the sources of funds targeted by the policies (Jiménez, Ongena, Peydró, Saurina, 2013). This will allow us to identify the effects of the new reserve requirements on the average supply of loans, both on the intensive and the extensive margins, and the heterogenous effects of these changes among different firm and bank characteristics.

The results on the intensive margin suggest that the higher reserve and liquidity requirements had a negative impact on non-financial firms through a cut in banks' loan supply. These effects are statistically and economically significant: a 10 percentage points increase on total reserve requirements translates into a cut in committed lending of 0,17%. When we analyze the impact of the introduced policies across different firm and bank characteristics we find that the cut in committed lending is lower for riskier firms and that larger banks are more capable of mitigating the effects of the policy. Moreover, we find that the higher reserve requirements have a positive effect on the probability that a firm ends a relationship with a (more affected) bank and starts a new relationship with a different banking institution.

The loan-level results suggest that the increase in reserve requirements tightened the supply of bank loans. However, some firms could have mitigated the negative effects of the lending channel by resorting to loans from banks less affected by the policy changes. In order to address this, we analyze the change in committed lending by all banks to a given firm between July and May, 2008. The results from the firm-level analysis suggest that firms with a higher credit rating are more able to mitigate the negative impact of the policy changes by changing banks.

[2] All these reserve requirements were not remunerated.

To summarize, the evidence presented in this paper is consistent with a scenario in which the main assumptions of the bank lending channel hold: Modigliani and Miller propositions are not satisfied for banks. Given the strong reliance of banks on short-term funding, one relevant policy question is whether the new standards on liquidity regulation proposed by Basel III will be associated with higher costs.

The rest of the paper proceeds as follows: Section 2 discusses the related literature, Section 3 introduces the data and the empirical strategy, Section 4 presents the results and Section 5 concludes with a discussion on some policy implications.

2 Literature Review

The Lending View of Monetary Policy

In 1988, Bernanke and Blinder developed a three asset model in order to prove that monetary policy can have a real impact through effects on the supply of bank loans. This "bank lending view" of monetary policy, hinges upon the notion that changes in the stance of monetary policy may be followed by movements in aggregate bank lending. The adverse selection problem that lies beneath the difference between insured and uninsured financing implies that banks' different degree of access to non-deposit funding has an important role on the effectiveness of this mechanism, hence, differences in the balance-sheet structure of banks should translate into different reactions to the monetary policy.

The two main ingredients of the lending channel of monetary policy are the failure of Modigliani-Miller's Theorem for banks and non-financial firms. On the banks side, this implies that banking institutions are not indifferent between different sources of funding. Stein (1998) developes the following argument: if the bank is not able to fully finance itself with insured deposits, this introduces an adverse selection problem. For example, if the funds that are not subject to reserve requirements are also not covered by deposit insurance, banks will face an adverse selection problem that will disable their ability to fully substitute one unit of insured funds with one unit of non-reservable funds. As a result, the lending behavior of banks can be affected through constraints on their ability to issue insured deposits. On the other side, another key ingredient for monetary policy to have an effect on the supply of loans is the failure of Modigliani-Miller's Theorem for non-financial firms, that is, some firms must be unable to frictionlessly substitute bank loans with alternative sources of funds. To be more precise, if some firms do not have access to the capital market and depend on bank loans to finance their projects, bonds and loans are not perfect substitutes. As a result, changes in the composition of banks' financing may have an effect on firms' investment decisions.

Although there are several studies that empirically address the implications of the lending channel of monetary policy, the debate is not fully settled. The common feature of all these studies is that they

base their analysis on aggregated data, which poses problems at the moment of disentangling loan-supply from loan-demand effects.

Naturally, one response was to advance one more step using disaggregated data in order to take into account the cross-sectional implications of the lending channel of monetary policy. The hypothesis beneath this approach is that some bank characteristics (such as size, liquidity and capitalization) have an impact only on the supply of loans, leaving unchanged the demand. Kashyap and Stein (1994), for instance, find results in line with the predictions of the lending view of monetary policy but, unfortunetely, this evidence also admits other interpretations. In particular, they find that a monetary contraction reduces the supply of bank loans while it increases the volume of commercial papers. However, although these results can be interpreted as evidence of the lending channel of monetary policy, they could also imply changes in the composition of loan demand: larger firms, with a better access to the capital market, could be demanding more credit. On a later study, Kashyap and Stein (1997), address the question of the transmission of monetary policy with a 20-year panel from US banks and find that the reaction to a contractionary monetary policy is stronger if banks have a less liquid balance sheet.

Finally, more recent studies, such as the one performed by Kwhaja and Mian (2008), explore on new methodologies in order to achieve a better identification of the bank lending channel: they focus on firms that borrow from more than one bank in order to have different degrees of exposition to the policy change (e.g. a firm may have a loan with two different banks: one with a bank with a high exposition to the policy change and one with a bank not exposed to it, hence one would expect the loan supply of the former to decline). They apply this methodology for a four-year panel on banks from Pakistan and find that a decline on banks' liquidity has a negative impact on the supply of loans both on the intensive and the extensive margins.

Macroprudential Policy

The recent financial crisis has called for the need to address systemic risk in financial markets. As Borio (2003) points out, in contrast to the microprudential policies that focus on individual institutions, the macroprudential approach of financial stability takes into account the interconnections and common exposures among institutions. Under this interpretation, the rationale for a macroprudential approach of financial regulation is to correct the market failures that may have a negative impact on the real sector.

The real and financial imbalances that accumulate during the so-called *build-up phase* of a financial crises carry with them negative implications when the process goes into reverse. A well-known example of these episodes are the banking crisis experienced in Latin America during the eighties and nineties. Goodhart and Perotti (2012) apply a historical analogy with the "Great Fire of London" that emphasizes in a very proper way the importance of assessing systemic risk: *"preventing fire propagation is more*

important than focusing on how to fight large fires once started". Given the propagation role of liquidity crises, the new features of financial regulation embodied into Basel III Accord aim to contribute to increase confidence on banks' ability to withstand liquidity shocks.

According to Blanchard (2013), the existing empirical evidence about the impact of macroprudential tools is still limited and mixed, being mainly represented by studies of the impact of dynamic provisions in Spain (Saurina, 2009; Jiménez, Ongena, Peydró, Saurina, 2013) and studies about the impact of LTV regulation (Crowe, Dell'Ariccia Igan, Rabanal, 2011). This opens the case for this study since it provides empirical evidence on the impact of macroprudential tools.

Credit Supply and Deposits

Finally, the different nature of the funds that banks manage on the liability side of their balance-sheets plays a role on the configuration of an incentive scheme that helps discipline the behavior of the banker. In particular, as Calomiris and Kahn emphasize (1991), depositors' right of early withdrawal and the eventual run on banks gives them the ability to monitor the behavior of the financial institutions. The rigid nature of deposits as a source of financing (based on the threat of a run by depositors, which refrains the bank from renegotiating) is the one that helps discipline the banker and enable him to comit to pay. However, as Rajan and Diamond (2000, 2001) stress, although short-term funding may increase the vulnerability to a financial crisis, banks need this type of funding in order to provide liquidity and credit. That is, it is the illiquid nature associtated to credit to problematic borrowers (with illiquid investment projects) and banks' ability to transform illiquid assets into liquid ones, what induce banks' reliance on short-term funding. One testable hypothesis from these teories, and for which there is no empirical evidence, is that restrictions to short-term funding of banks (deposits) imply a decrease in the supply of credit.

3 Data and Identification Strategy

Data

We have access to two datasets from the Central Bank of Uruguay in its role as banking regulator and supervisor. Both datasets cover the period from January 2007 to December 2008 and are available on a monthly frequency. The first dataset is the Credit Registry of the Central Bank of Uruguay (*Central de Riesgos*), which is an exhaustive record of all loans granted in the system with detailed information at the loan level. In particular, it contains information about the identity of the borrower, whether the borrower is a firm or a household, the country of residence, the economic sector to which it belongs, all the financial institutions with which he has a loan, the amount of the loan, the currency of the loan, its maturity, and the rating given by the bank to the firm. On the other hand, we also have access to

a dataset with balance sheet information for all the banks operating in the system during the period 2007-2008.

We focus on loans granted to non-financial private firms, making a total of 46.595 firms and 19 financial institutions for the total sample (years 2007 and 2008). Given that we focus only on loans granted to firms, this dataset is comprehensive, since the monthly reporting threshold is of approximately USD 1.500. The sample includes one public bank, 12 private commercial banks and 6 non-bank financial institutions. There is another public bank in the Uruguayan banking system, but it has been excluded from the sample since its main line of business are mortgages to households (while our focus is on loans granted to private firms) and it has experienced several restructures and recapitalizations.

During this period there were changes in the structure of the market. In particular, there was a fusion between two banks present in the Uruguayan banking system, and an acquisition of one bank by a foreign bank (not present in the country until that moment). Both cases were treated as if they were present from the beginning of the period (in order to avoid loosing the observations associated to the banks that disappeared).

Identification Strategy

Although the negative impact of the financial crisis led to a downwards revision of the projections about the performance of the developed economies, the growth figures for the emerging economies remained solid. Instead, the main concern for these economies were the inflationary pressures originated mainly by the higher prices of the commodities, context to which Uruguay was no stranger: the accumulated inflation rate for the year 2007 reached 8,50%. Under these conditions, the Uruguayan monetary authority introduced changes in the regulation of reserve requirements in order to reduce the amount of money in circulation.

This paper focuses on the effects of the increase in the reserve requirements introduced in Uruguay on June 2008. These can be summarized in three main changes: an increase in the reserve requirements for short-term deposits, an increase in the reserve requirements for deposits from agents from abroad (deposits from non-residents), and the introduction of a reserve requirement for funds from foreign banks.[3] Hence, the different degrees of exposition of banks to these three sources of funding will determine the intensity of the impact of the policy changes.

[3]The changes where introduced through the following acts of the Central Bank of Uruguay: "Circular 1991", "Circular 1992". In particular, the requirement for short-term local currency deposits increased 8 percentage points, while that for foreign currency deposits raised 10 percentage points. As a result, the requirements for short-term deposits in local and foreign currency went up to 25% and 35% respectively. In addition, the reserve requirement for deposits from non-residents increased 5 percentage points, reaching a level of 35%. Finally, the funds from foreign banks where included in the regulation for deposits from non-residents, so the reserve requirement for these funds went from zero to a rate of 35%.

One of the purposes of this paper is to study the effects of the policy changes on the average supply of loans. To do this, we match each loan with bank balance-sheet variables and aggregate all the different loans between a bank-firm pair, obtaining a measure of total committed lending for each bank-firm pair on each of the months of the total sample.

Following a difference-in-difference approach, we compare lending for the same firm before (May, 2008) and after (July, 2008) the policy change among banks that are more and less affected by the changes in the reserve requirements. One key aspect of the identification strategy is the focus on firms with more than one bank relationship; by analyzing the change in committed lending for the same firm, we can check if the firm experiences a higher drop in lending with the bank that is more exposed to the policy change. In addition, we analyze whether the effects of the policy changes were different across different firm and bank characteristics. That is, we want to check if the policy changes had effects, not only on the average supply of loans, but on the risk-taking behavior of banks.

Next, we analyze if the changes in the reserve requirements had some effect on credit continuation (extensive margin). For this, we define a binary variable that will take the value of 1 if a bank-firm relationship is not renewed after the policy change. To be more precise, our subsample in this case will include all the bank-firm loans included in the subsample for the intensive margin analysis plus all the bank-firm loans that terminated on the month after the policy is implemented. In addition, we check whether some firms changed their bank relationships between May and July and, in case they changed, if they turned to a less affected bank.

Finally, we ask whether some firms were able to mitigate the negative impacts of the policy changes by resorting to loans from less affected banks. The analysis at the firm level allows us to study the effects of the policy changes on firms' outcomes; that is, whether firms were able to substitute banks, resort to internal sources of finance or enter into financial distress.

Models

Policy Variable

We build our policy variable of interest taking into account the change in the reserve requirements for local and foreign currency deposits, deposits from foreign non-financial sector and deposits from foreign financial sector:

$STLC = \%Additional\ Reserve\ Req * (STLClevel)$
$STFC = \%Additional\ Reserve\ Req * (STFClevel)$
$NResi = \%Additional\ Reserve\ Req * (NResilevel)$
$FNResi = \%Additional\ Reserve\ Req * (FNResilevel)$
where

$STLClevel$=Deposits<30 days in local currency, both from residents and non-residents.
$STFClevel$=Deposits<181 days in foreign currency, only from residents.
$NResilevel$=Deposits<181 from Foreign Non-Financial Sector.
$FNResilevel$=Deposits<181 from Foreign Financial Sector.

We then add all the additional reserve requirement variables into one total variable and divide it by the total liabilities of the bank:

$$TotalAdditionalReserveRequirements = STLC + STFC + NResi + FNResi$$

$$\Delta ReserveReq_{bf,t-1} = \frac{TotalAdditionalReserveRequirements}{TotalLiabilities}$$

Intensive Margin of Lending - Average and Heterogenous Effects

For the analysis of the effects at the loan-level, we estimate two models. The first specification we estimate (Model 1) is the following:

$$\Delta logL_{bf,t+1} = \delta_i + \delta_s + \delta_r + \alpha_1 controls_{bf,t-1} + \alpha_2 \Delta ReserveReq_{bf,t-1} + \varepsilon_{bf,t+1} \quad (1)$$

where $\Delta logL_{bf,t+1}$ is the change in the logarithm of (strictly positive) committed credit by bank b to firm f.[4] δ_i are industry dummies, δ_s are size-debt dummies and δ_r are risk-type dummies [5] . The

[4]We winsorize the dependent variable of both specifications at the 1^{st} and 99^{th} percentile.
[5]According to the uruguayan regulation, a borrower will be classified into different categories according to the size of his debt. The borrower is a "highdebt borrower" if he has a debt with the bank that represents at least 10% of the minimum capital set by the regulation for banking institutions and the debt with the total system represents at least 15% of the

$controls_{bf,t-1}$ include bank characteristics, such as Size, Liquidity Ratio and Solvency Ratio, while $\Delta ReserveReq$ is our policy variable of interest (which stands for the ratio of total additional reserve requirements of the bank over total liabilities).

In Model 1, we regress the change in the log of committed credit in July 2008 with respect to May 2008 (the policy change takes effect on June 2008) on industry, firm-debt and firm-risk dummies, the already mentioned bank balance-sheet variables, and the policy variable of interest.

The second model we estimate (Model 2) includes firms fixed effects:

$$\Delta logL_{bf,t+1} = \delta_f + \alpha_1 controls_{bf,t-1} + \alpha_2 \Delta ReserveReq_{bf,t-1} + \varepsilon_{bf,t+1} \quad (2)$$

Both models are estimated for the sample of firms with more than one bank relationship (we also estimate the models for the sample of all bank-firm loans in order to check the external validity of the results).[6] In addition, given that the number of banks is low, clustering standard errors only at the bank level would introduce a downwards bias in their calculation, hence we decided to cluster standard errors at the bank*industry level (were we group industries into three main groups: Agriculture and Manufactures, Trade, and Rest) in order to have a greater number of clusters. The intuition behind this decision is that, while our policy variable varies across banks, it is also very likely that residuals will be correlated within firms belonging to the same industry group.

For robustness we will perform: placebo tests for months previous to the introduction of the policies and for the months after June 2008.[7] We also estimate both models for a sample excluding the public bank (given its nature and the fact that it represents almost 50% of the total banking system).

In addition to the analysis of the change in committed credit (average effects), we study whether these effects vary across different firm and bank characteristics. In particular, we add interactions of the policy variables with firm characteristics associated to the rating given by the bank and their classification according to the size of their debt.[8] We estimate the model for heterogenous effects across firm characteristics with firm fixed effects and firm and bank fixed effects. Moreover, we also estimate the heterogenous effects of the policy change across different bank characteristics, interacting the policy

minimum regulatory capital. Then, highdebt is a dummy that takes the value of one when the bank has reported the firm as a "highdebt borrower" and 0 if it is a "lowdebt borrower". On the other hand, the indicator for "highrisk" equals 1 if the firm has a rating of 3, 4 or 5, which are the categories for "compromised ability to pay", "very compromised ability to pay" and "irrecoverable debt".

[6] Given that the estimations are based on the sample of firms with more than one bank relationship (30% of the total sample), the results we obtain could be specific to these type of firms. In order to see the extent to which the results can be generalized to all the firms included in the sample, we estimate both models for the sample of all loans granted.

[7] The idea of the placebo tests is to check that the effect is indeed attributable to the policy changes introduced on June 2008, so we estimate the models with different time windows. If the effects on the supply of credit are attributable only to the changes on the reserve requirements of 2008, the estimated effects under the placebo tests should be insignificant.

[8] We group risk rating into 5 categories with 1 being the best and 5 the worst. On the other hand, *Highdebt* is a dummy that takes the value of one when the bank has reported the firm as a *"highdebt borrower"* and 0 if it is a *"lowdebt borrower"*.

variable with the three bank controls included in the models for the analysis of the average effects and also for a dummy variable that indicates if the bank is organized as a branch of a foreign institution.

Extensive Margin - Average and Heterogenous Effects:

Next, we analyze if the policy changes had some effect on the likelihood that a bank-firm pair is not renewed (extensive margin), as well as in the probability that a firm changes banks. Under a linear probability model, we study the average effects of the policy change on the probability that a loan that existed in period t-1 ends before period t+1. The model we estimate in this case is:

$$LEnd_{bf,t+1} = \delta_f + \alpha_1 controls_{bf,t-1} + \alpha_2 \Delta ReserveReq_{bf,t-1} + \varepsilon_{bf,t+1} \quad (3)$$

where:

$$LEnd_{t+1} = \begin{cases} 1, & \text{if a loan granted by bank b to firm f in period } s < t \text{ is ended in t} \\ 0, & \text{otherwise} \end{cases}$$

δ_f are firm fixed effects, $controls_{bf,t-1}$ includes bank variables (Size, Liquidity Ratio and Solvency Ratio) and $\Delta ReserveReq_{bf,t-1}$ is our policy variable.

In addition, the model we estimate for the likelihood of a firm changing its bank relationship between May and July is the following (that is, it starts a new relationship with a different bank on July and it doesn't continue the relationship with the bank from May):

$$LChange_{bf,t+1} = \delta_f + \alpha_1 controls_{bf,t-1} + \alpha_2 \Delta ReserveReq_{bf,t-1} + \varepsilon_{bf,t+1} \quad (4)$$

where:

$$LChange_{t+1} = \begin{cases} 1, & \text{if a firm changes bank between periods t and t+1} \\ 0, & \text{otherwise} \end{cases}$$

δ_f are firm fixed effects, $controls_{bf,t-1}$ includes bank variables (Size, Liquidity Ratio and Solvency Ratio) and $\Delta ReserveReq_{bf,t-1}$ is our policy variable.

Standard errors are again clustered at the bank and bank*industrygroup level for both external margin models.

Firm-Level Models

Another question is whether some type of firms were able to mitigate the negative impacts of the policy changes by substituting the loan supply of the affected banks with loans from banks less exposed to the funds targeted by the policy change. The setup in this case is:

$$\Delta logL_{f,t+1} = \delta_i + \alpha_1 controlsw_{f,t-1} + \alpha_2 \Delta ReserveReqw_{f,t-1} + \varepsilon_{f,t+1} \quad (5)$$

where $\Delta logL_{f,t+1}$ is the change in the logarithm of (strictly positive) committed credit by all banks to firm f, and δ_i are industry dummies.[9] The $controlsw_{f,t-1}$ include the same bank characteristics included under the loan-level analysis, and $\Delta ReserveReqw_{f,t-1}$is our policy variables of interest. Under the firm-level analysis, all the bank variables and the policy variable are calculated as a weighted average where the weights are given by the portion of loans granted by the banks that were lending to a given firm just before the policy reforms took place over the total loans granted to the firm. Moreover, we cluster standard errors at the mainbank level (the bank with the highest portion of loans granted to the firm over the total debt of the firm) and at the alternative cluster level (given by the interaction of the mainbank and the industry groups used for the loan-level models).

4 Results

Tables 1 to 4 display the estimates of the loan-level specifications for the sample of firms with more than one bank relationship (intensive margin). Table 1 presents the results for the estimation of the average effects of the policy changes, while Tables 2 to 4 show the estimates for the impact of the policy changes across different firm and bank characteristics (results of the estimations adding interaction terms of the policy variables with indicators of the risk and debt size of the firms and including bank fixed effects are given respectively in Tables 2 and 3, while Table 4 shows the results of the estimations adding interaction terms of the policy changes with bank characteristics). Next, Tables 5 to 7 display the results of the estimations for the extensive margin of both the average (Table 5) and heterogenous effects (adding interaction terms of the policy variables with firm characteristics in Table 6 and including also bank fixed effects in Table 7) of the policy changes for the sample of firms with more than one bank relationship.[10] Finally, Table 8 presents the estimates for the firm-level specification. Moreover, the results of the placebo tests performed under both specifications for the months before and after the policy changes are presented in Figures 1 to 4.[11]

Intensive Margin

Average Effects

[9] We winsorize the dependent variable of both specifications at the 1^{st} and 99^{th} percentile.

[10] The results of the estimations for the intensive and extensive margins under the total sample of firms are included in the Appendix.

[11] Supplementary graphs of placebo tests for more other time windows are inlcuded in the Appendix.

Under Model 1 (column (1) of Table 1), the coefficients of the policy variables for short-term funding and funding from foreign banks are both negative and statistically significant for the sample with multiple bank-firm characteristics, while the coefficient for funding from the non-resident non-financial sector, on the other hand, is positive and significant.[12]

The estimated effects under Model 1 suggest that the changes in the reserve requirements introduced in Uruguay during the first half of 2008 implied that banks with a higher exposition to the funds affected by the policy changes cut committed lending more than the less exposed banks. In terms of economic significance, these results mean that an increase of 10 pp in the reserve requirements for short-term deposits implies a cut in committed lending of 1,35%, while a 10 pp increase in the requirement for funds from foreign banks translates into a cut in lending of 0,11%. Meanwhile, a 10 pp increase in the reserve requirement for funding from the foreign non-financial sector implies an increase in lending of 0,29%.

When we analyze the effects under Model 2 (columns (2) and (3) of Table 4), the coefficients of the three policy variables are negative and statistically significant for the sample with multiple bank-firm characteristics.[13] As for the economic significance, these results imply that a 10 pp increase in the reserve requirements for short-term deposits translates into a cut in committed lending of 1,39%, while a 10 pp increase in the requirements for funds from non-residents and from foreign banks implies a cut in lending of 0,45% and 0,15% respectively.

It is important to stress the different impact among the three sources of funding. In particular, the main impact of the policy changes worked through short-term funding, which is consistent with the higher level of participation that these funds have on the liability side of the Uruguayan banking system.[14] In addition, the lower impact of the introduction of a reserve requirement for funds from foreign banks is compatible with the lower level of exposition of Uruguayan banks to this source of funding (although two institutions in particular display a high ratio of funds from foreign banks over total loans in June 2008). An unexpected result is the positive effect of the change in the reserve requirements for deposits from non-residents under the first specification. The comparison of this coefficient with that obtained under the second specification leads to conclude that accounting for firm unobserved characteristics (such as the degree of balance sheet dollarization or opennes to international trade) plays an important role in order to better identify the effect of the policy change on this particular source of funding.

[12]The coefficients for Short-Term Funding, Funding from Non-Residents and Funding from Foreign Banks are -0,135**, 0,029* and -0,011* respectively.

[13]The coefficients for Short-Term Funding, Funding from Non-Residents and Funding from Foreign Banks are -0,139*, -0,045** and -0,015** respectively.

[14]Before the financial crisis of 2002, the average ratio of short-term deposits over total deposits was 30%, while one of the characteristis of the Uruguayan banking system in the period after the crisis was the increasing participation of short-term deposits, reaching almost 80% of total deposits in June 2008

As a robustness check, we perform placebo tests for both specifications in order to check if the estimated effects are indeed attributable to the reforms introduced in the reserve requirements. Figures 1 to 12 display the estimated coefficients and its corresponding confidence intervals for the three policy changes by altering the time window for periods before and after the policy changes took place. We find that the estimated coefficients are statistically not significant under Model 2, while for Model 1 some coefficients are positive and statistically significant, meaning that the results are better for the second specification (if the effects are attributable to the policy changes, the estimated coefficients for different time windows should be insignificant).[15] In addition, we estimate the models with a dummy for public/private bank and also exluding the public bank (which represents almost 50% of the total banking system), and obtain the same results for the three policy variables.

Heterogenous Effects

In Tables 2 to 4 we report the results of the estimated effects across different bank and firm characteristics. The results under the first specification (column (1) of Table 2), show that higher risk firms related with banks more exposed to funds from foreign banks experienced a higher cut in lending (-0,028**). When the policy variables are interacted with the indicator for the size of the debt of the borrower, the estimates show a positive impact on firms related with banks more exposed to funding from the foreign non-financial sector (0,049**). Meanwhile, when we introduce bank fixed effects (column (1) of Table 3), the estimated coefficient for the interaction of the indicator of firms' risk with funds from foreign banks is -0,028**, while the coefficient of the interaction of non-resident funding with highdebt is 0,048**.

These results imply that the effect of the policy changes on the funds that come from abroad worked through a cut in lending for riskier firms and a possible reallocation of some of these funds to firms with a higher level of debt in the system. Moreover, given that the estimated coefficients under the specifications with bank fixed effects are similar, unobserved bank heterogeneity is unlikely to account for the variation in committed lending due to the policy changes.

Next, we analyze the results under the second specification (columns (2) and (3) of Tables 2 and 3), in which we also add interaction terms of the policy variables with indicators for: *highdebt*, *highrisk* and *highdebt*highrisk*. We find a negative effect of the policy changes associated to funds from abroad, but the results from this specification suggest that the effect worked through funds from the non-financial sector (-0.075*). The economic and statistical significance of the effects remain the same when we add industry dummies (column (3) of Table 2). In addition, we find a positive coefficient for the interaction of non-resident funding with *highdebt*highrisk* (0.115***) both under the specifications with and without industry dummies. Finally, when we estimate the effects with bank fixed effects we obtain a negative coefficient for the interaction of short-term funding with *highdebt*highrisk* (-0.508*) and a

[15] Out of 159 estimated coefficients, 92% of the cases are statistically not significant under Model 2, while 52% of the cases are statistically not significant under Model 1.

positive coefficient for the interaction with the policy variable associated with funds from non-residents (0.056**).

These results imply that if we account for firm and bank unobservable characteristics, banks that are more exposed to short-term funding will cut committed lending more to riskier firms with a higher level of debt in the banking system. This could be interpreted in the following way: banks that rely more on short-term funding, experience a stronger negative impact after the increase in reserve requirements; as a consequence, the restriction on the funds available to offer as loans could lead to an improvement of the pool of borrowers of these type of institutions. An interesting result is the positive coefficient for the interaction of the policy variable for non-resident funding with *highdebt*highrisk*, which may be explained by the higher risk-profile of the banks more exposed to funds from non-residents. [16]

Finally, we also analyze the change in committed lending across different bank characteristics. The most interesting result we obtain is reported in Table 4, where we interact the policy variables with a dummy for banks that are organized as branches of foreign banks (rather than subsidiaries).[17] We find that the policy changes associated to foreign funds from the non-financial sector affected more negatively the supply of loans of banks that are organized as branches of foreign institutions (-0.059*). This result is consistent with the profile of these institutions, since they are characterized by higher levels of exposition to foreign business.

Extensive Margin

Average Effects

In Table 5 we analyze the average effects of the policy changes on the probability that the bank-firm relationship ends (extensive margin). That is, the question now is whether the frequency with which a bank-firm relationship is not renewed is higher for banks more exposed to the policy changes. Under the first specification (column (1) of Table 8), we find a negative coefficient for the policy variable associated to short-term funding (-0,606***) and a positive coefficient for the policy variable of non-residents' funding (0,037**). These results suggest that a 1% reduction in short-term funding leads to a 61 basis points increase in the probability that a loan is not renewed. On the other hand, a 1% reduction in funds from non-residents leads to a 4 basis points decrease in the probability that a loan is not renewed.

When we account for firm unobservable characteristics (columns (2) and (3) of Table 5), the negative impact of the higher reserve requirements on short-term funding and on non-residents' funding remain statistically and economically significant (-0.670*** and 0.036** respectively). We obtain similar results

[16] One of the main characteristics of the Uruguayan banking system on the onset of the financial crisis of 2002 was the high level of participation of deposits from non-residents over total deposits (especially from Argentina), reaching almost 50% on December 2001. The negative consequences of the massive withdrawals of these funds during the crisis led to the introduction of prudential policies in order to prevent the systemic risks associated to them.

[17] During the period covered by the sample, three banks were organized as branches.

when we add industry dummies (column (3) of Table 5). Hence, the results for the second specification imply that a 1% reduction in short-term funding leads to a 67 basis points increase in the probability that a bank-firm relationship ends, while a 1% reduction in funds from non-residents implies a 4 basis points reduction in the probability that a loan is not renewed.

Heterogenous Effects

The results for the heterogenous effects on the extensive margin are reported in Tables 6 and 7. Although the signs of the average effects remain the same, we don't find statistically significant effects of the policies. Overall, the results for the extensive margin are somehow weak, given that the analysis is based only on the immediate or short-run effects of the policy changes. Given this time horizon, it is very unlikely that a bank-firm relationship that existed on June 2008 would stop existing on July 2008. However, since two months later our sample includes the events associated with Lehman Brother's Bankruptcy, we decided to focus only on the short-run effects of the policies.

External Validity

Given our focus on firms with more than one bank relationship and the fact that these represent around 30% of our sample, this could rise concerns about the external validity of the results. In order to analyze this, we estimate the models for the whole sample of bank-firm loans (Tables 9 to 14).

We find that the main results hold for the whole sample. In particular, the results for the intensive margin hold both for the average effects and the heterogenous effects (although the coefficients for the average effects of the first two policy variables are not statistically significant under Model 1). The larger coefficients found for the full sample suggest that the bank lending channel may be larger for firms related with a single bank, possibly because these firms may be more subject to a hold-up problem. Meanwhile, when we study the effects of the policy changes on the extensive margin, we find similar results for the average effects but not for the heterogenous effects.

Firm-Level Analysis

As was previously discussed, the results at the loan-level imply that the policy changes on reserve requirements introduced in Uruguay during the first half of 2008 tightened the supply of credit from banks. An interesting question now is whether some firms were able to mitigate these effects by resorting to loans from less affected institutions.

The results from the firm-level models (Table 11) show that, while all firms face a bank lending channel, those firms with a higher level of debt in the system are the ones less able to insulate from the negative impact of the policy changes (-0.141*). This result could be explained by a higher level of

bank dependence of these type of firms, which would make them more exposed to the lending channel of monetary policy.

On the other hand, when we focus on the level of risk associated to firms, in contrast to what we would have expected, we find that higher risk firms experienced a positive impact from the introduction of reserve requirements on funds from foreign banks (0.124*). This is consistent with Diamond and Rajan (JPE, 2001) and Calomiris and Kahn (AER, 1991) predictions: riskier projects are financed with short-term funds. As was discussed in Section 2, projects with potentially low creditworthiness tend to be financed with short-term funding such as funds from other banks. So, given that a higher reserve requirement on these funds diminishes the amount of funds that banks have available to lend, the positive impact we find could be associated to a reallocation of these funds to the less liquid and hence riskier projects.

The results at the firm-level suggest that these policy changes may have an impact on the real sector. In future work we will further analyze the effects of the higher reserve requirements on firms' decisions, complementing the datasets we have with a survey with balance-sheet information for a sample of non-financial firms.

5 Conclusions

Although the use of reserve and liquidity requirements as macroprudential tools has been very popular in Latin American economies, there's little evidence about the impact of these policies. In this paper, we study the role of reserve and liquidity requirements as macroprudential tools. In particular, we analyze the effects of the increase in the reserve requirements for different sources of funding on the average supply of credit and on the risk-taking behavior of banks.

Uruguay offers an excellent setting to study these effects given the changes introduced in the regulation regarding reserve reguirements in June, 2008 and the comprehensive datasets we have access to. We use a difference-in-difference approach comparing lending before and after the introduction of the policy changes among banks with different degrees of exposition to the funds targeted by the policies.

The results on the intensive margin suggest that the main assumptions of the bank lending channel of monetary policy hold: Modigliani and Miller propositions are not satisfied for banks. In particular, increases in reserve and liquidity requirements for different sources of funding (short-term funding, funds from the foreign non-financial sector and funds from foreign banks) have an impact on non-financial firms through changes in banks' lending behavior. The cut in committed lending is higher for firms with higher levels of risk and debt in the system and that are more related to banks that rely more on short-term funding. In addition, when analyzing the effect of the policies across different bank characteristics, we

find that those banks organized as branches of foreign institutions were the ones more affected by the increase in reserve requirements for funds from the non-financial foreign sector. However, given the focus on the short-run effects of the policies, the impacts on the extensive margin are not as significant as those found in the intensive margin.

These policies may also have real costs for corporate firms. When we analyze the effects of the higher reserve requirements at the firm level, we find that firms with a higher level of debt in the system are less able to insulate from the negative impact of the policy changes. This is a relevant conclusion for an economy like Uruguay, where the development of the capital market is in a very early stage and, as a consecuence, bank financing plays a key role in the investment decisions of firms.

The results of this study entail policy implications for macroprudential regulation. Although restrictions to short-term funding by banks may contribute to prevent threats that can later translate into risk propagation among the banking system, the strong reliance of banks on these type of funds plays an important role on the lending behavior of these institutions. As a consequence, the new standards proposed by Basel III may have a cost and, as predicted by Diamond and Rajan (JPE, 2001) and Calomiris and Kahn (AER, 1991), restrictions to short-term finance from banks imply a reduction of credit availability.

6 References

Bernanke, Ben and Blinder, Alan (1988), "Credit, Money, and Aggregate Demand", *American Economic Review, 78(2): 435-439.*

Blanchard, Olivier, Dell'Ariccia Giovanni, Mauro, Paolo (2013), "Rethinking Macro Policy II: Getting Granular", *IMF Staff Discussion Note.*

Borio, Claudio (2003), "Towards a Macroprudential Framework for Financial Supervision and Regulation", *Bank for International Settlements (BIS), WP Nº 128.*

Calomiris, Charles and Kahn, Charles (1991), "Role of Demandable Debt in Structuring Optimal Banking Arrangements", *American Economic Review, 81(3): 497-513..*

BCU, Regulation Acts from the Central Bank of Uruguay.
http://www3.bcu.gub.uy/a22.html.

Gambacorta, Leonardo, and David Marques-Ibanez (2011), "The Bank Lending Channel: Lessons from the Crisis", *Bank for International Settlements (BIS), WP Nº 345.*

Goodhart, Charles, and Perotti, Enrico (2012), "Preventive Macroprudential Policy", Column Vox.eu

Hanson, Samuel, Kashyap, Anil, Stein, Jeremy (2011), "A Macroprudential Approach to Financial Regulation", *Journal of Economic Perspectives 25, 3-28.*

Jiménez, Gabriel, Ongena, Steven, Peydró, José-Luis, Saurina (2013), "Macroprudential Policy, Countercyclical Bank Capital Buffers and Credit Supply: Evidence from the Spanish Dynamic Provisioning Experiments", *European Banking Center Discussion Paper Nº 2012-011.*

Jiménez, Gabriel, Ongena, Steven, Peydró, José-Luis, Saurina (2012), "Credit Supply and Monetary Policy: Identifying the Bank Balance-Sheet Channel with Loan Applications", *American Economic Review 102. 2301-2326.*

Kashyap, Anil, and Stein, Jeremy (2000), "What do a Million Observations on Banks Say About the Transmission of Monetary Policy", *American Economic Review 90(3): 407-428.*

Khwaja, Asim, and Mian, Atif (2008), "Tracing the Impact of Bank Liquidity Shocks: Evidence from and Emerging Market", *American Economic Review 98(4): 1413-1442.*

Stein, Jeremy (1998), "An Adverse Selection Model of Bank Asset and Liability Management with Im-

plications for the Transmission of Monetary Policy", *RAND Journal of Economics 29(3): 466-486.*

Rajan, Raghuram, and Diamond, Douglas (2001), "Liquidity Risk, Liquidity Creation, and Financial Fragility: A Theory of Banking", *Journal of Political Economy 109(2): 287-327.*

Rajan, Raghuram, and Diamond, Douglas (2001), "Banks, Short Term Debt and Financial Crises: Theory, Policy Implications and Applications", *Carnegie-Rochester Conference Series on Public Policy, 54(1): 37-71.*

7 Tables and Figures

Table 1: Panel A

Loan-Level Analysis	**Variable Definition**
Dependent Variables (bank-firm)	
$\Delta logL_{bf,t+1}$	Change in the logarithm of (strictly positive) committed credit granted by bank b to firm f between t-1 and t+1.
$LEnd_{bf,t+1}$	=1 if the bank-firm relationship ends during the period (t-1,t+1), =0 otherwise.
$LChange_{bf,t+1}$	=1 if the firm changes its bank relationship (and doesn't continue with the previous one) during the period (t-1,t+1), =0 otherwise.
Policy Variables	
ΔReserveReq	Ratio of bank's total additional reserve requirements over total liabilities. Banks' additional reserve requirements is the sum of the change in reserve requirements for: short-term local currency deposits, short-term foreign currency deposits, deposits from foreign non-financial sector, and deposits from foreign financial sector.
Bank-Level Variables	
Size	Logarithm of total assets of bank b at t-1.
Liquidity	Ratio of Available Liquidity over Total Assets of bank b at t-1. The Available Liquidity includes liquid assets in excess to the liquidity in the Central Bank of Uruguay plus assets portfolio (excluding the portfolio of securities that cannot be sold but held until investment).
Solvency	$=(Eligible\ Capital/RWA$ of bank b at t-1.
Branch	=1 if bank b is organized as a branch of a foreign bank, =0 otherwise.
Loan-Level Variables	
Highdebt	=1 if firm f is classified as a "highdebt" borrower, =0 otherwise.
Rating 1	=1 if firm f has a rating of 1A ("borrower with loan fully covered by warranty") and 1C ("borrower with strong capacity to pay"), =0 otherwise. Best Rating.
Rating 2	=1 if firm f has a rating of 2A ("borrower with adequate capacity to pay", delay in payment<30 days) and 2B ("borrower with potential problems to pay", delay in payment<60 days), =0 otherwise.
Rating 3	=1 if firm f has a rating of 3 ("borrower with compromised capacity to pay", delay in payment<120 days), =0 otherwise.
Rating 4	=1 if firm f has a rating of 4 ("borrower with very compromised capacity to pay", delay in payment<180 days), =0 otherwise.
Rating 5	=1 if firm f has a rating of 5 ("irrecoverable debt", delay in payment≥ 180 days), =0 otherwise. Worst Rating.
Firm-Level Analysis	**Variable Definition**
Dependent Variables (bank-firm)	
$\Delta logFL_{f,t+1}$	Change in the logarithm of (stricly positive) committed credit granted by all banks to firm f between t-1 and t+1.
Policy Variable	
ΔReserveReqw	Ratio of additional reserve requirements over assets for all the banks that were lending to the firm on May, 2008. Each bank value of the ratio is weighted by its loan volume to the firm on May, 2008 over total the total firm debt.

Table 1: Panel B

Variable	Mean	Std. Dev.	Min.	Max.
Dependent Variables				
ΔlogLjul08	0.018	0.579	-5.659	11.889
LEndjul08	0.0975	0.297	0	1
LChangejul08	0.003	0.053	0	1
ΔlogFLjul08	0.01	0.373	-6.658	3.138
Independent Variables				
ΔReserveReq	0.071	0.03	0	0.143
Ln(Total Assets)	5.424	1.82	2.639	8.908
Liquidity Ratio	0.183	0.139	0.047	0.491
Solvency Ratio	0.315	0.247	0.104	0.999
STLCratio	0.007	0.007	0	0.026
STFCratio	0.028	0.02	0	0.055
NResiratio	0.016	0.014	0	0.04
FNResiratio	0.02	0.029	0	0.112
STLC Deposits over Total Assets	0.074	0.069	0	0.234
STFC Deposits over Total Assets	0.247	0.183	0	0.507
NResi Deposits over Total Assets	0.237	0.187	0	0.517
FNResi Deposits over Total Assets	0.042	0.058	0	0.246
Loan-Level Variables				
Ln(Loan Amount)	14.882	1.931	11.009	22.313
Rating 1	0.438	0.496	0	1
Rating 2	0.222	0.416	0	1
Rating 3	0.071	0.256	0	1
Rating 4	0.053	0.224	0	1
Rating 5	0.217	0.412	0	1
Primary and Manufacturing Sector	0.418	0.493	0	1
Trade	0.3	0.458	0	1
Others	0.281	0.45	0	1

Table 2: Loan-Level Intensive Margin of Lending: Average Effects

	$\Delta logL_{bf,t+1}$ (Jul-May)				$\Delta logL_{bf,t+1}$(May-Mar)	$\Delta logL_{bf,t+1}$(Sep-Jul)	$\Delta logL_{bf,t+1}$ (Jul-May)
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta ReserveReq$	-0.307**	-0.342***	-0.277**	-0.278*	-0.018	-0.126	-0.166*
	(0.145)	(0.111)	(0.129)	(0.135)	(0.160)	(0.154)	(0.096)
Industry/debt/risk Fixed Effects	No	Yes	Yes	><	><	><	><
Firm Fixed Effects	No	No	No	Yes	Yes	Yes	Yes
Bank Controls	No	No	Yes	No	No	No	Yes
Number of Observations	9659	9659	9659	9659	9605	9957	9659

NOTE. The dependent variable is the change in the logarithm of (strictly positive) committed credit by bank b to firm f between july and may (where the policy change t is june). The policy variable $\Delta ReserveReq$ is the ratio of the change in bank's total reserve requirements (on short-term local currency deposits, short-term foerign currency deposits, deposits from foreign non-financial sector and deposits from foreign financial sector) over Total Liabilities. The estimations are performed for the sample of firms with more than one bank relationship. Standard errors are clustered at the bank*industry-group level (where the industry groups are: Primary and Manufactures, Trade, Rest). Columns (5) and (6) display the results of the estimations for the placebo tests performed for previous and posterior periods. "Yes" indicates that the set of characteristics of fixed effects is included. "No" indicates that the set of characteristics or fixed effects is not included. "><" indicates that the indicated set of characteristics or fixed effects are comprised in the wider included set of fixed effects. * Significant at 10 %,** Significant at 5 %,*** Significant at 1 %.

Table 3: Loan-Level Intensive Margin of Lending: Heterogenous Effects

Dependent Variable: $\Delta logL_{bf,t+1}$									
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\Delta ReserveReq$	-0.275	-0.562***		-2.002***	-0.487	-0.552*	-0.134	-0.830***	-0.896**
	(0.187)	(0.160)		(0.569)	(0.497)	(0.282)	(0.105)	(0.176)	(0.357)
$\Delta ReserveReq$*Rating2	0.301	0.886***	0.643**						0.554*
	(0.300)	(0.221)	(0.254)						(0.277)
$\Delta ReserveReq$*Rating3	-0.111	0.089	0.399						0.250
	(0.214)	(0.401)	(0.650)						(0.658)
$\Delta ReserveReq$*Rating4	-0.635	-0.185	0.167						0.136
	(0.622)	(0.556)	(0.635)						(0.697)
$\Delta ReserveReq$*Rating5	0.414**	0.662***	0.557**						0.756***
	(0.189)	(0.169)	(0.257)						(0.216)
$\Delta ReserveReq$*Highdebt	0.847	1.625	2.180						2.078
	(2.148)	(2.062)	(2.605)						(2.524)
$\Delta ReserveReq$*Size				0.490***				0.228***	0.155**
				(0.159)				(0.041)	(0.070)
$\Delta ReserveReq$*Liquidity					3025			0.407	0.766
					(4.041)			(1.133)	(1.446)
$\Delta ReserveReq$*Solvency						2754		-1.281**	-2.456*
						(1.817)		(0.614)	(1.231)
$\Delta ReserveReq$*Branch							1381	1469	0.342
							(0.932)	(1.268)	(1.366)
Firm Fixed Effects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	No	No	Yes	−−	−−	−−	−−	−−	−−
Firm-risk Controls	Yes	><	><	><	><	><	><	><	><
Bank Controls	No	No	><	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	9659	9659	9659	9659	9659	9659	9659	9659	9659

NOTE. The dependent variable is the change in the logarithm of (strictly positive) committed credit by bank b to firm f between july and may (where the policy change t is june). The policy variable $\Delta ReserveReq$ is the ratio of the change in bank's total reserve requirements (on short-term local currency deposits, short-term foerign currency deposits, deposits from foreign non-financial sector and deposits from foreign financial sector) over total Liabilities. The estimations are performed for the sample of firms with more than one bank relationship. Standard errors are clustered at the bank*firm-risk level (where risk level is low if the firm's rating is 1 or 2, and high if the rating is 3, 4 or 5). "Yes" indicates that the set of characteristics of fixed effects is included. "No" indicates that the set of characteristics or fixed effects is not included. "><" indicates that the indicated set of characteristics or fixed effects are comprised in the wider included set of fixed effects. "−−" indicates that the set of fixed effects cannot be included. * Significant at 10 %,** Significant at 5 %,*** Significant at 1 %.

Table 4: Loan-Level Extensive Margin of New Loans - Panel A

Dependent Variable: $LChange_{bf,t+1}$					
Model	(1)	(2)	(3)	(4)	(5)
$\Delta ReserveReq$	0.037**	0.022		0.064**	0.097
	(0.013)	(0.021)		(0.024)	(0.065)
$\Delta ReserveReq$*Rating2			0.124		0.134
			(0.097)		(0.091)
$\Delta ReserveReq$*Rating3			0.011		-0.000
			(0.043)		(0.058)
$\Delta ReserveReq$*Rating4			-0.200*		-0.244**
			(0.116)		(0.120)
$\Delta ReserveReq$*Rating5			0.053		-0.059
			(0.039)		(0.053)
$\Delta ReserveReq$*Highdebt			-0.048		0.027
			(0.107)		(0.069)
$\Delta ReserveReq$*Size				-0.015*	-0.029
				(0.008)	(0.018)
$\Delta ReserveReq$*Liquidity				0.076	-0.208
				(0.197)	(0.302)
$\Delta ReserveReq$*Solvency				0.064	0.547
				(0.136)	(0.357)
$\Delta ReserveReq$*Branch				-0.280*	-0.317**
				(0.146)	(0.129)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	No	−−	Yes	Yes	−−
Firm-Risk Controls	><	><	><	><	><
Bank Controls	No	Yes	><	><	Yes
Number of Observations	9686	9686	9686	9686	9686

Note: the dependent variable takes the value of 1 if a firm changes bank between period $t-1$ and period $t+1$ (and doesn't continue the relationship with the bank from May), and 0 otherwise (where the policy change t is june). The policy variable $\Delta ReserveReq$ is the ratio of the change in bank's total reserve requirements (on short-term local currency deposits, short-term foreign currency deposits, deposits from foreign non-financial sector and deposits from foreign financial sector) over total Liabilities. The estimations are performed for the sample of firms with more than one bank relationship. Standard errors are clustered at the bank*firm-risk level (where risk level is low if the firm's rating is 1 or 2, and high if the rating is 3, 4 or 5). "Yes" indicates that the set of characteristics of fixed effects is included. "No" indicates that the set of characteristics or fixed effects is not included. "><" indicates that the indicated set of characteristics or fixed effects are comprised in the wider included set of fixed effects. "−−" indicates that the set of fixed effects cannot be included. * Significant at 10 %,** Significant at 5 %,*** Significant at 1 %.

Table 4: Loan-Level Extensive Margin of Ending Loans - Panel B

Dependent Variable: $LEnd_{bf,t+1}$					
Model	(1)	(2)	(3)	(4)	(5)
$\Delta ReserveReq$	0.159***	0.090**		0.283***	0.190
	(0.022)	(0.037)		(0.084)	(0.124)
$\Delta ReserveReq$*Rating2			0.334**		0.355**
			(0.150)		(0.168)
$\Delta ReserveReq$*Rating3			0.260		0.279
			(0.245)		(0.251)
$\Delta ReserveReq$*Rating4			0.546**		0.493*
			(0.262)		(0.250)
$\Delta ReserveReq$*Rating5			0.171		0.022
			(0.123)		(0.086)
$\Delta ReserveReq$*Highdebt			1.310		1.379
			(1.064)		(1.050)
$\Delta ReserveReq$*Size				-0.041	-0.067*
				(0.024)	(0.035)
$\Delta ReserveReq$*Liquidity				-0.040	0.645
				(0.291)	(0.494)
$\Delta ReserveReq$*Solvency				-0.060	-0.080
				(0.168)	(0.390)
$\Delta ReserveReq$*Branch				-0.812	-1.160*
				(0.553)	(0.671)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	No	−−	Yes	Yes	−−
Firm-Risk Controls	><	><	><	><	><
Bank Controls	No	Yes	><	><	Yes
Number of Observations	10703	10703	10703	10703	10703

Note: the dependent variable takes the value of 1 if a a bank-firm relationship that existed in period $t-1$ ends in period $t+1$ and 0 otherwise (where the policy change t is june). The policy variable $\Delta ReserveReq$ is the ratio of the change in bank's total reserve requirements (on short-term local currency deposits, short-term foerign currency deposits, deposits from foreign non-financial sector and deposits from foreign financial sector) over total Liabilities. The estimations are performed for the sample of firms with more than one bank relationship. Standard errors are clustered at the bank*firm-risk level (where risk level is low if the firm's rating is 1 or 2, and high if the rating is 3, 4 or 5). "Yes" indicates that the set of characteristics of fixed effects is included. "No" indicates that the set of characteristics or fixed effects is not included. "><" indicates that the indicated set of characteristics or fixed effects are comprised in the wider included set of fixed effects. "−−" indicates that the set of fixed effects cannot be included. * Significant at 10 %,** Significant at 5 %,*** Significant at 1 %.

Table 5: Firm-Level Analysis

Dependent Variable: $\Delta logFL_{f,t+1}$					
Model	(1)	(2)	(3)	(4)	(5)
$\Delta ReserveReq$	-0.280*	-0.302	-0.308	-0.338	-0.491
	(0.150)	(0.524)	(0.349)	(1.659)	(2.010)
$\Delta ReserveReq$*Rating2		1.067**	0.793*		0.982**
		(0.459)	(0.412)		(0.390)
$\Delta ReserveReq$*Rating3		-0.159	-0.464		-0.134
		(0.805)	(0.639)		(0.549)
$\Delta ReserveReq$*Rating4		-0.767	0.259		-0.714
		(0.948)	(0.572)		(0.547)
$\Delta ReserveReq$*Rating5		0.408	0.535		0.460
		(0.563)	(0.369)		(0.364)
$\Delta ReserveReq$*Highdebt		0.947	-0.351		0.612
		(0.828)	(1.419)		(0.868)
$\Delta ReserveReq$*Size				0.155***	0.081**
				(0.041)	(0.038)
$\Delta ReserveReq$*Liquidity				0.167	0.022
				(1.078)	(0.813)
$\Delta ReserveReq$*Solvency				-0.266	0.029
				(0.949)	(0.660)
$\Delta ReserveReq$*Branch				-0.357	-0.061
				(1.582)	(1.674)
Industry Dummies	Yes	Yes	Yes	Yes	Yes
Bank Controls	No	No	Yes	Yes	Yes
Number of Observations	4288	4288	4288	4288	4288

Note: the dependent variable is the change in the logarithm of (strictly positive) committed cedit by all banks to firm f between july and may (where the policy change t is june). The estimations are performed for the same firms that are included in the loan-level analysis. Under the firm-level specification, all the bank variables are calculated as a weighted average where the weights are given by the portion of loans granted by the banks that were lending to a given firm just before the policy reforms took place (May, 2008) over the total loans granted to the firm. Standard errors are clustered at the bank*firm-risk level (where risk level is low if the firm's rating is 1 or 2, and high if the rating is 3, 4 or 5). The policy variable $\Delta ReserveReqw$ is the weighted average of the ratio of the change in bank's total reserve requirements (on short-term local currency deposits, short-term foerign currency deposits, deposits from foreign non-financial sector and deposits from foreign financial sector) over total Liabilities. Standard errors are clustered at the mainbank*firm-risk level (where the risk level is low if the firm's rating is 1 or 2, and high if the rating is 3, 4 or 5 and the mainbank is the bank with the highest portion of loans granted to the firm on May, 2008). "Yes" indicates that the set of characteristics of fixed effects is included. "No" indicates that the set of characteristics or fixed effects is not included. * Significant at 10 %,** Significant at 5 %,*** Significant at 1 %.