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

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Abstract

During the first half of 2008, the Central Bank of Uruguay introduced changes in the regulation of reserve and liquidity requirements, increasing the requirements for short-term funding and funding from non-residents as well as introducing a requirement for interbank funding. The combination of theses reforms with data that follows all loans granted to non-financial firms in Uruguay allow us to identify their impact on the supply of credit. 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. The results suggest that restrictions to short-term finance from banks imply a reduction of credit availability as predicted by Diamond and Rajan (JPE, 2001) and Calomiris and Kahn (AER, 1991).

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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 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 imply a cut in lending of 0,45% and 0,15% respectively. When we analyze the impact of the policies across different firm characteristics we find that the cut in committed lending is higher for riskier firms that hold a relationship with banks more exposed to foreign funding. Moreover, when we account for firm and bank unobserved characteristics, we find that higher risk firms that display higher levels of debt in the system experience a higher cut in lending by banks that are more exposed to short-term funding. Finally, the results of the analysis of the effects across different bank characteristics suggest that the policy changes associated to foreign funds have a stronger negative impact on the supply of loans of banks that are organized as branches of foreign institutions (rather than subsidiaries). This result is consistent with the profile of these institutions, since they usually exhibit higher levels of exposition to foreign businesses.

[2] All these reserve requirements were not remunerated.

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 level of debt in the system are less able to mitigate the negative impact of the policy changes by changing banks.

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 paper. 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 institution. 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, his 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 40.208 firms and 13 banks 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 and 12 private commercial banks. 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 (and 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]

[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%.

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.

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.

Finally, as an extension for future work, 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 me 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

Intensive Margin - 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:

$$\Delta logL_{bf,t+1} = \delta_i + \alpha_1 controls_{bf,t-1} + \alpha_2 STF_{bf,t-1} + \alpha_3 NRF_{bf,t-1} + \alpha_4 FBF_{bf,t-1} + \varepsilon_{bf,t+1} \quad (1)$$

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. The $controls_{bf,t-1}$ include loan and bank characteristics (the firm's rating given by the bank, and bank balance-sheet information such as Size, Liquidity Ratio, Tier1 Ratio, Doubtful Ratio, and Dollarization Ratio). $STF_{bf,t-1}$, $NRF_{bf,t-1}$, $FBF_{bf,t-1}$ are the three policy variables of interest: $STF_{bf,t-1}$ stands for short-term funding, $NRF_{bf,t-1}$ is the variable associated to deposits from the non-financial sector that is not located in Uruguay, and $FBF_{bf,t-1}$ refers to funds from foreign banks.

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 a combination of controls at the loan level, the already mentioned bank balance-sheet variables, the three policy variables of interest (short-term funding, funding from the non-resident non-financial sector, and funding from the non-resident financial sector), and industry dummies.

The second model we estimate (Model 2) is based on data in deviation with respect to means at the firm level.

$$\Delta log\tilde{L}_{bf,t+1} = \alpha_1 control\tilde{s}_{bf,t-1} + \alpha_2 STF\tilde{}_{bf,t-1} + \alpha_3 NRF\tilde{}_{bf,t-1} + \alpha_4 FBF\tilde{}_{bf,t-1} + \varepsilon_{bf,\tilde{t+1}} \quad (2)$$

where all the variables are demeaned by their average across firms.[5] We will also report results of this specification with industry dummies.

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*firm-debt level in order to have a greater number of clusters. The intuition behind

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

[5] We first compute the sample average of the variables for each firm and then subtract the average from each variable in order to estimate the demeaned model using OLS (fixed effects estimation).

[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.

this decision is that it is very likely that residuals will be correlated within firms with the same debt size holding a relationship with the same bank.[7]

For robustness we will perform: placebo tests for months previous to the introduction of the policies and for the months after June 2008, as well as estimations of both models with a dummy indicating whether the bank is public or private.[8] In addition, we 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 *highrisk* and *highdebt* indicators at the firm level.[9] Moreover, we add bank fixed effects and also interact the policy variables with a dummy indicating 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). Under a linear probability model, we study the average and heterogenous effects of the policy changes on the probability that a loan that existed in period t-1 ends before period t+1, both for Model 1 and Model 2. The dependent variable in this case is:

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

Standard errors are again clustered at the bank*firm-debt level.

External Validity

As was already mentioned, the firms that hold a relationship with more than one bank represent 30% of the whole sample. One could ask if focusing only on these firms could compromise the external validity of the results (that is, the extent to which the results hold for the whole sample of firms). In order to address this, we will also study the average and heterogenous effects of the policies both on the intensive

[7] 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 minimum regulatory capital.

[8] 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.

[9] *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"*. 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".

and extensive margins.

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 reforms. The setup in this case is:

$$\Delta logL_{f,t+1} = \delta_i + \alpha_1 controls_{f,t-1} + \alpha_2 STF_{f,t-1} + \alpha_3 NRF_{f,t-1} + \alpha_4 FBF_{f,t-1} + \varepsilon_{f,t+1} \quad (3)$$

where $\Delta logL_{f,t+1}$ is the change in the logarithm of (strictly positive) committed credit by all banks to firm f, δ_i are industry dummies.[10] The $controls_{f,t-1}$ include loan and bank characteristics (firm's rating given by the bank, bank balance-sheet information such as Size, Liquidity Ratio, Tier1 Ratio, Doubtful Ratio, Dollarization Ratio), and $STF_{f,t-1}$, $NRF_{f,t-1}$, $FBF_{f,t-1}$ are the three policy variables of interest. Under the firm-level analysis, 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 over the total loans granted to the firm.

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.[11] 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.[12]

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

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

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

Intensive Margin

Average Effects

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.[13]

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.[14] 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.[15] 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

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

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

[15]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

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.

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).[16] 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

[16] 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.

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 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. [17]

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).[18] 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.

[17] 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.

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

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 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: Intensive Margin: Average Effects. Multiple Relationship Sample.

Dependent Variable: $\Delta logL_{bf,t+1}$			
	Model 1 (1)	**Model 2 (2)**	**Model 2 (3)**
Short-Term Funding	-0.135**	-0.139*	-0.106
	(0.059)	(0.074)	(0.086)
Funding from non-residents	0.029*	-0.045**	-0.036**
	(0.016)	(0.021)	(0.018)
Funding from foreign banks	-0.011*	-0.015**	-0.014**
	(0.006)	(0.007)	(0.007)
Firm Characteristics	Yes	–	–
Bank Characteristics	Yes	Yes	Yes
Industry FE	Yes	No	Yes
Bank FE	No	No	No
R-squared	0.004	0.001	0.001
Number of Observations	4248	4248	4248
Cluster:	Bank*FirmDebt	Bank*FirmDebt	Bank*FirmDebt

Note: the dependent variable is the change in the logarithm of (strictly positive) committed credit by bank b to firm f. The estimations are performed for the sample of firms with more than one bank relationship. Column (1) displays the results of the estimations of the average effects of the policy changes under the first specification. Columns (2) and (3) show the results of the estimations of the average effects under the second specification (excluding and including industry dummies, respectively).
* p< 0.10,** p< 0.05,*** p< 0.01

Table 2: Intensive Margin: Heterogenous Effects (firm characteristics). Multiple Relationship Sample.

Dependent Variable: $\Delta logL_{bf,t+1}$			
	Model 1 (1)	**Model 2 (2)**	**Model 2 (3)**
Short-Term Funding	0.116	-0.528	-0.532
	(0.196)	(0.447)	(0.441)
Funding from non-residents	-0.003	0.041	0.043
	(0.017)	(0.031)	(0.030)
Funding from foreign banks	-0.008	-0.007	-0.010
	(0.016)	(0.025)	(0.025)
Short-term funding * highrisk	0.027	0.253	0.281
	(0.057)	(0.555)	(0.556)
Fun. non-residents * highrisk	-0.004	-0.075*	-0.074*
	(0.003)	(0.042)	(0.042)
Fun. foreign banks * highrisk	-0.028***	0.029	0.028
	(0.005)	(0.033)	(0.033)
Short-term funding * highdebt	-0.320	0.981	0.981
	(0.233)	(0.668)	(0.671)
Fun. non-residents * highdebt	0.049**	-0.094**	-0.096**
	(0.018)	(0.039)	(0.038)
Fun. foreign banks * highdebt	0.021	-0.012	-0.010
	(0.023)	(0.040)	(0.041)
Short-term funding * highdebt*highrisk		-0.883	-0.893
		(0.575)	(0.582)
Fun. non-residents * highdebt*highrisk		0.115***	0.115***
		(0.038)	(0.038)
Fun. foreign banks * highdebt*highrisk		-0.016	-0.015
		(0.046)	(0.046)
Firm Characteristics	Yes	–	–
Industry Dummies	Yes	No	–
Bank Characteristics	Yes	Yes	Yes
Bank Fe	No	No	No
R-squared	0.054	0.010	0.010
Number of Observations	4248	4248	4248
Cluster:	Bank*FirmDebt	Bank*FirmDebt	Bank*FirmDebt

Note: the dependent variable is the change in the logarithm of (strictly positive) committed credit by bank b to firm f. The estimations are performed for the sample of firms with more than one bank relationship. Column (1) displays the results of the estimations under the first specification including interaction terms of the policy variables with indicators of firms' risk level (*highrisk*) and debt size (*highdebt*). Columns (2) and (3) show the results under the second specification including also interaction terms of the policy variables with *highrisk*highdebt* (excluding and including industry dummies, respectively).
* p< 0.10,** p< 0.05,*** p< 0.01

Table 3: Intensive Margin: Heterogenous Effects (firm characteristics). Bank FE. . Multiple Relationship Sample.

Dependent Variable: $\Delta logL_{bf,t+1}$			
	Model 1 (1)	**Model 2 (2)**	**Model 2 (3)**
Short-term funding*highrisk	0.025	-0.115	-0.153
	(0.060)	(0.337)	(0.340)
Fun. non-residents*highrisk	-0.003	-0.017	-0.005
	(0.003)	(0.031)	(0.031)
Fun. foreign banks*highrisk	-0.028***	0.033	0.026
	(0.005)	(0.026)	(0.025)
Short-term funding*highdebt	-0.342	0.536	0.443
	(0.233)	(0.407)	(0.433)
Fun. non-residents*highdebt	0.048**	-0.035	-0.029
	(0.018)	(0.023)	(0.024)
Fun. foreign banks*highdebt	0.020	-0.014	-0.015
	(0.023)	(0.030)	(0.030)
Short-term funding * highdebt*highrisk		-0.508*	-0.417
		(0.280)	(0.310)
Fun. non-residents * highdebt*highrisk		0.056**	0.042
		(0.022)	(0.023)
Fun. foreign banks * highdebt*highrisk		-0.018	-0.011
		(0.036)	(0.036)
Firm Characteristics	Yes	–	–
Bank Characteristics	No	No	No
Industry FE	Yes	No	No
Bank FE	Yes	Yes	Yes
R-squared	0.053	0.008	0.007
Number of Observations	4248	4248	4248
Cluster:	Bank*FirmDebt	Bank*FirmDebt	Bank*FirmDebt

Note: the dependent variable is the change in the logarithm of (strictly positive) committed credit by bank b to firm f. The estimations are performed for the sample of firms with more than one bank relationship. Column (1) displays the results of the estimations under the first specification including interaction terms of the policy variables with indicators of firms' risk level (*highrisk*) and debt size (*highdebt*) and also including bank fixed effects. Columns (2) and (3) show the results under the second specification including also interaction terms of the policy variables with *highrisk*highdebt* and bank fixed effects (excluding and including industry dummies, respectively).
* p< 0.10,** p< 0.05,*** p< 0.01

Table 4: Intensive Margin: Heterogenous Effects (bank characteristics). Multiple Relationship Sample.

Dependent Variable: $\Delta logL_{bf,t+1}$		
	Model 2 (1)	**Model 2 (2)**
Short-Term Funding	-0.146*	-0.114
	(0.085)	(0.108)
Funding from non-residents	0.017***	0.019***
	(0.005)	(0.006)
Funding from foreign banks	-0.000	-0.002
	(0.008)	(0.008)
Short-Term Funding*Branch	0.283	0.202
	(0.210)	(0.238)
Funding from non-residents*Branch	-0.059*	-0.051
	(0.034)	(0.035)
Funding from foreign banks*Branch	-0.005	-0.009
	(0.017)	(0.017)
Firm Characteristics	–	–
Bank Characteristics	Yes	Yes
Industry FE	No	No
Bank FE	No	No
R-squared	0.001	0.00
Number of Observations	4248	4248
Cluster:	Bank*FirmDebt	Bank*FirmDebt

Note: the dependent variable is the change in the logarithm of (strictly positive) committed credit by bank b to firm f. The estimations are performed for the sample of firms with more than one bank relationship. Column (1) displays the results of the estimations under the first specification including interaction terms of the policy variables with an indicator for whether the bank is organized as a branch. Column (2) shows the results under the second specification including interaction terms of the policy variables with an indicator for whether the bank is organized as a branch.
* p< 0.10,** p< 0.05,*** p< 0.01

Table 5: Extensive Margin: Average Effects. Multiple Relationship Sample.

Dependent Variable: $LEnd_{bf,t+1}$			
	Model 1 (1)	**Model 2 (2)**	**Model 2 (3)**
Short-Term Funding	-0.606***	-0.670***	-0.657***
	(0.145)	(0.177)	(0.181)
Funding from non-residents	0.037**	0.036**	0.038**
	(0.015)	(0.015)	(0.015)
Funding from foreign banks	0.000	0.010	0.008
	(0.010)	(0.011)	(0.011)
Firm Characteristics	Yes	–	–
Bank Characteristics	Yes	Yes	Yes
Industry FE	Yes	No	Yes
Bank FE	No	No	No
R-squared	0.018	0.010	0.010
Number of Observations	6340	6340	6340
Cluster:	Bank*FirmDebt	Bank*FirmDebt	Bank*FirmDebt

Note: the dependent variable takes the value of 1 if a loan that existed in period $t-1$ ends before period $t+1$ and 0 otherwise. The estimations are performed following a linear probability model for the sample of firms with more than one bank relationship. Column (1) displays the results of the estimations under the first specification, while Columns (2) and (3) show the results under the second specification (excluding and including industry dummies, respectively).
* p< 0.10,** p< 0.05,*** p< 0.01

Table 6: Extensive Margin: Heterogenous Effects (firm characteristics). Multiple Relationship Sample.

Dependent Variable: $LEnd_{bf,t+1}$			
	Model 1 (1)	**Model 2 (2)**	**Model 2 (3)**
Short-Term Funding	-0.232	-0.428	-0.421
	(0.249)	(0.317)	(0.316)
Funding from non-residents	0.022	0.050**	0.051**
	(0.017)	(0.024)	(0.024)
Funding from foreign banks	0.006	-0.006	-0.007
	(0.012)	(0.021)	(0.022)
Short-term funding * highrisk	-0.141	-0.023	-0.027
	(0.223)	(0.211)	(0.211)
Fun. non-residents * highrisk	0.004	-0.004	-0.004
	(0.012)	(0.011)	(0.011)
Fun. foreign banks * highrisk	-0.002	0.003	0.004
	(0.010)	(0.017)	(0.017)
Short-term funding * highdebt	-0.292	-0.248	-0.236
	(0.175)	(0.280)	(0.281)
Fun. non-residents * highdebt	0.008	-0.011	-0.010
	(0.014)	(0.025)	(0.025)
Fun. foreign banks * highdebt	-0.005	0.009	0.007
	(0.011)	(0.020)	(0.020)
Firm Characteristics	Yes	–	–
Bank Characteristics	Yes	Yes	Yes
Industry FE	Yes	No	Yes
Bank FE	No	No	No
R-squared	0.038	0.011	0.010
Number of Observations	6340	6340	6340
Cluster:	Bank*FirmDebt	Bank*FirmDebt	Bank*FirmDebt

Note: the dependent variable takes the value of 1 if a loan that existed in period $t-1$ ends before period $t+1$ and 0 otherwise. The estimations are performed following a linear probability model for the sample of firms with more than one bank relationship. Column (1) displays the results of the estimations under the first specification including interaction terms of the policy variables with indicators of firms' risk level (*highrisk*) and debt size (*highdebt*). Columns (2) and (3) show the results under the second specification including also interaction terms of the policy variables with *highrisk*highdebt* (excluding and including industry dummies, respectively).
* p< 0.10,** p< 0.05,*** p< 0.01

Table 7: Extensive Margin: Heterogenous Effects (firm characteristics). Bank FE. Multiple Relationship Sample.

Dependent Variable: $LEnd_{bf,t+1}$			
	Model 1 (1)	**Model 2 (2)**	**Model 2 (2)**
Short-term funding*highrisk	-0.147	-0.208	-0.199
	(0.213)	(0.157)	(0.157)
Fun. non-residents*highrisk	0.004	0.007	0.007
	(0.011)	(0.008)	(0.008)
Fun. foreign banks*highrisk	-0.003	0.001	0.001
	(0.010)	(0.015)	(0.015)
Short-term funding*highdebt	-0.274*	-0.293	-0.285
	(0.136)	(0.242)	(0.252)
Fun. non-residents*highdebt	0.018	0.022	0.021
	(0.011)	(0.018)	(0.019)
Fun. foreign banks*highdebt	-0.011	-0.013	-0.013
	(0.009)	(0.023)	(0.022)
Firm Characteristics	Yes	–	–
Bank Characteristics	No	No	No
Industry FE	No	No	No
Bank FE	Yes	Yes	Yes
R-squared	0.041	0.038	0.037
Number of Observations	6340	6340	6340
Cluster:	Bank	Bank	Bank

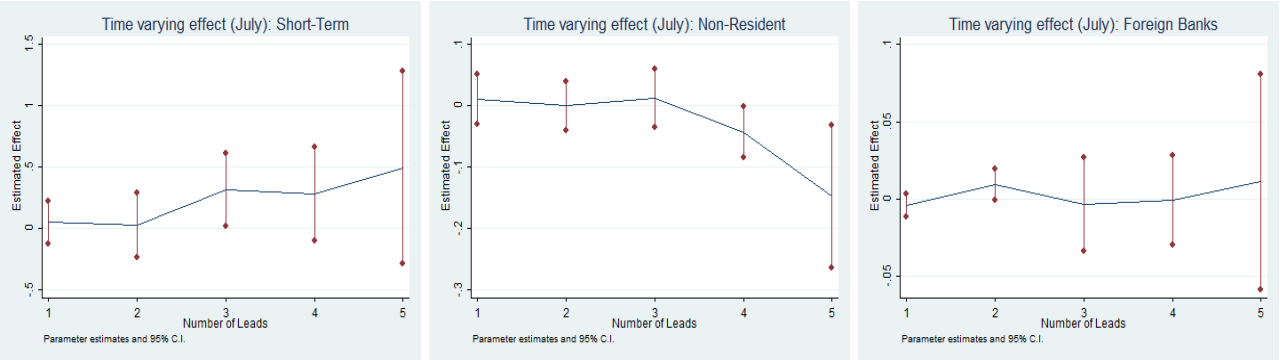
Note: the dependent variable takes the value of 1 if a loan that existed in period $t-1$ ends before period $t+1$ and 0 otherwise. The estimations are performed following a linear probability model for the sample of firms with more than one bank relationship. Column (1) displays the results of the estimations under the first specification including interaction terms of the policy variables with indicators of firms' risk level (*highrisk*) and debt size (*highdebt*) and also including bank fixed effects. Columns (2) and (3) show the results under the second specification including also interaction terms of the policy variables with *highrisk*highdebt* and bank fixed effects.
* p< 0.10,** p< 0.05,*** p< 0.01

Table 8: Firm-Level Analysis

Dependent Variable: $\Delta logL_{f,t+1}$			
	Firm-Level Model (1)	**Firm-Level Model (2)**	**Firm-Level Model (3)**
Short-Term Funding	0.204	-0.096	0.275
	(0.574)	(0.637)	(0.963)
Funding from non-residents	0.036	0.152	-0.073
	(0.153)	(0.092)	(0.202)
Funding from foreign banks	-0.072*	-0.074	-0.121**
	(0.040)	(0.063)	(0.053)
Short-Term Funding*Highdebt		0.804	
		-1.110	
Funding from non-residents*Highdebt		-0.141*	
		(0.082)	
Funding from foreign banks*Highdebt		-0.022	
		(0.078)	
Short-Term Funding*Highrisk			-0.393
			(0.876)
Funding from non-residents*Highrisk			0.101
			(0.072)
Funding from foreign banks*Highrisk			0.124**
			(0.049)
Bank Characteristics	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes
R-squared	0.007	0.019	0.009
Number of Observations	2748	2748	2748
Cluster:	Bank*FirmDebt	Bank*FirmDebt	Bank*FirmDebt

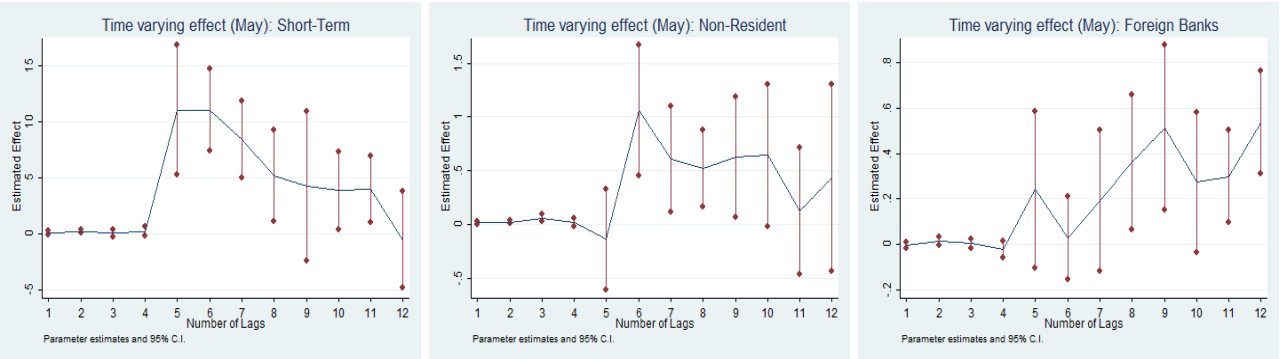
Note: the dependent variable is the change in the logarith of (strictly positive) committed cedit by all banks to firm f. The estimations are performed for the sample of firms with more than one bank relationship. Column (1) displays the results of the estimations including industry dummies and banks characteristics, while Columns (2) and (3) include interaction terms of the policy variables with *highdebt* and *highrisk* indicators, respectively. 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 over the total loans granted to the firm.
* p< 0.10,** p< 0.05,*** p< 0.01

Figure 1: Placebo Tests - Model 1. Period July-December, 2008.



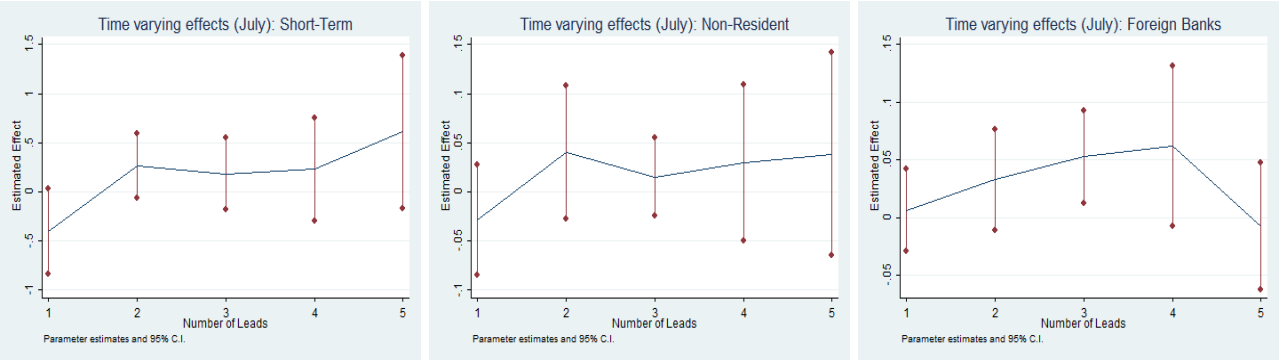
Note: each graph displays the estimated coefficient and its corresponding confidence interval. The horizontal axis displays the different time windows used in the regressions under Model 1 for the months after the policy changes were introduced (e.g. change in the log of committed lending between August and July 2008).

Figure 2: Placebo Tests - Model 1. Period May2008-May2007.



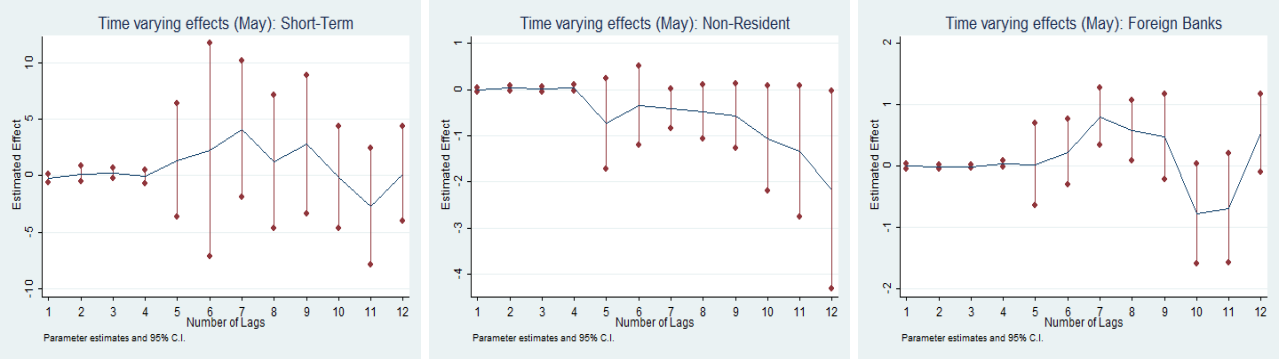
Note: each graph displays the estimated coefficient and its corresponding confidence interval. The horizontal axis displays the different time windows used in the regressions under Model 1 for the months before the policy changes were introduced (e.g. change in the log of committed lending between May and April 2008).

Figure 3: Placebo Tests - Model 2. Period July-December, 2008.



Note: each graph displays the estimated coefficient and its corresponding confidence interval. The horizontal axis displays the different time windows used in the regressions under Model 2 for the months after the policy changes were introduced (e.g. change in the log of committed lending between August and July 2008).

Figure 4: Placebo Tests - Model 2. Period May2008-May2007.



Note: each graph displays the estimated coefficient and its corresponding confidence interval. The horizontal axis displays the different time windows used in the regressions under Model 2 for the months before the policy changes were introduced (e.g. change in the log of committed lending between May and April 2008).

8 Appendix

Table 1: Definitions of dependent and independent variables.

Loan-Level Analysis	Variable Definition
Dependent Variables (bank-firm)	
Δ logLjul08	Change in the logarithm of (striclty positive) commmitted credit granted by bank b to firm f between July and May, 2008.
Lend	=1 if the bank-firm relationship ends during the period July-May, 2008, =0 otherwise.
Policy Variables	
Short-Term Funding	Logarithm of short-term funds of bank b at May, 2008.
Funds from Non-Residents	Logarithm of funds from non-resident non-financial sector of bank b at May, 2008.
Funds from Foreign Banks	Logarithm of funds from foreign banks of bank b at May, 2008.
Other variables	
Ln(Total Assets)	Logarithm of total assets of bank b at May, 2008.
Tier1 Ratio	Ratio of Tier I Capital of bank b at May, 2008.
Dollarization Ratio	Foreign Currency Deposits over Total Deposits of bank b at May, 2008.
Liquidity Ratio	Liquidi Assets ¡30d/Total Assets
Doubtful Ratio	Ratio of non-performing loans over total loans of bank b at May, 2008.
Provisions Ratio	Ratio of Provisions over total loans of bank b at May, 2008.
Public Bank	=1 if bank b is public, =0 otherwise.
highdebt	=1 if firm f is classified as a "highdebt" borrower, =0 otherwise.
highrisk	=1 if firm f has a rating of 3, 4 or 5, =0 otherwise.
Firm-Level Analysis	Variable Definition
Dependent Variables (bank-firm)	
Δ logLjul08	Change in the logarithm of (striclty positive) commmitted credit granted by all banks to firm f between July and May, 2008.

Table 2: Summary Statistics: Dependent Variables

Variable	Mean	Std. Dev.	Min.	Max.
ΔlogLjul08	0.015	0.664	-9.288	7.833
LEndjul08	0.1045	0.306	0	1

Table 3: Summary Statistics: Independent Variables

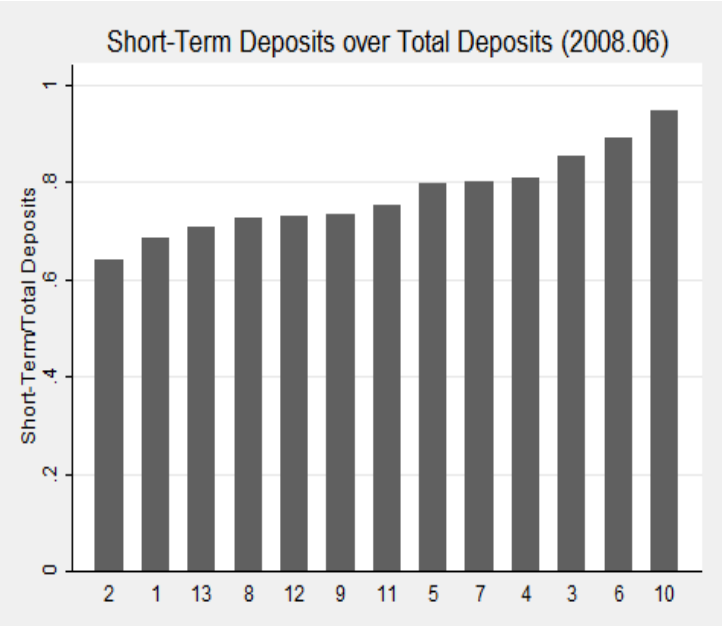
Variable	Mean	Std. Dev.	Min.	Max.
Loan-Level Characteristics				
Ln(Loan Amount)	14.292	2.119	2.567	22.684
Collateralized Loan	0.12	0.352	0	2
Only one bank	0.706	0.455	0	1
More than one bank	0.294	0.455	0	1
Ln(1+number of months)	2.472	0.233	0.693	2.565
Currency				
Local Currency	0.357	0.479	0	1
Foreign Currency	0.643	0.479	0	1
Maturity				
Maturity $<$ 1 year	0.414	0.493	0	1
Maturity 1-3 years	0.056	0.229	0	1
Maturity $>$ 3 years	0.225	0.418	0	1
Performing/Non-Performing				
Performing	0.695	0.46	0	1
Non-performing (60-120 days)	0.013	0.113	0	1
Non-performing (120-180 days)	0.006	0.076	0	1
Non-performing (180 days-2 years)	0.027	0.161	0	1
Written-off	0.259	0.438	0	1
Rating				
Bad Rating	0.245	0.43	0	1
Good Rating	0.755	0.43	0	1
Industry				
Primary Sector	0.247	0.431	0	1
Industry	0.099	0.298	0	1
Commerce	0.284	0.451	0	1

Continued on next page...

... table 11 continued

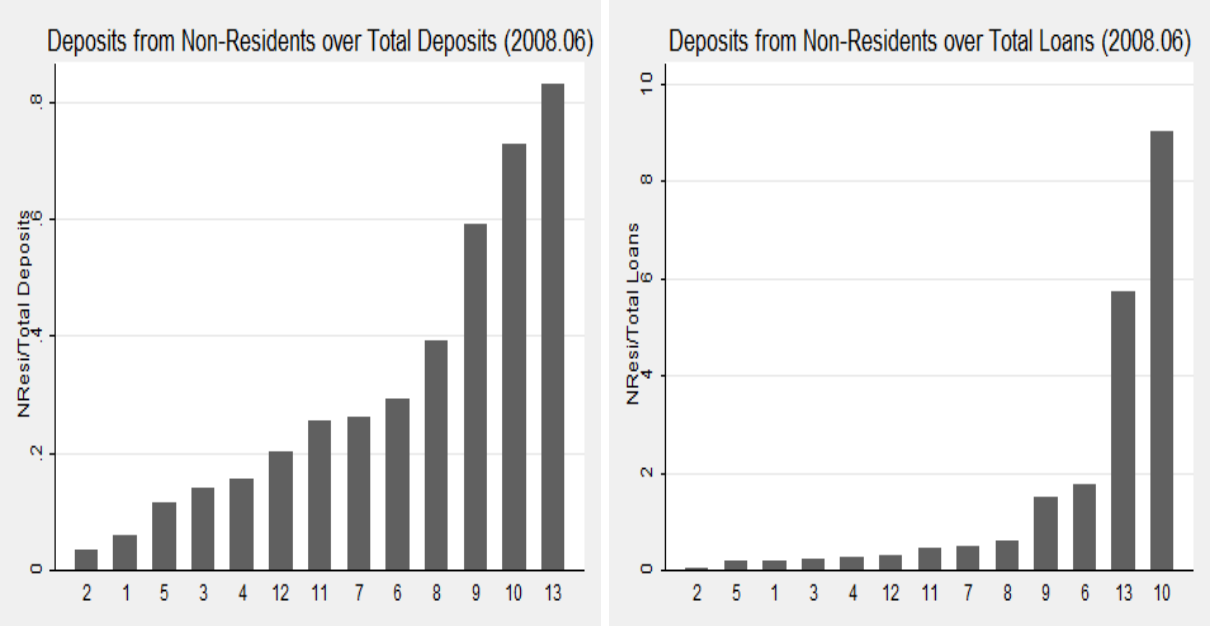
Variable	Mean	Std. Dev.	Min.	Max.
Construction	0.019	0.137	0	1
Services	0.304	0.46	0	1
Others	0.048	0.213	0	1
Bank-Level Characteristics				
Ln(Total Assets)	7.157	1.122	4.14	8.908
Liquidity Ratio	0.379	0.067	0.184	0.829
Tier1 Ratio	0.940	0.101	0.667	1
ROA	0.025	0.021	-0.021	0.046
Doubtful Ratio	0.014	0.006	0	0.024
Provisions Ratio	0.073	0.02	0.016	0.099
Leverage Ratio	7.541	3.124	2.521	13.504
Loan to Assets Ratio	0.34	0.101	0.026	0.484
Dollarization Ratio	0.751	0.114	0.498	0.983
Ln(Short-Term Deposits)	-0.279	0.099	-0.449	-0.056
Ln(Non-Resident Deposits)	4.495	1.606	0.963	6.333
Ln(Funds from Foreign Banks)	3.185	0.967	0.064	4.841

Figure 1: Short-Term Funding



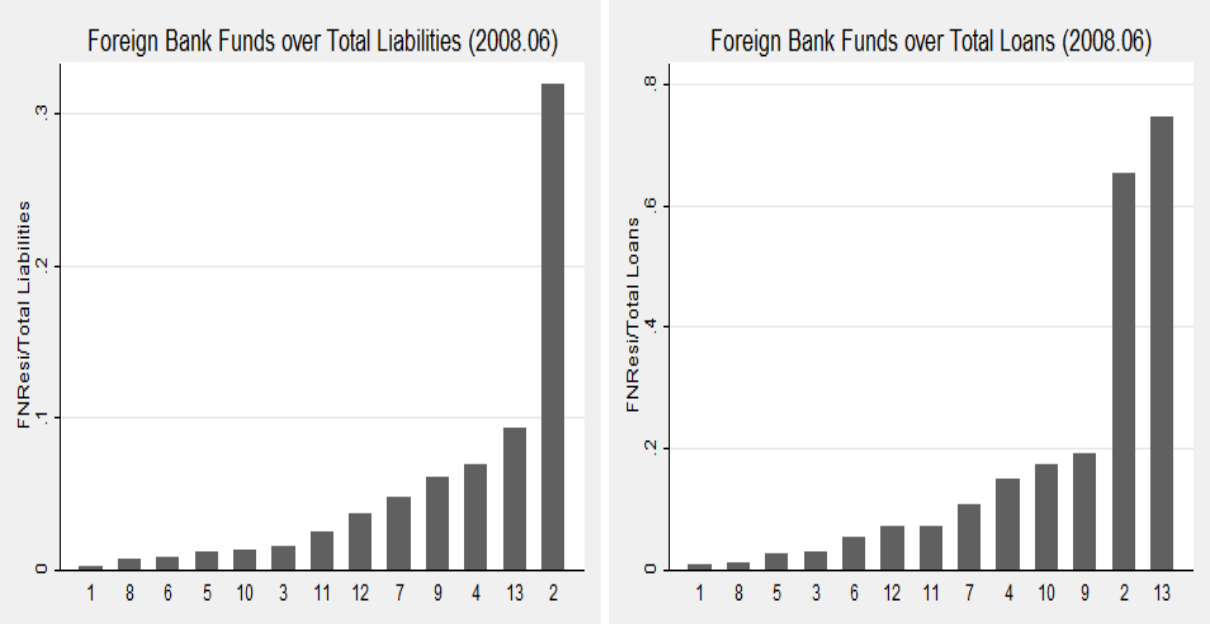
Note: each column corresponds to a bank.

Figure 2: Deposits from Non-Residents



Note: each column corresponds to a bank.

Figure 3: Funds from Foreign Banks



Note: each column corresponds to a bank.

Table 1: Intensive Margin: Average Effects. Total Sample.

Dependent Variable: $\Delta logL_{bf,t+1}$			
	Model 1 (1)	**Model 2 (2)**	**Model 2 (3)**
Short-Term Funding	-0.046	-0.141	-0.141
	(0.039)	(0.084)	(0.084)
Funding from non-residents	0.002	-0.029**	-0.029**
	(0.012)	(0.014)	(0.014)
Funding from foreign banks	-0.007**	-0.025***	-0.025***
	(0.003)	(0.007)	(0.007)
Firm Characteristics	Yes	–	–
Bank Characteristics	Yes	Yes	Yes
Industry FE	No	No	Yes
Bank FE	No	No	No
R-squared	0.002	0.001	0.001
Number of Observations	15810	15810	15810
Cluster:	Bank*FirmDebt	Bank*FirmDebt	Bank*FirmDebt

Note: the dependent variable is the change in the logarithm of (strictly positive) committed credit by bank b to firm f. The estimations are performed for the whole sample of firms. Column (1) displays the results of the estimations of the average effects of the policy changes under the first specification. Columns (2) and (3) show the results of the estimations of the average effects under the second specification (excluding and including industry dummies, respectively).
* p< 0.10,** p< 0.05,*** p< 0.01

Table 2: Intensive Margin: Heterogenous Effects (firm characteristics). Total Sample.

Dependent Variable: $\Delta logL_{bf,t+1}$			
	Model 1 (1)	**Model 2 (2)**	**Model 2 (3)**
Short-Term Funding	0.236*	-0.441	-0.478
	(0.132)	(0.410)	(0.406)
Funding from non-residents	-0.017	0.050*	0.052*
	(0.014)	(0.026)	(0.026)
Funding from foreign banks	-0.029**	0.011	0.011
	(0.013)	(0.027)	(0.028)
Short-term funding * highrisk	0.009	0.219	0.238
	(0.058)	(0.474)	(0.479)
Fun. non-residents * highrisk	-0.007**	-0.085**	-0.084**
	(0.003)	(0.039)	(0.040)
Fun. foreign banks * highrisk	-0.010*	0.012	0.011
	(0.005)	(0.029)	(0.029)
Short-term funding * highdebt	-0.330**	0.633	0.619
	(0.145)	(0.446)	(0.457)
Fun. non-residents * highdebt	0.048***	-0.077**	-0.077**
	(0.014)	(0.029)	(0.029)
Fun. foreign banks * highdebt	0.033**	-0.056	-0.052
	(0.015)	(0.051)	(0.051)
Short-term funding * highdebt*highrisk		-0.574	-0.554
		(0.431)	(0.431)
Fun. non-residents * highdebt*highrisk		0.103**	0.102**
		(0.039)	(0.039)
Fun. foreign banks * highdebt*highrisk		0.022	0.021
		(0.050)	(0.049)
Firm Characteristics	Yes	–	–
Bank Characteristics	Yes	Yes	Yes
Industry FE	No	No	Yes
Bank FE	No	No	No
R-squared	0.049	0.004	0.005
Number of Observations	15810	15810	15810
Cluster:	Bank*FirmDebt	Bank*FirmDebt	Bank*FirmDebt

Note: the dependent variable is the change in the logarithm of (strictly positive) committed credit by bank b to firm f. The estimations are performed for the whole sample of firms. Column (1) displays the results of the estimations under the first specification including interaction terms of the policy variables with indicators of firms' risk level (*highrisk*) and debt size (*highdebt*). Columns (2) and (3) show the results under the second specification including also interaction terms of the policy variables with *highrisk*highdebt* (excluding and including industry dummies, respectively).
* p< 0.10,** p< 0.05,*** p< 0.01

Table 3: Intensive Margin: Heterogenous Effects (firm characteristics). Bank FE. Total Sample.

Dependent Variable: $\Delta logL_{bf,t+1}$			
	Model 1 (1)	**Model 2 (2)**	**Model 2 (3)**
Short-term funding*highrisk	0.006	-0.314	-0.289
	(0.059)	(0.353)	(0.369)
Fun. non-residents*highrisk	-0.007**	-0.009	-0.009
	(0.003)	(0.028)	(0.030)
Fun. foreign banks*highrisk	-0.011*	0.030	0.029
	(0.005)	(0.025)	(0.024)
Short-term funding*highdebt	-0.339**	0.052	0.040
	(0.146)	(0.260)	(0.257)
Fun. non-residents*highdebt	0.048***	-0.001	-0.001
	(0.015)	(0.015)	(0.015)
Fun. foreign banks*highdebt	0.032**	-0.038	-0.036
	(0.015)	(0.031)	(0.031)
Short-term funding * highdebt*highrisk		0.017	0.013
		(0.299)	(0.309)
Fun. non-residents * highdebt*highrisk		0.024	0.023
		(0.025)	(0.026)
Fun. foreign banks * highdebt*highrisk		0.004	0.005
		(0.031)	(0.030)
Firm Characteristics	Yes	–	–
Bank Characteristics	No	No	No
Industry FE	No	No	Yes
Bank FE	Yes	Yes	Yes
R-squared	0.049	0.004	0.005
Number of Observations	15810	15810	15810
Cluster:	Bank*FirmDebt	Bank*FirmDebt	Bank*FirmDebt

Note: the dependent variable is the change in the logarithm of (strictly positive) committed credit by bank b to firm f. The estimations are performed for the whole sample of firms. Column (1) displays the results of the estimations under the first specification including interaction terms of the policy variables with indicators of firms' risk level (*highrisk*) and debt size (*highdebt*) and also including bank fixed effects. Columns (2) and (3) show the results under the second specification including also interaction terms of the policy variables with *highrisk*highdebt* and bank fixed effects (excluding and including industry dummies, respectively).
* p< 0.10,** p< 0.05,*** p< 0.01

Table 4: Extensive Margin: Average Effects. Total Sample.

Dependent Variable: $LEnd_{t+1}$			
	Model 1 (1)	**Model 2 (2)**	**Model 2 (3)**
Short-Term Funding	-0.555***	-0.426*	-0.416*
	(0.160)	(0.243)	(0.241)
Funding from non-residents	0.028*	0.018	0.019
	(0.017)	(0.017)	(0.016)
Funding from foreign banks	-0.011	0.008	0.006
	(0.013)	(0.010)	(0.012)
Firm Characteristics	Yes	–	–
Bank Characteristics	Yes	Yes	Yes
Industry FE	Yes	No	Yes
Bank FE	No	No	No
R-squared	0.017	0.002	0.002
Number of Observations	21916	21916	21916
Cluster:	Bank*FirmDebt	Bank*FirmDebt	Bank*FirmDebt

Note: the dependent variable takes the value of 1 if a loan that existed in period $t-1$ ends before period $t+1$ and 0 otherwise. The estimations are performed following a linear probability model for the whole sample of firms. Column (1) displays the results of the estimations under the first specification, while Columns (2) and (3) show the results under the second specification (excluding and including industry dummies, respectively).
* p< 0.10,** p< 0.05,*** p< 0.01

Table 5: Extensive Margin: Hetereogenous Effects. Total Sample

Dependent Variable: $LEnd_{t+1}$			
	Model 1 (1)	**Model 2 (2)**	**Model 2 (2)**
Short-Term Funding	0.002	-0.045	-0.038
	(0.280)	(0.314)	(0.316)
Funding from non-residents	0.021	0.044*	0.044*
	(0.017)	(0.024)	(0.024)
Funding from foreign banks	-0.017*	-0.026	-0.027
	(0.009)	(0.022)	(0.023)
Short-term funding * highrisk	-0.448*	-0.201	-0.202
	(0.242)	(0.236)	(0.236)
Fun. non-residents * highrisk	0.012	-0.003	-0.004
	(0.013)	(0.009)	(0.009)
Fun. foreign banks * highrisk	0.022	0.012	0.013
	(0.015)	(0.016)	(0.016)
Short-term funding * highdebt	-0.242	-0.209	-0.211
	(0.206)	(0.346)	(0.343)
Fun. non-residents * highdebt	-0.007	-0.026	-0.026
	(0.012)	(0.030)	(0.030)
Fun. foreign banks * highdebt	-0.006	0.019	0.017
	(0.013)	(0.019)	(0.019)
Firm Characteristics	Yes	–	–
Bank Characteristics	Yes	Yes	Yes
Industry FE	Yes	No	Yes
Bank FE	No	No	No
R-squared	0.047	0.004	0.004
Number of Observations	21916	21916	21916
Cluster:	Bank*FirmDebt	Bank*FirmDebt	Bank*FirmDebt

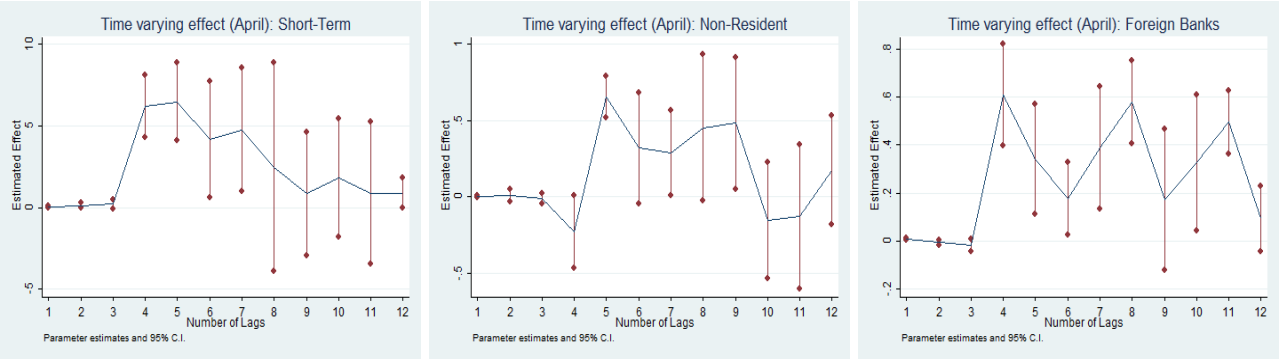
Note: the dependent variable takes the value of 1 if a loan that existed in period $t-1$ ends before period $t+1$ and 0 otherwise. The estimations are performed following a linear probability model for the whole sample of firms. Column (1) displays the results of the estimations under the first specification including interaction terms of the policy variables with indicators of firms' risk level (*highrisk*) and debt size (*highdebt*). Columns (2) and (3) show the results under the second specification including also interaction terms of the policy variables with *highrisk*highdebt* (excluding and including industry dummies, respectively).
* p< 0.10,** p< 0.05,*** p< 0.01

Table 6: Extensive Margin: Heterogenous Effects (firm characteristics). Bank FE. Total Sample

Dependent Variable: $LEnd_{t+1}$			
	Model 1 (1)	**Model 2 (2)**	**Model 2 (3)**
Short-term funding*highrisk	-0.415	-0.212	-0.210
	(0.251)	(0.164)	(0.162)
Fun. non-residents*highrisk	0.011	0.005	0.004
	(0.013)	(0.006)	(0.006)
Fun. foreign banks*highrisk	0.019	0.002	0.002
	(0.015)	(0.012)	(0.012)
Short-term funding*highdebt	-0.208	-0.150	-0.153
	(0.179)	(0.336)	(0.339)
Fun. non-residents*highdebt	-0.002	0.010	0.010
	(0.011)	(0.020)	(0.020)
Fun. foreign banks*highdebt	-0.011	-0.018	-0.018
	(0.011)	(0.023)	(0.023)
Firm Characteristics	Yes	–	–
Bank Characteristics	No	No	No
Industry FE	No	No	No
Bank FE	Yes	Yes	Yes
R-squared	0.049	0.037	0.037
Number of Observations	21916	21916	21916
Cluster:	Bank*FirmDebt	Bank*FirmDebt	Bank*FirmDebt

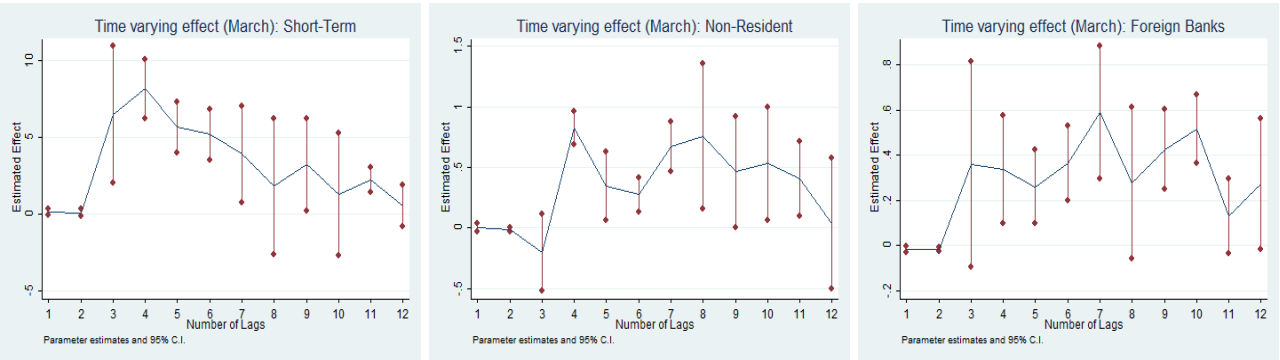
Note: the dependent variable takes the value of 1 if a loan that existed in period $t-1$ ends before period $t+1$ and 0 otherwise. The estimations are performed following a linear probability model for the whole sample of firms. Column (1) displays the results of the estimations under the first specification including interaction terms of the policy variables with indicators of firms' risk level (*highrisk*) and debt size (*highdebt*) and also including bank fixed effects. Columns (2) and (3) show the results under the second specification including also interaction terms of the policy variables with *highrisk*highdebt* and bank fixed effects.
* p< 0.10,** p< 0.05,*** p< 0.01

Figure 1: Placebo Tests - Model 1: Months previous to the Policy Change.
(Period April2008-April2007).



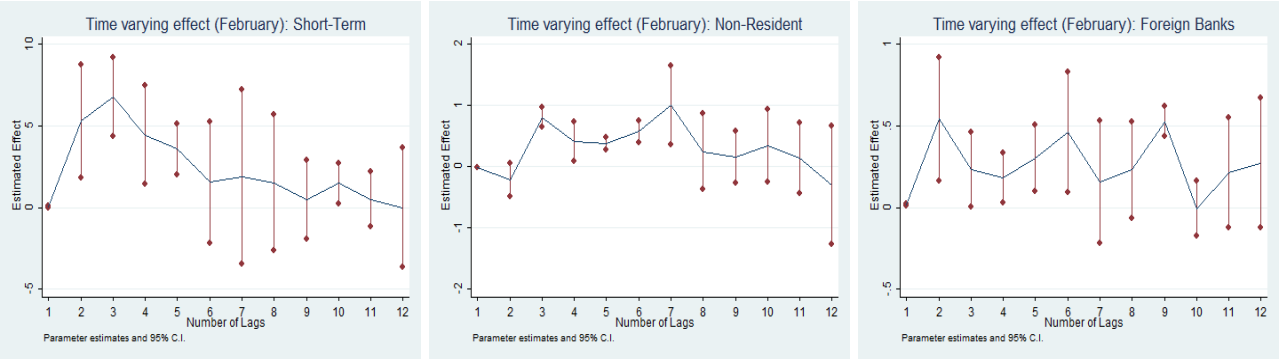
Note: each graph displays the estimated coefficient and its corresponding confidence interval. The horizontal axis displays the different time windows used in the regressions under Model 1 for the months before the policy changes were introduced (e.g. change in the log of committed lending between April and March 2008).

Figure 2: Placebo Tests - Model 1: Months previous to the Policy Change.
(Period March2008-March2007).



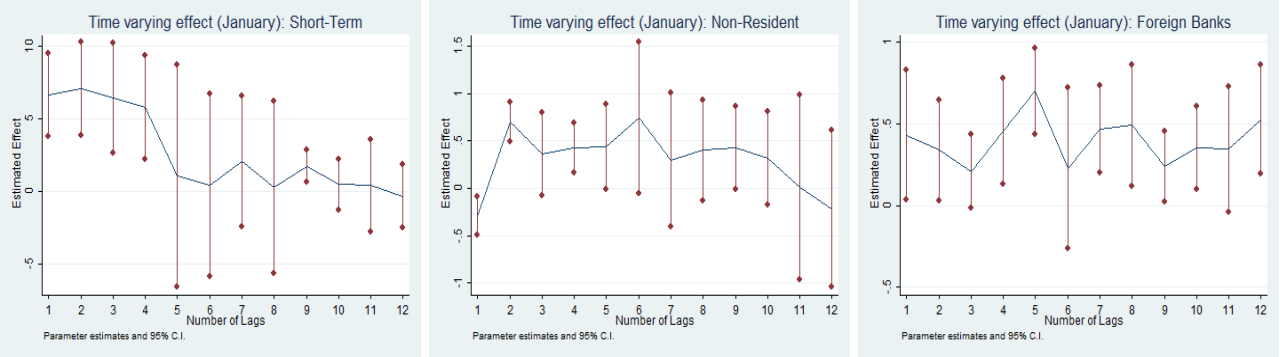
Note: each graph displays the estimated coefficient and its corresponding confidence interval. The horizontal axis displays the different time windows used in the regressions under Model 1 for the months before the policy changes were introduced (e.g. change in the log of committed lending between March and February 2008).

Figure 3: Placebo Tests - Model 1: Months previous to the Policy Change.
(Period February2008-February2007).



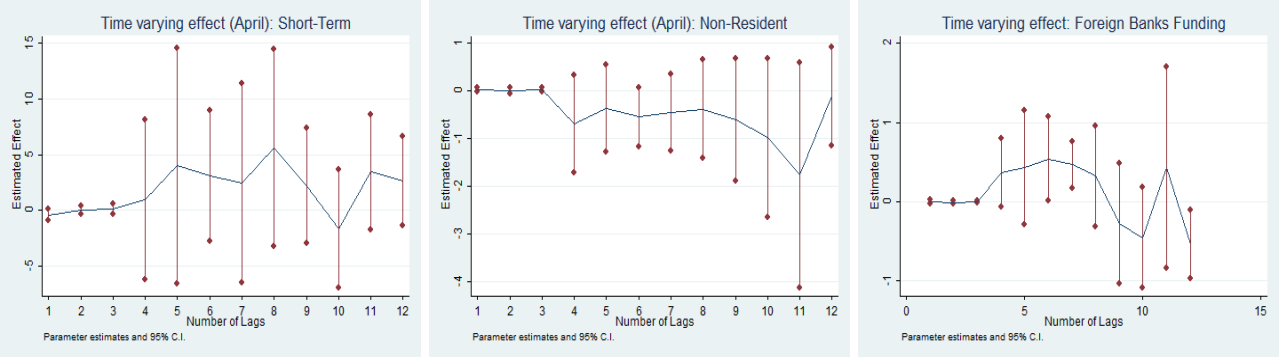
Note: each graph displays the estimated coefficient and its corresponding confidence interval. The horizontal axis displays the different time windows used in the regressions under Model 1 for the months before the policy changes were introduced (e.g. change in the log of committed lending between February and January 2008).

Figure 4: Placebo Tests - Model 1: Months previous to the Policy Change.
(Period January2008-January2007).



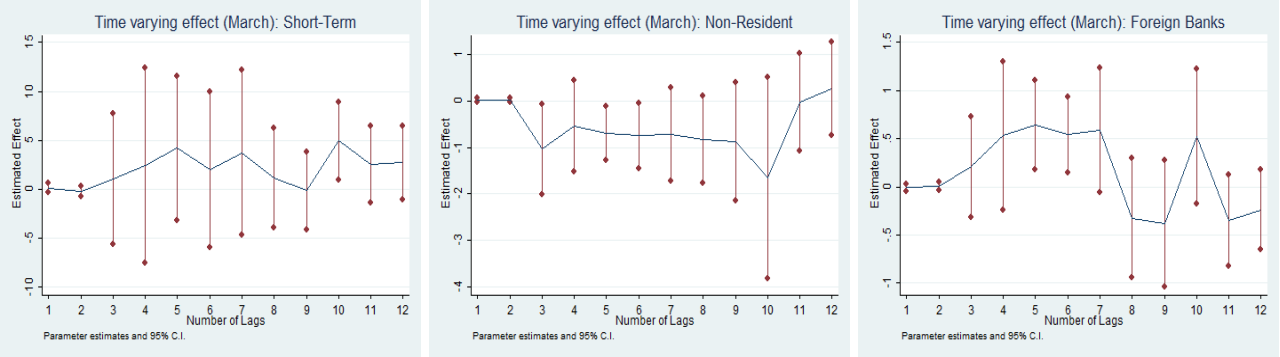
Note: each graph displays the estimated coefficient and its corresponding confidence interval. The horizontal axis displays the different time windows used in the regressions under Model 1 for the months before the policy changes were introduced (e.g. change in the log of committed lending between January 2008 and December 2007).

Figure 5: Placebo Tests - Model 2: Months previous to the Policy Change.
(Period April2008-April2007).



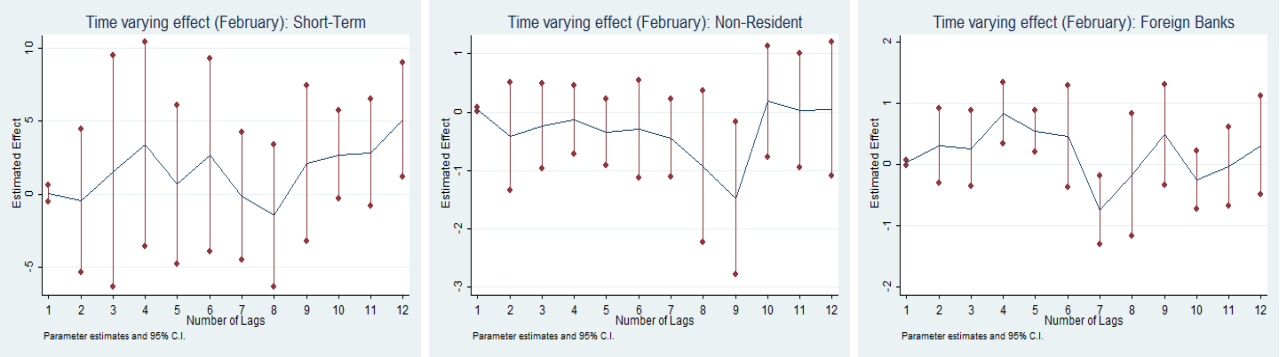
Note: each graph displays the estimated coefficient and its corresponding confidence interval. The horizontal axis displays the different time windows used in the regressions under Model 2 for the months before the policy changes were introduced (e.g. change in the log of committed lending between April and March 2008).

Figure 6: Placebo Tests - Model 2: Months previous to the Policy Change.
(Period March2008-March2007).



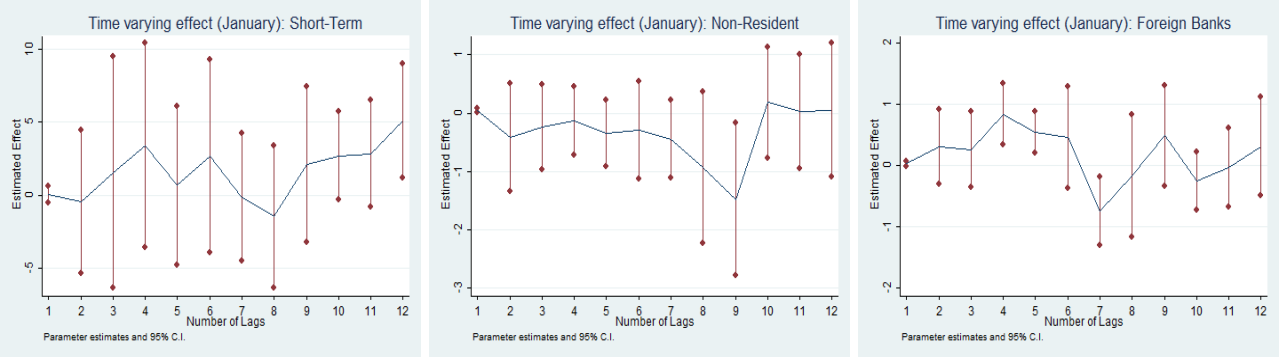
Note: each graph displays the estimated coefficient and its corresponding confidence interval. The horizontal axis displays the different time windows used in the regressions under Model 2 for the months before the policy changes were introduced (e.g. change in the log of committed lending between March and February 2008).

Figure 7: Placebo Tests - Model 2: Months previous to the Policy Change.
(Period February2008-February2007).



Note: each graph displays the estimated coefficient and its corresponding confidence interval. The horizontal axis displays the different time windows used in the regressions under Model 2 for the months before the policy changes were introduced (e.g. change in the log of committed lending between February and January 2008).

Figure 8: Placebo Tests - Model 2: Months previous to the Policy Change.
(Period January2008-January2007).



Note: each graph displays the estimated coefficient and its corresponding confidence interval. The horizontal axis displays the different time windows used in the regressions under Model 2 for the months before the policy changes were introduced (e.g. change in the log of committed lending between January 2008 and December 2007).