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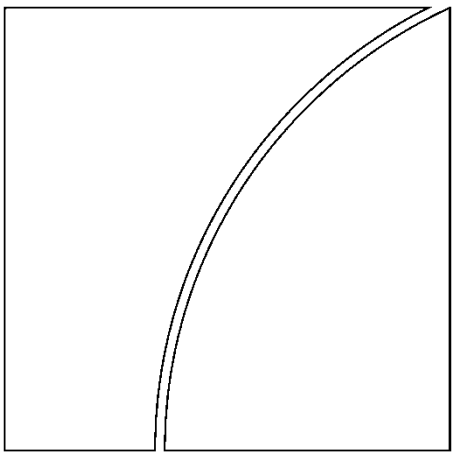

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by Leonardo Gambacorta and Paolo Emilio Mistrulli

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BANK HETEROGENEITY AND INTEREST RATE SETTING: WHAT LESSONS HAVE WE LEARNED SINCE LEHMAN BROTHERS?

by Leonardo Gambacorta* and Paolo Emilio Mistrulli♣

Abstract

A substantial literature has investigated the role of relationship lending in shielding borrowers from idiosyncratic shocks. Much less is known about how lending relationships and bank-specific characteristics affect the functioning of the credit market in an economy-wide crisis, when banks may find it difficult to perform the role of shock absorbers. We investigate how bank-specific characteristics (size, liquidity, capitalization, funding structure) and the bank-firm relationship have influenced interest rate setting since the collapse of Lehman Brothers. Unlike the existing literature, which has focused chiefly on the amount of credit granted during the crisis, we look at its cost. The data on a large sample of loans from Italian banks to non-financial firms suggest that close lending relationships kept firms more insulated from the financial crisis. Further, spreads increased by less for the customers of well-capitalized, liquid banks and those engaged mainly in traditional lending business.

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Contents

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1. Introduction[1]

The recent financial crisis has dramatically shown how banks, by modifying their behaviour in the credit market, may propagate and amplify the economic consequences of the turmoil. The public debate has been mainly focused on banks' ability to lend enough money to households and firms in order to finance their consumption and investment activities. By contrast, less attention has been paid to the dynamic of the cost of bank lending in a severe financial crisis. This seems quite odd since the response of bank interest rates to systemic shocks is another channel through which banks may affect the level of economic activity.

An analysis of bank interest rate setting behaviour during the crisis has also been largely absent from the existing literature. The majority of studies focus on the response of credit aggregates and output (the existence of a credit crunch), but pay limited attention to the effects on prices. One relevant exception is Santos (2011); however, that paper analyzes the market for syndicated corporate loans, which is a quite specific segment of the credit market, highly dominated by large firms. The scant evidence on the effects of the crisis on the cost of credit in retail banking is mainly due to the lack of micro data at the bank-firm level. As far as we are aware, data on loan interest rates at the bank-firm level are available with a comprehensive degree of detail only from the credit registers of a few countries.

This paper studies the price setting behaviour of Italian banks during the recent financial crisis. Using a unique dataset, containing information at the bank-firm level, we are able to tackle two main issues. First, we test whether lending relationship characteristics played a role in containing the effect on the cost of credit during the crisis. In particular, our aim is to verify whether relationship lending helps firms be, at least partially, shielded against the consequences of the financial crisis. Second, we test whether banks' characteristics such as size, liquidity, capitalization and fund-raising structure affected loan interest rate setting during the recent crisis.

We argue that, in a severe financial crisis, lending relationships may affect the functioning of the credit market differently than in normal times when firms are hit by a specific shock. In

[1] We wish to thank Michele Benvenuti, Claudio Borio, Enisse Kharroubi, Michael King, Danilo Liberati, Petra Gerlach-Kristen, Pat McGuire, Kostas Tsatsaronis and, in particular, one anonymous referee for very helpful comments. The opinions expressed in this paper are those of the authors only and do not necessarily reflect those of the Bank of Italy or the Bank for International Settlements. Email: leonardo.gambacorta@bis.org; paoloemilio.mistrulli@bancaditalia.it.

an economy-wide crisis, banks are also distressed, and they might not be able to insulate firms from shocks. Thus, comparing the case of a firm-specific shock to that of an economy-wide crisis, one might expect that relationship banks in the latter case lower the cost of credit by less than in a firm-specific shock. This may be due to the fact that close lending relationships are not enough to shield firms from shocks since banks might also be not able to perform their insurer role, and this, ultimately, depends on their endowments of capital and liquidity.

Along these lines, Santos (2011) finds that firms that obtained a syndicated loan after the onset of the crisis paid an additional spread over Libor compared to similar loans they took out from the same bank prior to the crisis. Moreover, he finds that these banks increased the interest rates on their syndicated loans to bank-dependent borrowers by more than they did on their loans to borrowers that have access to the bond market. No significant effect of bank-firm relationship on interest rate setting is found in the case of the syndicated loan market. The presence of similar mechanisms in the bank retail market during the last crisis is therefore an issue that needs to be investigated empirically.

The case of Italy is an excellent laboratory for three reasons. First, the crisis had a different impact on different categories of banks (De Mitri et al. 2010), which allows us to exploit the cross-sectional dimension to test for heterogeneity in the response to the banking crisis. The coefficient of variation calculated on interest rates on credit lines applied to firms passed from 25% before the Lehman crisis to 40% in the first quarter of 2010. Second, and most importantly, Italy is a bank-based economy so that distortions in credit supply may have a sizeable impact, especially for small and medium-sized enterprises (SMEs) that are highly dependent on bank financing. Third, the detailed data available for Italy allow us to test hypothesis without making strong assumptions.

We focus on multiple lending only, which is the situation in which a firm has a business relationship with more than one bank. Multiple lending is a long-standing characteristic of the bank-firm relationship in Italy (Foglia et al., 1998; Detragiache et al., 2000). The reference to multiple lending is very useful because in this way, even in a cross-sectional analysis, we are able to include in our econometric model bank or firm fixed effects, which allow us to control for all (observable and unobservable) lender or borrower characteristics. Around 80% of Italian non-financial firms have multiple lending relationships, so the study is also relevant from a macroeconomic point of view.

Since bank interest rates could be sluggish in adjusting, we analyze the interest rates on overdraft loans that are modified unilaterally and at very short intervals by credit intermediaries; this allows us to fully capture in our quarterly data the effects of the shocks in the interbank market or a change in banks' behaviour due to a repricing of credit risk. Moreover, since our analysis takes into account the change in banks' price conditions over a two-year horizon (2008:q2–2010:q1), it is reasonable to believe that the repricing for changes in risk perceptions is completely included in our sample.[2]

We investigate overdraft facilities (i.e. credit lines) also for three other reasons. First, this kind of lending represents the main liquidity management tool for firms – especially the small ones (with fewer than 20 employees) that are prevalent in Italy – which cannot afford more sophisticated instruments. Second, since these loans are highly standardized among banks, comparing the cost of credit among firms is not affected by unobservable (to the econometrician) loan-contract-specific covenants. Third, overdraft facilities are loans granted neither for some specific purpose, as is the case for mortgages, nor on the basis of a specific transaction, as is the case for advances against trade credit receivables. As a consequence, according to Berger and Udell (1995) the pricing of these loans is highly associated with the borrower-lender relationship, thus providing us with a better tool for testing the role of lending relationships in bank interest rate setting.

The data come from four sources:

i) the Credit Register (CR) maintained by the Bank of Italy, containing detailed information on all loan contracts granted to each borrower whose total debt from a bank is above 75,000 euros (30,000 euros since January 2009; no threshold is required for bad loans);

ii) the Bank of Italy Loan Interest Rate Survey, including information on interest rates charged on each loan reported to the CR and granted by a sample of about 200 Italian banks; this sample accounts for more than 80% of loans to non-financial firms and is highly representative of the universe of Italian banks in terms of bank size, category and location;

iii) the CERVED database, which contains firms' balance sheet information;

[2] The nominal interest rate applied to overdrafts is typically the sum of a spread and the one-month policy rate. Current account contracts establish that changes in the policy rates are incorporated automatically, while the spread is revised at discrete intervals, typically every year, or when a valid motivation, such as significant changes in the economic condition of the client, takes place (art. 118 of the 1993 Consolidated Law on Banking). The period analyzed (more than two years) is therefore sufficient to capture changes in the spread.

iv) the Supervisory Reports of the Bank of Italy, from which we obtain the bank-specific characteristics.

Our main findings are that close lending relationships allowed firms to be more insulated from the financial crisis. This holds regardless of how lending relationships are measured (i.e. using the functional distance between the bank and the borrower; the concentration of lenders; the length of borrowers' credit history; and the event that, during the period under investigation, a new lending relationship was established or a pre-existing one terminated). We also find that the effects of the crisis on interest rate spreads were lower for clients of well capitalized and liquid banks or of intermediaries whose business model is more focused on traditional lending.

To tackle the endogeneity issue that typically arise in trying to disentangle demand and supply factors, we also control for the effect of the financial crisis on interest rates by estimating a two-equation system that also models the impact on lending quantities. This also helps to control for possible forms of cross-subsidization, i.e. banks could modify the spread charged on current accounts while modifying, at the same time, the overall lending supply.

The paper is organized as follows. Section 2 describes some stylised facts on bank interest rate setting after Lehman's collapse. After a description of the econometric model and the data in Section 3, Section 4 shows the empirical results. Robustness checks are presented in Section 5. The last section summarizes the main conclusions.

2. Some facts on bank interest rate setting after Lehman's default

Before discussing the main channels that have affected banks' price setting during the crisis, it is important to analyze some stylized facts that could have influenced the loan interest rate pattern. The level of the interest rate on overdrafts is quite strongly correlated with the three-month interbank rate (Figure 1). Therefore, as a result of the drop in money market rates after Lehman's default, the level of interest rates paid on overdrafts was also significantly reduced. This obviously lowered firms' cost of financing in a period of weak demand and subdued economic activity. However, the reduction in the interest rates charged to firms was significantly lower than that experienced by money market rates, and therefore the spread between the two rates, typically considered a measure of credit risk (together with monopolistic power), increased to a level (slightly less than 4 per cent) similar to that reached in 2003 in connection with the default of two important multinational Italian dairy and food corporations (Parmalat and Cirio).

The rise of the spread was due to an increase in expected credit risk that materialized soon afterwards. After Lehman's default, the bad debt flow ratio for non-financial corporations doubled, on average, from 1.2 to 2.7 per cent (Figure 2). That increase was larger in magnitude than the one recorded during the 2003 crisis, when the ratio rose to 2.6 per cent, from 1.4 per cent at the end of 2002. The drop in bank lending was very large for medium-sized and large firms, while loans to small non-financial firms stagnated (Figure 3).

A glance at Figures 1-3 clearly reveals that the effects of the crisis started in the third quarter of 2008. In the econometric analysis, therefore, we will investigate the change in bank interest rates and lending in the period 2008:q2–2010:q1.

Following Albertazzi and Marchetti (2010) and De Mitri et al. (2010), we focus on the period after Lehman's default, which can reasonably be considered an unexpected shock. After Lehman's collapse, the uncertainty regarding banks' potential losses increased sharply, along with market risk aversion (Angelini et al., 2011). Italian credit intermediaries in this period experienced a sudden, strong shock to their desired capital level, at a time when adjusting capital was extremely difficult if possible at all, so that the banks with lower capital ratios pre-Lehman were likely to be those with more inadequate capital ratios post-Lehman. We thus use the pre-Lehman cross-bank variation in bank capital levels and other bank-specific characteristics to investigate post-Lehman bank interest rate setting. The choice of 2008 as starting year of the crisis in Italy is also consistent with Schularick and Taylor (2011).

Figure 4 provides a preliminary analysis of the heterogeneity in banks' repricing policies during the period 2008:q2–2010:q1. The analysis suggests that both bank-firm lending relationships and bank-specific characteristics matter, but to a somewhat different extent. Panel (a) shows that the increase in the spread between loan rates on credit lines and money market rates differed among firms depending on the length of the credit history. In particular, firms with a longer credit history benefited more from the reduction in money market interest rates. Panel (b) shows whether the pass-through was affected by the distance between banks' headquarters and firms (functional distance). Functional distance affects the ability of banks to collect soft information (Agarwal and Hauswald, 2010) and is negatively correlated with the "closeness" of the lending relationship. For firms that are closest to the bank's headquarters (i.e. the bank and the firm are headquartered in the same province) the increase in the interest rate spread was lowest. Apart from the case in which the bank is headquartered at the maximum distance from the firm, i.e. outside the firm's geographical area (North-East, North-West,

Centre, South or Islands), the spread pass-through shows a positive correlation with the functional distance. All in all, these results suggest that functionally close lending relationships are beneficial to borrowers.

Panel (c) indicates that firm characteristics also matter, in particular firms' credit-worthiness. The graph shows that during the crisis Italian banks tried to apply higher spreads to riskier firms: the increase in the spread was more pronounced for more risky firms (i.e. firms with high *Z*-scores, used to predict their default) compared to other firms.[3]

The propensity of credit intermediaries to pass on changes in spread conditions also depends on their specific characteristics. First of all, we find that (panel (d)) small banks increased their spread by less than larger banks. This interpretation is consistent with a well-established literature indicating that small banks have closer ties with their borrowers and stand by them more in a financial crisis. More generally, we find that banks more oriented toward traditional lending activity (we measure this by computing the ratio of loans over total assets) increased their spread by less than other banks (panel (e)).

Panel (f) indicates that banks active in the securitization market had on average a higher ability to smooth the effects of the financial crisis on their clients. This result deserves further attention because during the crisis the ability of banks to sell loans to the market was drastically reduced. However, in the euro area ABSs were typically self-retained and used as collateral in refinancing operations with the central bank. This seems to imply that the insulation effect of securitization is strictly linked with banks' decisions on liquidity and capital positions. For this reason, in the last two panels of Figure 5 we focus on the effects of liquidity and capital on those banks that were not particularly active in the securitization market (those with a level of activity below the median). Indeed, for those banks capital and liquidity positions are more binding since they can less easily securitize their loans than other banks. Panels (g) and (h) show that liquid and well-capitalized banks insulated their clients more in the financial crisis.

3. Identification strategy and data

The financial crisis that unfolded after the default of Lehman Brothers was largely unexpected. Starting in September 2008, disruptions in interbank markets multiplied and credit started decelerating at a fast pace (see Section 2). Therefore, by comparing bank interest rates

[3] On Italian banks' repricing during the crisis, see Vacca (2011).

for each firm in the second quarter of 2008 with those in the first quarter of 2010, we can investigate the effect of an unexpected shock on banks' interest rate setting behaviour.

The baseline cross-section equation estimates the change in the interest rate applied by bank *j* on the credit line of firm *k* between June 2008 and March 2010 ($\Delta i_{j,k}$):

$$\Delta i_{j,k} = \alpha + \Psi r_{j,k} + \Gamma d_k + \Pi s_j + \varepsilon_{j,k} \quad (1)$$

The literature that studies banks' interest rate setting behaviour generally assumes that banks operate under oligopolistic market conditions.[4] This means that a bank does not act as a price-taker but sets its loan rates taking into account the kind of relationship it has with the borrower ($r_{j,k}$), the demand for loans it faces (d_k) and its specific balance sheet characteristics (s_j). In equation (1) $r_{j,k}$ represents a vector of variables that control for the bank-firm relationship, d_k is a vector of firm-specific characteristics that take into account loan demand effects, and s_j is a vector of bank-specific characteristics that influence loan supply shifts.

Changes in banks' pricing could influence some of the firm and bank characteristics and determine an endogeneity problem. For example, an increase in the interest spread could cause a default or very simply a change in a firm's *Z*-score. In order to avoid such an endogeneity bias, all variables $r_{j,k}$, d_k, s_j are considered prior to the start of the crisis (with some exceptions as the dummy that highlights those banks that benefited from rescue packages during the crisis). In other words, our strategy is to look at how changes in interest rates were affected by bank and firm characteristics prior to the crisis. The main cost of this strategy is that we do not capture all the forces at work during the crisis, but the results are clean and not subject to the endogeneity problem.

Since the model analyzes the change in the interest rates over a cross-section of overdraft contracts over the same period of time (June 2008–March 2010) all explanatory variables that have the same impact for the bank-firm relationship during this period, such as general changes in macroeconomic conditions (policy rates, real GDP, inflation, interest rate volatility), are captured by the constant α. Following Albertazzi and Marchetti (2010) and Hale and Santos

[4] For a survey on modelling the banking firm, see Santomero (1984), Green (1998) and Lim (2000).

(2009) we cluster standard errors ($\varepsilon_{j,k}$) at the firm level.[5] The list of all variables used in the regression is reported in Table 1.

3.1 Bank-firm relationship

The empirical literature shows that in several circumstances borrowers and lenders benefit from establishing long-lasting and close relationships.[6] Relationship lending is a sort of implicit contract that ensures the availability of finance to the firm in the early stages of an investment project and allows the bank to partake in the returns (Boot, 2000; Ongena and Smith, 2000; Berger and Udell, 2006).[7] The role of relationship lending in a period of crisis, however, has been less investigated. While a wide literature has studied the role of lending relationships for the case of idiosyncratic shocks, i.e. a firm's financial distress (Degryse and Ongena, 2005), less is known about the role of lending relationships in a global crisis. For the case of firm-specific shocks, the literature shows that close lending relationships are beneficial to firms since relationship banks are more prone to support a distressed borrower (Elsas and Krahnen, 1998). Naturally, this comes at a cost for firms. They pay an insurance premium to banks by disbursing, on average, more for credit than firms which are not involved in close lending relationships (Sharpe, 1990; Petersen and Rajan, 1994). In particular, firms pay relatively more for credit in good times and less in bad ones, i.e. when the firm is financially distressed. All this means that on average, firms involved in close relationships pay more for credit, and the differential includes the insurance premium. De Mitri et al (2010) provide evidence on the link between bank-firm relationships and the supply of loans during the crisis.

The literature on banks' price setting focuses mainly on the effects of monetary policy shocks on interest rate changes. The study by Berger and Udell (1992) for the US shows that those credit institutions that maintain close ties with their non-bank customers will adjust their lending rates comparatively less and more slowly. Banks may offer implicit interest rate insurance to risk-averse borrowers in the form of below-market rates during periods of high

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[5] For a general discussion on different approaches used to estimating standard errors in finance panel data sets, see Petersen (2009).

[6] The importance of the bank-firm relationship for supplied lending has been widely documented both in bank oriented financial systems such as Japan (Aoki and Patrick, 1994), Germany (Harhoff and Körting, 1998) and Italy (Angelini et al.,1998) and in more market oriented ones such as the U.S. (Petersen and Rajan, 1994; Berger and Udell, 1995).

[7] It is worth noting that the relevance of soft information for firm financing also varies over time and across countries, according to lending technology (Berger and Udell, 2006), protection of property rights and other institutional factors (Beck et al. , 2008).

market rates, for which the banks are later compensated when market rates are low. Having this in mind, banks that have a close relationship with the clients should be more inclined to insulate them from the effects of a financial crisis on the cost of credit. Along those lines, Gambacorta (2008) finds that in Italy those banks with large volumes of long-term business with households and firms change their prices less frequently than the others in the case of a monetary policy shock.

What is different in an economy-wide crisis is that banks may themselves be suffering from losses which may make them unable to "insure" firms against the effects of financial distress. Thus, comparing the case of a firm-specific shock to that of an economy-wide crisis, one might expect that relationship banks in the latter case lower the cost of credit by less than in a firm-specific shock. Furthermore, a global crisis may affect banks' risk attitude and then their response to firms' financial distress too. The evidence of the effects of a global crisis on interest rate setting is very scarce. One relevant exception is the paper by Santos (2011), who focuses on the syndicated loan market and finds that firms that borrowed after the onset of the crisis paid an additional 16 basis points over Libor when compared to the loans they took out from the same bank prior to the crisis. In addition he finds that these banks increased the interest rates on their loans to bank-dependent borrowers by more than they did on their loans to borrowers that have access to the bond market. Contrary to the "insurance" theory highlighted above, in the case of Santos (2011) the bank-firm relationship seems to be associated with a higher increase in banking rates in case of a crisis. This effect could also depend on the risk of forbearance lending (or "zombie lending") where banks may delay the recognition of losses on their credit portfolio by inefficiently rolling over loans (but at higher prices) to corporations with which they had close relationships (Peek and Rosengren, 2005; Caballero et al., 2008). The effect of the bank-firm relationship on interest rate setting in the case of a crisis is therefore an issue that has to be investigated empirically.

A crucial aspect for the analysis is the way bank-firm relationship characteristics are measured. The literature on relationship lending does not identify a unique variable that captures the whole nature of the lender-borrower relationship. As a consequence, we have included in the specification several alternative measures.

i) Functional distance

The distance between lenders and borrowers affects the ability of banks to gather soft information, i.e. information that is difficult to codify, which is a crucial aspect of lending

relationships (see Agarwal and Hauswald, 2010; Mistrulli and Casolaro, 2010). We control for the distance between the lending bank headquarters and firm headquarters by four dummy variables: DISTh1 is equal to 1 if firm *k* is headquartered in the same province[8] where bank *j* has its headquarters; DISTh2 is equal to 1 if: a) DISTh1=0 and b) firm *k* is headquartered in the same region where bank *j* has its headquarters; DISTh3 is equal to 1 if: a) DISTh2=0 and b) firm *k* is headquartered in the same geographical area where bank *j* has its headquarters; DISTh4 is equal to 1 if DISTh3=0.

ii) Creditor concentration.

We define three measures for creditor concentration: 1) the number of banks lending to a given firm (NUM); 2) the Herfindahl index computed on the amount of lending granted by each bank to a given firm (HERFDEBT); 3) the share of loans granted by each bank to the firm (SHARE), to measure the relative importance of each bank to the firm. The three measures are highly correlated and therefore we use them as alternative controls for creditor concentration. Only measure 3) is a bank-firm specific variable, i.e. it varies for every combination of bank-firm, while measures 1) and 2) are invariant by firm and cannot be used when the specification includes a firm fixed effect.

iii) Credit history

Asymmetric information may be mitigated by means of repeated interaction with the banking system by which borrowers gain in terms of reputation (Diamond, 1989). We control for the length of the borrower's credit history by measuring the number of years elapsed since the first time a borrower was reported to the Credit Register (CREDIT HISTORY).[9] This variable also tells us how much information has been shared among lenders through the Credit Register over time. Information sharing may work as a discipline device (Padilla and Pagano. 2000) because each bank accessing the Credit Register may be informed of a borrower's payment difficulty. It may also increase the competition in the credit market since it tends to mitigate possible "informational capture" phenomena. In both cases, one may expect that these two factors help borrowers access the credit market (i.e. lower interest rates; higher amount of money borrowed). Conversely, the existence of information sharing may have perverse effects

[8] Italy is divided into 20 regions, each consisting of many provinces, for a total of 103. Regions are usually grouped into 5 geographical areas: North-West, North-East, Centre, South, Islands.

[9] Our measure for the duration of a firm's relationship with the banking system is truncated at 12.5 years since we do not have information about credit history prior to January 1995.

in terms of banks' information gathering efforts since banks may free-ride on other banks' information collection activity. We compute this indicator at June 2008, prior to Lehman's default. We allow for possible nonlinearities by including a quadratic term for the length of the relation.

iv) Switching relationships

Terminating or starting lending relationships may also affect a borrower's access to the credit market. Closing an existing relationship may be interpreted as a "bad signal" about the borrower's solvency to other banks. For this reason, we compute a dummy variable (CLOSE_REL) which equals 1 if a borrower has terminated a relationship with at least one bank, 0 otherwise. Conversely, we also define a dummy (OPEN_REL) which is equal to 1 if a borrower has started at least one relationship with a bank that was not previously part of the pool of lenders, 0 otherwise. Both of these indicators are computed for the period June 2008–March 2010.

3.2 Firm-specific characteristics: loan demand

Apart from the lending relationship, we control for firm-specific characteristics which presumably affect loan demand. The effect of a recession on loan demand is ambiguous. On the one hand, the slowdown in real activity tends to lower the demand for credit: Worse economic conditions make some projects unprofitable and hence reduce the demand for credit (Kashyap, Stein and Wilcox, 1993). On the other hand, the decrease in revenues caused by the recession may reduce the reliance of firms on self-financing (Friedman and Kuttner, 1993) and cause an increase in the use of credit lines, at least in the short term.[10] In order to control for loan demand we define the following variables:

i) Firm's size and business legal structure

We distinguish between small businesses (SMALL_FIRM; i.e. firms with less than 20 employees) and other firms since a wide literature has indeed indicated that the behaviour of small firms (and their credit risk) is quite different from the others (e.g. small firms, due to their great opacity, do not issue bonds as larger firms do). We also control for the business legal

[10] Using flow of funds data from the United States, Cohen-Cole et al. (2008) show that the amount of lending did not decline during the first quarters of the financial crisis. This was not due to "new" lending but mainly to the use of loan commitments, lines of credit and securitization activity returning to banks' balance sheets.

structure with a dummy that takes the value of 1 if a company is organized to give its owners limited liability (LTD). This dummy is highly correlated (-0.89***) with the dummy SMALL and therefore we use them as alternative controls for firms' size.

ii) Firm's default probability

The riskiness of firms is measured by the *Z*-score, an indicator of the probability of default which is computed annually by CERVED[11] on balance sheet variables (the methodology is described by Altman, 1968, and Altman et al., 1994). The *Z*-score indicator takes values from 1 to 9. We have constructed 9 different dummies for each category. A dummy ZSCORE_NA takes the value of 1 for those firms for which no *Z*-score is available. The *Z*-score is based on annual data and refers to the end of 2007.

iii) Firm's industry and location

A number of regressions also include a set of industry fixed effects (defined at the 2 digit NACE level, yielding a set of 55 industry dummies) and 103 province fixed effects for the province in which the firm has its head office. In some of the regressions we introduce firm fixed effects to control for unobserved heterogeneity in firms which may be correlated with relationship lending variables or with supply side effects.

3.3 Bank-specific characteristics: loan supply

According to the "bank lending channel" thesis, an unexpected adverse shock on bank funding should have a larger effect on those banks that are perceived as more risky by the market. Since non-reservable liabilities are not insured and there is an asymmetric information problem about the value of banks' assets, risky banks suffer more through a drying-up of the bond or interbank market.

The effects of the crisis on bank pricing should therefore be larger for less liquid banks, which cannot protect their loan portfolio against adverse shocks simply by drawing down cash and securities (Stein, 1998; Kashyap and Stein, 2000), and poorly capitalized banks, which have less access to markets for uninsured funding (Peek and Rosengren, 1995; Kishan and Opiela,

[11] CERVED is a company which provides financial analysis and balance sheet data on Italian firms. For more information, see the Appendix and http://www.cerved.com/xportal/web/eng/aboutCerved/aboutCerved.jsp.

2000; Van den Heuvel, 2003).[12] The effect of bank size is a priori ambiguous. On the one hand, small banks, which are more subject to asymmetric information problems, should be more affected by the crisis (Kashyap and Stein, 1995). On the other hand, small banks may be more efficient than larger ones in collecting and processing soft information (Berger and Udell, 2002; Berger et al., 2005) and this could amplify their willingness to preserve the bank-firm business relationship. This is particularly the case for mutual banks in Italy (Gambacorta, 2004).

To control for a bank supply response to the financial crisis, we start therefore with the traditional indicators of size (logarithm of total assets, SIZE), liquidity (cash and securities over total assets, LIQ) and capitalization (excess capital over total assets, CAP).

The use of these bank-specific characteristics feeds into the current policy debate on the new capital and liquidity requirements drawn up by the Basel Committee on Banking Supervision (BCBS, 2009 and 2010), usually referred to as Basel III. However, the definitions of bank capital and liquidity used in this paper refer to the old world and are different with respect to the one adopted in the new regulation. In particular, while the concept of bank capital in Basel III is "tangible common equity" (a concept close to TIER I), the notion of excess capital used in the paper is calculated using at the numerator a definition of bank capital that includes more items subject to evaluation (such as the so-called TIER II). Also, the liquidity ratio represents a short cut with respect to the new definition. Under the BCBS's proposal, banks will be required to meet two new liquidity requirements – a short-term requirement called the Liquidity Coverage Ratio (LCR) and a long-term requirement called the Net Stable Funding Ratio (NSFR). The LCR ensures that banks have adequate funding liquidity to survive one month of stressed funding conditions. The NSFR addresses the mismatches between the maturity of a bank's assets and that of its liabilities.

We also control for other bank-specific characteristics which are worth investigating to detect loan supply shifts: a) the ratio between deposits and total funding; b) a dummy for mutual banks; c) the orientation to traditional intermediation activity; d) the interbank average interest rate prior to the crisis; e) the bank's geographical zone; f) dummies for banks that belong to a group or a bank holding company; g) a measure of the importance of loan securitization at the

[12] All these studies on cross-sectional differences in the effectiveness of the "bank lending channel" refer to the US. The literature on European countries is far from conclusive (see Altunbas et al., 2002; Ehrmann et al., 2003). For Italy see Gambacorta (2004) and Gambacorta and Mistrulli (2004).

bank level; and h) a dummy for banks that received specific rescue packages during the period of investigation.

The first indicator (a) is in line with Berlin and Mester (1999): banks that depend heavily on wholesale funding (i.e. bonds) will adjust their loan interest rates by more (and more quickly) than banks whose liabilities are more retail oriented. The reason for this result is that wholesale markets are dominated by informed investors who react quickly to any news compared to what happens in the retail market, where depositors tend to monitor less the overall economic outlook because of the existence of deposit insurance. Therefore an important indicator in analyzing the pass-through between market and banking rates is the ratio between deposits and total funding (RETAIL), including deposits, bonds and interbank borrowing. Banks which use relatively more bonds and interbank debt than deposits for financing purposes come under greater pressure because their costs increase contemporaneously and to a similar extent to market rates.

The second indicator (b), MUTUAL is a dummy variable for cooperative banks (mutual banks), which are subject to a special regulatory regime and have been shown in the literature to focus on relationship lending (Angelini et al., 1998).

The third indicator (c) measures how much banks are involved in traditional lending activity. Our indicator is defined as the ratio of total lending to total assets (LENDING). We expect a firm borrowing from banks that are relatively more specialized in lending to benefit more from the reduction in money interest rates. Indeed, these banks have invested more in costly information gathering and then tend to be more prone to insulate their borrowers from shocks in order to fully benefit from their information investments, which presumably need time to be completely reaped.

The fourth indicator (d) controls for the level of the average interbank spread during the period of financial turmoil (August 2007–August 2008) prior to Lehman's default. We obtain this information from transactions on the electronic market for interbank deposits (e-Mid). As in Angelini et al. (2011) we compute the spread between the interest rate on time deposits and the repo rates on corresponding maturities. Then we compute an average interbank deposit rate by weighting each rate with the amount of transactions. Finally, we compute the variation of the average interest rate between August 2007 and September 2008.

To control for geographical differences among credit intermediaries (e) we also insert geographical dummies for the main headquarters of the bank. In certain specifications, bank fixed effects will help us to control for this and other unobserved heterogeneity in the bank which may be correlated with relationship lending variables or with demand side effects.

Following Ashcraft (2006), we also use affiliation with a group to check for the presence of internal capital markets in bank holding companies (f). The reason for this test is that the presence of internal capital markets in bank holding companies is important to isolate exogenous variation in the financial constraint faced by subsidiary banks. For those small banks belonging to a group that do not have direct access to the interbank market we calculate variable (d) by using the interest rate applied to the holding bank.

Banks' pricing may be also influenced by how active the bank is in the securitization market. There is for example evidence that securitization has reduced the influence of monetary policy changes on credit supply. In normal times (i.e. when there is no financial stress), this would make the bank lending channel less effective (Loutskina and Strahan, 2006). In line with this hypothesis, Altunbas et al. (2009) find that, prior to the recent financial crisis, banks making more use of securitization were more sheltered from the effects of monetary policy changes. However, their macro-relevance exercise highlights the fact that securitization's role as a shock absorber for bank lending could even be reversed in a situation of financial distress. We therefore include in the econometric model, as an additional control, the ratio of securitized lending over total loans (SEC_RATIO) in the three years prior to Lehman's default (g).

Finally we compute a dummy (h) that takes the value of 1 if a bank has received a specific rescue package in the period under investigation (Panetta et al, 2009).

Table 2 gives some basic information on the variables used in the regressions. The change in the interest rate is expressed in percent. This means that the average reduction in the interest rates on overdrafts (across bank-firm observations) during the period under investigation is 1.6 percentage points. For cleaning outliers, we dropped the first and last 5% percentile of the distribution of the dependent variables. The final database includes 194,000 observations and around 80,000 firms. More details on the statistical sources are provided in the Appendix.

4.Results

4.1 Bank-firm relationship

The results of the econometric analysis are summarized in Tables 3–5. The first column of Table 3 presents a baseline equation with bank-firm distance variables, the share of lending granted by each bank to a given firm together with both bank and firm fixed effects. The inclusion of both fixed effects is possible because we focus on multiple lending only, which, as discussed in the Introduction, is a long-standing characteristic of bank-firm relationships in Italy. This specification allows us to control for all (observable and unobservable) bank and borrower characteristics and to detect in a very precise way the effects of distance. The coefficients show that with increasing functional distance, the change in the interest rates tends to be larger. In other terms, firms borrowing at a shorter distance are better insulated from shocks, consistent with the view that distance negatively affects the ability of banks to gather soft information, thus making it more difficult to establish close ties with borrowers. From an economic point of view, the difference in the interest rate received by a firm that is headquartered in the same region (DISTh2) with respect to the benchmark case in which the firm is headquartered in the same province is equal to 10 basis points.

The interest rate change during the crisis is negatively correlated with the share of lending granted by each bank to a given firm. In other words, in the extreme case that a firm has overdraft contracts with many banks but it receives almost all credit from only one (SHARE is approximately equal to 1), then the interest rate charged by the main bank is 25 basis points lower relative to the other credit intermediaries.

By using firm fixed effects we are prevented from including other relationship lending variables that do not change with respect to the bank-firm matching. For example, the Herfindahl index calculated on the amount of lending granted by each bank to a given firm is collinear with the firm effect dummy (and also highly correlated with SHARE). Therefore in the second column of Table 3 we drop firm fixed effects and SHARE and include the alternative lending relationship variables discussed in the previous section. We also include firm-specific characteristics which aim at controlling for demand shifts. The results show that, consistent with the literature on relationship lending analyzing the case of firm idiosyncratic shocks, even in the case of a systemic financial crisis those firms that have a closer tie with the lender tend to be more insulated. The change in the interest rate is lower for firms with more concentrated credit. This is also confirmed by the results in column 3, where we replace the Herfindahl index with

the number of banks lending to a given firm: the lower the number of banks that have a business relationship with a given firm, the lower is the increase of its interest rate during the period of crisis. This result is in line with Elsas (2005).

Repeated interaction with the banking system also has an effect on bank interest rate setting. The variable CREDIT_HISTORY, representing the number of years elapsed since the first time a borrower was reported to the Credit Register, is negatively correlated with the change in lending rates. The last column in Table 3 checks for the existence of possible non-linearities in the relationship between CREDIT_HISTORY and the change in the interest rate. A graphic analysis of the results is reported in the first panel of Figure 5 and shows the simulated drop in the lending rate applied to firms' overdraft facilities with respect to different levels of CREDIT_HISTORY. Since our measure for the duration of a firm's relationship is truncated at 12.5 years the maximum benefit is equal to 0.35 percentage points.

Terminating an existing relationship is interpreted as a "bad signal" about a borrower's solvency to other banks: other things being equal, the interest rate increases by 2 basis points. By contrast, starting a new relationship with another bank that was not previously part of the pool of lenders is interpreted as a "good signal": the interest rate decreases by 5 basis points.

4.2 Firm-specific characteristics: loan demand

Apart from lending relationship factors, the transmission of shocks to loan rates depends on some firm characteristics. First of all, in all equations reported in Table 3, except for column I, we control for a firm's credit-worthiness (measured at the beginning of the period under investigation) by using its *Z*-score. Since it is reasonable to assume that the crisis hit more fragile firms (i.e. those with a high score) harder, it is not surprising that we find that a larger variation in loan interest rates for less sound firms. Column IV in Table 3 also indicates that even after their riskiness is controlled for, small firms benefited less from the decline in money market interest rates. We also checked whether some different behaviour of loan rates emerges when we compare limited versus unlimited liability firms. This control (LTD) cannot be used together with that for firm size due to high collinearity (small firms tend be unlimited ones). Columns II–III in Table 3 indicate that this control has no impact on the dependent variable.

4.3 Bank-specific characteristics: loan supply

In Table 4 we report the results of some estimations which focus on bank-specific characteristics. Similarly to the previous section, we drop bank fixed effects and we include some bank-specific controls. In this setting, we can only continue to control for factors varying with the bank-firm pair like our functional distance regressors.

First of all, we control for the cost of funding in the interbank market (INT_RATE). We find that the level of the interbank rate paid on average by each bank in the period August 2007–August 2008, characterized by financial turmoil, is positively associated with the change in the interest rate on overdraft lending. Those banks that suffered the problems in the interbank market more were those that were less able to protect their clients.

Second, the dummy MUTUAL, which stands for cooperative banks, has a negative coefficient, but the effects are very low and statistically not different from zero.

As regards the bank-specific characteristics, liquid and well-capitalized banks insulate their clients more in the financial crisis. Also, banks with a high proportion of traditional lending activity tend to change their prices less. The effect for the variable size is indeed positive: small banks protect their clients more. This evidence matches previous results in the literature for the monetary transmission channel. Liquid banks can protect their loan portfolio against a shock simply by drawing down cash and securities (Stein, 1998; Kashyap and Stein, 2000). Well-capitalized banks that are perceived as less risky by the market are better able to raise uninsured funds in order to compensate for difficulties in the funding market (Peek and Rosengren, 1995; Kishan and Opiela, 2000; Van den Heuvel, 2003; Gambacorta and Mistrulli, 2004). Therefore the effects on lending generally detected for liquid and well-capitalized banks are mirrored by their higher capacity to insulate clients from the effects on interest rates as well.

To get a sense of the economic impact of the above-mentioned results, well-capitalized banks (those that have a capital ratio greater than 2 standard deviations with respect to the average) supplied credit lines at an interest rate at least 10 basis points below the average. This impact is even higher for highly liquid banks (those with a liquidity ratio above 2 standard deviations of the average bank), which applied interest rates at least 28 basis points lower. Small banks (those with a size below 2 standard deviations of the bank dimension) applied a discount of 24 basis points.

Banks that securitize their assets to a larger extent have, on average, a higher ability to smooth the effects of the financial crisis on their clients (see the second column of Table 4). This result is interesting, because during the crisis the ability of banks to sell securitized products directly to the market was drastically reduced. However, in the euro area ABSs were typically self-retained and used as collateral in refinancing operations with the central bank. This implies that the insulation effect of securitization changed in nature but remained in place. In this respect, a similar insulating effect of securitization is detected on lending supply in the US and EU countries (Gambacorta and Marques-Ibanez, 2011).

The relationship between capitalization and bank interest rate setting may be not linear. For example, using banking data from 1984 to 1993, Calem and Rob (1999) find a U-shaped relationship between equity capital and risk-taking. Undercapitalized banks take large risks because of the deposit insurance's coverage of bankruptcy costs. Risk is then decreasing in capital up to a critical level of capitalization at which each additional unit of capital per asset increases risk-taking because of the increasing marginal benefit of gambling. In order to tackle this point we have introduced a quadratic term for capitalization (CAP_2) in the third column of Table 4. The results, summarized also in the second panel of Figure 5, show that the relationship is slightly non-linear.

It is interesting to note that, in contrast with the evidence for the US on lending (Kashyap and Stein, 1995), the effect for SIZE is positive. The fact that the interest rate on overdraft facilities of smaller banks is less sensitive in a financial crisis than that of larger banks could reflect the close customer relationship between small banks and small firms, widely documented for the Italian case (Angeloni et al., 1995; Angelini et al., 1998; Gambacorta, 2004). This result is also consistent with Ehrmann et al. (2003), where size does not emerge as a useful indicator for the distributional effect of monetary policy on lending, not only in Italy but also in France, Germany and Spain.

The liability structure also seems to influence banks' pricing decision. A bank with a high proportion of deposits tends to change its interest rates by more. This could be due to cost pressure on banks that rely more heavily on a branching structure, which could be particularly intense in financial crises when credit losses increase and loan demand is reduced.

In this paper we chose to use unconsolidated capital and liquidity ratios, in order to exploit the heterogeneity of behaviour and conditions across banks belonging to the same group. However, the presence of internal capital markets in bank holding companies is

important to isolate exogenous variation in the financial constraint faced by subsidiary banks. To check the robustness of the results in the fourth column of Table 4 we introduce a dummy for those banks which belong to a group. However, the effect is not statistically significant (see column four in Table 4), even if we consider separately a dummy for bank holding companies (the results regarding this last specification are not reported for the sake of brevity).

Finally, the results indicate that firms borrowing from banks obtaining public assistance by means of a rescue package (RESCUED) benefited more, other things being equal, in terms of the cost of credit, due to an amelioration in banks' solvency and liquidity positions (see the fifth column of Table 4).

5. Robustness checks

One possible objection to our results reported so far is that banks set simultaneously both prices and quantities. The first robustness check is therefore to see if results are confirmed when equation (1) is estimated simultaneously with a bank lending equation. In particular we consider the following equation:

$$\Delta l_{j,k} = \alpha + \Psi r_{j,k} + \Gamma d_k + \Pi s_j + \varepsilon_{j,k} \qquad (2)$$

where the dependent variable is the change in the logarithm of outstanding loans supplied by bank *j* on total credit lines of firm *k* between June 2008 and March 2010 ($\Delta l_{j,k}$).

To tackle the simultaneity issue, we have estimated the system composed by equations (1) and (2) by means of the seemingly unrelated regression equations (SURE) model, proposed by Zellner (1962). In this way we allow for the errors term to be correlated across equations. This helps us to control also for possible forms of cross-subsidization, i.e. banks could increase the spread charged on current accounts while extending, at the same time, the overall amount of supplied lending, or vice versa. In the estimation we can include both bank and firm controls, but we have to exclude bank and firm effects. For this reason we have enriched the set of variables by including a dummy (US>GR) that takes the value of 1 for those firms that have used their credit lines for an amount greater than the value granted by the bank, and zero elsewhere. This dummy should help to control for those increases in interest rates and lending quantities not caused by an autonomous shift in the lending supply by the bank.

The results reported in the first and the second column of Table 5 are in line with our previous findings. We obtain a similar picture for loan quantities, with close relationships being

beneficial also in terms of the amount borrowed. One exception is the share of the lending granted by each bank to the firm. While we find that a bank with a high share of lending to a given firm tends to reduce the cost of credit more, on the contrary it reduces, other things being equal, the amount borrowed. This may be interpreted as the effect of a greater need of banks to diversify better their loan portfolio by avoiding too much credit concentration following the crisis. It might be the case that banks' risk aversion increased as a consequence of the crisis. It is worth stressing that even considering lending supply, well-capitalized and highly liquid banks were better able to shield the credit portfolio of their clients. Interestingly, banks with a higher proportion of retail funding protected their clients more by reducing supplied lending less. This is probably due to the fact that in the presence of a high preference for liquidity and the presence of deposit insurance, retail deposits were less affected than the issuance of bonds and CDs by the turmoil on financial markets.

Following Albertazzi and Marchetti (2010) and De Mitri et al. (2010) we have also estimated the lending equation (2) by using as dependent variable the change in outstanding loans extended by bank j to firm *k*, divided by the firm's total assets at the beginning of the period. The use of this variable rather than the rate of growth of loans is motivated by the fact that in many cases the amount of credit at bank-firm level at the beginning of the period (September 2008) or at the end (March 2010) was negligible, resulting in a disproportionate number of observations with, respectively, a huge positive rate of growth or a rate of growth equal to -100%. The results (not reported for the sake of brevity) are qualitatively similar to those reported in Table 5 and do not change the main message of the study.

Another robustness check has been to estimate the system (1)-(2) including also firms that have a relationship with only one bank. This is possible because the estimation is performed by including both bank and firm controls, while excluding bank and firm fixed effects. The results – presented in the last part of Table 5 – confirm qualitatively the previous conclusions.

We also try to get a sense of why bank capitalization and liquidity were important characteristics after Lehman's collapse to preserve the bank-firm relationship. One possible explanation is that well-capitalized and liquid banks were less affected by the consequences of the crisis in the interbank market. If those banks could raise funds at a lower cost, they may have been more able to set lower interest rates for their clients and to provide them with more loans. We have therefore estimated the following simple equation:

$$\Delta INT\_RATE_j = \alpha + \Phi s_j + \varepsilon_j \quad (3)$$

where the dependent variable is the increase in the average interbank spread between the time deposit rate and the repo rate on corresponding maturities applied to bank *j* between June 2008 and March 2010 ($\Delta INT\_RATE_{j,}$). The latter is regressed on a constant (α) and a vector of bank-specific characteristics (s_j). The results reported in the first panel of Table 6 show that high capitalization and liquidity, together with bank dimensions, are important characteristics that helped financial intermediaries to contain the overall increase of the interbank spread after Lehman's collapse. Interestingly, the second panel of Table 6 shows that those bank-specific characteristics were less important in the first part of the financial turmoil (2007:q2–2008:q2), where the increase of the spread was indeed lower for small banks.

Finally, we have also checked whether results are the same after controlling for firms that have specific access to the syndicated loan market. In particular, we have included in the specifications a dummy that takes the value of one if the bank-firm contracts also include a syndicated loan. In all the specifications the coefficient of the dummy is always equal to -0.10* (significance level 10%). This means that firms that have access to the syndicated loan market with a given bank pay 10 basis points less than other firms on the credit line applied by the same bank, other things being equal. All other results remain exactly the same. Is this effect dependent on the specific bank-firm relationship or on the fact that the firm is less bank-dependent? To check for this we have constructed another dummy that takes the value of one for all firms that have a syndicated loan, independently of the bank. This extends the effect of the dummy to all banks, also those with which the firm does not have a specific syndicated loan. The coefficient of the dummy in this case is equal to 0.05, but it is no longer statistically significant. This means that the lower interest rate paid on the credit line during the period of crisis depends on the specific bank-firm relationship and not on the fact that the firm is less bank-dependent.

It is also interesting to note that for those firms that have access to the syndicated loan market, typically very big, the effect of the distance to the main seat of the bank tends to vanish. By running the same regressions in Table 3 and 4 only for firms that have received at least one syndicated loan, the variables DISTh2, DISTh3 and DISTh4 are statistically not different from zero. Conversely, the variable SHARE remains negative and significant (coefficient -0.47**). This means that the higher the share of loans granted by a specific bank, the lower the interest rate paid by the firms (that also have access to the syndicated loan market). It is worth noting

that this effect, equal to 47 basis points, is roughly double that reported in Tables 3–5 on the whole sample of firms.

6. Conclusions

The role of relationship lending and bank-specific characteristics in shielding borrowers from idiosyncratic shocks has been deeply investigated. Conversely, much less is known about their role in an economy-wide crisis. Recently, some papers have investigated the dynamic of lending supply in the financial crisis. In this paper, we focus on the cost of credit, an issue little investigated by previous contributions because of the limited data availability. To this end we have used detailed information at the bank-firm level from the Italian Credit Register, merged with Supervisory Reports of the Bank of Italy. The richness of the database allows us to take into account bank, firm and bank-firm relationship characteristics.

We find that, in an economy-wide crisis, lending relationships and bank-specific characteristics matter. In the period June 2008–March 2010, the spread between loan rates and the interbank rate increased due to the overall rise in credit risk. However, for those firms that had closer relationships with their lenders, the interest spread increased less than that for other firms. We have measured the closeness of the lending relationship using different indicators: the functional distance between the bank and the borrower; the concentration of lenders; the length of borrowers' credit history; and the event that, during the period under investigation, a new lending relationship was established or a pre-existing one terminated. All indicators point in the same direction, showing the importance of the lending relationship in shielding clients from the effects of the crisis.

We also find that bank-specific characteristics affect bank interest rate setting. In particular, banks which are less liquid or less well capitalized were less likely to shield their corporate clients from an increase in the loan interest spread. Other bank characteristics also mattered for the spread pass-through: banks more oriented to lending smoothed interest rates more, and the same held for banks with a high disposition towards lending activity via securitization.

All in all, our results indicate that close lending relationships allowed firms to be more insulated from the financial crisis and that the ability of banks to shield their borrowers from shocks crucially depends on their capital and liquidity condition. From a policy perspective, these findings support the focus of Basel III on core capital and funding liquidity risk.

Appendix – Technical details regarding the data

We construct the database linking a number of different sources. From the Italian Credit Register (CR)[13] we obtain information on the interest rate, the amount lent, the type of loan contract and the tax code of the borrower.

The second source of data is the CERVED database, which includes balance sheet information on about 500,000 companies, mostly privately owned. Balance sheet data are as of December 2007. This is important since credit decisions in June 2008 on how to set firms' interest rates on credit lines are based on December 2007 balance sheet information. Moreover, importantly, balance sheet variables from December 2007 are predetermined with respect to the dynamic of interest rates (and credit) between June 2008 and March 2010. We match data from CERVED and from the Credit Register obtaining a dataset of bank-firm loans matched with balance sheet information on the borrower.

Third, from the database of the Banking Supervision Department of the Bank of Italy we obtain information on most relevant characteristics of the banks (size, liquidity, capitalization, funding structure). Importantly, for all the banks in the sample, we obtain information on the credit concentration of the local credit market in June 2008. We compute Herfindahl indexes for each province (similar to counties in the US) using the data on loans granted by banks.

We include in our sample firms for which we have complete balance sheet information as of December 2007 and which have a credit line with at least two Italian banks in June 2008. This focuses the analysis on 216,000 observations. We clean outliers from the data, cutting the top and bottom fifth percentile of the distribution of the dependent variables we use in the regression.[14] An observation has been defined as an outlier if it lies within the top or bottom fifth percentile of the distribution of the dependent variables ($\Delta i_{j,k}$ and $\Delta l_{j,k}$). After these steps our sample reduces to around 194,000 observations (80,000 firms), which we use for the empirical analysis.

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[13] The Italian Credit Register is maintained by the Bank of Italy and collects information from all supervised intermediaries operating in Italy (banks, special purpose vehicles, other financial intermediaries providing credit) on borrowers obtaining loans from a single intermediary which is at least equal to 75,000 euros.

[14] Similar results, from a qualitative point of view, are obtained by imposing a less restrictive filter of 1%. In this case many of the firms that are recovered have to be excluded from the analysis in any case because of their missing *Z*-scores.

Tables and figures

Table 1

VARIABLES DESCRIPTION

Variables	Symbols	Description
Dependent variables	$\Delta i_{j,k}$	Change in the interest rate on overdraft on current account
	$\Delta l_{j,k}$	Change in the logarithm of total lending
Bank-firm relationship ($r_{j,k}$)	NUM_REL	Number of banks lending to a given firm
	HERFDEBT	Herfindahl index calculated on the amount of lending granted by each bank to a given firm
	SHARE	The share of loans granted by each bank to the firm
	DISTh1	Dummy equal to 1 if firm i is headquartered in the same province where the bank j has its headquarter; 0 elsewhere.
	DISTh2	Dummy equal to 1 if: a) DISTh1=0 and b) firm i is headquartered in the same region where bank j has its headquarters; 0 elsewhere.
	DISTh3	Dummy equal to 1 if: a) DISTh2=0 and b) firm i is headquartered in the same geographical area where bank j has its headquarters; 0 elsewhere.
	DISTh4	Dummy equal to 1 if DISTh3=0; 0 elsewhere.
	CRED_HISTORY	Number of years elapsed since the first time a borrower was reported to the Credit register.
	CLOSE_REL	Dummy equal to 1 if a borrower has terminated a relationship with at least one bank, 0 otherwise.
	OPEN_REL	Dummy equal to 1 if a borrower has started at least one relationship with a bank that was not previously part of the pool of lenders, 0 otherwise.
Firm-specific characteristics: loan demand (dj)	SMALL_FIRM	Dummy equal to 1 if the firm has fewer than 20 employees, 0 otherwise.
	LTD	Dummy equal to 1 if the firm is organized to give its owners limited liability, 0 otherwise.
	Z-SCORE	Altman's indicator of the probability of default for a firm. The Z-SCORE indicator takes the value from 1 (low risk) to 9 (high risk). For a limited number of firms no *Z*-score is available.
	US>GR	Dummy equal to 1 if the firm has used its credit lines for an amount greater than the value granted by the bank, 0 otherwise.
	Industry fixed effects	A set of 55 industry dummies defined at the 2 digit NACE level.
	Province dummies	A set of 103 province dummies in which the firm has its head office.
Bank-specific characteristics: loan supply (s_k)	SIZE	Log of total assets
	LIQ	Liquidity ratio given by cash and securities over total assets
	CAP	Excess capital given by the difference between regulatory capital and capital requirements over risk-weighted assets
	RETAIL	Ratio between deposits and total bank funding (excluding capital)
	MUTUAL	Dummy for mutual banks
	LENDING	Lending to total asset ratio
	INT_RATE	Average interbank spread between time deposit rate and the repo rate on corresponding maturities (August 2007–August 2008)
	GROUP	Dummy equal to 1 if a bank belongs to a group; 0 elsewhere.
	SEC_RATIO	Ratio of securitized lending over total loans
	RESCUED	Dummy equal to 1 if a bank has received assistance by means of rescue package in the estimation period; 0 elsewhere.
	Bank zone dummies	Geographical dummies for the main headquarters of the bank.

Note: For more information on the definition of the variables, see the Appendix.

Table 2

SUMMARY STATISTICS

Variable	Observations	Mean	Std. Dev.	Min	Max
Dependent variables:					
$\Delta i_{j,k}$	194,476	-1.579	1.897	-5.420	2.500
$\Delta l_{j,k}$	194,476	-0.017	0.828	-4.359	4.559
Bank-firm relationship:					
HERFDEBT	194,476	0.392	0.199	0.031	1.000
SHARE	194,476	0.274	0.236	0.001	0.999
NUM_REL	194,476	1.478	0.629	0.693	4.290
DISTh1	194,476	0.293	0.455	0.000	1.000
DISTh2	194,476	0.279	0.448	0.000	1.000
DISTh3	194,476	0.169	0.375	0.000	1.000
DISTh4	194,476	0.250	0.433	0.000	1.000
CRED_HISTORY	194,476	10.004	3.499	0.333	12.500
CLOSE_REL	194,476	0.512	0.500	0.000	1.000
OPEN_REL	194,476	0.415	0.493	0.000	1.000
Firm–specific characteristics:					
SMALL_FIRM	194,476	0.226	0.419	0.000	1.000
LTD	194,476	0.731	0.444	0.000	1.000
Z-SCORE2	194,476	0.016	0.124	0.000	1.000
Z-SCORE3	194,476	0.167	0.373	0.000	1.000
Z-SCORE4	194,476	0.195	0.396	0.000	1.000
Z-SCORE5	194,476	0.201	0.401	0.000	1.000
Z-SCORE6	194,476	0.296	0.456	0.000	1.000
Z-SCORE7	194,476	0.063	0.242	0.000	1.000
Z-SCORE8	194,476	0.167	0.373	0.000	1.000
Z-SCORE9	194,476	0.011	0.104	0.000	1.000
Z-SCORE_NA	194,476	0.004	0.061	0.000	1.000
US>GR	194,476	0.161	0.367	0.000	1.000
Bank-specific characteristics:					
SIZE	194,476	9.987	1.670	6.122	12.937
LIQ	194,476	26.705	12.838	4.183	93.366
CAP	194,476	6.496	4.800	0.235	20.175
RETAIL	194,476	53.201	13.465	0.798	84.284
MUTUAL	194,476	0.066	0.247	0.000	1.000
LENDING	194,476	67.170	14.427	6.363	92.475
INT_RATE	194,476	0.295	0.088	0.074	0.760
GROUP	194,476	0.903	0.297	0.000	1.000
SEC_RATIO	194,476	1.66	2.37	0.000	39.47
RESCUED	194,476	0.251	0.433	0.000	1.000

Table 3

BANK-FIRM RELATIONSHIP, CREDIT DEMAND AND BANK FIXED EFFECTS

Dependent variable: change in the interest rate on overdraft facilities (2008:q2-2010:q1)	(I) Baseline equation for distance, bank share and fixed effects	(II) All bank-firm relationship variables, loan demand controls and bank-fixed effects	(III) Number of bank relationships	(IV) Small firms	(V) Non-linear effects of credit history
DISTh2	0.091 ***	0.094 ***	0.095 ***	0.089 ***	0.089 ***
	(0.019)	(0.013)	(0.013)	(0.013)	(0.013)
DISTh3	0.231 ***	0.219 ***	0.221 ***	0.213 ***	0.213 ***
	(0.025)	(0.017)	(0.017)	(0.017)	(0.017)
DISTh4	0.164 ***	0.175 ***	0.177 ***	0.166 ***	0.166 ***
	(0.023)	(0.016)	(0.016)	(0.016)	(0.016)
SHARE	-0.250 ***			-0.219 ***	-0.219 ***
	(0.034)			(0.019)	(0.019)
HERFDEBT		-0.197 ***			
		(0.028)			
NUM_REL			0.040 ***		
			(0.010)		
CRED_HISTORY		-0.024 ***	-0.024 ***	-0.025 ***	-0.015 **
		(0.001)	(0.001)	(0.001)	(0.007)
CRED_HISTORY_2					-0.001 **
					(0.000)
CLOSE_REL		0.018	0.021 *	0.023 **	0.023 **
		(0.011)	(0.011)	(0.010)	(0.010)
OPEN_REL		-0.047 ***	-0.045 ***	-0.048 ***	-0.048 ***
		(0.010)	(0.011)	(0.010)	(0.010)
ZSCORE2		-0.043	-0.037	-0.038	-0.038
		(0.073)	(0.073)	(0.073)	(0.072)
ZSCORE3		0.077	0.084	0.083	0.083
		(0.066)	(0.066)	(0.066)	(0.066)
ZSCORE4		0.172 ***	0.182 ***	0.18 ***	0.18 ***
		(0.063)	(0.063)	(0.063)	(0.063)
ZSCORE5		0.337 ***	0.350 ***	0.347 ***	0.347 ***
		(0.063)	(0.063)	(0.063)	(0.063)
ZSCORE6		0.505 ***	0.518 ***	0.515 ***	0.514 ***
		(0.063)	(0.063)	(0.063)	(0.063)
ZSCORE7		0.680 ***	0.695 ***	0.691 ***	0.691 ***
		(0.063)	(0.063)	(0.063)	(0.063)
ZSCORE8		0.809 ***	0.822 ***	0.82 ***	0.82 ***
		(0.065)	(0.065)	(0.065)	(0.065)
ZSCORE9		0.983 ***	0.995 ***	0.991 ***	0.991 ***
		(0.076)	(0.076)	(0.076)	(0.076)
ZSCORE_NA		0.675 ***	0.681 ***	0.688 ***	0.689 ***
		(0.092)	(0.092)	(0.092)	(0.092)
LTD		-0.007	-0.007		
		(0.028)	(0.029)		
SMALL_FIRM				0.250 *	0.250 *
				(0.140)	(0.140)
Industry-province dummies	no	yes	yes	yes	yes
Firm fixed effects	yes	no	no	no	no
Bank fixed effects	yes	yes	yes	yes	yes
Number of obs.	194,476	194,476	194,476	194,476	194,476
Adj R-Squared	0.637	0.085	0.085	0.085	0.085

Notes: Parameter estimates are reported with robust standard errors in brackets (cluster at individual firm level). The symbols *, **, and *** represent significance levels of 10%, 5%, and 1% respectively. Coefficients for dummies and fixed effects are not reported.

Table 4

BANK-FIRM RELATIONSHIP, CREDIT SUPPLY AND FIRM FIXED EFFECTS

Dependent variable: change in the interest rate on overdraft facilities (2008:q2-2010:q1)	(I) Distance, bank-specific characteristics and firm fixed effects	(II) Securitization activity	(III) Non-linear effects of bank capital	(IV) Effect for banks that belong to a group	(V) Rescued banks
DISTh2	0.023	0.024	0.023	0.022	0.013
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
DISTh3	0.275 ***	0.290 ***	0.288 ***	0.289 ***	0.272 ***
	(0.029)	(0.029)	(0.029)	(0.030)	(0.030)
DISTh4	0.093 ***	0.103 ***	0.100 ***	0.102 ***	0.091 ***
	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)
SHARE	-0.237 ***	-0.241 ***	-0.236 ***	-0.241 ***	-0.227 ***
	(0.045)	(0.045)	(0.045)	(0.045)	(0.045)
INT_RATE	0.602 ***	0.501 ***	0.518 ***	0.485 ***	0.525 ***
	(0.102)	(0.102)	(0.103)	(0.103)	(0.103)
MUTUAL	-0.067	-0.051	-0.043	-0.027	-0.027
	(0.042)	(0.042)	(0.042)	(0.047)	(0.047)
SIZE	0.037 ***	0.041 ***	0.046 ***	0.037 ***	0.077 ***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)
CAP	-0.008 ***	-0.005 ***	-0.002 *	-0.005 ***	-0.008 ***
	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
CAP_2			-0.0008 ***		
			(0.0002)		
LIQ	-0.010 ***	-0.007 ***	-0.009 ***	-0.007 **	-0.009 ***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
LENDING	-0.015 ***	-0.012 ***	-0.015 ***	-0.012 ***	-0.020 ***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
RETAIL	0.010 ***	0.011 ***	0.010 ***	0.011 ***	0.010 ***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
SEC_RATIO		-0.025 ***	-0.030 ***	-0.026 ***	-0.018 ***
		(0.004)	(0.004)	(0.004)	(0.004)
GROUP				0.046	0.046
				(0.040)	(0.040)
RESCUED					-0.363 ***
					(0.034)
Firm fixed effects	yes	yes	yes	yes	yes
Bank zone dummies	yes	yes	yes	yes	yes
Number of obs.	194,476	194,476	194,476	194,476	194,476
Adj R-Squared	0.6223	0.6227	0.6228	0.6228	0.6237

Notes: Parameter estimates are reported with robust standard errors in brackets (cluster at individual firm level). The symbols *, **, and *** represent significance levels of 10%, 5%, and 1% respectively. Coefficients for dummies and fixed effects are not reported.

Table 5

BANK-FIRM RELATIONSHIP, CREDIT SUPPLY AND DEMAND

Regressors	(I) SURE estimation - multiple lending only (Zellner's seemingly unrelated regression)		(II) SURE estimation - all credit relationships (Zellner's seemingly unrelated regression)	
	Eq. 1: Dependent variable: change in the interest rate on overdraft facilities (2008:q2-2010:q1)	Eq. 2: Dependent variable: change in the log of total outstanding loans (2008:q2-2010:q1)	Eq. 1: Dependent variable: change in the interest rate on overdraft facilities (2008:q2-2010:q1)	Eq. 2: Dependent variable: change in the log of total outstanding loans (2008:q2-2010:q1)
DISTh2	0.023 *	-0.050 ***	0.021 *	-0.036 ***
	(0.012)	(0.006)	(0.012)	(0.005)
DISTh3	0.233 ***	-0.076 ***	0.226 ***	-0.058 ***
	(0.015)	(0.007)	(0.014)	(0.006)
DISTh4	0.074 ***	-0.101 ***	0.072 ***	-0.073 ***
	(0.015)	(0.007)	(0.013)	(0.006)
SHARE	-0.259 ***	-0.754 ***	-0.156 ***	-0.449 ***
	(0.019)	(0.009)	(0.014)	(0.006)
CRED_HISTORY	-0.025 ***	0.009 ***	-0.025 ***	0.009
	(0.001)	(0.001)	(0.001)	(0.000)
CLOSE_REL	0.012	-0.058 ***	0.015 *	-0.075 ***
	(0.009)	(0.004)	(0.009)	(0.004)
OPEN_REL	-0.040 ***	0.015 ***	-0.037 ***	0.012 ***
	(0.009)	(0.004)	(0.009)	(0.004)
SMALL_FIRM	0.199 **	-0.052	0.191 **	-0.020
	(0.091)	(0.042)	(0.082)	(0.037)
INT_RATE	0.288 ***	-0.089 ***	0.261 ***	-0.105 ***
	(0.054)	(0.024)	(0.050)	(0.022)
MUTUAL	0.022	0.064 ***	-0.014	0.057 ***
	(0.024)	(0.011)	(0.021)	(0.010)
SIZE	0.112 ***	0.011 ***	0.108 ***	0.006 ***
	(0.005)	(0.002)	(0.005)	(0.002)
US>GR	0.606 ***	0.124 ***	0.579	0.105 ***
	(0.012)	(0.005)	(0.010)	(0.005)
CAP	-0.005 ***	0.004 ***	-0.004 ***	0.004 ***
	(0.001)	(0.001)	(0.001)	(0.001)
LIQ	-0.008 ***	0.006 ***	-0.008 ***	0.005 ***
	(0.001)	(0.001)	(0.001)	(0.001)
LENDING	-0.013 ***	0.008 ***	-0.013 ***	0.006 ***
	(0.001)	(0.001)	(0.001)	(0.001)
RETAIL	0.009 ***	0.001 ***	0.008 ***	0.001 ***
	(0.000)	(0.000)	(0.000)	(0.000)
SEC_RATIO	-0.015 ***	0.003 ***	-0.015 ***	0.002 **
	(0.002)	(0.001)	(0.002)	(0.001)
RESCUED	-0.322 ***	0.067 ***	-0.29 ***	0.044 ***
	(0.018)	(0.008)	(0.016)	(0.008)
Industry-province dummies	yes	yes	yes	yes
ZSCORE dummies	yes	yes	yes	yes
Bank zone dummies	yes	yes	yes	yes
Number of obs.	194,476	194,476	194,476	194,476
Adj R-Squared	0.052	0.079	0.052	0.082

Notes: Robust standard errors in brackets. The symbols *, **, and *** represent significance levels of 10%, 5%, and 1% respectively. Coefficients for the dummies are not reported.

Table 6

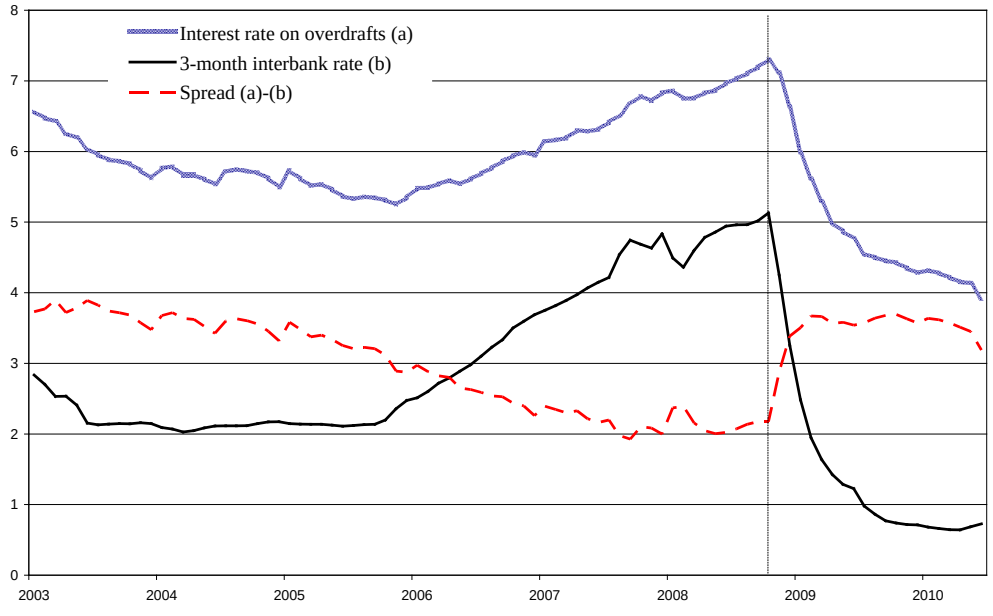
BANK-SPECIFIC CHARACTERISTICS AND INCREASE IN THE INTERBANK SPREAD

Dependent variable: change in the average interbank spread rate at the bank level	(I) After Lehman's default (2008:q2-2010:q1)	(II) Initial period of financial turmoil (2007:q2-2008:q2)
SIZE	0.0202 *	-0.0115 *
	(0.011)	(0.006)
CAP	-0.009 **	-0.0017
	(0.004)	(0.002)
LIQ	-0.011 ***	-0.0003
	(0.004)	(0.002)
LENDING	-0.0105 ***	0.001
	(0.004)	(0.002)
RETAIL	-0.002 ***	-0.002 ***
	(0.001)	(0.001)
RESCUED	0.025	
	(0.084)	
CONSTANT	1.2974 ***	0.4858 **
	(0.408)	(0.227)
Number of obs.	168	168
Adj R-Squared	0.1478	0.147

Notes: Parameter estimates are reported with robust standard errors in brackets. The symbols *, **, and *** represent significance levels of 10%, 5%, and 1% respectively.

Fig. 1

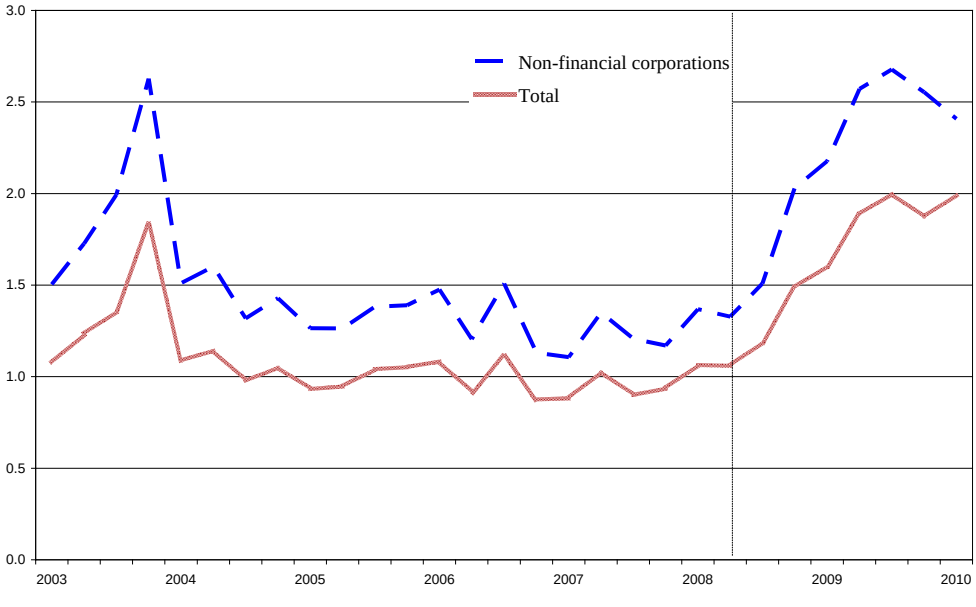
Interest rates on overdrafts and interbank rate in Italy (1)
(Monthly data; percentage points)



Source: Bank of Italy.
(1) Current account overdrafts expressed in euros. The vertical dotted line indicates Lehman's default.

Fig. 2

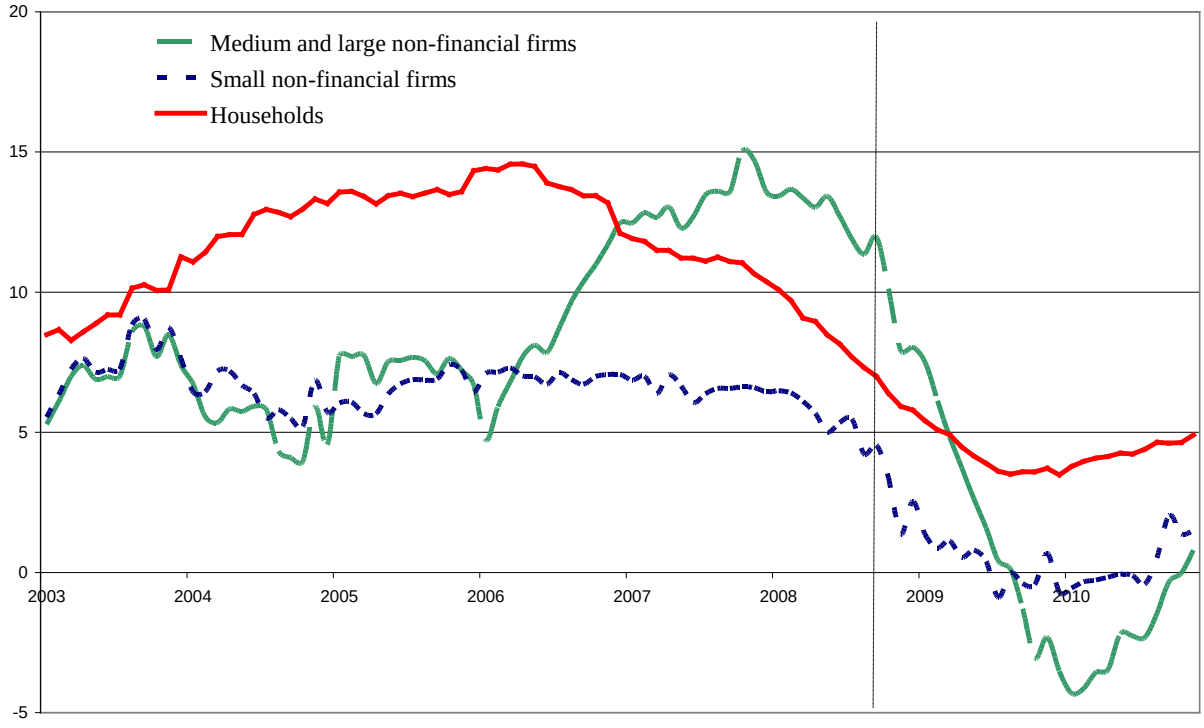
Ratio of new bad debts to outstanding loans (1)
(Seasonally adjusted, annualized quarterly data; percentages)



Sources: Central Credit Register and supervisory reports.
(1) Annualized flow of adjusted new bad debts in the quarter as a percentage of total loans excluding adjusted bad debts at the end of the previous quarter. All the time series are adjusted for seasonal effects, where applicable. The dotted line indicates the quarter prior to Lehman's default.

Fig. 3

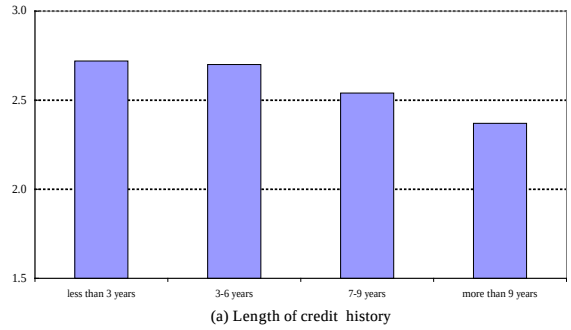
Bank lending to the private sector (1)
(Monthly data; annual growth rates)



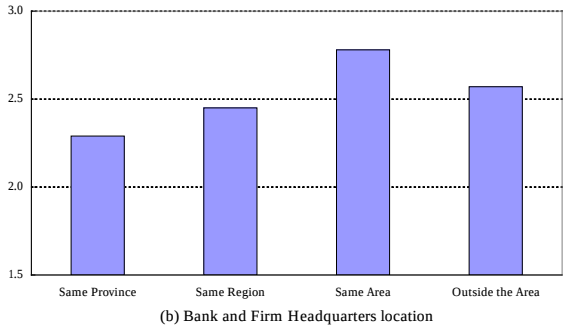
Source: Bank of Italy.
(1) Bad loans are excluded. The series are corrected for the impact of securitization activity. The vertical dotted line indicates Lehman's default.

Fig. 4

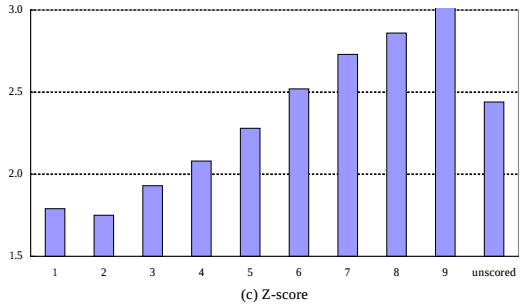
Change in the spread between the interest rate on overdrafts and three-month Euribor
(*June 2008 and March 2010*; *median values*)



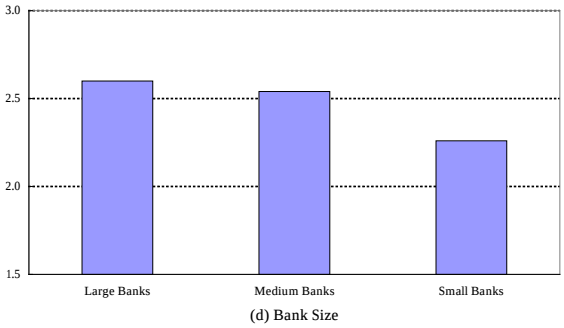
(a) Length of credit history



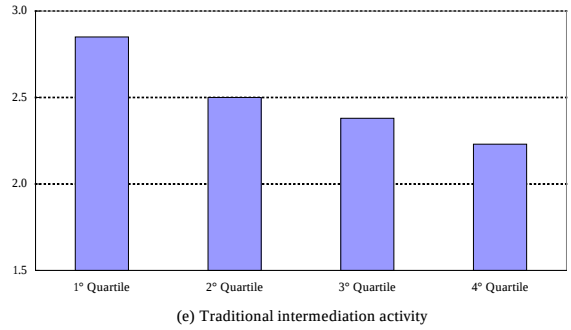
(b) Bank and Firm Headquarters location



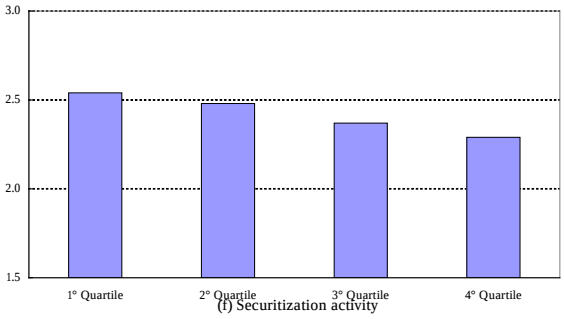
(c) Z-score



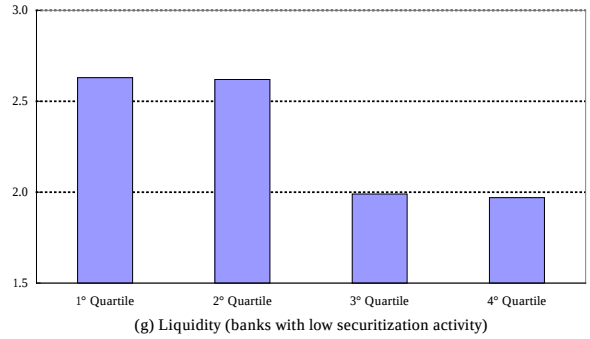
(d) Bank Size



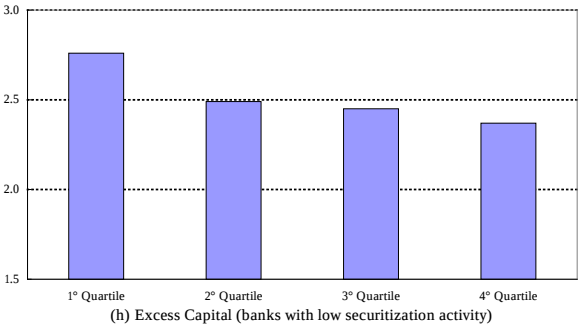
(e) Traditional intermediation activity



(f) Securitization activity



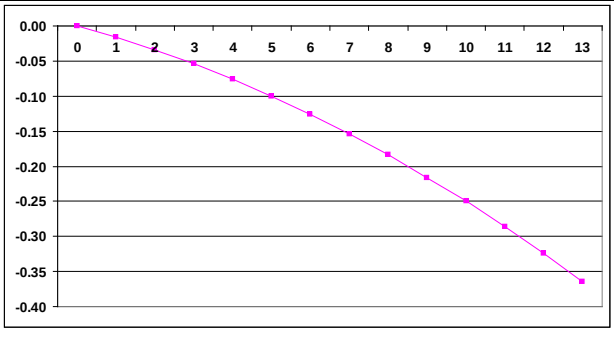
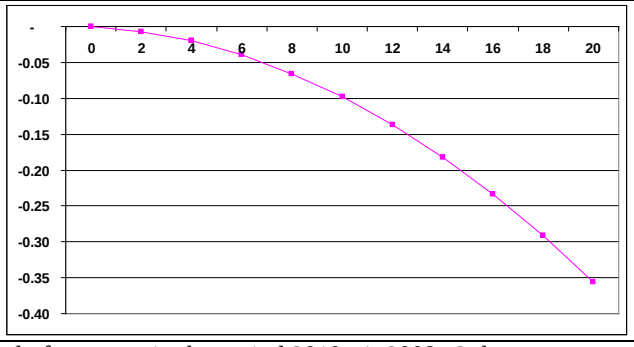
(g) Liquidity (banks with low securitization activity)



(h) Excess Capital (banks with low securitization activity)

Fig. 5

Non-linear effects (1)

Credit history (x-axis): Number of years elapsed since the first time a borrower was reported to the Credit Register	Excess capital (x-axis): Difference between regulatory capital and capital requirements over risk-weighted assets
	

(1) The vertical axis reports the effect on the interest rate on overdraft account in the period 2010:q1–2008:q2 due to a change in the variable reported in the horizontal axis.

References

Agarwal, S. and Hauswald R. (2010), "Distance and Private Information in Lending", *The Review of Financial Studies*, 23, 2757-2788.

Albertazzi, U. and Marchetti D. (2010), "Lending Supply and Unnatural Selection: An Analysis of Bank-Firm Relationships in Italy After Lehman", Bank of Italy, Temi di discussione, 756.

Altman, E.I. (1968), "Financial ratios, discriminant analysis and the prediction of corporate bankruptcy", *Journal of Finance*, 35, 1001-1016

Altman, E.I., Marco G. and Varetto F. (1994), "Corporate distress diagnosis: Comparisons using linear discriminant analysis and neural networks (the Italian experience)", *Journal of Banking and Finance*, 18, 505-529

Altunbas, Y., Fazylow O. and Molyneux P. (2002), "Evidence on the Bank Lending Channel in Europe", *Journal of Banking and Finance*, 26, 2093-2110.

Altunbas, Y., Gambacorta L. and Marques-Ibanez D. (2009), "Securitisation and the bank lending channel", *European Economic Review*, 53, 996-1009.

Angelini, P., Di Salvo P. and Ferri G. (1998), "Availability and Cost of Credit for Small Businesses: Customer Relationships and Credit Cooperatives", *Journal of Banking and Finance*, 22, 925-954.

Angelini, P., Nobili A. and Picillo C. (2011), "The Interbank Market After August 2007: What Has Changed, and Why?", *Journal of Money, Credit and Banking*, 43, 923–958.

Angeloni, I., Buttiglione L., Ferri G. and Gaiotti E. (1995), "The Credit Channel of Monetary Policy across Heterogeneous Banks: The Case of Italy", Bank of Italy, Temi di discussione, 256.

Aoki, M. and Patrick, H. (1994, eds), The Japanese Main Bank System: Its Relevance for Developing and Transforming Economies. Oxford: Oxford Univ. Press.

Ashcraft, A. (2006), "New Evidence on the Lending Channel", *Journal of Money, Credit, and Banking*, 38, 751-76.

Basel Committee on Banking Supervision (BCBS) (2009), "International framework for liquidity risk measurement, standards and monitoring", consultative document, Basel.

Basel Committee on Banking Supervision (BCBS) (2010), "Basel III: A global regulatory framework for more resilient banks and banking systems", Basel.

Beck, T., Demirguc-Kunt A. and Maksimovic V. (2008), "Financing patterns around the world: Are small firms different?", *Journal of Financial Economics*, 89, 467-487.

Berger, A.N. and Udell G.F. (1992), "Some Evidence on the Empirical Significance of Credit Rationing", *Journal of Political Economy*, 100, 1047-1077.

Berger, A.N. and Udell G.F., (1995). "Relationship Lending and Lines of Credit in Small Firm Finance", *Journal of Business*, 68, 351-379.

Berger, A.N. and Udell G.F. (2002), .Small Business Credit Availability and Relationship Lending: The Importance of Bank Organisational Structure., *The Economic Journal*, 112, 32-53

Berger, A.N., Miller, N.H., Petersen, M.A., Rajan, R.G. and Stein, J.C. (2005), Does Function Follow Organizational Form? Evidence from the Lending Practices of Large and Small Banks., *Journal of Financial Economics*, 76, 237-269.

Berger, A.N. and Udell, G.F. (2006), "A More Complete Conceptual Framework for SME Finance", *Journal of Banking and Finance*, 30, 2945-66.

Berlin, M. and Mester L.J. (1999), "Deposits and Relationship Lending", *Review of Financial Studies*, 12, 579-607.

Boot, A.W.A (2000), "Relationship banking: What do we know?", *Journal of Financial Intermediation*, 9, 7-25.

Caballero, R.J., Hoshi, T., Kashyap, A.K. (2008), "Zombie Lending and Depressed Restructuring in Japan," *American Economic Review*, 98, 1943-77.

Calem, P. and Rob R. (1999), "The Impact of Capital-Based Regulation on Bank-Risk Taking", *Journal of Financial Intermediation*, 8, 317-52.

Cohen-Cole, E., Duygan-Bump B., Fillat J. and Montoriol-Garriga J. (2008), "Looking behind the aggregates: A reply to facts and myths about the financial crisis of 2008", Federal Reserve Bank of Boston, Working Paper Series, 5.

Degryse, H. and Ongena S. (2005), "Distance, Lending Relationships, and Competition", Journal of Finance, 1, 231-66.

De Mitri, S., Gobbi G. and Sette E. (2010), "Relationship Lending in a Financial Turmoil", Bank of Italy, Temi di discussione, 772.

Detragiache, E., Garella, P. and Guiso, L. (2000), "Multiple versus Single Banking Relationships: Theory and Evidence", *Journal of Finance*, 55, 1133-1161.

Diamond, D.W., (1989), "Reputation Acquisition in Debt Markets", *Journal of Political Economy*, 97, 828-862.

Ehrmann, M., Gambacorta L., Martinez Pagés J., Sevestre P. and Worms A. (2003), "Financial Systems and the Role of Banks in Monetary Policy Transmission in the Euro Area", in Angeloni I., Kashyap A. and Mojon B. (eds.), Monetary Policy Transmission in the Euro Area, Cambridge, Cambridge University Press.

Elsas, R. (2005) "Empirical Determinants of Relationship Lending", *Journal of Financial Intermediation*, 14, 32-57.

Elsas, R., and Krahnen J.P. (1998), "Is Relationship Lending Special? Evidence from Credit-File Data in Germany", *Journal of Banking and Finance*, 22, 1283-1316.

Foglia, A., Laviola, S. and Marullo Reedtz, P. (1998), "Multiple Banking Relationships and the Fragility of Corporate Borrowers" *Journal of Banking and Finance*, 22, 1441-1456.

Friedman, B. and Kuttner K. (1993), "Economic Activity and the Short-Term Credit Markets: an Analysis of Prices and Quantities", *Brooking Papers on Economic Activity*, 2, 193-283.

Gambacorta, L. (2004), "Inside the Bank Lending Channel", *European Economic Review*, 49, 1737-1759.

Gambacorta, L. (2008), "How Do Banks Set Interest Rates?", *European Economic Review*, 52, 792-819.

Gambacorta, L. and Marques-Ibanez D. (2011), "The Bank Lending Channel: Lessons from the Crisis", *Economic Policy*, 26, 135-182.

Gambacorta, L. and Mistrulli P. (2004), "Does Bank Capital Affect Lending Behavior?", *Journal of Financial Intermediation*, 13, 436-457.

Green, C.J. (1998), "Banks as Interest Rate Managers", *Journal of Financial Services Research*, 14, 189-208.

Hale G. and Santos J.A.C. (2009), "Do banks price their informational monopoly?", *Journal of Financial Economics*, 93, 185-206.

Harhoff, D. and Körting T. (1998), "Lending relationships in Germany . Empirical evidence from survey data", *Journal of Banking and Finance*, 22, 1317-1353.

Kashyap, A. and Stein J.C. (1995), "The Impact of Monetary Policy on Bank Balance Sheets", *Carnegie Rochester Conference Series on Public Policy*, 42, 151-195.

Kashyap, A. and Stein J.C. (2000), "What Do a Million Observations on Banks Say About the Transmission of Monetary Policy", *American Economic Review*, 90, 407-428.

Kashyap, A., Stein J.C. and Wilcox D. (1993), "Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance", *American Economic Review*, 83, 78-98.

Kishan, R.P. and Opiela T.P. (2000), "Bank Size, Bank Capital and the Bank Lending Channel", *Journal of Money, Credit and Banking*, 32, 121-141.

Lim, G.C. (2000), "Bank Interest Rate Adjustments: Are They Asymmetric?", *The Economic Record*, 77, 135-147.

Loutskina, E. and Strahan P.E. (2006), "Securitization and the declining impact of bank finance on loan supply: Evidence from mortgage acceptance rates", NBER Working Paper 11983.

Mistrulli, P. and Casolaro L. (2010), "Distance, Lending Relationships and Interest Rates", Bank of Italy, mimeo.

Padilla, A.J. and Pagano M., (2000) "Sharing Default Information as a Borrower Discipline Device", *European Economic Review*, 44, 1951-1980.

Panetta, F., Faeh T., Grande G., Ho C., King M., Levy A., Signoretti F.M., Taboga M. and Zaghini A. (2009), "An assessment of financial sector rescue programmes", BIS Papers 48.

Peek, J. and Rosengren E.S. (1995), "Bank Lending and the Transmission of Monetary Policy"; in Peek J. and E.S. Rosengren (eds.), *Is Bank Lending Important for the Transmission of Monetary Policy?*, Federal Reserve Bank of Boston Conference Series 39, 47-68.

Peek, J. and Rosengren E.S. (2005), "Unnatural Selection: Perverse Incentives and the Misallocation of Credit in Japan", *American Economic Review*, 95, 1144-1166.

Petersen, M.A. (2009), "Estimating Standard Errors in Finance Panel Data Sets: Comparing Approaches", *The Review of Financial Studies*, 22, 435–80.

Petersen, M. and Rajan R. (1994), "The Benefits of Lending Relationships: Evidence from Small Business Data", *The Journal of Finance*, 49, 3-37.

Ongena, S. and Smith, D.C. (2000), "Bank relationships: a Review", in Harker P.T., Stavros A.Z. (eds.), *Performance of Financial* Institutions: Efficiency, Innovation, Regulation, 221-258.

Santomero, A.M. (1984), "Modeling the Banking Firm: A Survey", *Journal of Money Credit and Banking*, 16, 576-602.

Santos, J. (2011), "Bank Corporate Loan Pricing Following the Subprime Crisis", *Review of Financial Studies*, 24, 1916-1943.

Schularick, M. and Taylor A.M. (2011), "Credit booms gone bust: monetary policy, leverage and financial crises, 1870-2008", *American Economic Review*, forthcoming.

Sharpe, S.A. (1990), "Asymmetric Information, Bank Lending and Implicit Contracts: a Stylized Model of Customer Relationships", *Journal of Finance*, 45, 1069-1087.

Stein, J.C. (1998), "An Adverse-Selection Model of Bank Asset and Liability Management with Implications for the Transmission of Monetary Policy", *RAND Journal of Economics*, 29, 466-486.

Van den Heuvel, S.J. (2003), "Does Bank Capital Matter for Monetary Transmission?", *Federal Reserve Bank of New York Economic Policy Review*, May, 258-265.

Vacca, V. (2011), "An unexpected crisis? Looking at pricing effectiveness of different banks", Bank of Italy, Temi di discussione, 814.

Zellner, A. (1962), "An efficient method of estimating seemingly unrelated regression equations and tests for aggregation bias", *Journal of the American Statistical Association*, 57, 348–368.