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BANK BALANCE SHEETS AND THE TRANSMISSION OF FINANCIAL SHOCKS TO BORROWERS: EVIDENCE FROM THE 2007-2008 CRISIS

by Emilia Bonaccorsi di Patti[#] and Enrico Sette*

Abstract

We use Italian data on bank lending to firms to study the transmission of shocks affecting bank balance sheets to the volume and cost of credit granted to business borrowers and to the probability of banks accepting loan applications from new borrowers during the 2007-2008 financial crisis. The identification of the credit-supply effect is based on a difference-in-difference approach because: a large number of firms in Italy borrow from more than one bank; the shocks to the wholesale funding market were exogenous to Italian banks; and Italian banks were affected to a varying extent by the crisis depending on their funding structure. Results indicate that supply conditions worsened most for the banks that were most exposed to the interbank market and for those that made the most use of securitization. While the initial capital position of banks did not significantly affect their lending, the deterioration of bank capitalization as proxied by charge-offs and profitability had a significant impact. Furthermore, our results suggest that bank capital influenced lending indirectly, with higher capital reducing the elasticity of lending to the shocks on the funding side.

JEL Classification: G21, E51, E44.
Keywords: bank balance sheet, transmission of shocks, credit supply, financial crisis.

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1. Introduction[1]

The financial crisis of 2007-08 started with a disruption of money markets, extreme volatility of interest rates and the drying up of the securitization market. After the French bank BNP Paribas froze redemptions for three investment funds in August 2007, citing its inability to value structured products, the spread between unsecured and secured rates on interbank loans widened up. This event was the starting point of a period of instability in the interbank market both in Europe and US. The lack of transparency in the secondary markets of asset-backed securities and uncertainty on the credit risk of counterparties severely impaired the ability of many banks to obtain long-term funding, leading to the distress of some large and interconnected intermediaries. Funding liquidity risk played a major role in propagating the crisis from markets to financial intermediaries (Brunnermeier, 2009). As the crisis unfolded after the default of Lehman, difficulties on the funding side interacted with adverse shocks to bank capital due to losses on bank portfolios. Indications from lending surveys in the US and Europe suggest that the shock to funding cost and availability as well as the stress on bank capitalization both contributed to a negative supply shift in credit markets, consistent with the theoretical literature on the bank lending channel.

Following the crisis there has been renewed attention in understanding the role of financial intermediaries in the transmission of shocks from financial markets to the real economy. The traditional models of financial intermediation focused on imperfect substitutability between deposits and other funding sources for banks, or between loans and bonds for firms (e.g. Blinder, 1992, Bernanke and Gertler, 1995, Kashyap and Stein, 2000). Empirical evidence on the bank credit channel focused primarily on liquid assets holdings and bank capital as the main balance sheet characteristics that could affect the transmission of monetary impulses to the credit market and thereby to the economy.

The recent evidence from the crisis, instead, points towards additional mechanisms related to a new intermediation model that prevailed among large banks before the crisis (Disyatat, 2011). First, disruptions of the wholesale funding market, manifest in the unwillingness to lend by participants due to uncertainty on the solvency of counterparties, and extreme volatility in interest rates, are believed to be responsible for banks' reduced ability to extend credit.

Second, before the crisis the development of the securitization market had diminished the frictions due to the imperfect substitutability between loans and other assets. Banks could issue

[1] We thank for useful comments Giorgio Albareto, Marcello Bofondi, Nicola Cetorelli, Giorgio Gobbi, Silvia Magri, Joao Santos, and seminar participants at the Bank of Italy. All errors are our own. The opinions expressed do not necessarily reflect those of the World Bank, the Bank of Italy, the Eurosystem or their staffs.

illiquid loans and transform them into liquid securities to be sold on the market. The impact of this change in the business model of banks is testified by the reduced effectiveness of the bank lending channel in the years of the securitization boom (Altunbas, Gambacorta and Marques, 2009). During the crisis the drying up of the securitization market reintroduced such frictions.

A number of recent studies focusing on the default of Lehman confirm that indeed the crisis determined a shock to bank balance sheets on the funding side and, consequently, an adverse effect on lending supply. For example, Ivashina and Scharfstein (2010) find that syndicated lending to US firms dropped dramatically after Lehman's default and the reduction in lending was negatively correlated with each bank's share of retail funding. Data from the Portuguese credit register show that banks that relied more on interbank finance before the crisis experienced a sharper decrease in loan supply during the crisis than other banks (Iyer et al., 2011).

Other analyses focusing on equity capital as the major constraint to bank lending, particularly after Lehman, find mixed evidence. Based on information on loan rejection rates over the current financial crisis, Puri, Rocholl and Steffen (2011) find that German saving banks affiliated with Landesbanken heavily exposed to subprime lending reduced acceptance rates by more than other saving banks. Gambacorta and Marques (2011) find a limited effect of equity capital, while they find that a stronger reliance on wholesale funding and on securitizations had a substantial impact on credit growth in bank-level cross-country regressions on a sample of European banks. Santos (2011) studies loan pricing following the subprime crisis and shows that banks that incurred larger losses on their loans increased spreads more. Interestingly, he does not find any significant effect of bank capital on spreads.

A few studies analyzed Italian data from the crisis. Using a smaller dataset than ours, including only firms with more than 50 employees, Albertazzi and Marchetti (2010) analyze the six month period after Lehman collapsed (September 2008-March 2009) to explore the relevance of evergreening by banks and the role of bank capital. They find a negative effect on the growth of loans to risky borrowers for larger less-capitalized banks but no effect for smaller less-capitalized banks, which suggests that other determinants could be playing a role. Two major differences with respect to their analysis are the following. First, they use unconsolidated data while we use group-level data; second, they consider capital as the main transmission channel of the crisis instead of a wider set of bank variables. Foglia et al. (2010) show that the probability that firms declared to be credit constrained is higher if the banks they borrow from had lower capital and liquidity ratios but the results are sensitive to the specification. These firms are shown to have reduced investment

(Gaiotti, 2011). Finally, Gambacorta and Mistrulli (2011) document that the Lehman shock had an impact on the interest rate charged by banks but do not consider quantities or loan applications.[2]

In this paper we study the role of bank balance sheet characteristics in transmitting the turbulence from financial to credit markets, specifically to loan quantities and prices. In line with the literature on the bank credit channel we explore the role of the capital and liquidity position of banks at the onset of the crisis. We also consider the new channels arising from banks' dependence on wholesale funding and the extent to which banks employed securitization before the crisis.

For each of the two critical shocks that occurred during the crisis, the disruption of the interbank market during the Summer of 2007 and the default of Lehman in the Fall of 2008, we relate the change in lending and the cost of credit before and after the shock to bank balance sheet conditions prior to the shock. As a further step, we study the probability that a credit relationship is terminated and, employing information on loan applications, the probability that a new relationship is established. Loan application data have been shown to be particularly useful to identify supply shifts (Jiménez et al., 2010a).

We study separately 2007 and 2008 to provide evidence on the narrative that stress on bank capital was relevant in 2008 but not in 2007, and that liquidity problems were the main constraint for banks in 2007 but played a more limited role in 2008 after the Eurosystem expanded its support to banks.

A novel aspect of our analysis is that we not only assess the role of each bank balance sheet variable but also explore how they interacted with each other.[3] For example, in normal times banks can shift between asset types reducing liquid securities, such as government bonds, when credit demand is sustained or in response to a tightening of monetary policy conditions (Kashyap and Stein, 2000; Loutskina, 2010; Loutskina and Strahan, 2009). However, if banks are constrained because of capital, they cannot expand risky loans. This suggests that the level of capital could influence the elasticity of lending to liquid assets. Another possible interaction effect could be due to less capitalized banks facing a stronger adverse effect from the interbank shock if their counterparties were more concerned about their solvency. These and other interaction effects are discussed below.

[2] They do not include important controls such as measures of bank profitability, and use a long time period so that selection problems due to the exit of firms from the sample are particularly relevant.

[3] Recent research on monetary policy transmission (Jimenez et al. (2010a)) before the crisis suggests that bank capital and liquidity affect how bank react to changes in monetary policy conditions. Banks with lower capital or liquidity ratios restrict credit supply more when monetary policy is tightened. Similarly, Jimenez et al. (2010b) show that lower capitalized banks grant, expand and prolong credit to riskier firms in response to lower overnight rates. Adrian and Shin (2011) underline the interaction between asset pricing and intermediaries' balance sheet which makes leverage to be procyclical.

One of the main challenges of any analysis of a change in lending conditions is how to identify supply shifts as opposed to demand shifts. Thanks to the availability of a large data set of bank-firm relationships recorded in the Italian Credit Register we resort to the following strategy. [4] As many firms borrow from more than one bank and banks differed in terms of initial funding structure, liquidity and capitalization, we can use a difference-in-difference approach that yields an unbiased estimate of the bank-level effect on each lending relationship. Firm fixed effects control for variation in credit demand across firms and allow us to identify differential effects on credit growth and cost across banks lending to the same firms. The freeze in the interbank market in August 2007, and Lehman default in September 2008 were largely unexpected, at least in their size, and were unrelated to Italian banks' conditions, so that they represent exogenous shocks to Italian banks' balance sheet structure. This ensures that our estimates are not biased by banks changing lending in anticipation of the shocks to their balance sheets.

With respect to the existing literature we provide evidence not only on the impact of the crisis on credit quantities but also on the cost of credit, the survival of credit relationships and the willingness of banks to give loans to new clients, whereas other studies focus on only on some of these dimensions. Furthermore, our study provides a more complete analysis of bank balance sheets, considering jointly wholesale funding, liquidity, capital, and securitization activity. Finally, we analyze interactions among capital and funding, liquidity, profitability, thus studying the way bank capitalization affects banks sensitivity to shocks.

Understanding how adverse financial impulses are transmitted through the banking system in periods of stress is of utmost importance for policy makers because it contributes to assess which policy responses could be most effective in sustaining credit flows, e.g. injecting liquidity, as opposed to recapitalize banks, or if both actions need to be taken together. Our analysis is also relevant in light of the new Basel framework for liquidity and the proposals to limit the reliance of banks on wholesale funding.

Our results indicate that the structure of banks' balance sheets before the shocks affected both subsequent loan growth and the cost of credit and that the channels differed between 2007 and 2008. Consistent with the narrative, in 2007 the initial exposure to interbank markets and the extent to which the bank securitized before the crisis were key determinants of its ability to lend, with a negative effect on credit and a positive one on the interest rate paid by borrowers. We show some evidence that the share of liquid assets before the shock acted as a buffer to the difficulties to get

[4] This approach is employed by Khwaja and Mian (2008) to assess the impact of a liquidity shock to Pakistani banks, and by Iyer et al. (2011) in their study of the impact of the crisis on Portuguese banks. Similarly, Gan (2007) employed data from Japan to estimate the effect on lending of the shock to bank portfolios based on their exposure to the real estate market when the housing bubble collapsed.

wholesale funding in this first phase of the crisis. In 2008 the adverse effect of the interbank reliance remains but, as losses started to weaken the capital position of banks, profitability was an additional driver of subsequent lending growth. Our data also show that banks that experienced higher loan charge-offs raised the cost of credit more, as well as those that securitized more before the crisis. In this second period we do not find any effect of the share of liquid assets held by banks or the reliance of banks on securitizations on credit growth.

A novel result is that, while in neither period the initial level of the capital ratio had a significant effect on lending growth or the cost of credit, the level of the capital ratio changes the (semi-) elasticity of other relevant variables. Lending growth by better capitalized banks is less sensitive to shocks to funding or to profitability.

The results on the growth of credit are robust to excluding relationships that are interrupted and consistent with evidence on new relationships. A greater initial exposure to the interbank market increases the probability that a relationship is interrupted and reduces the probability that a loan application is accepted in both 2007 and 2008. While securitization mattered for relationship survival in 2007 it did not in 2008. Instead, profitability raised the probability that a loan application is accepted and reduced the probability that a relationship is terminated in 2008.

Our findings emphasize the need for a comprehensive approach when designing policies aimed at increasing the resilience of banks and mitigating fluctuations in credit flows. First, the structure of bank funding plays a critical role in the transmission of shocks and should be monitored together with the liquidity position of banks. Second, when most banks have a substantial capital buffer above regulatory limits, as in the case of Italy at the onset of the crisis, capital ratios have mostly an indirect effect on credit supply because they affect the sensitivity of banks to funding shocks. Countercyclical capital buffers can contribute to provide headline for lending when banks face shocks to other funding sources.

2. Italian banks and the 2007-08 Financial Crisis

The crisis originated in financial markets and was later transmitted to the real sector, leading to the most severe recession after World War II. Its origin can be traced back to developments in the US economy, where growing imbalances were accumulating in the private sector and government financial positions, in an environment of persistently low interest rates.

While in some European countries there were similar imbalances with banks expanding in an unprecedented way their leverage in conjunction with housing and asset prices bubbles, in Italy a

more traditional intermediation model and more prudent supervision prevented the accumulation of excessive risks in the financial sector.

The direct exposure of Italian banks to toxic assets and US subprime loans was negligible. Asset-backed securities and other structured products held by Italian banks amounted to about 32 billion Euros at the end 2007, 23 billion at the end 2008, less than 1 per cent of total assets. Still, when the crisis erupted, Italian intermediaries suffered from losses on stock market values and other securities held in their portfolios.

Italian banks were affected primarily through the wholesale funding market. Figure 1 shows the dynamics of the Euro area interbank spread between the Euribor and Eurepo, documenting the sharp increase in the spread on unsecured interbank transactions. The illiquidity of the interbank market, together with the drying-up of the securitizations market produced a large negative shock to bank funding conditions. Some evidence suggests that banks partly compensated the reduced availability of funds from these sources by placing bonds with retail customers and moving to bilateral interbank transactions.[5]

As the crisis turned into a global recession at the end of 2008, also the Italian economy started to contract. As shown in Figure 2, defaulting loans as a proportion of existing loans started to increase adding further stress to bank balance sheets. The impact of losses on bank capital was initially limited but as firms' balance sheets started to reflect the effects of the recession banks anticipated further deterioration in the loan portfolio. Furthermore, market participants reassessed risks and banks started to anticipate future higher capital requirements from markets and regulators. Given the difficulties of raising equity due to market conditions, capital constraints could have interacted with funding difficulties, possibly exacerbating the transmission of the financial shock to the real economy.

The impact of the crisis on credit growth is depicted in Figure 3. The slowdown in credit expansion started in the second half of 2007. Following the default of Lehman the rate of growth of loans to nonfinancial firms dropped and became negative by the end of 2009.

Evidence from the responses of the Italian banks participating to the Euro Area Bank Lending Survey conducted on a quarterly basis suggests that both supply and demand contributed to credit dynamics. According to the banks, difficulties in accessing liquidity markets first, and capital constraints after, contributed to a tightening of credit supply conditions (Bank of Italy, 2010; Del Giovane, Eramo and Nobili, 2010; Panetta and Signoretti, 2010). The survey data suggest also that banks reduced their risk tolerance.

[5] See the Bank of Italy Annual Report for the years 2007 and 2008.

This evidence is corroborated by the behavior of the stocks of loans to non financial firms, measured in terms of commitments and in terms of credit drawn (disbursed). Figure 4 reports both variables and shows that commitments tend to lead credit disbursed, as expected. In the short term firms drawdown credit that is available on their lines more intensively since they expect that credit commitments starts to be reduced. Figure 3 also shows credit growth broken down by bank size, following the Bank of Italy classification of banking entities based on assets, on a consolidated basis. There are four classes: 1) top five groups, 2) other large banks or groups, 3) small banks, 4) local cooperative banks. The local cooperative banks are mutual banks and operate on a regional or sub-regional level because of legal constraints. The top five largest groups had a share of total industry asset of 52 per cent at the end of 2008. They own foreign subsidiaries and are active in major international markets. The other commercial banks largely follow a traditional intermediation model catering the domestic market.

The figure shows an interesting pattern. Loan growth started to slow down in the first quarter of 2007 for the major banking groups, after many years of robust expansion. In the fourth quarter of 2007 credit growth decelerated further for the top five groups while it continue to accelerate for the other banks, particularly the small groups.

One obvious candidate for explaining this pattern is the different funding structure of the banks. The five largest banking groups have a higher share of assets that are funded by wholesale sources. The share of assets funded by retail deposits is much higher for the other banks and retail funding markets were unaffected by the crisis. This hypothesis is consistent with subsequent dynamics. The decline in lending continued in the second half of 2008, turning into a contraction for the largest five banking group. Lending growth, instead, continued for the small banks, although at a declining rate. A purely demand side shock would not explain this pattern unless borrowers were affected by the crisis with different intensity and such intensity were correlated with their sorting across banks. This explanation would also be inconsistent with the evidence based on microeconomic data that the borrowers of large banks tended to open new credit relationships with small banks to compensate for reduced credit availability (see the Annual Report of the Bank of Italy on 2009).

As bank balance sheets weakened, other constraints might have played a role, particularly bank capital. The Euro Area Bank Lending Survey shows that Italian banks tightened credit supply conditions starting in the third quarter of 2008 (Figure 5). The answers to the survey suggest that participating banks perceived to be more capital constrained (see Bank of Italy Economic Bulletin). Contrary to intermediaries in other countries Italian banks did not experience large losses on Lehman-related assets; however, after the default of Lehman they started to expect a deterioration

of the loan portfolio because of the recession. Mean capital ratios for different bank types are reported in Figure 6. The largest banking groups held substantially less capital relative to total (risk-weighted) assets already before the crisis; the data show a slight reduction in capital ratios in 2008.

As shown in Table 1, in 2007 the average growth rate of credit commitments was lower for banks that have a larger initial share of funding from the interbank market, those that securitized a larger share of their loans, and those that held a lower share of liquid assets. The level of the capital ratio does not appear to be strongly correlated with credit growth. In the 2008 data, instead, the contraction of credit commitments is milder if banks were more capitalized and had a smaller volume of write-offs.

In what follows we present the empirical strategy to test for the relevance of the funding and capital channels of transmission employing bank-firm data to control for firm-level demand for credit. We study separately 2007 and 2008 for two reasons. First, for Italian banks, the August 2007 shock was mostly a shock to the cost of funding and to liquidity, with limited implications for the capital position of banks. After the default of Lehman, instead, the crisis had a truly global impact, and was transmitted to the real sector producing consequences for the quality of the loan portfolios of banks. Second, the implementation of monetary policy by the European Central Bank changed significantly in the fourth quarter of 2008. In order to provide ample liquidity to the market the European Central Bank moved to a fixed rate tender procedure with full allotment and narrowed the corridor (see ECB monthly Bulletin for further details). This allowed banks to obtain all the liquidity they demanded at a given interest rate, which could have compensated for difficulties in getting funds on the market.

3. The empirical strategy

3.1 The baseline regression

We compare loan growth and the change in the cost of credit across firms borrowing from banks with different funding structure, capital, liquidity ratio, profitability. In what follows we illustrate the empirical model for loan growth. The interest rate model is similar and will be briefly described at the end of the section.

Loan growth is specified as a function of bank variables, relationship characteristics and firm fixed effects. The equation estimated is given by:

$$\Delta CREDIT_{i,j}=\beta_1 INTERBANK_i+\beta_2 CAPITAL_i+\beta_3 LIQUIDITY_i+\beta_4 SECURITIZE_i+$$
$$\beta_5 CHARGEOFFS_i+\beta_6 ROA_i+\beta_7 BANKSIZE_i+\beta_8 MUTUAL\_BANK_i+$$

$$\rho_1 SHARE_{i,j} + \rho_2 DISTANCE_{i,j} + \rho_3 PASTDUE_{i,j} + \rho_4 LOGLOANS_{i,j} + \alpha_j + \varepsilon_{i,j} \quad (1)$$

The variables indexed by i measure bank characteristics while those indexed by i,j control for bank-firm relationship characteristics; α_j are firm fixed effects. *INTERBANK* and *CAPITAL* are measures of the reliance on the interbank market and the capital ratio of the bank, respectively. The semi-elasticities β_1 and β_2 measure the effect of banks' funding and capital position on the rate of growth of credit, defined as total loans committed by bank i to firm j.[6] Although there are many different dimensions that could capture the funding structure of banks, we focus on the ratio between interbank deposits and total assets to measure the importance of wholesale funding for the bank. Adding other variables would increase the risk of multicollinearity.

We control for the share of liquid assets the bank has, as they could act as a buffer if the bank needs to expand credit (*LIQUIDITY*) by substituting securities with loans. In the absence of capital constraints, as loans are weighted more than liquid assets for regulatory capital purposes, banks can sell liquidity to expand credit. For the 2007 sample, we expect the coefficient of liquidity to have a positive sign. During the crisis banks were hoarding liquidity due to expectations of further scarcity and uncertainty about counterparty risk so we cannot know a priori the sign of the relationship between the initial position in liquid assets and credit growth in the 2008 sample.

The variable *SECURITIZE* measures the extent to which the bank securitized loans before the crisis and controls for shock to the bank funding strategy due to the drying up of the securitization market. We expect this variable to have a negative coefficient.

We include the variable *CHARGEOFF* measuring the write-offs and provisions on loans the bank has done in the previous period as a measure of the quality of the bank's assets. We argue that it is more appropriate than the stock of bad loans as it reflects better the degree of ongoing deterioration of the portfolio rather than the effect of past defaults. This variable is meant to capture the expected impact of loan quality on capital. The current capital ratio is an important determinant of the ability of the bank to expand lending but banks take into account actual and expected deviations from their desired capital ratio when setting the growth rate of loans. The impact of the crisis on capital was twofold. On one side the unexpected losses on bank assets affected capital because of charge-offs; on the other hand, banks faced difficulties to raise new equity. Given the short-term constraints on raising new equity, we argue that the volume of loan loss provisions and write-offs should proxy for the short term evolution of the capital ratio. We expect a negative effect of charge-offs on loan growth.

[6] We also run regressions including a dummy for whether the bank belongs to a banking group and for whether the bank (each intermediary within a group) has been involved either as target or as acquirer in an M&A and results hold.

We also include the return on assets (ROA) before the crisis as a measure of bank profitability. ROA is measured in June and profits are the flow of profits between January and June, while assets are measured at June, and thus represent a leading indicator of end-of-year profits which may accrue to capital for the part that is not distributed as dividend. Then, we expect ROA to have a positive effect on bank's ability to extend credit.

Finally, we include a dummy taking the value one if the bank is a mutual bank (MUTUAL_BANK), zero otherwise, since such intermediaries are subjected to special regulation on capital and have limitations on the geographical scope of their activity.

The details on data sources and the construction of the variables are in Section 3 below.

The identification of the supply effect on credit results from the following conditions. The first is that borrower fixed effects in the regression control for firm-level heterogeneity in demand and other characteristics. The second is that banks were exposed to the shock with varying degree depending on their initial conditions. The large banks that raised a substantial share of their funding on international markets before the crisis were more affected by the crisis. The local banks, largely funded with deposits and bonds placed with retail customers, were relatively shielded from the initial shock. Therefore, the regressions are run with data on firms that borrow from at least two banks, and the effect of shocks to bank funding and capital is estimated relying on the within-firm variation. The third condition is that banks did not anticipate the shocks, so that their degree of liquidity, the reliance on interbank funding, their capital position, were not adjusted in advance to better withstand the expected shocks.

We include relationship controls in the regression as each bank may apply different conditions to firms with which it has a closer relationship. To capture this we include a measure of distance between the borrower and the bank, and the share of total credit to the firm held by the bank. We also control for how important as a funding source the bank is by the log of the amount of the loan commitment at the beginning of the period ($LOGLOANS_{ij}$). The variable *PASTDUE* is a dummy equal to 1 if the firm is past-due on its loans with bank i. The α_i are the firm fixed effects so we do not include any firm-level control.

The equation for the change in the cost of credit is very similar:

$$\Delta RATE_{ij} = \beta_1 INTERBANK_i + \beta_2 CAPITAL_i + \beta_3 LIQUIDITY_i + \beta_4 SECURITIZE_i + \beta_5 CHARGEOFFS_i + \beta_6 ROA_i + \beta_7 BANKSIZE_i + \beta_8 MUTUAL\_BANK_i + \rho_1 SHARE_{ij} + \rho_2 DISTANCE_{ij} + \rho_3 PASTDUE_{ij} + \rho_4 LOGLOANS_{ij} + \rho_5 RATE_{ij} + \alpha_j + \varepsilon_{ij} \quad (2)$$

The cost of credit is computed as the average interest rate paid by firms on outstanding balances at the end of the quarter, including commissions and fees. We focus on the cost of

revolving credit lines as their amount and conditions can be renegotiated at short notice by banks. Changes in the Euribor, that is the reference rate for loans on the Italian market, are common to all borrowers and are absorbed in the constant. Our estimates capture the extent to which presumably more constrained banks changed rates to their borrowers.

All the variables are the same as in equation (1) with the exception of *RATE*, which we include as a measure of the initial cost of credit for firm *j* at bank *i.* The variable controls for differences in the initial cost of revolving credit lines across lenders. Due to the fee structure in place in Italy, the actual cost of a revolving credit line is affected by the way the line is used: this may be very large if the line is used up to its limit for just a couple of days, e.g. to pay wages or taxes. The initial level of the rate helps controlling for such unobserved characteristics of the credit relationship.

In all regressions we cluster standard errors at the bank level since our key bank variables do not vary across firms. Not clustering would severely underestimate the standard errors. In the following Section we describe the data and variables employed in the analysis.

3.2 Impact on small and risky borrowers

The baseline specification estimates the average effect for all firms. We modify the regression to take into account the possibility that banks changed supply conditions only to specific groups of borrowers. In particular, we test if smaller, riskier, more leveraged, less profitable borrowers faced greater constraints, as the survey evidence suggests. Other studies found that small firms tend to be affected more by adverse shocks to banks.

The regression equation is modified to include interaction terms between the key bank variables in equation (1) and a dummy identifying the firm type under investigation:

$$\begin{aligned}\Delta CREDIT_{i,j} = {} & \boldsymbol{\beta}(BANK\ VARIABLES_i) + \boldsymbol{\zeta}(BANK\ VARIABLES_i)*FIRMDUMMY_j \\ & +\beta_7 BANKSIZE_i+\beta_8 MUTUAL\_BANK_i+\rho_1 SHARE_{i,j}+\rho_2 DISTANCE_{i,j}+ \\ & \rho_3 PASTDUE_{i,j} +\rho_4 LOGLOANS_{i,j} + \alpha_j + \varepsilon_{i,j}\end{aligned} \tag{3}$$

The vector ζ is the set of coefficients of the interaction terms between the bank characteristics and the dummy identifying either firms in the lowest quartile of the size distribution of firm or firms in the highest quartile of the distribution of leverage. The same specification is estimated for the change in the cost of credit.

3.3 Interactions between bank balance sheet characteristics

The baseline model is further modified to investigate the possibility that the effect of the different sources of constraint to credit supply interact with each other. For example, the ability of the bank to sustain lending by selling liquid assets may depend on the capital position of the bank. If capital is binding because the bank has faced high losses, banks may hold more liquidity than desired because they do not have enough capital to support more loans. Similarly, a stronger funding position might not be enough to increase loans if the bank faces capital constraints or if charge-offs are eroding its capital base. We modify the baseline model including interactions between liquidity, interbank exposure, securitization, loan charge-offs, and the bank capital ratio.

$$\Delta CREDITi,j = \boldsymbol{\beta}(BANK\ VARIABLES) + \boldsymbol{\gamma}(BANK\ VARIABLES)*CAPRATIO + \beta_7 BANKSIZE + \beta_8 MUTUAL\_BANK + \rho_1 SHARE + \rho_2 DISTANCE + \rho_3 PASTDUE + \rho_4 LOGLOANS + \alpha_j + \varepsilon_{i,j} \quad (4)$$

The interaction term coefficients capture any variation in the impact of the bank balance sheet characteristics on credit growth that is dependent on the level of initial capital the bank has.

4. The data

4.1 Data sources and main dependent variables

We employ a very large data set of credit relationships between Italian banks and non-financial firms. We merge information from four sources: i) data on loans from the Central Credit Register (CR); ii) data on the cost of credit for a representative sample of Italian banks from a special section of the CR); iii) Supervisory Reports on banks' balance sheets; iv) financial variables on borrowers from the Firm Register (Cerved). The CR is a centralized system managed by the Bank of Italy that tracks the credit exposures of the clients of resident banks. Banks can file inquiries to the CR about loan applicants to verify their creditworthiness, specifically regarding the total amount of outstanding loans and the borrower default history. To be recorded in the CR a borrower has to have either loan commitments or loans outstanding of at least 75,000 euros.

At each reporting date (end of the month), banks provide information on credit committed by type of loan, the amount of credit actually disbursed, whether the loan is collateralized or not. The loan types are: i) loans backed by account-receivables, ii) term loans, iii) revolving credit lines. The information on interest rates is instead collected quarterly and refers to the average cost paid by the borrower on credit disbursed for each type of loan, with commissions and fees included.

To construct our data set, we start from the cross-section of all credit relationships recorded in the CR at the end of June 2007 and referring to businesses. If the borrower is already in default status with one lender we drop the relationship. If the lender belongs to a banking group we aggregate all the credit relationships each firm has with banks of the same group. We do this for three reasons: first, lending policies are typically decided at the group level; second, funding, especially interbank funding, is conducted at the group level, and funds are then redistributed through the internal capital market among member banks; third, the regulatory capital ratios are imposed both at the group and at the individual level. We also include loans granted by financial companies that are part of banking groups as many groups include specialized intermediaries that do factoring and leasing. We want to make sure we do not underestimate the credit provided by the same entity.

We then collect the data on the same relationships as of December 2007 and compute growth rates for both credit committed and disbursed. To account for changes in the composition of banking groups or mergers and acquisitions between independent banks occurred between June and December 2007 we construct pro-forma data for the June 2007 relationships by applying the group structure as of December 2007. Loans that were securitized between June and December are attributed to the originating bank if the vehicle is controlled by the originator because the bank is still lending to the firm and still has an exposure in terms of risk.

Growth rates are computed as percentage changes in credit commitments. In computing growth rates we need to take into account the cases in which credit drops to zero or the relationship is no longer observed at the end of the period. There are three possible reasons: i) the firm has defaulted and the bank no longer extends credit; ii) the relationship has been interrupted either by choice of the borrower or of the lender; iii) the observation is censored because of the CR threshold. In case i) we can observe defaulted loans in register regardless their amount. Cases ii) and iii) are treated in the same way since it is not possible to distinguish them. This could lead us to overestimate the magnitude of the reduction in credit but not whether there was or not a drop. To ensure the robustness of the results we estimate the regressions both keeping all the cases in which credit goes to zero and setting credit growth to -100 per cent (baseline), and dropping them, thus analyzing the intensive margin. In this case, as a further robustness check, we also estimated the model measuring growth rates by the difference in the log of committed credit, and results, available on request, are unchanged.

The credit data were then matched with the firm variables from Cerved, described below in Section 4.3. Cerved collects the balance sheets of approximately 500,000 firms from the official Italian Firm Register. We employ the Cerved data referring to 2006 to limit endogeneity with

respect to credit conditions and to reflect the balance sheets that the banks could observe between June and December 2007.

We repeated the procedure to construct the matched bank-firm data for credit relationships observed at the end of June 2008. Pro-forma relationships were obtained applying to June 2008 the banking group compositions observed in December 2008. The Cerved balance sheet data refer in this case to 2007.

The match of Cerved with the CR yields over 700,000 relationships referring to about 300,000 firms in each period. Many Cerved firms do not have loans in the CR and many of the firms in CR do not have balance sheets in Cerved, mostly because they are small and the data are incomplete. Since we have firm fixed effects in our main specification, the sample used for the regressions only includes firms that borrow from at least two banks. The resulting samples contain about 630,000 relationships in the first phase of the crisis (2007), and about 655,000 in the second one (2008).

In our main regression we study the behavior of total credit commitments. For robustness we also estimate regressions for total credit disbursed. The dynamics of the two components may differ significantly as in Italy the costs of unused credit commitments is typically included in up-front fees. While credit commitments reflect relatively more the supply-side decisions of banks, credit disbursed is mainly driven by firms' decisions about how much they draw from the available commitments. Past observation has shown that the ratio of drawn to committed tends to increase when credit demand is high and then is followed by an expansion in credit commitments during credit booms. Symmetrically, the ratio increases when credit supply is not accommodating demand during a tightening of loan supply; in this case both commitments and credit drawn contract or slowdown with commitments leading (see also Figure 4).

The distribution of the growth rate of credit in our sample of bank-firm relationships is shown in Table 2. On average, credit commitments decreased in both periods while credit disbursed increased. Credit disbursed is more volatile than credit commitments, as firms use available credit depending on their liquidity needs. This explains why mean growth is positive. However, median growth is negative in both periods for both committed and disbursed indicating that credit disbursed did decrease for most relations.

In the empirical analysis of the cost of credit we employed data on the interest rates charged by banks to firms on credit drawn from revolving credit lines, comprehensive of fees and commissions. The cost is the annualized rate charged in the quarter of reference on loans disbursed. In our analysis we compare the change in the cost of credit between the second and fourth quarters of 2007 and 2008, respectively. We focus on revolving credit lines as their conditions can be

renegotiated at short notice by the bank. We expect that changes in the cost of funding are transmitted to the cost of credit lines more quickly than to other forms of credit.

These data are available for a representative sample of the banking system (about 90 per cent of business loans outstanding in Italy) so we lose some of the observations due to missing information on rates.

The distribution of interest rates is shown in Table 2. In 2007, median rates increased by 44 basis points, although the mean was slightly negative (17 basis points). In 2008, the median was again positive, 28 basis points, while the mean was almost zero (8 basis points). These are in line with expectations: policy rates in 2008 decreased substantially after Lehman default, and this may explain the lower median value for rates in 2008 than in 2007, despite the stronger increase in the rates on unsecured interbank deposits.

4.2 Bank variables

Bank variables are constructed from data in the Supervisory Reports filed with the Bank of Italy. In what follows we employ the term bank and use consolidated data when the individual bank belongs to a group, unconsolidated if that bank does not belong to a group. We exclude subsidiaries of foreign banks from the sample, since we do not observe the data for the parent company.[7]

The variable *INTERBANK* is the ratio of total borrowing from other banks to total assets. *LIQUIDITY* is the sum of cash holdings and sovereign bonds divided by total assets.[8] Both variables are averages of the data for the previous three semesters (June 2006, December 2006 and June 2007; June 2007, December 2007, and June 2008). We take averages to smooth temporary fluctuations in banks' liquidity needs because we want to capture the structural liquidity ratio.

The capital ratio (*CAPRATIO*) is given by the standard ratio of regulatory capital to total risk weighted assets. As discussed in Section 2, we need to control for the quality of assets in addition to having a measure of the current capital ratio to capture the bank's ability to expand lending. Ideally we would need a forward looking measure of loan defaults, for example provisions, to measure the bank's expectations about portfolio quality. However, such measure is not available and we can use only the aggregate of provisions and charge-offs. We construct the ratio of loan loss provisions and charge-offs to t-1 loans (*CHARGEOFF*). The data refer to the semester that precedes the one under study so *CHARGEOFF* contains provisions for the expected losses in the upcoming

[7] We also exclude a small government owned bank specialized in credit to sport activities that has a very large capital ratio (above 90%). The bank has only 125 relationships in our dataset, so results are not affected by its exclusion.

[8] We also estimated the model using the ratio of cash plus securities (including shares, corporate bonds, etc.) to total assets as the measure of liquidity and results were broadly unchanged. We believe that cash and sovereign bonds as liquid assets better captures the actual liquidity position of banks as securities such as shares and corporate bonds traded at a significant discount as the crisis unfolded.

semester and charge-offs from the previous one. Other studies do not account for this dimension, which we believe can be particularly important when it is very costly to raise new equity on the market. The variable ROA is given by the ratio of profits (or losses) to total assets, computed at the beginning of each period (June 2007 or June 2008). Profitability in the first half of the year is a leading indicator of end of year profits which can be retained to increase bank capital. The variable *SECURITIZE* is a measure of the reliance of the bank on securitization as a means to mobilize its portfolio before the crisis. We compute the annual volume of securitized loans in the years 2004-2006 and cumulate it. The sum is normalized by bank total assets as of June 2007.[9] Bank size is measured by the log of gross total assets.

Table 3 reports descriptive statistics of the bank variables. The intermediaries in our sample are highly heterogeneous in terms of size, capitalization, reliance on the interbank market for funding, volume of securitization. The comparison between the first and the second phase of the crisis shows that in the latter, capitalization and the reliance on the interbank market was lower, while charge-offs were higher. Most banks did not securitize any loan between 2004 and 2006 but the relatively large value of the standard deviation reflects the fact that few banks engaged in substantial securitization. Table 4 shows the correlation matrix of the bank-level variables. The correlations among the bank variables employed in the regressions mostly capture the difference in business model between the larger banks and the small retail oriented ones.

4.3 Relationship and Firm Controls

In all regressions we include relationship-specific controls for the willingness of the bank to extend further credit to the borrower. The log volume of credit committed at the beginning of each sample period (*LOGLOANS*) and the share of bank i in total credit to firm j (*SHARE*) measure the exposure of the bank to each firm and how important the lender is with respect to all funding sources to the firm. The signs of the coefficients are ambiguous. If a bank already has a high exposure to the firm, it may be less willing to increase it further; however, if the firm is financially fragile and dependent on the bank, there could be an incentive to keep lending further in the hope that cyclical economic conditions improve. The strength of the relationship is measured by a dummy taking the value zero if bank i has a branch in the same zip code in which the firm has its head office (*DISTANCE*). Banks that are physically close to the firm or provide loans based on a stronger relationship with the firm are expected to have incentives to smooth credit in difficult times to that firm, *ceteris paribus*. If the firm has already loans that are past due with the bank, the bank will be less likely to grant additional credit. Therefore, we include a dummy variable taking the

[9] For the 2008 sample we also tried normalizing the variable by June 2008 assets, and results are unchanged.

value one if firm j had past due loans with bank i (*PASTDUE*) at the beginning of each sample period (June 2007, June 2008).

For the purpose of analyzing differential effects of the bank funding shocks on different types of borrowers, we focus on size or risk. We identify small firms as those in the bottom quartile of the distribution of sales. Riskier borrowers are identified according to three alternative definitions: i) those whose leverage, computed as total debt divided by total assets[10], is in the top quartile of the distribution; ii) those classified in the top 3 notches of Altman's Z-score as computed and released by Cerved[11] (Altman et al. 1994); iii) those with operating profits in the bottom quartile of the distribution. The main descriptive statistics of the firms included in the sample are shown in Table 5.

Table 6 reports sample statistics. The bank variables have a very different distribution than in the bank-level raw data because the sample is dominated by the large banks that lend to many borrowers.[12]

5. Results from the baseline regression and heterogeneous borrower effects

5.1 June-December 2007

Column 1 in Table 7 shows results from the estimation of the baseline model. The main variables have the expected sign. The exposure of the bank to the interbank market is negative and significant and the measure of liquidity is positive and significant. Based on the estimated coefficients, a one standard deviation increase in the exposure to the interbank market led to a lower growth of credit commitments by 0.86 percentage points. A bank whose share of liquid assets over total assets was higher by one standard deviation increased its credit commitments by 0.56 percentage points. Both are economically significant effects as the mean growth of commitments in our sample is -3.8 percent.

Coefficients on the capital ratio, loan write-offs, and return on assets are not statistically significant. This is in line with the idea that the August 2007 shock had a limited impact on bank capital, and is consistent with findings in other studies (Iyer et al., 2011).

Regarding the other bank level controls, the extent to which banks securitized their loans prior to the crisis has a negative and highly significant coefficient. A one standard deviation increase in the ratio of amount of loans securitized to total assets led to a -1.5 percentage point

[10] For a large number of smaller borrowers no data are available on financial debt. Leverage is computed as 1-(equity/assets).
[11] Cerved uses a scale of 9 scores with credit risk increasing from low to high values.
[12] For robustness purposes we repeat the estimation without the two largest banks, and results, available upon request hold.

lower growth in credit commitments. As argued above, this variable measures both the extent to which the bank accessed another source of funding that was important before the crisis, and the business model of the bank. Overall these results point to the importance of the funding structure for credit growth and no direct effect of the capital position of the bank.

The coefficients of the relationship controls have the expected sign. The growth of credit commitments is larger in relationships with banks that are geographically closer. If the borrower had already past-due loans with the banks credit grows less, as expected.

In Column 2 of Table 7 we report the results of a robustness check in which the dependent variable is the growth rate of committed revolving credit lines. These lines are mostly unsecured and can be terminated at short notice by the parties. The securitization variable remains statistically significant and negative while the coefficients of the exposure to the interbank market and liquidity both have the expected sign but are no longer significant. The coefficient of loan charge-offs is statistically significant and positive. This result however is not robust since it is entirely driven by one of the largest banks, which accounts for thousands of the relationships in our sample. If estimates are run excluding this very large intermediary, the coefficient of loan charge-offs is insignificant. This result could be explored in further analyses.

Finally, column 3 shows estimates of a regression of credit disbursed instead of credit committed. Results indicate that firms draw credit less from banks that have a higher ratio of securitized to total assets. The usage of credit lines is employed by banks to monitor borrowers health: internal monitoring procedures of banks often require loan officers to explore the reasons for a more intense usage of the lines. This piece of information is typically used when banks decide to renegotiate credit lines. Our results are consistent with this possibility: firms may want to reveal less information about their financial health to banks that were more exposed to the crisis, possibly fearing that such banks could be more inclined to cut credit if borrowers show signs of fragility.

We study this possibility in further detail, and in particular, we examine whether the elasticity of credit to banks' balance sheet variables, and thus to their exposure to the shock, differs as a function of firm characteristics. Table 8 reports regressions that include interaction terms between the bank variables and dummies that identify the riskier or smaller firms. None of the interaction terms is statistically significant, indicating little evidence of heterogeneous elasticity of credit to banks' balance sheet variables across firms. The linear term for capital is negative and marginally significant in the regressions with interactions for riskier and low profitability firms. This may be due to banks with less capital granting relatively more credit to safer and more profitable firms.

We then turn to the transmission of the shock to interest rates charged on revolving credit lines. Table 9 shows the results. In column 1 we report coefficient estimates for the baseline regression for the cost of credit, inclusive of fees and commissions. The higher the reliance of the bank on the interbank market and on securitizations prior to the crisis the greater the relative increase in rates. The cost of credit lines from banks with a one standard deviation higher share of interbank funding to total assets increased by 17 basis points more, that from banks with the same increase in securitizations over total assets prior to the crisis increased by 52 basis points more. These findings reflect the fact that these banks were those that faced the largest increase in the cost of funds. The initial level of the cost of credit is negatively related to its change during the shock.[13] This is expected as banks are less likely to increase rates much if these were already higher.

Columns 2 to 5 of Table 9 investigate whether firm size or risk mattered in how bank variables affected the cost of credit. Again, there is little evidence of differences in the elasticity of the cost of credit to bank balance sheet structure across firms. Only the interaction between interbank funding and the dummy for riskier firms is marginally significant. Its negative sign indicates that the elasticity of the interest rate to bank's reliance on interbank funding is smaller if the borrower is riskier. This may seem counterintuitive, but it can be rationalized by the fact that the pricing of credit to riskier borrowers is mostly affected by firm-specific characteristics than by bank characteristics, at least as long as the real sector is not hit by a system-wide shock. Interestingly, loan charge-offs still have a positive but now significant (at the 10 percent level) coefficient, indicating that banks with more credit write-offs increase the cost of credit more. This result is in line with Santos (2011).

5.2 June-December 2008

We now turn to study the second period, in which changes of loan commitments are measured between June and December 2008. We expect the variables that have an impact on future capital (bank profitability and loan charge-offs) to matter more than in the previous periods. Results from the estimation of the baseline regression are shown in Column 1 of Table 10. Among the bank variables, both the reliance on interbank funding prior to the crisis and return on assets have a significant effect on credit growth. In particular, a one standard deviation increase in the extent to which banks raise funds in the interbank market leads to a 0.71 percentage points lower credit growth, while a one standard deviation increase in bank ROA leads to a 2.55 percentage points higher credit growth. These are economically significant effects when compared to a mean credit

[13] The initial level of outstanding revolving credit lines is defined before the change in the cost of credit during the crisis.

growth of -4.63 percent in the sample. The other variables, in particular liquidity, have the expected sign, but none is significant. This may be due to the effect of the unprecedented monetary policy interventions put in place by the ECB easing liquidity concerns of banks.

Column 2 shows results from the baseline model regressed on the growth rate of revolving credit lines. Now, only loan charge-offs is significant, and negative, indicating that banks with greater portfolio deterioration contracted credit more. Loan charge-offs also capture bank's appetite for risk, and we can expect that, in the presence of a system-wide recession, banks with more loan charge-offs tend to reduce their supply of unsecured credit lines. Column 3 shows results for the growth rate of credit drawn: firms use credit more from banks with higher ROA. This, as in the 2007 sample, supports the idea that firms use more intensely the credit lines granted by healthier banks.

Table 11 shows the results of regressions with the interaction terms for small and riskier firms. None of the interactions is significant, indicating again little heterogeneity in the elasticity of credit to bank balance sheet structure for different borrowers. Finally, we analyze the pass-through of the shock to interest rates. Table 12 (column 1) reports the estimated coefficients for the baseline regression for the cost of credit. The reliance on securitizations before the crisis, and loan charge-offs have a positive and significant effect. In particular, a one standard deviation increase in either variable leads to a 0.36 and 0.86 basis point higher cost of credit, respectively. Column 2 to 5 show regressions with heterogeneous effects of the bank variables across firms. Banks with more capital increased the cost of credit less to riskier and smaller firms. There is a difference in the effect of liquidity and of interbank funding between smaller and larger firms. However, the total effect of liquidity, capital ratio, interbank funding, is not significant on either class of firms. Similarly, the effect of interbank funding for riskier firms is not significant. These results again suggest that there has been little heterogeneity in the elasticity of interest rates to bank balance sheet structure.

Overall, these results suggest that in the 2007 sample, bank liquidity, exposure to the interbank market and securitization activity were particularly important in shaping the dynamic of credit supply both in terms of quantity and cost. After the default of Lehman, bank profitability has a strong influence on the growth of credit commitments and we interpret this as indicating that banks were paying greater attention to the evolution of capital ratios. This interpretation is consistent with a strong positive and significant effect of loan charge offs on the cost of credit.

6. Results on interactions between bank balance sheet variables

In this section we study whether bank balance sheet variables have non linear effects on credit supply. We focus our attention mostly on the capital ratio, whose role has been stressed by

the theoretical literature on the bank lending channel. Estimates from regressions on credit quantity for the June-December 2007 data are shown in Table 13. Results uncover an interesting pattern: securitizations and ROA matter less the more capitalized is the bank. In particular, in the first phase of the crisis, a one standard deviation drop in the capital ratio from the mean (this essentially represents a depletion of excess capital since the capital ratio drops to around 8 percent[14]), raises the semi-elasticity of the growth of credit commitments to ROA by about 80 basis points (from 5.4 to 6.2 per cent), and lowers that to securitizations by about 25 basis point (from -1.5 to -1.25 per cent). The total effect of capital is not significant at the average level of liquidity, interbank funding, reliance on securitizations.

Our results also suggest that there is a positive and significant interaction between the shares of liquid assets and of interbank funding, indicating that banks are more sensitive to their liquidity position if they rely more on interbank funding, and similarly, the negative effect of interbank funding on credit growth is mitigated by banks' liquidity. This is what we would expect if liquid assets are employed as a buffer to compensate adverse shocks to funding availability.

Table 14 shows results from the same regressions estimated on the 2008 data. As in the 2007 sample, the capital position of the bank increases its sensitivity to the impact of the shock, although the relevant channels are somewhat different: a one standard deviation drop in capital ratio, raises (in absolute value) the semi-elasticity of the growth of credit commitments to securitizations by about 36 basis points; those to bad loan provisions and to ROA by about 32 basis points. This is consistent with the expectation that banks that already absorbed more losses on their loan portfolio or were less profitable, took a more prudent stance towards borrowers the less their initial capital position.

The same regressions were estimated for the change in the interest rate as the dependent variable. In the 2007 sample none of the interactions is significant. In the 2008 sample only those between capital and liquidity, capital and securitizations, interbank funding and liquidity are significant, indicating that the effect of liquidity in dampening interest rate increases is stronger the more the bank is capitalized, the effect of the exposure to the interbank market in passing through interest rate raises is weaker the more the bank has liquid assets, and finally the effect of the reliance on securitizations is weaker the more the bank is capitalized (results are not reported for the sake of brevity, but are available upon request).

[14] We use the distribution of bank variables from the bank-firm relations sample. See Table 6.

7. Relationship survival and new relationships

The analysis discussed so far focuses on the dynamics of credit volume and cost for relationships that were already observed at the beginning of each period and treats equally a reduction in credit and the interruption of the relationship. As a next step, we study the dynamics of relationships distinguishing between those that still exist at the end of each period and those that are no longer observed.

Column 1 of Table 15 shows results from the baseline regression estimated on the subsample of relationships in place both at June 2007 and at December 2007. The results are very similar to those for the entire sample. Banks with more liquidity, with less exposure to the interbank market, and that securitized their loans less prior to the crisis, increased credit granted more. Now, also ROA is significant and positive, indicating that more profitable banks increased credit commitments more.

In Column 2 we show the estimated coefficients for the probability that a relationship in place at June 2007 no longer exists by the end of the year. We define a dummy variable equal to 1 if a credit relationship in place at June 2007 is no longer observed at December 2007[15]. About 8 per cent of the relationships in our sample are cut.[16] The model is estimated as a linear probability model to avoid estimating a Probit with a very large number of fixed effects. The probability that a relationship is terminated is larger if banks rely more on the interbank market and if they securitize assets more prior to the crisis. As expected, the probability a relationship is cut is higher if the firm is geographically more distant from the borrower.

The results for the 2008 data are shown in columns 4 and 5 of Table 15. The frequency of relationships interrupted in this sample is 6.2 per cent. Column 4 displays estimates from relationships that are in place in both June and December 2008. Both liquidity and ROA are positive and significant, while interbank funding is negative and marginally not significant (p-value 0.116). These results are similar to those for the entire sample. Moreover, as reported in column 5, the probability a relationship is cut increases in the bank reliance on interbank funding and if banks have a lower ROA. Overall, these results point to a somewhat weaker, though still significant, effect of interbank funding and the liquidity position, and a more important role for bank profitability in the 2008 than in the 2007 period.

Finally, we consider the extensive margin, i.e. the decision of a bank to grant loans to new clients. Banks might allocate credit preferably to existing borrowers when they are constrained and

[15] There is the possibility that the relationship is no longer observed because it falls below the CR reporting threshold. In this case we are overestimating relationship severed by treating relationships that experience a cut in credit as going to zero.

[16] The sample size drops because we use in the estimation only firms that have multiple relationships. If a firm has two relationships, and one of these is cut, we exclude the firm from the estimation, as it becomes a single-banked firm.

be more reluctant to lend to new borrowers. We use data on loan applications recorded in the Credit Register to study the probability that a loan application is accepted. The CR records requests of information by banks on a given borrower and keeps track of the motivation of the request, typically a loan application by a new client. Therefore, we indirectly have data on the number of applications by each borrower to each bank within a given period. We count all the queries submitted by banks between June 2007 and December 2007 and between June 2008 and December 2008. Then, we check in the Credit Register if the bank granted any credit to the loan applicant in the sample period and in the following three months. For example, we consider a loan application submitted to a bank between June 2007 and December 2007 as accepted if we observe that the bank grants credit to the borrower between June 2007 and the end of March 2008.

We then estimate regressions with the same set of explanatory variables and a binary dependent variable defined as equal to 1 if the application of firm j to bank i is accepted, 0 otherwise. The frequencies of accepted applications are 39.6 per cent in 2007 and 25.7 in 2008. Again, the regression is estimated as a linear probability model with firm fixed effects using firms that posted at least two loan applications. We prefer to use the linear probability model because there are many possible unobservables at the firm level that we cannot control for. Including the firm fixed effects reduces by more than half the sample as it requires at least two applications by each firm in the same period. We repeated the estimation without the firm fixed effects over the whole sample of firm applying for loans and results are qualitatively the same.

Results for 2007 are reported in column 3 of Table 15. We find that banks with a lower exposure to the interbank market are more likely to accept loan applications, as expected: a one standard deviation increase in interbank funding over total assets decreases the probability a loan application is accepted by about 1.8 percent.

Results for 2008 are shown in column 6 of Table 15. They indicate that banks with more liquid assets and with higher ROA are more likely to accept loan applications as in the 2007 sample. A one standard deviation increase in the share of liquid to total assets raises the probability a loan application is accepted by about 1.7 per cent, the same increase in ROA raises the probability by about 1 percent.

The study of the probability of initiating new credit relationships confirms the overall picture: bank profitability plays a more prominent role after Lehman, with the unfolding of the global recession and expectations of higher capital requirements, than in the 2007 sample. On the other hand, liquidity still plays a role, while banks' reliance on interbank funding seems to be somewhat less important.

8. Conclusions

The evidence from the empirical analysis supports the view that initial banks' balance sheet structure mattered for loan growth once the banks were hit by the crisis. Overall, we find some evidence that the frictions that mattered were different in 2008 from 2007. In 2007 the exposure to interbank markets, the use of securitizations before the crisis, and the share of liquid assets had significant effects on credit growth. In 2008 the data support a strong effect of bank profitability and loan charge-offs (the latter mainly on the cost of credit), given the initial level of capitalization, which suggests that concerns for the evolution of capital were playing a role.

As in other studies, we do not find any significant effect of the level of the capital ratio on lending growth. However, we do find evidence suggesting that the initial capital position affected the elasticity of credit growth to the other balance sheet variables. The effect of the funding structure on credit supply critically depends on the degree of banks' capitalization, as suggested by models of the bank credit channel (Kashyap and Stein, 1993). While capital ratios in our data have little "direct" effect on credit growth at the average of the sample, they significantly impact on the (semi-) elasticity of the funding variables: better capitalized banks are less sensitive to shocks to funding.

Finally, our analysis of changes in the cost of credit indicates that banks that relied more on securitizations and on the interbank markets prior to the crisis, and that had higher loan charge-offs, increased interest rates on revolving credit lines more than the other banks, thereby transmitting to customers a higher fraction of the increase in the aggregate cost of funding caused by the crisis.

Overall, the policy message arising from our results is that the funding structure of banks and liquidity are very important in shaping the bank lending channel during a crisis. A robust result that could be further explored is that banks' reliance on securitization represented a source of weakness to the shock. Macroprudential and monetary policy models should therefore include the funding structure of banks and their business models in evaluating the response of credit volumes and standards to shocks.

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TABLES AND FIGURES

Figure 1: Interbank Spreads on Euro market (Euribor – Eurepo)

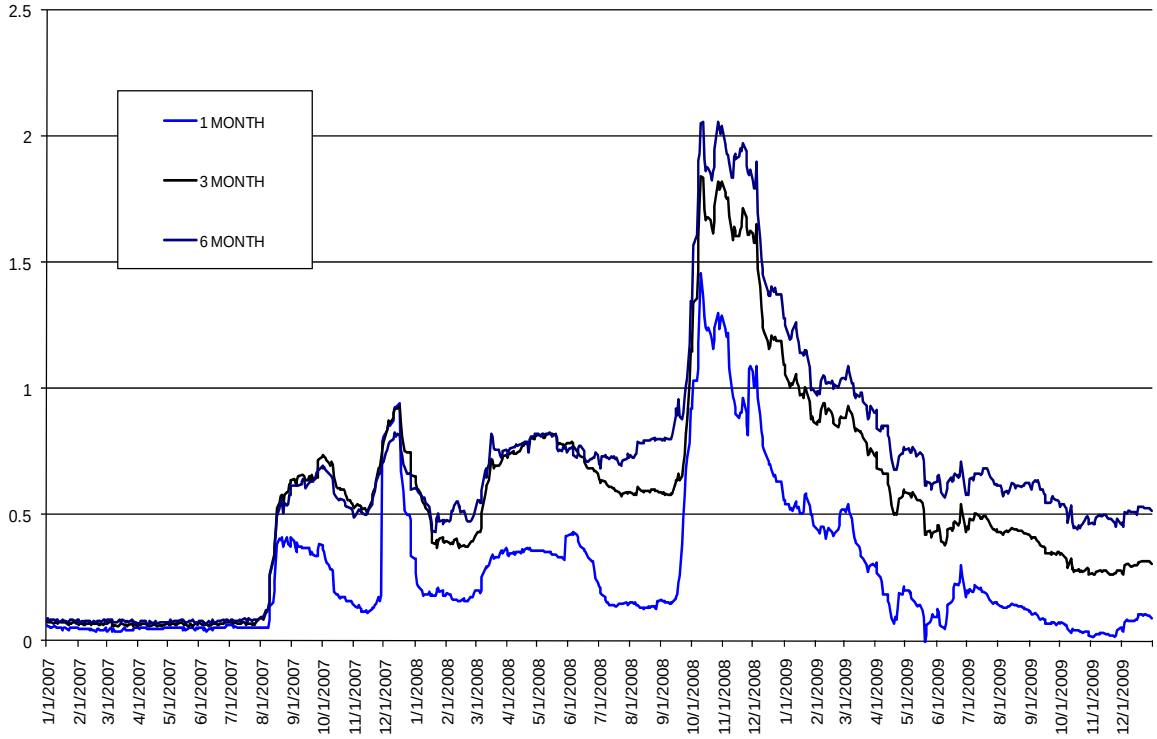

Figure 2: GDP Growth and Loan Default

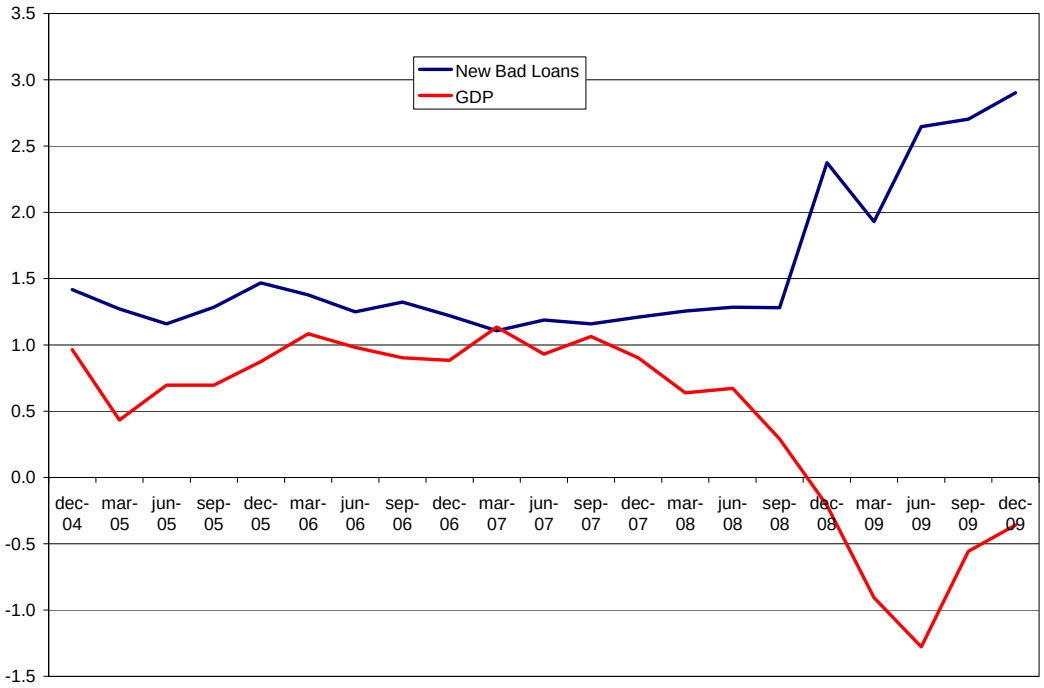

Figure 3: Loan Growth for different types of Banks

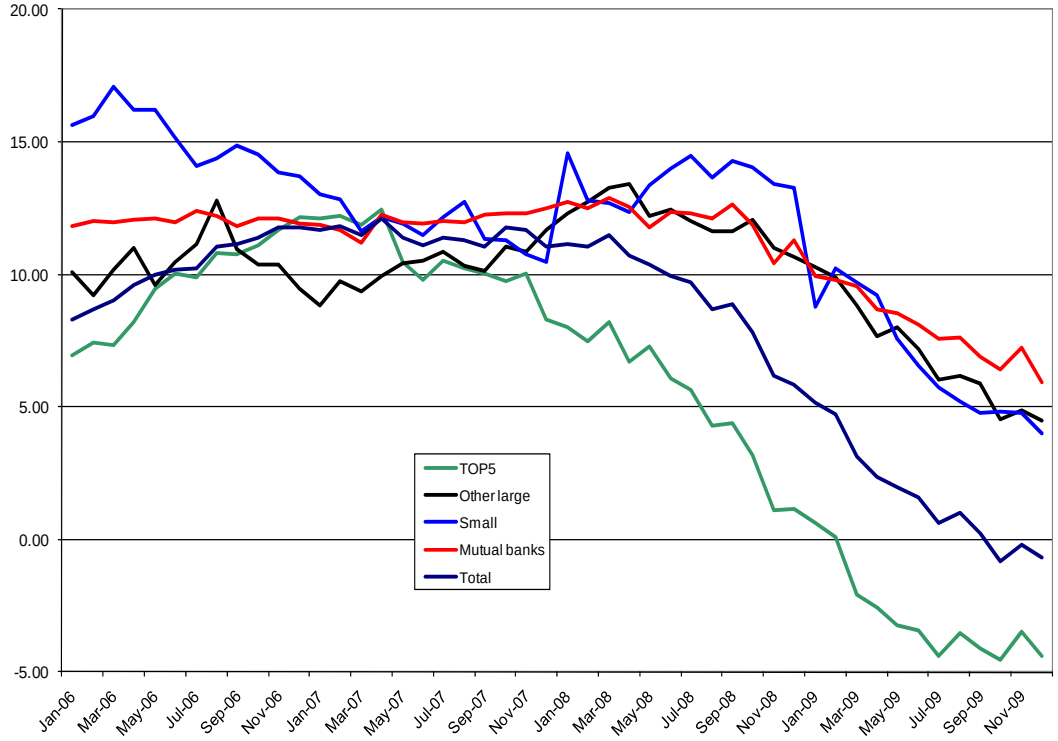

Figure 4: Credit commitments and credit drawn, stocks

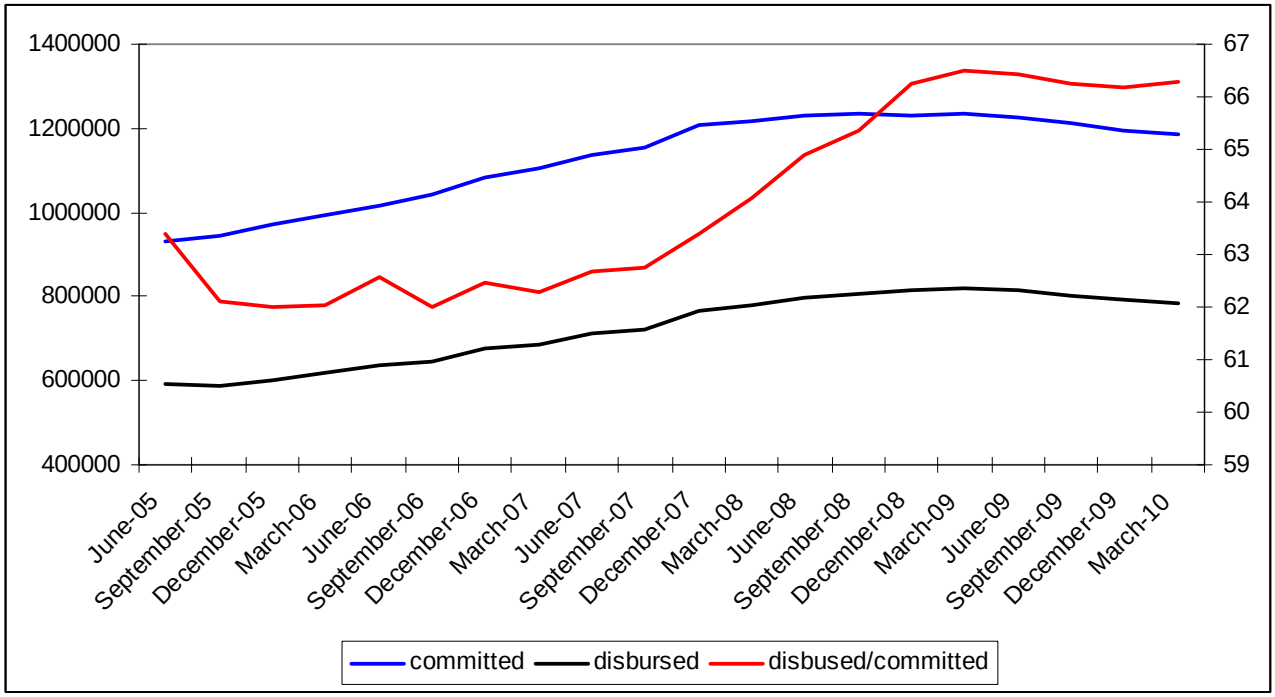

Figure 5: Net Percentage of Italian Banks that tightened credit supply conditions
Euro Area Bank Lending Survey

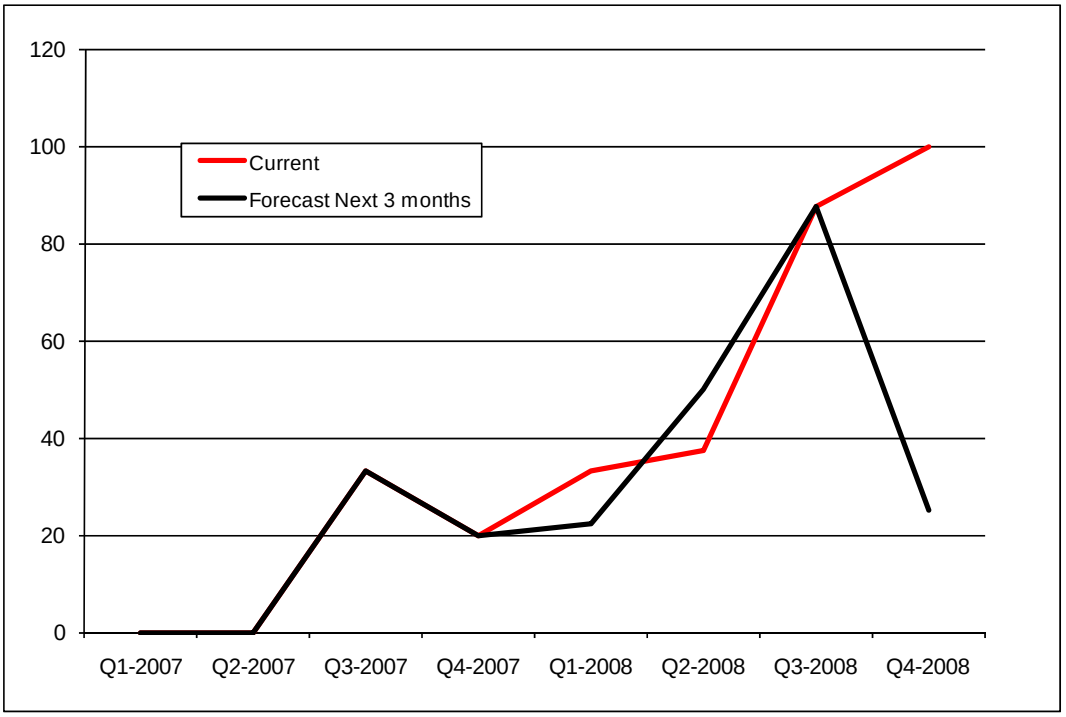

Figure 6: Capital ratio by bank size class (% of risk-weighted assets)

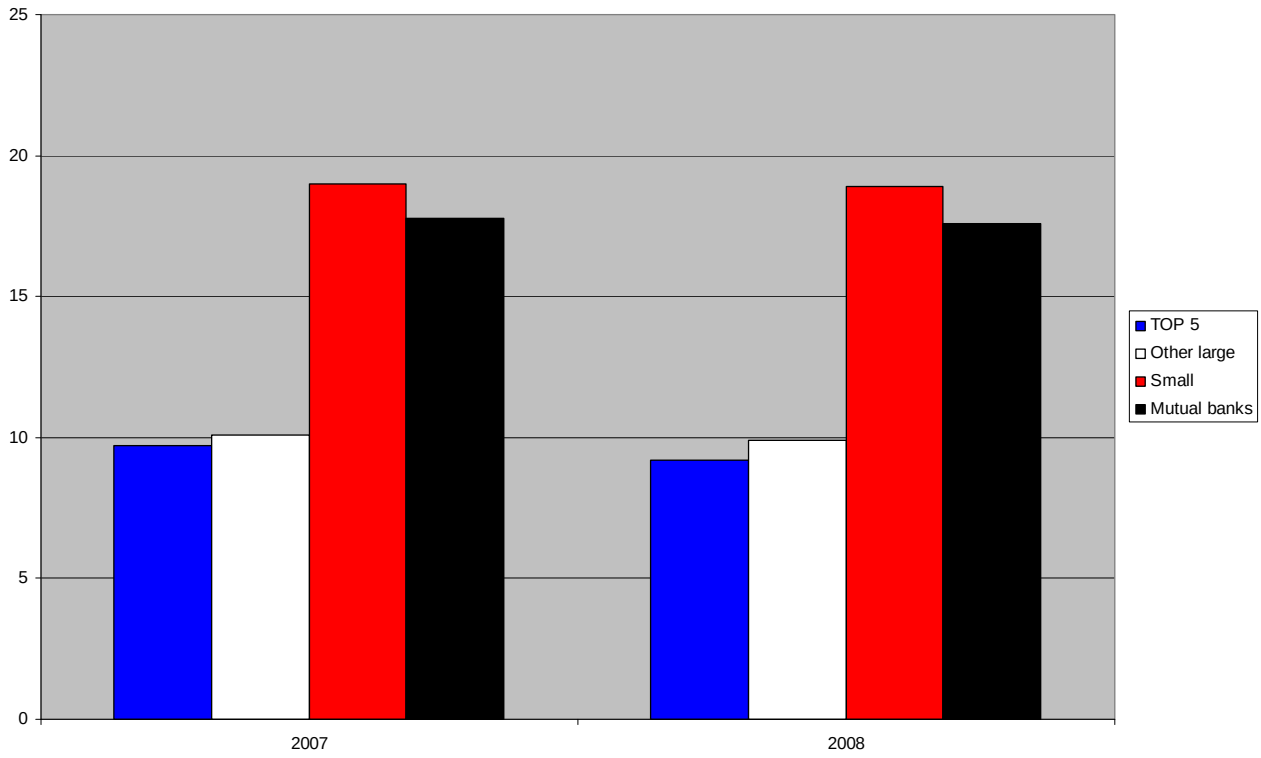

Table 1: Bank Credit growth conditional on the distribution of bank characteristics

	June-December 2007			June-December 2008		
	Growth of credit commitments					
	<25 pct	*25-75 pct*	*>75 pct*	*<25 pct*	*25-75 pct*	*>75 pct*
Capital ratio	-5.7	-4.9	-5.5	-6.9	-5.9	-3.4
Liquid Assets/Assets	-5.9	-5.0	-5.1	-6.9	-5.9	-2.7
Interbank borrowing/Assets	-5.4	-4.8	-6.0	-2.9	-6.0	-8.0
Securitizations/Assets	-4.8	-5.2	-5.9	-4.4	-5.7	-7.2
Charge-offs/loans	-5.7	-4.9	-5.3	-3.9	-6.1	-6.6
Return on Assets	-6.1	-5.3	-4.1	-7.9	-4.7	-5.5

Table 2: Descriptive statistics of credit growth and interest rate changes.

		2007			2008		
		Mean	**Median**	**Std.dev**	**Mean**	**Median**	**Std.dev**
		Dependent Variables					
ΔCREDIT	Growth rate of credit commitments (percentage points)	-3.8	0	43.1	-4.63	0	37.5
ΔDISB	Growth rate of credit disbursed (percentage points)	17.1	-3.05	116.7	14.43	-4.24	108.5
ΔRATE	Change in the cost of credit for revolving credit lines (percentage points)	-0.17	0.44	8.28	0.08	0.28	7.57

Table 3: Statistics on Banks

Variable name	Definition	June 2007			June 2008		
		Mean	**Median**	**Std.dev**	**Mean**	**Median**	**Std.dev**
INTERBANK	Interbank borrowing divided by total assets	3.73	1.34	9.18	3.8	1.3	9.8
CAPRATIO	Regulatory capital divided by risk weighted assets	17.3	14.6	8.41	17.4	14.5	9.9
LIQUIDITY	Cash and Sovereign bonds divided by Total Assets	16.2	14.2	9.90	15.4	13.9	9.8
SECURITIZE	Cumulated securitizations 2004-2006 divided by Total Assets	1.52	0	5.82	1.5	0	5.81
CHARGEOFF	Loan Loss Provisions and Charge-offs divided by the t-1 stock of loans	0.29	0.12	2.5	0.24	0.16	0.42
ROA	Profits divided by total assets	0.43	0.48	0.64	0.25	0.37	0.82
SIZE	Total Assets (million Euros)	5,301	293	50,359	5,563	323	53,012
N. of banks		538			537		
of which mutual		387			381		
N. of firms		176,997			185,260,		

Table 4: Correlation matrix of Bank Variables

	CAPRAT.	LIQUID.	INTERB.	SECURIT.	CH-OFF	ROA	BS	MUT.B.
CAPRATIO	1							
LIQUIDITY	0.60	1						
INTERBANK	-0.32	-0.28	1					
SECURITIZE	-0.16	-0.22	0.13	1				
CHARGEOFF	-0.17	-0.17	0.33	0.26	1			
ROA	0.06	0.09	0.17	-0.46	-0.15	1		
BANKSIZE	-0.49	-0.44	0.51	-0.12	0.23	0.53	1	
MUTUAL B.	0.53	0.62	-0.36	-0.03	-0.19	-0.09	-0.61	1

	CAPRAT.	LIQUID.	INTERB.	SECURIT.	CH-OFF	ROA	BS	MUT.B.
CAPRATIO	1							
LIQUIDITY	0.52	1						
INTERBANK	-0.29	-0.03	1					
SECURITIZE	-0.11	-0.19	0.20	1				
CHARGEOFF	0.01	-0.15	0.03	0.26	1			
ROA	0.06	0.22	0.01	-0.59	-0.12	1		
BANKSIZE	-0.52	-0.37	0.58	-0.12	0.23	0.14	1	
MUTUAL B.	0.50	0.56	-0.31	-0.03	-0.19	0.07	-0.61	1

Table 5: Firms in the Sample, descriptive statistics

All variables except for leverage are in thousands of Euros. Leverage is defined as (1-equity)/total assets.

Variable name	2006			2007		
	Mean	Median	Std.dev	Mean	Median	Std.dev
SALES	6,301	1058	130,895	6,475	1,080	126,933
ASSETS	5,877	981	182,198	6,073	1,003	193,654
OPERATING PROFITS	453	70	22,564	482	73	23459
INVESTMENT	1,185	67	148,359	816	76	17255
LEVERAGE	0.79	0.86	0.20	0.79	0.86	0.20
N. OF LENDERS	2.6	2	2.5	2.6	2	2.4

Table 6: Sample statistics

The statistics refer to the sample of bank-firm relationship data employed in the estimation. All variables with the exception of the growth rates are measured as of June of each year. Dependent variables measure the change in the given variable between June and December of each year.

Bank Characteristics							
		June 2007			**June 2008**		
		Mean	**Median**	**Std.dev**	**Mean**	**Median**	**Std.dev**
CAPRATIO	Regulatory capital / Risk Weighted Assets	10.6	10.1	2.7	10.4	9.9	2.7
LIQUIDITY	Liquid Assets/Total Assets	5.6	4.6	4.7	5.9	4.8	4.8
INTERBANK	Interbank Borrowing/Total Assets	17.1	15.7	12.9	18.7	12.4	16.7
SECURITIZE	Cumulated Securitizations 2004-2006 /Total Assets	2.7	1.1	5.4	2.7	1.1	5.5
CHARGEOFF	Loan Loss Provisions and Charge-offs/Total Loans at the beginning of the period	0.31	0.26	0.22	0.31	0.28	0.19
ROA	Profits/Total Assets	0.66	0.53	0.58	0.21	0.33	0.80
BANKSIZE	Total Assets (billion euros)	263.0	92.8	354.5	285.2	115.7	371.9
MUTUAL B.		0.09			0.09		
Relationship Characteristics							
LOGCREDIT	Log of credit commitments from bank i to firm j at the beginning of the period	12.9	12.7	1.2	12.9	12.8	1.2
SHARE	Share of commitments from bank i to firm j	28.0	22.3	21.1	28.3	22.7	21.2
DISTANCE	Equal to 1 if the bank has a branch in same postcode as the firm HQ	0.41			0.33		
PASTDUE	Equal to 1 if firm j is past-due on loans from bank i at the beginning of the period.	0.022			0.02		
N. of obs. credit commitments		629,085			654,165		
N. of obs. credit disbursed		526,359			555,640		
N. of obs. cost of credit		270,403			297,693		

Table 7: Credit commitments (June-December 2007)

VARIABLES	ΔCREDIT	ΔREVOLVING CREDIT LINES	ΔDRAWDOWNS
	(1)	(2)	(3)
CAPRATIO	-0.251	0.0111	-0.126
	(0.155)	(0.138)	(0.274)
LIQUIDITY	0.120*	0.121	0.192
	(0.0627)	(0.137)	(0.129)
INTERBANK	-0.0668***	-0.00637	-0.0367
	(0.0210)	(0.0497)	(0.0390)
SECURITIZE	-0.283***	-0.178**	-0.463***
	(0.0752)	(0.0846)	(0.0946)
CHARGEOFF	0.696	11.73***	-1.473
	(2.190)	(3.183)	(3.101)
ROA	1.973	1.818	2.634
	(1.249)	(1.238)	(2.002)
BANKSIZE	-0.206	-0.193	0.0438
	(0.314)	(0.332)	(0.402)
MUTUAL BANK	0.852	1.272	2.339
	(1.116)	(1.074)	(1.982)
LOGCREDIT	-0.455	-7.855***	-31.83***
	(0.661)	(0.395)	(0.865)
SHARE	-0.0445**	0.205***	1.240***
	(0.0198)	(0.0115)	(0.0396)
DISTANCE	-1.617***	-1.074**	-3.348***
	(0.586)	(0.445)	(1.035)
PASTDUE	-1.820**	-0.500	-7.423***
	(0.713)	(0.974)	(1.240)
FIRM FIXED EFFECTS	YES	YES	YES
Observations	629085	512232	526359
R-squared	0.468	0.419	0.463

Standard errors clustered at the bank level in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Table 8: Credit commitments (June-December 2007)

Small and riskier borrowers

VARIABLES	ΔCREDIT	ΔCREDIT	ΔCREDIT	ΔCREDIT
FIRM DUMMY:	High Risk	Small	High Leverage	Low Profits
	(1)	(2)	(3)	(4)
CAPRATIO	-0.283*	-0.266	-0.262	-0.273*
	(0.168)	(0.167)	(0.164)	(0.156)
LIQUIDITY	0.131**	0.111*	0.107*	0.127**
	(0.0613)	(0.0663)	(0.0640)	(0.0634)
INTERBANK	-0.0663***	-0.0642***	-0.0661***	-0.0624***
	(0.0194)	(0.0217)	(0.0204)	(0.0212)
SECURITIZE	-0.280***	-0.282***	-0.279***	-0.282***
	(0.0749)	(0.0752)	(0.0742)	(0.0745)
CHARGEOFF	0.694	0.696	0.675	0.716
	(2.158)	(2.153)	(2.147)	(2.148)
ROA	1.952	1.988	2.018	1.973
	(1.249)	(1.249)	(1.250)	(1.239)
BANKSIZE	-0.206	-0.204	-0.185	-0.207
	(0.312)	(0.314)	(0.310)	(0.311)
MUTUAL BANK	0.768	0.799	0.819	0.799
	(1.106)	(1.113)	(1.118)	(1.109)
LOGCREDIT	-0.396	-0.413	-0.359	-0.425
	(0.668)	(0.669)	(0.677)	(0.670)
SHARE	-0.0489**	-0.0485**	-0.0558***	-0.0470**
	(0.0199)	(0.0201)	(0.0208)	(0.0202)
DISTANCE	-1.651***	-1.587***	-1.623***	-1.614***
	(0.584)	(0.579)	(0.585)	(0.577)
PASTDUE	-1.752**	-1.865**	-2.004***	-1.781**
	(0.771)	(0.786)	(0.715)	(0.756)
FIRMDUMMY*CAPRATIO	0.115	0.139	0.0563	0.113
	(0.101)	(0.130)	(0.0870)	(0.0978)
FIRMDUMMY*LIQUIDITY	-0.0321	0.0478	0.0730	-0.0338
	(0.0541)	(0.0563)	(0.0454)	(0.0558)
FIRMDUMMY*INTERBANK	-0.00106	-0.0249	0.00552	-0.0189
	(0.0260)	(0.0176)	(0.0141)	(0.0184)
FIRM FIXED EFFECTS	YES	YES	YES	YES
Observations	603398	606363	592357	610619
R-squared	0.464	0.465	0.458	0.465

Standard errors clustered at the bank level in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Table 9: Cost of Credit (June-December 2007) Baseline and Small and Riskier borrowers

	ΔRATE	ΔRATE	ΔRATE	ΔRATE	ΔRATE
		High Risk	Small	High Leverage	Low Profits
	(1)	(2)	(3)	(4)	(5)
CAPRATIO	0.0581	0.0741	0.0564	0.0746	0.0666
	(0.0731)	(0.0764)	(0.0762)	(0.0780)	(0.0755)
LIQUIDITY	0.0200	0.0176	0.0165	0.0200	0.0158
	(0.0292)	(0.0279)	(0.0309)	(0.0290)	(0.0302)
INTERBANK	0.0137*	0.0167**	0.0141*	0.0169*	0.0138*
	(0.00815)	(0.00807)	(0.00840)	(0.00892)	(0.00818)
SECURITIZE	0.0959***	0.0978***	0.0978***	0.0992***	0.0972***
	(0.0254)	(0.0256)	(0.0255)	(0.0258)	(0.0254)
CHARGEOFF	0.807	0.843*	0.853*	0.897*	0.846*
	(0.503)	(0.505)	(0.504)	(0.509)	(0.507)
ROA	-0.776	-0.764	-0.761	-0.787	-0.768
	(0.553)	(0.550)	(0.549)	(0.563)	(0.551)
BANKSIZE	0.122	0.121	0.118	0.126	0.119
	(0.117)	(0.117)	(0.117)	(0.119)	(0.117)
MUTUAL BANK	-0.0126	-0.00729	-0.0315	-0.0156	-0.0160
	(0.322)	(0.324)	(0.323)	(0.324)	(0.323)
RATE	-0.328***	-0.328***	-0.328***	-0.328***	-0.328***
	(0.00700)	(0.00696)	(0.00707)	(0.00726)	(0.00706)
LOGCREDIT	0.0363	0.0373	0.0396	0.0381	0.0400
	(0.0236)	(0.0245)	(0.0245)	(0.0238)	(0.0243)
SHARE	-0.00239	-0.00270*	-0.00291*	-0.00307*	-0.00270
	(0.00166)	(0.00162)	(0.00165)	(0.00164)	(0.00164)
DISTANCE	-0.221	-0.221	-0.219	-0.220	-0.220
	(0.151)	(0.151)	(0.152)	(0.156)	(0.152)
PASTDUE	0.193	0.154	0.169	0.219*	0.178
	(0.123)	(0.127)	(0.125)	(0.116)	(0.127)
FIRMDUMMY*CAPRA.		-0.0405	0.00811	-0.0440	-0.0317
		(0.0317)	(0.0409)	(0.0359)	(0.0229)
FIRMDUMMY*LIQ.		0.00552	0.0279	-0.00214	0.0168
		(0.0205)	(0.0227)	(0.0191)	(0.0123)
FIRMDUMMY*INTERB.		-0.00803*	-0.00640	-0.0120	-0.00150
		(0.00441)	(0.00675)	(0.00892)	(0.00470)
FIRM FIXED EFFECTS	YES	YES	YES	YES	YES
Observations	270403	261065	262294	244556	263272
R-squared	0.533	0.531	0.531	0.529	0.532

Standard errors clustered at the bank level in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Table 10: Credit commitments (June-December 2008)

VARIABLES	ΔCREDIT	ΔREVOLVING CREDIT LINES	ΔDRAWDOWNS
	(1)	(2)	(3)
CAPRATIO	0.0579	0.151	0.0948
	(0.149)	(0.189)	(0.274)
LIQUIDITY	0.0962	-0.0464	0.173
	(0.0799)	(0.117)	(0.138)
INTERBANK	-0.0713**	0.0728	-0.0171
	(0.0289)	(0.0456)	(0.0501)
SECURITIZE	-0.0419	0.00920	-0.144
	(0.0839)	(0.139)	(0.141)
CHARGEOFF	-1.142	-9.074***	-1.799
	(2.108)	(3.240)	(3.504)
ROA	3.009***	-3.062	4.405***
	(0.444)	(2.166)	(0.868)
BANKSIZE	-0.419*	-0.902**	-0.599
	(0.216)	(0.401)	(0.426)
MUTUAL BANK	0.382	0.0709	1.069
	(0.822)	(1.490)	(1.618)
LOGCREDIT	0.0420	-12.24***	-31.64***
	(0.556)	(1.967)	(0.876)
SHARE	-0.0250*	0.260***	1.244***
	(0.0140)	(0.0221)	(0.0371)
DISTANCE	-2.727***	-1.995***	-3.682***
	(0.521)	(0.684)	(1.027)
PASTDUE	-2.204***	-1.425**	-5.845***
	(0.590)	(0.652)	(1.800)
FIRM FIXED EFFECTS	YES	YES	YES
Observations	654165	528979	555640
R-squared	0.371	0.349	0.451

Standard errors clustered at the bank level in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Table 11: Credit Commitments (June-December 2008)

Small and riskier borrowers

VARIABLES	ΔCREDIT	ΔCREDIT	ΔCREDIT	ΔCREDIT
FIRM DUMMY:	High Risk	Small	High Leverage	Low Profits
	(1)	(2)	(3)	(4)
CAPRATIO	0.0579	0.0581	0.0537	0.0669
	(0.154)	(0.161)	(0.172)	(0.156)
LIQUIDITY	0.102	0.0937	0.118	0.104
	(0.0797)	(0.0842)	(0.0822)	(0.0809)
INTERBANK	-0.0727**	-0.0704**	-0.0744**	-0.0707**
	(0.0296)	(0.0301)	(0.0301)	(0.0301)
SECURITIZE	-0.0416	-0.0405	-0.0397	-0.0418
	(0.0851)	(0.0851)	(0.0860)	(0.0850)
CHARGEOFF	-1.269	-1.288	-1.216	-1.328
	(2.133)	(2.132)	(2.151)	(2.121)
ROA	3.074***	3.070***	3.137***	3.039***
	(0.444)	(0.445)	(0.450)	(0.444)
BANKSIZE	-0.416*	-0.413*	-0.412*	-0.416*
	(0.220)	(0.219)	(0.219)	(0.218)
MUTUAL BANK	0.335	0.267	0.291	0.342
	(0.828)	(0.824)	(0.817)	(0.828)
LOGCREDIT	0.115	0.112	0.171	0.132
	(0.558)	(0.559)	(0.554)	(0.555)
SHARE	-0.0313**	-0.0310**	-0.0401***	-0.0307**
	(0.0146)	(0.0143)	(0.0144)	(0.0147)
DISTANCE	-2.692***	-2.716***	-2.749***	-2.670***
	(0.516)	(0.516)	(0.526)	(0.507)
PASTDUE	-2.209***	-2.213***	-2.349***	-2.211***
	(0.640)	(0.608)	(0.653)	(0.626)
FIRMDUMMY*CAPRATIO	0.0435	0.0354	0.0353	-0.0145
	(0.145)	(0.116)	(0.0713)	(0.0771)
FIRMDUMMY*LIQUIDITY	-0.106	0.0123	-0.0395	-0.0381
	(0.0960)	(0.0669)	(0.0535)	(0.0417)
FIRMDUMMY*INTERBANK	0.00291	-0.0270	0.00383	-0.0105
	(0.0245)	(0.0201)	(0.0129)	(0.0117)
FIRM FIXED EFFECTS	YES	YES	YES	YES
Observations				
R-squared	626719	629272	612515	617579

Standard errors clustered at the bank level in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Table 12: Cost of Credit (June-December 2008) Baseline and Small and Riskier borrowers

	ΔRATE	ΔRATE	ΔRATE	ΔRATE	ΔRATE
		High Risk	Small	High Leverage	Low Profits
	(1)	(2)	(3)	(4)	(5)
CAPRATIO	0.135	0.143	0.157	0.178*	0.137
	(0.0916)	(0.0927)	(0.0980)	(0.0980)	(0.0933)
LIQUIDITY	-0.0234	-0.0243	-0.0277	-0.0393	-0.0228
	(0.0336)	(0.0337)	(0.0351)	(0.0337)	(0.0343)
INTERBANK	0.000245	8.91e-05	0.00133	0.00225	-0.000683
	(0.0116)	(0.0117)	(0.0119)	(0.0117)	(0.0121)
SECURITIZE	0.0634**	0.0642**	0.0647**	0.0653**	0.0649**
	(0.0253)	(0.0254)	(0.0252)	(0.0258)	(0.0258)
CHARGEOFF	2.009***	2.010***	2.009***	1.986***	1.982***
	(0.728)	(0.713)	(0.708)	(0.726)	(0.724)
ROA	0.667	0.684	0.692	0.678	0.685
	(0.470)	(0.467)	(0.462)	(0.474)	(0.471)
BANKSIZE	0.142**	0.143**	0.143**	0.151**	0.147**
	(0.0627)	(0.0629)	(0.0625)	(0.0642)	(0.0636)
MUTUAL BANK	-0.239	-0.257	-0.266	-0.277	-0.239
	(0.388)	(0.390)	(0.392)	(0.397)	(0.392)
RATE	-0.309***	-0.310***	-0.310***	-0.310***	-0.310***
	(0.00775)	(0.00773)	(0.00773)	(0.00775)	(0.00780)
LOGCREDIT	-0.0365	-0.0359	-0.0361	-0.0414	-0.0407
	(0.0508)	(0.0544)	(0.0542)	(0.0532)	(0.0543)
SHARE	-0.000468	-0.000638	-0.000670	-0.000481	-0.000512
	(0.00173)	(0.00195)	(0.00190)	(0.00196)	(0.00190)
DISTANCE	0.0735	0.0816	0.0755	0.0909	0.0902
	(0.116)	(0.114)	(0.113)	(0.117)	(0.117)
PASTDUE	0.191*	0.208*	0.177	0.171	0.191*
	(0.105)	(0.112)	(0.107)	(0.108)	(0.106)
FIRMDUMMY*CAPRAT.	-	-0.0856**	-0.168**	-0.0570	0.00416
	-	(0.0385)	(0.0644)	(0.0414)	(0.0265)
FIRMDUMMY*LIQ.	-	0.0245*	0.0416**	0.0259	-0.00132
	-	(0.0139)	(0.0210)	(0.0178)	(0.0115)
FIRMDUMMY*INTERB.	-	-0.00349	-0.0133**	-0.00454	0.00112
	-	(0.00309)	(0.00665)	(0.00493)	(0.00250)
FIRM FIXED EFFECTS	YES	YES	YES	YES	YES
Observations	297693	286774	287944	268960	282120
R-squared	0.517	0.516	0.516	0.515	0.516

Standard errors clustered at the bank level in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Table 13: Interactions among capital, liquidity, reliance on interbank funding (June-December 2007)

VARIABLES	ΔCREDIT (1)	ΔCREDIT (2)	ΔCREDIT (3)	ΔCREDIT (4)	ΔCREDIT (5)	ΔCREDIT (6)
CAPRATIO	-0.167	-0.164*	-0.323**	-0.268*	-0.140	-0.214
	(0.214)	(0.0929)	(0.144)	(0.156)	(0.141)	(0.155)
LIQUIDITY	0.202*	0.114*	0.146**	0.123**	0.133**	-0.0242
	(0.105)	(0.0601)	(0.0593)	(0.0618)	(0.0619)	(0.0844)
INTERBANK	-0.0663***	0.138	-0.0609***	-0.0643***	-0.0597***	-0.146***
	(0.0212)	(0.221)	(0.0195)	(0.0194)	(0.0199)	(0.0393)
SECURITIZE	-0.281***	-0.278***	-1.552***	-0.277***	-0.235***	-0.276***
	(0.0756)	(0.0775)	(0.340)	(0.0745)	(0.0623)	(0.0680)
CHARGEOFF	0.667	0.352	3.360*	-0.314	0.502	0.378
	(2.175)	(2.287)	(1.892)	(3.388)	(2.058)	(1.922)
ROA	1.827	2.608**	0.0745	1.902	6.251***	1.371
	(1.195)	(1.075)	(1.172)	(1.234)	(2.294)	(1.067)
CAPRATIO*LIQUID.	-0.00607					
	(0.00595)					
CAPRATIO*INTERB.		-0.0208				
		(0.0226)				
CAPRATIO*SECURIT.			0.128***			
			(0.0318)			
CAPRATIO*CHARG.				0.0567		
				(0.0814)		
CAPRATIO*ROA					-0.431*	
					(0.253)	
LIQUIDITY*INTERB.						0.0160**
						(0.00744)
BANKSIZE	-0.172	-0.274	0.00121	-0.187	-0.182	-0.217
	(0.318)	(0.321)	(0.220)	(0.325)	(0.313)	(0.291)
MUTUAL BANK	0.920	0.391	1.314	0.911	1.499	1.493
	(1.100)	(0.922)	(0.988)	(1.117)	(1.137)	(0.992)
LOGCREDIT	-0.455	-0.475	-0.637	-0.464	-0.606	-0.475
	(0.663)	(0.620)	(0.588)	(0.655)	(0.547)	(0.665)
SHARE	-0.0445**	-0.0439**	-0.0376**	-0.0442**	-0.0395**	-0.0440**
	(0.0198)	(0.0185)	(0.0179)	(0.0197)	(0.0168)	(0.0198)
DISTANCE	-1.651***	-1.493***	-1.800***	-1.652***	-1.531***	-1.688***
	(0.575)	(0.475)	(0.526)	(0.602)	(0.488)	(0.560)
PASTDUE	-1.820**	-1.768**	-1.984***	-1.825**	-1.868***	-1.775**
	(0.717)	(0.701)	(0.684)	(0.715)	(0.719)	(0.700)
FIRM FIXED EFFECTS	YES	YES	YES	YES	YES	YES
Observations	629085	629085	629085	629085	629085	629085
R-squared	0.468	0.468	0.469	0.468	0.469	0.468

Standard errors clustered at the bank level in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Table 14: Interactions among capital, liquidity, reliance on interbank funding (June-December 2008)

VARIABLES	ΔCREDIT (1)	ΔCREDIT (2)	ΔCREDIT (3)	ΔCREDIT (4)	ΔCREDIT (5)	ΔCREDIT (6)
CAPRATIO	0.119	0.137	0.000882	-0.0353	0.0283	0.0835
	(0.235)	(0.0901)	(0.131)	(0.153)	(0.148)	(0.143)
LIQUIDITY	0.142	0.0859	0.114	0.108	0.108	0.00634
	(0.123)	(0.0789)	(0.0729)	(0.0769)	(0.0775)	(0.0837)
INTERBANK	-0.0727**	0.125	-0.0617**	-0.0763***	-0.0754***	-0.107**
	(0.0282)	(0.200)	(0.0304)	(0.0291)	(0.0286)	(0.0436)
SECURITIZE	-0.0382	-0.0466	-1.358**	-0.0260	-0.0268	-0.0499
	(0.0856)	(0.0884)	(0.535)	(0.0845)	(0.0837)	(0.0842)
CHARGEOFF	-1.229	-0.839	-1.063	-3.178	-1.695	-0.662
	(2.139)	(2.329)	(1.902)	(2.523)	(2.079)	(2.280)
ROA	2.990***	3.104***	2.508***	3.060***	4.165***	2.881***
	(0.431)	(0.383)	(0.481)	(0.432)	(0.579)	(0.462)
CAPRATIO*LIQUID	-0.00350					
	(0.00649)					
CAPRATIO*INTERB		-0.0207				
		(0.0213)				
CAPRATIO*SECURIT			0.133**			
			(0.0544)			
CAPRATIO*CHARG.				0.121**		
				(0.0545)		
CAPRATIO*ROA					-0.118**	
					(0.0562)	
LIQUIDITY*INTERB.						0.00563
						(0.00465)
BANKSIZE	-0.401*	-0.424**	-0.456**	-0.387*	-0.392*	-0.469**
	(0.222)	(0.215)	(0.212)	(0.218)	(0.214)	(0.223)
MUTUAL BANK	0.328	0.280	-0.337	0.579	0.652	0.686
	(0.852)	(0.802)	(0.780)	(0.826)	(0.856)	(0.848)
LOGCREDIT	0.0437	0.00545	0.0165	0.0390	0.0206	0.0345
	(0.557)	(0.521)	(0.548)	(0.554)	(0.543)	(0.554)
SHARE	-0.0252*	-0.0240*	-0.0237*	-0.0248*	-0.0242*	-0.0249*
	(0.0140)	(0.0128)	(0.0139)	(0.0139)	(0.0136)	(0.0139)
DISTANCE	-2.735***	-2.570***	-2.735***	-2.693***	-2.680***	-2.654***
	(0.515)	(0.389)	(0.492)	(0.516)	(0.497)	(0.509)
PASTDUE	-2.201***	-2.209***	-2.197***	-2.199***	-2.196***	-2.184***
	(0.591)	(0.579)	(0.591)	(0.587)	(0.588)	(0.585)
FIRM FIXED EFFECTS	YES	YES	YES	YES	YES	YES
Observations	654165	654165	654165	654165	654165	654165
R-squared	0.371	0.371	0.371	0.371	0.371	0.371

Standard errors clustered at the bank level in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Table 15: Credit Commitments for Continuing Relationship and Relationship Dynamics

	2007			2008		
VARIABLES	ΔCREDIT (1)	Pr(cut=1) (2)	Pr(accept=1) (3)	ΔCREDIT (4)	Pr(cut=1) (5)	Pr(accept=1) (6)
CAPRATIO	-0.174	0.0742	-0.140	0.0101	-0.0469	0.0582
	(0.112)	(0.0668)	(0.148)	(0.102)	(0.0616)	(0.124)
LIQUIDITY	0.109**	-0.0230	0.171	0.0865*	-0.0166	0.369**
	(0.0516)	(0.0278)	(0.151)	(0.0515)	(0.0418)	(0.163)
INTERBANK	-0.0357***	0.0293**	-0.138***	-0.0309	0.0416***	-0.0733
	(0.0133)	(0.0141)	(0.0516)	(0.0196)	(0.0147)	(0.0664)
SECURITIZE	-0.157***	0.138***	0.00992	-0.00346	0.0340	0.0992
	(0.0391)	(0.0475)	(0.0794)	(0.0537)	(0.0473)	(0.112)
CHARGEOFF	1.141	0.441	3.081	-0.00887	1.104	-1.371
	(1.304)	(1.139)	(2.649)	(1.342)	(1.020)	(2.518)
ROA	1.937**	-0.153	2.510	1.902***	-1.313***	1.447***
	(0.817)	(0.645)	(1.824)	(0.336)	(0.196)	(0.502)
BANKSIZE	0.0466	0.187	-0.306	-0.269*	0.105	-0.373
	(0.164)	(0.189)	(0.516)	(0.142)	(0.115)	(0.485)
MUTUAL BANK	0.728	-0.209	2.869	0.280	-0.120	-2.634
	(0.809)	(0.540)	(1.905)	(0.607)	(0.388)	(1.601)
LOGCREDIT	-6.082***	-4.023***	-	-5.325***	-4.234***	-
	(0.611)	(0.292)	-	(0.573)	(0.186)	-
SHARE	-0.00564	0.00585	-	-0.00949	-0.0116	-
	(0.0215)	(0.00769)	-	(0.0152)	(0.00747)	-
DISTANCE	-1.246***	0.489*	-	-1.590***	1.239***	-
	(0.402)	(0.261)	-	(0.369)	(0.240)	-
PASTDUE	-0.174	0.0742	-	0.188	2.059***	-
	(0.112)	(0.0668)	-	(0.396)	(0.536)	-
FIRM FIXED EFFECTS	YES	YES	YES	YES	YES	YES
Observations	568711	629085	290575	603738	654165	320302
R-squared	0.330	0.656	0.643	0.334	0.437	0.660

Standard errors clustered at the bank level in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

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