

# The real effects of relationship lending\*

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## Abstract:

This paper studies the real consequences of relationship lending on firm activity in Italy following both the Lehman default shock and the European sovereign debt crisis. We use a large dataset merging the comprehensive Italian Credit and Firm Registers. We find that following the Lehman default shock, banks offered more favourable continuation lending terms to firm with stronger relationships. The more favourable credit conditions enabled relationship firms to maintain stronger investment and employment relative to firms with weaker relationships. However, after the European sovereign debt crisis the insulation effects of tighter bank-firm relationships weakened. Banks were less able to maintain the positive differential in credit growth and lower interest rates to relationship firms.

JEL Codes: E44, G21

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## 1. INTRODUCTION

The consequences of credit restrictions on the real economy can be severe. Financially-driven recessions have been shown to be longer and deeper, as investment and employment drop more strongly following a credit crunch, than during recessions in which the banking system is not impaired (Jordà et al. 2013). Among the ways firms try to overcome the consequences of credit restrictions, relationship lending stands out as one of the most prominent. The effectiveness of relationship lending in smoothing fluctuations in credit and in providing liquidity insurance to firms, even during crises, is now well established. By contrast, the extent to which relationship lending has real effects, by allowing relationship borrowers to maintain higher investment and employment utilization rates than other firms during crises, is still an important open question.

In this paper we study whether firms with tighter banking relationships had stronger investment and greater labour utilization rates than other firms during the crisis, thus providing first evidence on the real effects of relationship lending. After establishing that banks provide more credit to relationship borrowers in a crisis, we show the way this support operates. In particular, we study whether relationship lending affects to a greater extent working capital, relative to fixed capital loans. Next we test whether and how this translates into higher investment and employment by relationship borrowers.

An additional important question we also explore is whether the support provided by relationship banks is different when the banking system faces an external relative to a systemic (existential) shock. We study this by comparing the effects of relationship lending following the Lehman default shock, when the Italian banking system was only partly affected and after the European sovereign debt crisis, which represented a systemic shock to both the Italian economy and the banking system. *A priori*, it is not clear how a systemic shock to the banking system would affect relationship lending. On the one hand, when the probability of bank default increases, the future value of relationship capital will be more heavily discounted as the bank may not be around to reap the benefits. This would cause an erosion of the insulation effects of relationship banking. On the other hand, in a period of heightened macroeconomic uncertainty, the private information derived from banking relationships may be especially valuable when assessing the quality of loans.

Our results show that following the Lehman default shock, firms that had longer banking relationships used the insulation to maintain stronger investment and employment. However, the insulation provided by relationship banks weakened after the European sovereign debt crisis, especially for those intermediaries with higher leverage. As a result, firms reacted mainly by reducing investment, while we do not find a similar reduction in employment growth. Taken together with the evidence that banks were less able to maintain the favourable interest rates on term-loans following the European sovereign debt crisis, our results suggest that firms substituted capital with labour as the cost of longer-term loans became relatively more expensive.

Our data include all Italian banks and a random sample of 10% of firms reporting in the Italian Credit Register between 2003 and 2014 for which we have actual credit granted, a measure of

the interest rate charged, and the history and structure of individual bank-firm relationships. This information allows us to improve on the identification of the effects of relationship lending following the Lehman default shock and European sovereign debt crisis. Banks may be willing to be a relationship lender only if the borrower is sound. In turn, sound borrowers may obtain more credit during a financial crisis because their probability of default is lower, or they have a stronger demand for credit. This may induce a spurious correlation between relationship lending and credit supply. We address these key identification issues on the quantity and price of credit from banks to firms by focusing on firms borrowing from at least two banks and including firm fixed effects in all regressions (Khwaja and Mian, 2008), effectively comparing the change in credit granted and in the interest rate charges to the same firm by relationship and transactional banks. Observing individual bank-firm relationships over time allows us to include also bank\*time fixed effects. This is important because by controlling for bank-level time varying unobservables we can take care of the possibility that banks that rely more on relationship lending may have been differentially exposed to the financial crisis.

To estimate the real effects of relationship lending, we compare credit, investment and employment in firms that differ by the average length of their credit relationships, weighted by the shares of credit from each bank. To address endogeneity concerns, between the propensity of firms to engage in relationship lending and firm characteristics, we perform a number of checks. First, we test for sorting, to examine whether firms with significant existing relationships with banks have systematically different characteristics. We find little evidence of such a systematic relationship.

Even in the absence of systematic relationships between observable firm characteristics, there exists the possibility of unobserved correlation. We therefore also conduct instrumental variables estimation. In Italy there was a wave of mergers and acquisitions between 2004 and 2006, as the fragmented banking industry underwent a period of consolidation. When banks merge or are subject to takeovers, existing relationship capital between banks and firms can be lost as branches are closed and existing managers transferred to exploit economies of scale. As this wave of consolidations took place to boost profitability in the Italian banking sector, the breaking of existing relationship from this M&A activity are likely to be independent of the characteristics of individual firms. We use these exogenous breaks in bank-firm relationships and instrument the average length of relationships with its change due to the M&A activity.

Our findings contribute to the large literature on the effect of relationship lending on credit supply (Degryse et al 2009). In this respect, our paper is most closely related to Sette and Gobbi (2015) and Bolton et al. (2016) who estimate the insulating effect of bank-firm relationships on both the quantity and cost of bank credit following the Lehman default shock. Our paper is also closely related to Beck et al. (2015) who study the effect of relationship lending over the business cycle, using survey data of bank CEOs and firms. They infer bank-firm relationships by the propensity of a firm to be located close to branches of banks that specialise in relationship lending, finding that relationship lending alleviates credit constraints during a cyclical downturn but not during a boom period. They find that following the Lehman default shock, the lower propensity to report credit constraints in firms located nearer to relationship banks is associated with stronger asset growth, sales and employment.

The main novelty of our paper is that we examine the extent to which relationship lending attenuates the real effects of a crisis, by allowing relationship borrowers to maintain higher investment and employment utilization rates than other firms. Moreover, we study how the terms by which relationship lenders cushion financial shocks, may influence the margin of firm adjustment. For example, if banks insulate firms from financial shocks with greater short-term lending but do not insulate long-term funding, firms may choose to maintain more flexible factors of production such as employment, but reduce long-term investment in fixed assets. In contrast to Beck et al. (2015) our credit registry data allows us to directly observe lending relationships, loan volume, type and costs. To the best of our knowledge, our work is the first to study how banks adjust the different types of loans during a shock.

Shocks to the balance sheets of banks can have effects at the firm level via credit supply (Bernanke (1983), Holmstrom and Tirole (1997), Diamond and Rajan (2006), Adrian and Shin (2011), Stein (1998 and 2011)). The empirical evidence is large (Kashyap and Stein 2000, Gambacorta and Mistrulli 2004, Peydrò et al. 2012, Peydrò et al. 2013, Iyer et al. 2014, Amiti and Weinstein (2013)). A further contribution of the paper is to test whether relationship banking can continue to soften the financial shock to firms when the banking sector itself is facing a systemic shock. We do this by examining the performance of relationship banking in Italy following the European sovereign debt crisis, arguably more systemic in nature compared to the external funding shock following the Lehman default (Panetta et al., 2009).

Finally, our paper is related to research on the transmission of financial shocks to the real economy. Many studies identify financial shocks by exploiting the importance of banking relationships and the cost to borrowers to switch lenders. Some studies determine bank-firm relationships through syndicated loans. Chodorow-Reich (2014) shows that firms which had syndicated loan relationships with banks that experienced a greater deterioration in their health following the Lehman default shock had a lower likelihood of obtaining a loan, paid a higher interest rates and reduced employment by more than firms with relationships to healthier lenders. Acharya, Eisert, Eufinger and Hirsch (2015) find that firms which had syndicated loan relationships to banks with higher exposure to euro area sovereign debt, experienced a greater contraction in lending which depressed investment, job creation, and sales growth following the European sovereign debt crisis.

Other studies, follow a similar identification strategy but use credit register data. Cingano, Manaresi and Sette (2013) identify a credit shock by exploiting firm relationships with banks that had greater exposure to interbank market funding around the Lehman default, finding a negative effect on investment, employment and value added in Italian firms. Bentolila et al (2016) find that firms with relationships to the weakest banks in Spain, experienced reduced credit supply and weaker employment between 2006 and 2010. Bofondi, Carpinelli and Sette (2013) measure the impact on credit supply of the shock to the Italian sovereign debt around the European sovereign debt crisis by exploiting heterogeneity in the location of banks' headquarters and Bottero, Lenzu and Mezzanotti (2016) extend the results to consider the real effects, finding weaker investment and employment in firms with greater exposure to Italian sovereign debt, in line with Acharya et al. (2015).

Differently from this literature, our paper tests whether heterogeneity in the duration of existing relationships can have real effects in a crisis, rather than differences in relationships with lenders with heterogeneous exposure to financial stress.

The paper is structured as follows: Section 2 discusses the empirical strategy and how we tackle the main identification challenges to identify relationship lending and loan supply shifts. Section 3 describes the dataset, Section 4 shows the main results of the effects of relationship banking on credit supply and the cost of firms' financing. Section 5 shows the main results on the real effects of relationship banking on firm activity: investment and employment. Section 6 verify the robustness of the results and examines heterogeneity of relationship banking across firm types. The last section summarises the main conclusions.

## **2. EMPIRICAL STRATEGY**

### **2.1 Measures of Relationship Lending**

Banking relationships reduce the information asymmetries between borrowers and lenders and thus ameliorate credit rationing that can occur due to these frictions. To run our tests, we adopt a proxy for the amount of information about the borrower accumulated by the bank: the duration of the relationship between the bank and the firm. The longer the relationship, the greater the ability of the lender to accumulate information capital about the borrower (Boot, 2000). Longer relationships may also signal a long-term implicit contract between the bank and the borrower, in which the banks provide liquidity insurance (Elsas and Krahenen, 1998). This measure has been commonly used in the literature to capture how relationships affect credit supply (Degryse, Kim and Ongena, 2009; Sette and Gobbi, 2015).

The empirical evidence on the effects of the length of credit relationships is rich. Longer relationships seem to improve firms' access to credit not only in normal times (Petersen and Rajan, 1994; Angelini, Di Salvo and Ferri, 1998; Harhoff and Körting, 1998) but also during a crisis period (Sette and Gobbi, 2015). However, their effects on the cost of credit are mixed. Berger and Udell (1995), Brick and Palia (2007), Bharath et al (2011) find that relationship banks charge a lower interest rate than transactional banks, while Degryse and Ongena (2005) and Ioannidou and Ongena (2010) show that interest rates increase with the duration of the relationship. Sette and Gobbi (2015) focus on crisis times and find that borrowers with longer relationships pay lower interest rates after the Lehman shock.

### **2.2 Measures of Credit Supply**

We measure credit supply using the annual growth rate of, and the change in interest rates on, total credit granted by a bank to a firm. This helps us to control also for possible forms of cross-subsidization, i.e. banks could increase the supply of credit on a specific contract, while at the same time reduce the overall amount of supplied lending, or vice versa.

To further examine how relationship banks insulate firms we also separately examine how relationship banking affects the composition of bank credit in terms of revolving credit lines

and term-loans. Revolving credit lines are a crucial source of financing for firms, especially in times of crisis (Acharya et al 2014) and Berger and Udell (1995) argue that lines of credit are most suited to studying the effects of relationship lending, as they represent a formalisation of the bank-firm relationship.

However, in periods of financial crisis that persist over many months, firms may be better insulated by the certainty offered by term-loans. These long-term sources of funding may be better matched with longer-term investments in fixed assets that can take many month or years before the firm can realise the benefits. Therefore, it is also important to understand how relationship banking shields the mix of credit to firms to understand the real effects of relationship banking.

## **2.3 Identification challenges:**

### *2.3.1 Relationship lending on credit supply*

Identifying the causal effect of relationship lending on credit supply poses severe challenges. First, borrowers' unobservable characteristics may be correlated with the measures of relationship lending. This is especially likely to occur during a financial crisis. For example, banks may be more willing to continue lending to better borrowers, so that longer relationships are observed only if borrowers are of high quality. In turn, better borrowers may obtain more credit during a financial crisis, inducing a spurious positive correlation between the length of a credit relationship and credit supply. Second, borrowers' demand for credit is likely to be correlated with their quality, e.g. better firms may experience a lower reduction in output, and thus a stronger demand for credit, during a financial crisis, especially when followed by a significant downturn in economic activity. Finally, bank's characteristics, and the impact of the financial crisis on banks (such as the increase in the cost of funding) are likely to be correlated with banks' lending policies before the financial crisis, and thus with the characteristics of lending relationships. We address these identification challenges by estimating all models on the sample of firms that have multiple bank relationships and including both firm\*time and bank\*time fixed effects, thus controlling for observable and unobservable supply and demand factors. We are therefore able to more precisely uncover the effects of bank-firm relationship characteristics on lending. The firm\*time fixed effects control for all firm observed and unobserved heterogeneity (quality, demand for credit, riskiness, etc.) in each period. This amounts to comparing credit supply from banks with different relationships, in terms of duration, and share of credit, with the same firm.

The bank\*time fixed effects control for all bank observed and unobserved heterogeneity in each period. This is particularly important after the financial crisis due to its heterogeneous impact on banks, on the strategies followed by banks in building relationships with customers, and lending policies during the crisis.

As in Khwaja and Mian (2005) a key identifying assumption is that firms do not have a bank-specific demand for credit that is related to the strength of the lending relationship. We

therefore, include additional controls that capture characteristics about individual bank-firm relationships to attenuate concerns about the violation of this assumption. In particular, we include the amount of credit granted, the amount drawn and share of credit granted as revolving facilities to control for the overall importance of particular relationships and the differing nature of demands from different credit facilities.

A further condition for identifying the causal effect of relationship lending on credit supply is that banks and firms did not adjust the structure of their relationships in anticipation of the shock. For the Lehman default shock, this is a reasonable assumption in the case of Italy, as the financial crisis originated in the US financial sector and the default of Lehman was largely unanticipated. However, for the European sovereign debt crisis, banks and firms may have already adjusted the structure of their relationships. To account for this possibility we fix our measure of relationships to those that existed in 2006, before the effects of the financial crisis may have caused banks and firms to adjust the structure of relationships. Hence, both the Lehman default shock and the European sovereign debt crisis financial crisis may be considered as an exogenous shock with respect to the structure of the relationships between banks and firms in Italy before the financial crisis.

### *2.3.2 Relationship lending on firm investment and employment*

Identifying the causal effect of relationship lending on firm activity poses even greater challenges than identifying its causal effect on credit supply. To estimate the causal effect of relationship lending on firm investment and employment it is not possible to exploit the multiple bank-firm credit relationships to control for heterogeneous firm demand or bank specific shocks. We tackle this problem by first testing for sorting, to examine whether firms with longer existing relationships with banks have systematically different observable characteristics than those with shorter relationship (Imbens and Wooldridge 2009). We find little evidence of such a systematic relationship.

Even in the absence of a systematic relationship between observable firm characteristics, there exists the possibility of unobserved correlation between firm characteristics and relationship duration, especially in the period between the Lehman default and the European sovereign debt crisis.

As a first step, in our baseline estimates we use information on bank relationships as of 2006. In particular, we measure relationship lending intensity as the credit-weighted average duration of credit relationships as of 2006. We use this measure to evaluate the effect of relationship lending on firm credit, investment and employment in all subsequent years. This measure is less affected by the endogenous selection of relationships during the crisis.<sup>1</sup> We interact this measure with a dummy crisis and include firm fixed effects. The latter help controlling for systematic differences in (time-invariant) unobservable firm characteristics.

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<sup>1</sup> However, it may be considered a noisy measure of relationship lending since it mechanically gives short durations to firms that started their activity in the first half of the 2000s. We therefore, also consider a time varying measure of relationship intensity.

As a second step we also conduct instrumental variable estimation to further address potential endogeneity concerns. Between 2004 and 2006, the Italian banking system underwent a wave of mergers and acquisitions, as the fragmented industry underwent a period of consolidation. When a bank is merged or acquired, the existing relationships between banks and firms are likely to be damaged as branches are closed and existing managers transferred to exploit economies of scale. A number of studies have documented that bank mergers increase the probability of relationship termination, especially for customers of target banks: Sapienza (2002) and Bonaccorsi di Patti and Gobbi (2007) for Italy, Erel (2011) for the United States and Degryse, Masschelein, and Mitchell (2011) for Belgium.

Because there is a higher probability of relationship termination for firms that had relationships with banks that merged, the credit weighted duration of relationships should also be shorter on average for firms more exposed to merged banks, all else equal. Thus, we instrument the credit weighted duration of relationships in 2006, with the change in credit weighted relationships due to mergers and acquisition activity between 2004-2006.

In our identification, for the instrument relevance condition to be satisfied, we need the relatively mild condition that the strength of bank-firm relationships were weakened by acquisitions. For instrument exogeneity, the bank merger and acquisition decision must be uncorrelated with activity of the firms in the merged banks. As this wave of consolidations mainly involved the largest banks and took place to create Italian banking groups of sufficient size to compete with those from other European countries, the mergers are likely to be independent of the characteristics of relationships these banks had with firms.<sup>2</sup> While it is still possible that the decision to terminate existing relationships in merged banks may be correlated with firm quality, we consider this to be less of a concern as the motivation for the mergers was not related to repairing bank balance sheets.

## 2.4 The model: relationship lending on credit supply

To perform our tests of relationship lending on credit supply, we run the following bank-firm relationship-level regressions:

$$\begin{aligned}
 \Delta Y_{ijt} = & \beta_1 \text{relationship duration}_{ijt-1} \\
 & + \beta_2 \text{relationship duration}_{ijt-1} * D(\text{post 2008}) \\
 & + \beta_3 \text{relationship duration}_{ijt-1} * D(\text{post 2011}) \\
 & + \gamma X_{ijt-1} + \alpha_{it} + \delta_{jt} + \varepsilon_{ijt}
 \end{aligned} \tag{1}$$

where the dependent variable  $\Delta Y_{ijt}$  is either the change in log volume of total credit, revolving credit lines or term-loans for regressions on the quantity of credit granted. For regressions on the interest rate on loans,  $\Delta Y_{ijt}$  is either the change in the annual percentage rates on revolving

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<sup>2</sup> The wave of M&As in the Italian market in the mid-2000s was not due to the need of consolidating the system to rescue weak banks. It was rather the reaction of banks to the need to create larger players to compete in the progressively more integrated European market (IMF, 2006).



credit lines or term loans, granted by bank  $j$  to firm  $i$  between year  $t$  and  $t-1$ . The *relationship duration* $_{i,j,t}$  is the duration of the relationship between bank  $j$  and firm  $i$  in years counting back from year  $t+1$ .  $D(\text{post } 2008)$  and  $D(\text{post } 2011)$  are dummy variables taking the value of 1 for years 2008 onwards and 2011 onwards respectively, and zero elsewhere. We use multi-year horizons to analyse the effect of relationship lending during crisis periods to overcome some of the problems detected when analysing relationships over a shorter horizon. For example, using flows of funds data from the United States, Cohen-Cole et al. (2008) explain that the amount of lending did not decline in the US during the first quarters of the crisis not because of “new” lending but mainly because of the use of loan commitments, lines of credit and securitisation activity returning to banks’ balance sheets.

We use a vector of bank-firm level control variables,  $X_{ijt-1}$ , dated in period  $t-1$  to limit endogeneity issues. The vector includes: log credit granted by bank  $j$  to firm  $i$  to capture size effects which may determine the rate at which a loan can grow; ii) the share of the credit line that has been drawn by firm  $i$  from bank  $j$  to control for the fact that firms which have not drawn much of existing credit lines from a bank are less likely to apply for credit extension; iii) the share of total credit (revolving credit lines, loans backed by accounts receivable and term-loans) granted by bank  $j$  to firm  $i$ . In our regression of loan-level interest rates we also include the level of interest rates on revolving credit lines and term-loans. Finally,  $\delta_{jt}$  and  $\alpha_{it}$  are respectively bank\*time and firm\*time fixed effects that control for bank specific and firm specific unobserved shocks.

## 2.5 Relationship lending on firm level credit supply, investment and employment

### 2.5.1 OLS regressions

We use two approaches to test for the effect of relationship lending on firm level credit supply, investment and employment: one based on OLS estimates and another using instrumental variables. The first estimates the following OLS regressions

$$\begin{aligned} \Delta Z_{it} = & \beta_1 \text{relationship weighted share of credit}_{it-1} \\ & + \beta_2 \text{relationship weighted share of credit}_{it-1} * D(\text{post } 2011) \\ & + \beta_3 \text{relationship weighted share of credit}_{it-1} * D(\text{post } 2008) + \gamma Y_{it-1} \\ & + \theta_i + \mu_t + \varepsilon_{it} \end{aligned} \tag{2}$$

where, the dependent variables considered,  $\Delta Z_{it}^r$ , are the log change credit of firm  $i$  in period  $t$ , the change in fixed assets scaled by the book value of lagged fixed assets to capture the impact of relationship lending on investment and the log change in labour costs in firm  $i$  in period  $t$ , to measure the impact on employment. The *relationship weighted share of credit* $_{i,t-1}$  is defined as  $\sum_j \text{relationship duration}_{ijt-1} * \text{credit}_{ijt-1}$  and measures the share of credit to firm  $i$  from relationship with bank  $j$  in period  $t-1$  weighted by the length of relationship.

In our baseline estimates the length of relationship is defined as the log duration in years of the relationship between bank  $j$  and firm  $i$  fixed in 2006. While this is our preferred measure because it better addresses concerns about any endogenous breaking and forming of relationships in response to the financial crisis, this definition does not allow us to identify  $\beta_1$ , the pre-crisis relationship between relationship lending as these are absorbed by the firm fixed effects  $\theta_i$ . We therefore, estimate an alternative time-varying measure of firm relationships with banks that allow the identification of  $\beta_1$ .

We use a vector of firm level control variables,  $Y_{it-1}$ , dated in period  $t-1$  that include: i) return on assets, measured as earnings before interest, tax, depreciation and amortization (EBITDA) over the book value of total assets. As most of the firms in our sample are not listed, we use this measure as an alternative to Tobin's Q which is typically used in investment regressions (Gala and Gomes, 2013); ii) firm leverage, the ratio of total assets divided by the book value of equity; iii) the ratio of EBITDA to interest expenses, as firms with lower debt servicing costs have higher internal funds to finance additional expenditures; iv) log total assets to capture size effects and diminishing marginal productivity of either capital or labour.

### 2.5.2 IV regressions

To attenuate further possible remaining concerns about the potential correlation between the formation of banking relationships and firm type in OLS estimation, we also estimate instrumental variable regressions. In Italy there was a wave of mergers and acquisitions between 2004 and 2006, as the fragmented industry underwent a period of consolidation. We use the exogenous breaking in bank-firm relationships due to mergers and acquisitions to instrument the relationship weighted share of credit. Our instrument is defined as

$$\begin{aligned} \text{Relationship instrument} = & \sum_j \text{relationship duration}_{ijt-1} * \text{credit}_{ijt-1} - \\ & \sum_j \text{relationship duration}_{ijt-1}^{\text{merger}} * \text{credit}_{ijt-1}^{\text{merger}} \end{aligned}$$

where  $\text{relationship duration}_{ijt-1}^{\text{merger}}$  is the duration of relationships with banks that experienced a merger. Thus the instrument is the difference between the realized relationship duration, and the relationship duration with merged banks, as of 2006. The instrument is based on the idea that mergers and acquisitions are likely to lead to a destruction of credit relationships thereby causing an exogenous change in the average length of relationships. For our identification, we need the relatively mild condition that the strength of bank-firm relationships are weakened by acquisitions.

### 3. DATA AND DESCRIPTIVE STATISTICS

We use data on credit to Italian non-financial firms from the Italian Credit Register (“Centrale dei Rischi”, CR). This is maintained by the Bank of Italy (Italy's central bank) and collects, from all intermediaries operating nationwide, information on individual borrowers with an outstanding exposure (credit commitments, credit drawn, guarantees) of over 75,000 Euros with a single intermediary. The database includes information on the granting institution and the identity (unique tax identifier) of the borrower. One section of the CR contains information on the interest rate and the fees and commissions charged on all loans granted by a representative sample of Italian banks accounting for more than 80% of total bank lending in Italy. Firm level balance sheet and income statement data are from the Cerved database and Company Accounts Data Service (Centrale dei Bilanci, CADS), proprietary databases maintained by the CERVED group.

We construct the sample as follows. First, we take a random sample of the CR, to keep the size of the dataset within manageable limits. We keep firms with the random CR code ending in “7”, in practice selecting a random sample of 10% of the CR. Second, we include relationships between all banks operating in Italy and Italian non-financial firms included in the Cerved and CADS databases between 2003 and 2014. We aggregate credit to a given firm from all banks belonging to the same banking group, as both lending and funding policies are decided at the banking group level, and considering individual banks that are members of the same group separately may lead to bias. Therefore, the controls for relationship lending are computed on the basis of the relationship between a banking group and a firm.

Third, we select firms that are granted credit by at least two banks to be able to include firm-fixed effects in the regressions. About 80% of the firms in the sample borrow from more than one bank. Multiple banking is a structural characteristic of bank-firm relationships in Italy (Foglia, Laviola, and Marullo Reedtz, 1998; Detragiache, Garella, and Guiso, 2000; Gobbi and Sette 2013), and it is more common than in other countries (Ongena and Smith, 2000; Degryse, Kim and Ongena, 2009). This means that our results are also relevant from a macroeconomic point of view.

We also include data on interest rates. These are available for a subset of bank-firm relationships. The sample of banks reporting in the Italian Loan Interest Rate Survey has been selected following a stratification procedure by size and geographical areas that allows a high representativeness for each product.<sup>3</sup>

Overall, the sample we used in the baseline regressions includes 314,649 credit relationships between 20,325 non-financial firms and 125 Italian banks.

Our data is at an annual frequency, time stamped at the end of year (end December) as the usage of available credit is strongly seasonal (Jimenez, Lopez, and Saurina, 2009). This is particularly important for the analysis of the cost of credit because if in a given month a credit

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<sup>3</sup> In particular, the sample has been selected following the principles of Regulation 63/2002 (ECB/2001/18) of the European Central Bank that ensure high quality for the interest rate statistics. More details are available in: [http://www.bancaditalia.it/statistiche/quadro\\_norma\\_metodo/metodoc/en\\_suppl\\_57\\_03.pdf](http://www.bancaditalia.it/statistiche/quadro_norma_metodo/metodoc/en_suppl_57_03.pdf).

line is not used, the data do not record an interest rate. Hence, comparing the same month of subsequent years allows us to obtain a cleaner measure of the dynamics of the cost of credit in our sample.

Table 1 reports summary statistics of the bank-firm relationship- variables used in the analysis. We have 314,649 bank-firm-year observations. Over the sample period, mean annual growth in total credit is negative at 0.5% per annum while median is no change. The composition of credit growth shows that on average revolving credit lines remained broadly stable, but term loans declined on average by nearly 10% a year, with a wide dispersion. Median interest rates on revolving credit lines increased by 40 basis points while median interest rates on term loans increased by 15 basis points. We track the duration of relationships since 1998. The median duration of bank-firm relationships is 6 years. In our distribution of relationships there is a slight positive skew, with the 25<sup>th</sup> percentile around 3 years and 75<sup>th</sup> percentile around 8 years, resulting in a mean relationship slightly shorter than the median at 5.7 years. The mean log level of credit granted is 12.95 (corresponding to 420,000 Euros), around 70,000 Euros greater than the median. On average around 60% of credit granted is drawn and around 20% of revolving credit lines are used.

Table 2 reports firm-level summary statistics. At the firm level, our dataset has more than 73,000 firm-year observations. The distribution of annual credit growth at the firm level is broadly similar to that at the bank-firm relationship level, although the mean growth rate is higher at 2.8%. We define the investment rate as the change in fixed assets divided by lagged fixed assets. Due to the lumpy nature of firm investment, there is a large difference between the mean investment rate (19% per year) and median investment rate (-0.5% per year). In contrast both mean and median growth in employment costs are more similar, at 4.7% and 3.9% respectively highlighting the smoother adjustment of firm employment. Our baseline firm-level measure of the log relationship duration weighted share of credit (fixed in 2006) has a mean of 1.4 (corresponding to 4.7 years) broadly similar to the mean of the full sample. This is shorter than the average measured at the bank-firm relationship, indicating that firms tend to borrow smaller quantities from those with longer relationships. The mean annual return on assets is 0.6% but the median is slightly lower at 0.4%. Firm leverage is broadly symmetrically distributed with a median of 85% and an interquartile range between 71% and 93%. Firms in the sample have a strong profit to interest expense ratio with a median of around 300%. Finally, total assets of the mean firm in our dataset is around €3 million. Total assets at 25<sup>th</sup> percentile is €1.2 million euros and at the 75<sup>th</sup> percentile, €6.5 million.

## **4. BASELINE RESULTS – RELATIONSHIP LEVEL**

### **4.1 Credit quantity at the relationship level**

Table 3 examines the effect of bank relationships on the quantity of credit from the estimation of equation (1) between bank  $j$  and firm  $i$ . All regressions include both Firm\*Time and Bank\*Time fixed effects to control for heterogeneous firm and bank level shocks. All standard errors are double clustered by creditor bank and borrower firm. Columns (1) and (2) test how

the duration of bank-firm relationships affect total credit growth. Column (1) shows that on average over our sample period, the longer the duration of a bank-firm relationship, the stronger the credit growth. However, column (2) shows that prior to 2008, credit growth is decreasing in relationship duration, although it is not statistically significant. Rather, the average positive coefficient over the sample is driven by the post Lehman default shock period, shown by the strongly positive coefficient on the interaction term between *relationship duration* and the post 2008 dummy variable. This confirms the result in Sette and Gobbi (2015) and Bolton et al (2016), whereby relationship banks increased their loan supply during bad times.

This insulation to relationship borrowers continued almost unchanged during the European sovereign debt crisis. Although the coefficient on the interaction of *relationship duration* and the post 2011 dummy variable is negative, suggesting some reduction in insulation, it is not statistically significant. Therefore, even when the Italian banking system faced the systemic shock of the sovereign debt crisis, banks continued to protect the volume of credit in relationships to a similar extent as that immediately after the Lehman default shock.

The remaining control variables show that relationships with a larger stock of existing credit granted experienced weaker growth in credit. Those with a greater share of drawn-credit relative to granted-credit experienced stronger total credit growth as did firms with a greater share of revolving credit lines to total loans.

Columns (3)–(6) decompose total credit into revolving credit lines and term loans to separately assess the effects of relationship lending on the two types of credit. Column (3) shows that on average over our sample period, the longer the bank-firm relationship, the higher the growth in revolving credit lines. Column (4) shows that this effect is also present before the Lehman default shock, consistently with the view that lines of credit are a formalisation of the bank-firm relationship as argued by Berger and Udell (1995). Indeed, revolving credit lines 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.

Following the Lehman default shock, the coefficient on the interaction between relationship duration and the post 2008 dummy variable is also positive and significant, showing that for firms with longer relationships, revolving credit lines provided additional insulation to loan supply during the financial shock. Similar to the results for total credit, following the European sovereign default shock, the negative coefficient on the interaction term between relationship duration and the post 2011 dummy variable shows some evidence of a weak reduction of the insulating effects of relationship on revolving credit lines, relative to the 2008-2010 period, however, the coefficient is not statistically significant and the combined insulation effect (sum of the post 2008 and post 2011 dummy variables) still exceeds the pre-crisis level. Finally, column (5) and (6) show there is not a significant relationship between the quantity of term-loans and relationship lending. However, the signs on the coefficients across the crisis periods are consistent with those for total credit.

## 4.2 Credit cost at the relationship level

Table 4 examines the effect of bank relationships on the cost of credit. All regressions include both Firm\*Time and Bank\*Time fixed effects to control for heterogeneous firm and bank level shocks. Columns (1) and (2) present estimates of the effect of relationship duration on the average cost of revolving credit lines between bank  $j$  and firm  $i$ . Column (1) shows that on average over our sample period, the longer the relationship, the higher the change in the interest rates on revolving credit lines. Column (2) shows that this result is driven by higher interest rates on longer relationships in the pre-crisis period. Following both the Lehman default shock and the sovereign debt crisis, our estimates indicate that this premium did not change. These results are consistent with Bolton et al (2016) who argue that firms are willing to pay an insurance premium for relationships during good times for enhanced credit supply during downturns.

The pricing of term-loans in relationships displayed a similar dynamic to revolving credit, until the European sovereign debt crisis. Column (4) shows that prior to the financial crisis, the longer the relationship between banks and firms, the higher the average change in interest rates on term loans. However, the negative coefficient on the *relationship duration* and *Post 2008* dummy variable shows that following the Lehman default shock, relationships insulated firms from the rise in cost of longer term funding. The size of the coefficient more than offset the pre-crisis premium firms paid to maintain the relationship. However, following the European sovereign default crisis, banks still provided additional insulation to relationship borrowers from a rise in the cost of term loans but to a lesser degree compared with the 2008-2010 period. Our results indicate that the insulation to the costs of term-loans from longer relationships approximately halved, relative to the 2008-2010 period. Nevertheless, the insulation properties of longer bank relationships on the costs of term loans remained significant, relative to the pre-2008 levels even during this period of extreme stress.

## 4.3 Bank capital and other bank characteristics

Our analysis so far includes bank\*time fixed effects. While this specification is fully robust to the potential effect of bank heterogeneity, it prevents us from getting insights on the effects of specific bank characteristics on the supply of credit. In particular, we test whether banks with different levels of capital provide more credit, conditional on the relationship lending characteristics. This test is a robustness of the baseline, in that it shows the main bank characteristics that drive lending. To analyse the impact of bank capital on relationships, we drop the Bank\*Time fixed effects and include bank fixed effects only. Columns (1) and (2) estimate the effect of bank capital on total lending. The results show that bank capital had a significant insulation effect following the Lehman default shock. Banks with higher capitalization (measured by the Tier 1 ratio) were better able to insulate lending to firms. This insulation also continued through the European sovereign debt crisis. The positive coefficient on the Tier 1 ratio interacted with the post 2011 dummy variable suggests that the insulation effects of better capitalised banks were even stronger (although not statistically significant).

Columns (3) to (6) estimate the effect of capital ratios on the cost of revolving credit lines and term loans. In columns (3) and (4), the negative coefficient on the interaction between the Tier 1 capital ratio and the post 2008 dummy shows that following the Lehman default shock, banks with higher Tier 1 capital ratios were able to provide cheaper revolving credit lines. After the European sovereign debt crisis, columns (5) and (6) show that the cost of term loans granted to firms declined by more in banks with stronger Tier 1 capital ratios. As the European sovereign debt crisis materially increased the longer-term funding costs of banks, stronger bank capitalisation ratios helped insulate firms from the funding shock faced by banks.

## **5. RELATIONSHIP LENDING AND FIRM ACTIVITY**

### **5.1 Testing for sorting of bank-firm relationships**

To assess the real effects of relationship lending, we need to leave the realm of Firm\*Time fixed effects that control for heterogeneous firm demands and types. However, the formation and breaking of relationships may be endogenous to firm demands or types. This presents a serious challenge to estimating the real effects of relationship lending. To address this concern we first test for the presence of sorting in bank-firm relationships by comparing the distribution of relationship durations across different firm level characteristics as suggested by Imbens and Wooldridge (2009). Table 6 presents tests for the presence of sorting by comparing the normalised difference of the average relationship duration in firms at different quartiles of the distribution of observable firm characteristics. In particular, the statistics present the normalised difference between the average relationship duration in firms in a particular quartile of the distribution to those in the rest of the distribution. As the table shows, the test statistic of normalised differences is almost always less than the reference threshold of 0.25, indicating that such differences are not statistically significant. Firm leverage is an exception, where firms with shorter credit weighted relationship durations have higher leverage. This is being driven by the fact that large firms have higher leverage but also tend to have a lower relationship borrowing intensity – possibly due to smaller information asymmetries. As this test is only a univariate test, it does not account for the effect that controlling for firm size in the following regressions would mop up this correlation.

### **5.2 Relationships and total credit at the firm level**

The first part of Table 7 examines the effect of relationship duration on total credit at the firm level from estimating equation (2) by OLS. At the firm level, our baseline specification measure of relationship borrowing intensity is the credit-weighted relationship duration computed as the logarithm of the number of years of a credit relationship between a bank and a firm in 2006 weighted by the share of credit to the firm in that relationship (columns 1 and 2).<sup>4</sup> Following the Lehman default shock, the positive coefficient on the 2006 credit-weighted relationship duration interacted with the *Post 2008* dummy variable shows that firms with

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<sup>4</sup> We include firm fixed effects, which absorb the relationship duration measure when it is kept fixed as of 2006. These are important to control for time-invariant firm unobservable characteristics which may correlate with the intensity of bank-firm relationships.

longer relationships had stronger credit growth. The insulating effects of relationships on total credit remained broadly unchanged during the European sovereign debt crisis, shown by the insignificant coefficient on the interaction with the post 2011 dummy variable. Taken together the results at the firm level confirm those at the relationship level. To put this in economic terms, moving the credit-weighted relationship duration from the 25<sup>th</sup> to 75<sup>th</sup> percentile increases total credit growth by 3.5 percentage points after 2008, approximately a 70% increase.

The control variables show that firms with higher return on assets and a higher operating profit to interest expenses ratios experienced stronger credit growth, while larger firms and firms with higher leverage had weaker credit growth.

### **5.3 Relationships and investment**

The results from estimating equation (2) on the investment rate are presented in the second part of Table 7 (columns 3 and 4). The positive and significant coefficient on the weighted relationship duration term after 2008 shows that following the Lehman default shock, firms with longer relationships had higher investment rates. Taken together with the results in the first part of Table 7, this suggests that longer relationships insulated credit supply from the effects of the global financial crisis and allowed these firms to maintain higher investment rates.

The sum of the coefficients on the post 2008 and post 2011 dummy variables, measures the overall post 2011 effect of relationship duration on investment. Importantly, following the European sovereign debt crisis, the negative coefficient on the firm's credit weighted relationship-duration interacted with the *post 2011* dummy variable is negative and significant. But the sum remains positive. Therefore, longer relationships continued to insulate firm investment from the financial shock, but to a lesser degree. Interestingly, we do not find a reduction in the insulation to firm credit post 2011. Therefore, the weaker investment in relationship intensive borrowers cannot be explained by weaker credit supply.

Regression (2) shows that the inclusion of additional firm level control variables increases the precision of the post 2011 estimate of the effect of relationships on investment. The control variables show that firms with higher return on assets, higher leverage and higher profits relative to interest expenses have stronger investment rates, while larger firms have lower investment rates.

The effect of relationship lending on firm investment during the crisis is economically significant. Following the Lehman default shock, moving from the 25<sup>th</sup> to 75<sup>th</sup> percentile in the credit weighted relationship duration, increases the investment rate by 6.6 percentage points. However, due to the reduced insulation effects after the European sovereign debt crisis, moving from the 25<sup>th</sup> to the 75<sup>th</sup> percentile in weighted relationship duration, results in a smaller 3.8 percentage point higher investment rate. Nevertheless, this is still sizeable given the median investment rate over the sample period is -0.45 percent.



## 5.4 Relationships and employment

The third part of Table 7 presents OLS estimates of the effect of bank-firm relationships on labour cost growth, which we use as a measure of employment. While this choice is mainly due to better data availability, in several respects this choice may be preferable because it can better capture changes in part-time work, overtime and differences in the human capital of employees.

Columns (5) and (6) show that following the Lehman default shock in 2008, firms with longer weighted relationship duration experienced stronger employment growth. This indicates that the insulation from the financial shock from longer banking relationships helped smooth employment, similar to that for credit supply and investment. However, similar to the results for credit supply, but in contrast to the results for investment, the insulation effects of longer banking relationships on employment were not reduced after the European sovereign debt crisis, shown by the positive but statistically insignificant coefficient on the weighted *relationship duration \* D(post 2011)* variable.

## 5.5 Instrumental variable regressions

Although tests showed little evidence of systematic sorting between the credit-weighted relationship duration and other observable firm characteristics, and even though we also included firm-fixed effects in our preferred specification, there is still a residual possibility of unobserved correlation affecting our results. Therefore, to address the remaining endogeneity concerns between the formation of banking relationships and firm type in OLS estimation, we also estimate instrumental variable regressions by instrumenting the credit weighted duration of bank-firm relationships in 2006 with the difference between the credit weighted relationship duration in 2006 and the credit relationship duration involving only banks which merged in 2006. In this way, we capture the extent to which relationship durations were exogenously terminated by mergers and acquisitions. The instrument is strong: the Kleibergen-Paap test statistics is very large in all three regressions.

The IV estimates presented in Table 8 confirm the effect of banking relationships on firm activity derived from OLS estimates. Column (1) shows estimates of the effect of relationships on total credit growth. Firms with longer banking relationships experienced stronger credit growth following the Lehman default shock. The point estimate from the IV regression is twice as large as the equivalent OLS regression. This suggests that our OLS may suffer from some downward bias. The enhanced insulation from relationships following the Lehman default financial shock resulted in a higher investment rate (column 2) and higher employment growth (column 3). Again, the IV coefficients are larger than the OLS regressions. Overall, these results are consistent with the effects found by Beck et al (2015) following the Lehman default shock in a panel of Eastern European economies.

Following the European sovereign debt crisis in 2011, the negative coefficient on the weighted *relationship duration \* D(Post 2011)* term in column (1) indicates some evidence of a reduction in the insulation to credit supply afforded to firms with longer banking relationships although the estimate is not statistically significant. This is consistent with the relationship-level results

in Table 3. Confirming the OLS results column (2) shows a reduction in the higher investment rate of firms with longer banking relationships following the European sovereign debt crisis. The coefficient estimates suggest that around half of the insulation effects of relationships on investment were lost. Nevertheless, for employment, the insignificant coefficient on relationship duration interacted with the post 2011 dummy variable in column (3) shows that after the sovereign debt crisis, firms with longer banking relationship continued to support employment relative to those with shorter relationships by a similar extent.

## **6. ROBUSTNESS TESTS**

The robustness of the above results have been checked in a number of ways. All results are summarised in Appendix A.

### **6.1 Sample and specification**

Not all the relationships included in the baseline sample had information on interest rates, as the latter are available for a representative sample of banks (about 100 bank holding companies, including all major banking groups). Table A1 re-estimates our baseline relationship regressions on a homogenous sample for which we observe information at the relationship-level on both the volume of credit and the interest rate. The results confirm those of the baseline. The regression on the quantity of term loans in column (4) deserves a mention, because in the homogenous sample, the coefficient of the relationship duration and the post 2008 dummy variable is larger and significant at the 10% level, indicating that the insulation effects of relationships may also be present in term loans.

Table A2, includes interactions of both the post 2008 and post 2011 crisis dummies with all the relationship level controls. Column (1) confirms the baseline result that relationships insulated total borrowing of firms from the Lehman default shock. Column (2) confirms that the initial insulation was evident in credit from revolving credit lines following the Lehman default shock. But in contrast to the baseline specification, including all crisis interactions shows that there was a statistically significant and complete loss of this insulation to revolving credit lines following the European sovereign debt crisis. In column (3), the effect on interest rates on revolving credit lines following the European sovereign debt crisis suggests however, that they decreased. This could be due to either credit rationing, with requests for revolving credit lines only being extend to lower credit risk relationships. Columns (4) and (5) also suggests stronger evidence of a complete reversal in the insulating effect of relationships on term loans following the European sovereign debt crisis.

An additional check has been to check the robustness of the results in Table 7 by using an alternative time-varying measure of a firm's relationship borrowing intensity, constructed as the logarithm of the number of years of a credit relationship between a bank and a firm in the previous year weighted by the share of credit to the firm. This relationship measure enables us to study how the effects of relationships changed over the crisis, but is less exogenous to

relationships changes that might have been triggered by the crisis. The results (not reported for the sake of brevity) are qualitatively very similar.

## **6.2 Alternative explanations**

A potential bias affecting our results is the possible presence of bank-specific demand for credit, correlated with the duration of lending relationships. Borrowers, in particular during a financial crisis, may demand credit first from relationship lenders, anticipating that transactional lenders may tighten their supply of credit.

We test for this in a number of ways. First, it is possible that firms turn to relationship lenders for new loans in periods of stress. Table A3, formally tests for this by including a control variable that indicates if a firm received a new term loan from the bank. Column (1) shows that credit growth is stronger in relationships when a new loan was granted. Nevertheless, our baseline results on the insulation effects of relationship lending in crisis are unaffected. Column (5) shows some effect on the interest rate on term loans. The coefficient on the interaction of relationship duration and the Post 2011 crisis dummy variable is no longer significant. While the new loan dummy variable is positive and significant, indicating that new loans attracted a higher interest rate.

Another formal test of bank specific demand shocks that we perform is examine whether effect of relationship duration is still present in a subsample of relationships which are important to the firm. Table A4, re-estimates our baseline regressions on a subsample of relationships where the drawn credit is greater than 50% of the total credit granted from revolving credit lines. Again, the point estimates of the effects of relationships during the two crisis periods are barely changed. The exception is on the interest rate on term loans in column (5) where reversal of the insulation effect of relationships following the European sovereign debt crisis is no longer significant.

Our final robustness test for bank specific demands is including a dummy for relationships where loans are past due by at least 90 days. Table A5 shows that our baseline results of insulation from relationships after the Lehman default shock and some weaker insignificant reversal after the European sovereign debt crisis.

## **6.3 Firm heterogeneity**

Finally, we test whether the results of the relationship-level regressions are heterogeneous across firms. The analysis of firm heterogeneity allows us to better understand which firms are supported by relationship lending during different stages of the financial crisis and for which firms the insulation effects of relationship lending may have been reduced after the European sovereign debt crisis. Tables A6 and A7 re-estimate our baseline regressions on subsamples of firms split by above and below media leverage and profitability (measured by the return on assets) respectively. Both tables show some evidence that the reversal in the insulation effects of relationship lending on credit were concentrated in more vulnerable firms with higher leverage and lower profitability.

Comparing columns (3) and (4) in Table A6, the increase and reversal of the insulation provided by relationships in revolving credit was only present in firms with above median leverage. Similarly, in Table A7, columns (3) and (4) show that the use and reversal in the insulation of relationships is only present in firms with below median profitability, measured by the return on equity. This is consistent with the idea that during a systemic shock, the support provided by relationship lenders is weaker, precisely for those firms that would need support the most. These results are also useful to rule out the possibility that our proxy for relationship lending is actually capturing a form of loan evergreening: banks trapped into longer relationships support firms during a crisis because failing to do so would have adverse consequences on capital ratios. Our results show that this was not the case. If loan evergreening was present, that is not captured by our measure of relationship lending.

## 7. CONCLUSIONS

The role of relationship lending in shielding borrower lending conditions from idiosyncratic shocks has been deeply investigated. Conversely, much less is known about how such insulation effects were utilised firms in a crisis, in particular whether they translated into higher investment and employment.

This paper tries to fill this gap in the literature by analysing in a comprehensive way all the steps in the mechanism: we analyse first how relationship lending affects the supply of lending and the cost of firm's funding and subsequently how such insulation effects influence firms' investment and employment decision. 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 also contribute to the literature by analysing two moments of the crisis: the period after Lehman's default (2008-2009) when the Italian banking system was relatively unaffected and the period of European sovereign debt crisis (2010-2013), when Italian banks were facing much graver risk.

We find that following the Lehman default shock, firms that had longer relationships with banks experienced higher credit growth and lower interest rates on term loans. Though still present, the insulation effects of relationship lending were weakened by the European sovereign debt crisis. In particular, banks were less able to maintain the favourable interest differential on term-loans for firms with longer relationships because of the sharp rise in the cost of long term bank funding.

We also find that following the Lehman default shock, firms that had longer banking relationships used the insulation to maintain stronger investment and employment growth. However, the insulation effect provided by relationship banks weakened after the European sovereign debt crisis, especially for those banks with a greater leverage. As a results firms

reacted mainly by reducing investment, while we do not find a similar reduction to employment growth.

Taken together with the evidence that banks were less able to maintain the favourable interest rates on term-loans following the European sovereign debt crisis, our results suggest that firms substituted capital with labour as the cost of longer-term loans became relatively more expensive. This evidence suggests that the term-structure of interest rates influences firm choices on the composition of capital and labour in production.

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Table 1: Descriptive Statistics: Bank-firm level

	$\Delta\text{Log}$ (Total credit)	$\Delta\text{Log}$ (Revolving credit lines)	$\Delta\text{Log}$ (Term loans)	$\Delta(\text{Interest}$ rate on revolving credit lines)	$\Delta(\text{Interest}$ rate on term loans)	Relationship duration (in years)	Log (relationshi p duration)	Log credit granted	Drawn credit /credit granted	Share of revolving credit lines used
Mean	-0.490	0.281	-8.771	0.210	-0.0459	5.740	1.704	12.95	56.78	23.90
Median	0	0	-9.245	0.426	0.155	6	1.946	12.77	60.09	13.22
Standard deviation	36.08	43.44	67.97	5.800	1.547	3.625	0.717	1.091	32.42	27.66
25 <sup>th</sup> percentile	-11.84	0	-37.94	-1.200	-0.324	3	1.386	12.13	30.81	5.245
75 <sup>th</sup> percentile	7.891	0	11.57	1.715	0.872	8	2.197	13.59	85.11	31.03
No. of observations	314649	278883	169803	216944	136387	314649	314649	314649	314649	314649

Table 2: Descriptive Statistics: Firm level

	$\Delta\text{Log}$ (Total credit)	Investment Rate (growth rate of fixed assets)	$\Delta\text{Log}$ (Employment costs)	Credit weighted log relationship duration in 2006	Credit weighted log relationship duration	Return on assets	Leverage (Debt / total assets)	EBITDA/ Interest expense	Log (total assets)
Mean	2.837	19.49	4.682	1.400	1.436	0.592	80.53	6.782	8.036
Median	0	-0.451	3.879	1.478	1.491	0.438	84.60	3.403	7.879
Standard deviation	31.30	78.66	24.34	0.511	0.573	4.840	16.39	13.89	1.262
25 <sup>th</sup> percentile	-11.92	-9.309	-4.664	1.060	1.043	-0.252	71.37	1.700	7.144
75 <sup>th</sup> percentile	17.72	17.08	12.87	1.810	1.866	1.885	93.23	7.037	8.781
No. of observations	73397	73073	70496	59837	73397	71487	73343	73041	73394

Table 3: Effects of relationship banking on lending

	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta\text{Log}$ (Total credit)	$\Delta\text{Log}$ (Total credit)	$\Delta\text{Log}$ (Revolving credit lines)	$\Delta\text{Log}$ (Revolving credit lines)	$\Delta\text{Log}$ (Term loans)	$\Delta\text{Log}$ (Term loans)
Relationship duration <sub>t-1</sub>	0.493** (0.200)	-0.245 (0.292)	1.189*** (0.195)	0.702** (0.306)	0.151 (0.336)	-0.549 (0.823)
Relationship duration <sub>t-1</sub> *D(Post 2008)		1.111*** (0.348)		0.906** (0.429)		1.038 (1.087)
Relationship duration <sub>t-1</sub> *D(Post 2011)		-0.208 (0.341)		-0.489 (0.337)		-0.215 (0.944)
Log credit granted <sub>t-1</sub>	-14.33*** (0.427)	-14.33*** (0.427)	-13.03*** (0.605)	-13.03*** (0.606)	-9.018*** (0.799)	-9.018*** (0.800)
Drawn/granted <sub>t-1</sub>	0.0452*** (0.00500)	0.0453*** (0.00500)	0.0991*** (0.00850)	0.0992*** (0.00850)	0.00247 (0.0315)	0.00262 (0.0315)
Share revolving credit lines <sub>t-1</sub>	0.0534*** (0.00485)	0.0534*** (0.00487)	-0.610*** (0.0274)	-0.610*** (0.0274)	0.416*** (0.0230)	0.416*** (0.0231)
Bank*Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm*Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	314649	314649	268953	268953	138698	138698
R-squared	0.401	0.401	0.382	0.382	0.397	0.397

Note: The table shows OLS estimates of regressions for annual changes in credit granted by banks to Italian non-financial firms between 2002 and 2013. The estimation is based on a random sample of 10% of firms reporting in the Italian Credit Register for which we have information on credit quantity. Control variables are: duration, the number of years since the bank and the firm have a relationship, counting back from September 2008; D(Post 2008): dummy variable taking the value of one for years 2008 onwards and zero elsewhere; D(Post 2011): dummy variable taking the value of 1 for years 2011 onwards and zero elsewhere; Log credit granted: logarithm of total credit (revolving credit lines, loans backed by accounts receivable, term loans) granted by the bank to the firm; drawn/granted: the ratio of the drawn (used) credit to granted credit from the revolving credit lines granted by the bank to the firm; Share revolving credit lines: the share of revolving credit lines over total loans. Further details on the dependent and control variables are in the appendix. Robust standard errors in parentheses (double clustered at the bank and firm level). The symbols \*, \*\* and \*\*\* indicate significance at the 10%, 5% and 1% level respectively.

Table 4: Effects of relationship banking on interest rates

	(1)	(2)	(3)	(4)
	$\Delta$ (Interest rate on revolving credit lines)	$\Delta$ (Interest rate on revolving credit lines)	$\Delta$ (Interest rate on term loans)	$\Delta$ (Interest rate on term loans)
Relationship duration <sub>t-1</sub>	0.209*** (0.0265)	0.256*** (0.0494)	-0.00254 (0.00735)	0.0214** (0.00907)
Relationship duration <sub>t-1</sub> *D(Post 2008)		-0.0572 (0.0550)		-0.0438*** (0.0130)
Relationship duration <sub>t-1</sub> *D(Post 2011)		-0.0144 (0.0679)		0.0251* (0.0150)
Log credit granted <sub>t-1</sub>	-0.238*** (0.0306)	-0.238*** (0.0306)	-0.0686*** (0.00657)	-0.0687*** (0.00655)
Drawn/granted <sub>t-1</sub>	0.000395 (0.000515)	0.000387 (0.000515)	-0.000820*** (0.000204)	-0.000824*** (0.000203)
Share revolving credit lines <sub>t-1</sub>	-0.0104*** (0.000984)	-0.0104*** (0.000985)	0.00127*** (0.000253)	0.00126*** (0.000253)
Level of interest rate on revolving credit lines <sub>t-1</sub>	-0.473*** (0.0114)	-0.473*** (0.0114)		
Level of interest rate on term loans <sub>t-1</sub>			-0.310*** (0.00806)	-0.310*** (0.00807)
Bank*Time fixed effects	Yes	Yes	Yes	Yes
Firm*Time fixed effects	Yes	Yes	Yes	Yes
Observations	199820	199820	103185	103185
R-squared	0.567	0.567	0.799	0.799

Note: The table shows OLS estimates of regressions for annual changes in interest rates on credit granted by banks to Italian non-financial firms between 2002 and 2013. The estimation is based on a random sample of 10% of firms reporting in the Italian Credit Register for which we have information on credit quantity. Control variables are: duration, the number of years since the bank and the firm have a relationship, counting back from September 2008; D(Post 2008): dummy variable taking the value of one for years 2008 onwards and zero elsewhere; D(Post 2011): dummy variable taking the value of 1 for years 2011 onwards and zero elsewhere; Log credit granted: logarithm of total credit (revolving credit lines, loans backed by accounts receivable, term loans) granted by the bank to the firm; drawn/granted: the ratio of the drawn (used) credit to granted credit from the revolving credit lines granted by the bank to the firm; Share revolving credit lines: the share of revolving credit lines over total loans; Level of interest rate on revolving credit lines (term loans): the weighted average of the interest rate inclusive of fees and commissions on revolving credit lines (term loans) from bank  $i$  to firm  $j$ . Further details on the dependent and control variables are in the appendix. Robust standard errors in parentheses (double clustered at the bank and firm level). The symbols \*, \*\* and \*\*\* indicate significance at the 10%, 5% and 1% level respectively.

Table 5: Bank capital and relationship lending

	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta\text{Log}$ (Total credit)	$\Delta\text{Log}$ (Total credit)	$\Delta(\text{Interest}$ rate on revolving credit lines)	$\Delta(\text{Interest}$ rate on revolving credit lines)	$\Delta(\text{Interest}$ rate on term loans)	$\Delta(\text{Interest}$ rate on term loans)
Relationship duration <sub>t-1</sub>	-0.199 (0.356)	-0.211 (0.339)	0.268*** (0.0525)	0.263*** (0.0468)	0.0248 (0.0166)	0.0283 (0.0183)
Relationship duration <sub>t-1</sub> *D(Post 2008)	0.970* (0.530)	0.982*** (0.0834)	-0.0808 (0.0623)	-0.0720 (0.0539)	-0.0711*** (0.0245)	-0.0757*** (0.00718)
Relationship duration <sub>t-1</sub> *D(Post 2011)	-0.180 (0.493)	-0.160 (0.499)	-0.00875 (0.0627)	-0.00640 (0.0603)	0.0685*** (0.0156)	0.0637*** (0.0157)
Tier 1 capital ratio	-0.417** (0.205)	-0.271 (0.188)	0.00122 (0.0535)	-0.0208 (0.0531)	0.0100 (0.0109)	-0.00809 (0.0118)
Tier 1 capital ratio <sub>t-1</sub> *D(Post 2008)	0.490*** (0.181)	0.452*** (0.167)	-0.0864** (0.0333)	-0.0505* (0.0298)	0.00842 (0.0108)	0.0104 (0.0100)
Tier 1 capital ratio <sub>t-1</sub> *D(Post 2011)	0.114 (0.175)	0.0796 (0.191)	-0.0673 (0.0425)	-0.0317 (0.0492)	-0.0368*** (0.0119)	-0.0394*** (0.0111)
Interbank funding ratio		0.0712 (0.0668)		-0.0418*** (0.00990)		-0.00193 (0.00232)
Liquidity ratio		0.0452 (0.0678)		0.0174 (0.0195)		-0.000258 (0.00309)
Bank size		0.389 (1.487)		0.458 (0.640)		-0.184** (0.0915)
Mutual Bank		1.144e+06 (9.582e+09)		-181707 (1.729e+09)		-283.6 (7.423e+07)
Level of interest rate on revolving credit lines <sub>t-1</sub>			-0.472*** (0.0117)	-0.473*** (0.0117)		
Level of interest rate on term loans <sub>t-1</sub>					-0.317*** (0.00771)	-0.317*** (0.00777)
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	312491	312399	198848	198807	102168	102138
R-squared	0.396	0.396	0.555	0.555	0.789	0.790

Note: The table shows OLS estimates of regressions for annual changes in total credit and interest rates granted by banks to Italian non-financial firms between 2002 and 2013. The estimation is based on a random sample of 10% of firms reporting in the Italian Credit Register for which we have information on credit quantity. Control variables are: duration, the number of years since the bank and the firm have a relationship, counting back from September 2008; D(Post 2008): dummy variable taking the value of one for years 2008 onwards and zero elsewhere; D(Post 2011): dummy variable taking the value of 1 for years 2011 onwards and zero elsewhere; Tier 1 capital ratio: bank's ratio of Tier 1 capital to total assets; Interbank funding ratio: bank's ratio of interbank funding to total assets; bank size: logarithm of total assets; mutual bank: dummy variable equal to zero if the bank is a mutual bank, otherwise zero; Level of interest rate on revolving credit lines (term loans): the weighted average of the interest rate inclusive of fees and commissions on revolving credit lines (term loans) from bank  $i$  to firm  $j$ . Further details on the dependent and control variables are in the appendix. Robust standard errors in parentheses (double clustered at the bank and firm level). The symbols \*, \*\*, and \*\*\* indicate significance at the 10%, 5% and 1% level respectively.

Table 6: A test for the presence of sorting in bank-firm relationships

	1st Quartile	2nd Quartile	3rd Quartile	4th Quartile	Standard deviation
Leverage (Total debt/Total assets)	85.14 (0.30)	83.15 (0.18)	81.66 (0.08)	80.34 (0.00)	15.74
Return on assets	0.53 (0.06)	0.60 (0.07)	0.72 (0.10)	0.75 (0.10)	5.19
EBITDA/Value added	40.57 (0.15)	36.88 (0.08)	35.98 (0.07)	34.26 (0.03)	48.92

Note: The number in parentheses is the normalized difference of the average length of bank-firm credit relationships (weighted by the share of credit) measured as of end-2006 between the average for the quartile in column and the average of the other quartiles (Imbens and Wooldridge 2009). If the statistic in parenthesis is less than 0.25, then the difference is not statistically significant.

Table 7: Effects of Relationship lending at the firm level

VARIABLES	Dependent variable: $\Delta\text{Log}$ (Total credit)		Dependent variable: Investment Rate		Dependent variable: $\Delta\text{Log}$ (Labour costs)	
	(1)	(2)	(3)	(4)	(5)	(6)
Weighted relationship duration*D(Post 2008)	4.396*** (0.667)	4.341*** (0.665)	8.697*** (1.753)	8.839*** (1.745)	4.302*** (0.515)	4.449*** (0.513)
Weighted relationship duration*D(Post 2011)	1.075 (0.700)	0.913 (0.695)	-3.376* (1.739)	-3.764** (1.721)	0.467 (0.546)	0.421 (0.543)
Return on assets		0.327*** (0.0458)		1.004*** (0.115)		0.410*** (0.0369)
Firm leverage		-0.195*** (0.0202)		0.725*** (0.0550)		-0.0512*** (0.0170)
EBITDA/interest expenses		0.179*** (0.0200)		0.341*** (0.0485)		0.0405*** (0.0109)
Log (firm total assets)		-11.98*** (0.684)		-48.83*** (1.922)		-5.346*** (0.553)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	57544	57544	57338	57338	55769	55769
R-squared	0.203	0.202	0.225	0.225	0.288	0.287

Note: The table shows OLS estimates of regressions for annual changes in credit granted by banks to Italian non-financial firms between 2002 and 2013. The estimation is based on a random sample of 10% of firms reporting in the Italian Credit Register for which we have information on credit quantity. Control variables are: Weighted relationship duration, the average of the log of the number of years since the bank and the firm have a relationship weighted by the share of credit to the firm in each in each relationship; D(Post 2008): dummy variable taking the value of one for years 2008 onwards and zero elsewhere; D(Post 2011): dummy variable taking the value of 1 for years 2011 onwards and zero elsewhere; Return on assets: earnings before interest, tax, depreciation and amortization (EBITDA) over the book value of total assets; Firm leverage: ratio of total assets divided by the book value of equity. Further details on the dependent and control variables are in the appendix. Robust standard errors in parentheses (double clustered at the bank and firm level). The symbols \*, \*\* and \*\*\* indicate significance at the 10%, 5% and 1% level respectively.

Table 8: Instrumental variable estimates of relationship lending on firm borrowing, investment and employment

	(1)	(2)	(3)
	$\Delta\text{Log}$ (Total credit)	Investment rate	$\Delta\text{Log}$ (Labour costs)
Weighted relationship duration*D(Post 2008)	9.194*** (1.553)	11.68*** (4.057)	6.449*** (1.185)
Weighted relationship duration*D(Post 2011)	-2.072 (1.537)	-6.584* (3.818)	1.138 (1.151)
Time fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Observations	57544	57338	55769
R-squared	0.201	0.225	0.287
Kleibergen-Paap weak identification F-statistic	753.59	745.15	708.43

Note: The table shows instrumental variable estimates of regressions of the log change in credit, of the investment rate, and of the change in labour cost on the measure of relationship lending (the average of the log of the number of years since the bank and the firm have a relationship weighted by the share of credit to the firm in each in each relationship). The instrument is the difference between the credit-weighted length of relationships and the average length of relationships affected by M&As in 2006.

## Appendix A: Robustness tests

Table A1: Homogeneous sample for credit quantity and interest rates

	(1)	(2)	(3)	(4)	(5)
	$\Delta\text{Log}$ (Total credit)	$\Delta\text{Log}$ (Revolving credit lines)	$\Delta(\text{Interest}$ rate on revolving credit lines)	$\Delta\text{Log}$ (Term loans)	$\Delta(\text{Interest}$ rate on term loans)
Relationship duration <sub>t-1</sub>	-0.324 (0.339)	0.748** (0.346)	0.256*** (0.0494)	-1.462 (0.889)	0.0214** (0.00907)
Relationship duration <sub>t-1</sub> *D(Post 2008)	1.685*** (0.448)	0.956* (0.495)	-0.0572 (0.0550)	2.092* (1.130)	-0.0438*** (0.0130)
Relationship duration <sub>t-1</sub> *D(Post 2011)	-0.0902 (0.407)	-0.699 (0.422)	-0.0144 (0.0679)	0.0533 (0.969)	0.0251* (0.0150)
Log credit granted <sub>t-1</sub>	-17.53*** (0.422)	-13.39*** (0.596)	-0.238*** (0.0306)	-6.266*** (0.651)	-0.0687*** (0.00655)
Drawn/granted <sub>t-1</sub>	0.0774*** (0.00530)	0.105*** (0.00794)	0.000387 (0.000515)	-0.0233** (0.0109)	- 0.000824** *
Share revolving credit lines <sub>t-1</sub>	0.0670*** (0.00703)	-0.602*** (0.0266)	-0.0104*** (0.000985)	0.361*** (0.0220)	0.00126*** (0.000253)
Level of interest rate on revolving credit lines <sub>t-1</sub>			-0.473*** (0.0114)		
Level of interest rate on term loans <sub>t-1</sub>					-0.310*** (0.00807)
Bank*Time fixed effects	Yes	Yes	Yes	Yes	Yes
Firm*Time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	208134	199820	103185	199820	103185
R-squared	0.429	0.396	0.409	0.567	0.799

Note: The table shows OLS estimates of regressions for annual changes in credit granted by banks to Italian non-financial firms between 2002 and 2013. The estimation is based on a random sample of 10% of firms reporting in the Italian Credit Register for which we have information on both credit quantity and interest rates. The sample used in column 1 includes only firm-bank relationships for which we observe either interest rates on revolving credit lines or on term loans. The regressions in column 2 and 4 are run on a sample of bank-firm relationships for which we observe both credit quantities and interest rates on revolving credit lines loans; regressions in columns 3 and 5 are run on a sample for which we observe both credit quantities and interest rates on term loans. Control variables are: duration, the number of years since the bank and the firm have a relationship, counting back from September 2008; D(Post 2008): dummy variable taking the value of one for years 2008 onwards and zero elsewhere; D(Post 2011): dummy variable taking the value of 1 for years 2011 onwards and zero elsewhere; Log credit granted: logarithm of total credit (revolving credit lines, loans backed by accounts receivable, term loans) granted by the bank to the firm; drawn/granted: the ratio of the drawn (used) credit to granted credit from the revolving credit lines granted by the bank to the firm; Share revolving credit lines: the share of revolving credit lines over total loans. Further details on the dependent and control variables are in the appendix. Robust standard errors in parentheses (double clustered at the bank and firm level). The symbols \*, \*\* and \*\*\* indicate significance at the 10%, 5% and 1% level respectively.



Table A2: All interactions

	(1)	(2)	(3)	(4)	(5)
	$\Delta\text{Log}$ (Total credit)	$\Delta\text{Log}$ (Revolving credit lines)	$\Delta(\text{Interest}$ rate on revolving credit lines)	$\Delta\text{Log}$ (Term loans)	$\Delta(\text{Interest}$ rate on term loans)
Relationship duration <sub>t-1</sub>	0.0738 (0.308)	0.787** (0.345)	0.187*** (0.0537)	-0.0674 (0.773)	0.0259*** (0.00954)
Relationship duration <sub>t-1</sub> *D(Post 2008)	0.754** (0.331)	1.037** (0.462)	0.0935 (0.0629)	0.370 (1.068)	-0.0472*** (0.0139)
Relationship duration <sub>t-1</sub> *D(Post 2011)	-0.433 (0.330)	-1.098*** (0.329)	-0.127** (0.0611)	-0.276 (0.963)	0.0330** (0.0161)
Log credit granted <sub>t-1</sub>	-16.10*** (0.563)	-13.81*** (0.817)	-0.0188 (0.0539)	-12.45*** (1.085)	-0.0307*** (0.00849)
Log credit granted <sub>t-1</sub> *D(Post 2008)	2.096*** (0.596)	-0.311 (0.977)	-0.301*** (0.0511)	4.015*** (1.037)	-0.0305** (0.0134)
Log credit granted <sub>t-1</sub> *D(Post 2011)	1.056* (0.557)	3.331*** (1.062)	-0.0274 (0.0666)	1.909** (0.932)	-0.0579*** (0.0157)
Drawn/granted <sub>t-1</sub>	0.0378*** (0.00823)	0.115*** (0.0101)	0.00205** (0.000958)	-0.0289 (0.0243)	0.00082*** (0.000201)
Drawn/granted <sub>t-1</sub> *D(Post 2008)	0.00212 (0.00811)	-0.0306*** (0.00847)	-0.00286** (0.00128)	0.0424* (0.0250)	-0.00185*** (0.000408)
Drawn/granted <sub>t-1</sub> *D(Post 2011)	0.0208** (0.00888)	0.0121 (0.0125)	0.00112 (0.00146)	0.0106 (0.0340)	-0.00144** (0.000606)
Share revolving credit lines <sub>t-1</sub>	0.0589*** (0.00769)	-0.647*** (0.0353)	-0.0102*** (0.00188)	0.469*** (0.0315)	-0.000296 (0.000359)
Share revolving credit lines <sub>t-1</sub> *D(Post 2008)	-0.00934 (0.0109)	-0.0310 (0.0530)	-0.000121 (0.00204)	-0.0155 (0.0480)	0.00166** (0.000680)
Share revolving credit lines <sub>t-1</sub> *D(Post 2011)	0.00200 (0.00986)	0.191*** (0.0519)	-0.000221 (0.00164)	-0.133*** (0.0392)	0.00164** (0.000818)
Interest rate on revolving credit lines <sub>t-1</sub>			-0.460*** (0.0163)		
Interest rate on revolving credit lines <sub>t-1</sub> *D(Post 2008)			-0.0677*** (0.0174)		
Interest rate on revolving credit lines <sub>t-1</sub> *D(Post 2011)			0.115*** (0.0169)		
Interest rate on term loans <sub>t-1</sub>					-0.396*** (0.0223)
Interest rate on term loans <sub>t-1</sub> *D(Post 2008)					0.0222 (0.0237)
Interest rate on term loans <sub>t-1</sub> *D(Post 2011)					0.149*** (0.0127)
Bank*Time fixed effects	Yes	Yes	Yes	Yes	Yes
Firm*Time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	314649	268953	199820	138698	103185
R-squared	0.402	0.383	0.569	0.398	0.802

Note: The table shows OLS estimates of regressions for annual changes in credit granted by banks to Italian non-financial firms between 2002 and 2013. The estimation is based on a random sample of 10% of firms reporting in the Italian Credit Register for which we have information on credit quantity. Control variables are: duration, the number of years since the bank and the firm have a relationship, counting back from September 2008; D(Post 2008): dummy variable taking the value of one for years 2008 onwards and zero elsewhere; D(Post 2011): dummy variable taking the value of 1 for years 2011 onwards and zero elsewhere; Log credit granted: logarithm of total credit (revolving credit lines, loans backed by accounts receivable, term loans) granted by the bank to the firm; drawn/granted: the ratio of the drawn (used) credit to granted credit from the revolving credit lines granted by the bank to the firm; Share revolving credit lines: the share of revolving credit lines over total loans. Further details on the dependent and control variables are in the appendix. Robust standard errors in parentheses (double clustered at the bank and firm level). The symbols \*, \*\* and \*\*\* indicate significance at the 10%, 5% and 1% level respectively.

Table A3: Relationship lending, controlling for the granting of new term loans

	(1)	(2)	(3)	(4)	(5)
	$\Delta\text{Log}$ (Total credit)	$\Delta\text{Log}$ (Revolving credit lines)	$\Delta(\text{Interest}$ rate on revolving credit lines)	$\Delta\text{Log}$ (Term loans)	$\Delta(\text{Interest}$ rate on term loans)
Relationship duration <sub>t-1</sub>	-0.222 (0.292)	0.704** (0.305)	0.256*** (0.0494)	-0.498 (0.823)	0.0296*** (0.00919)
Relationship duration <sub>t-1</sub> *D(Post 2008)	1.101*** (0.347)	0.905** (0.428)	-0.0574 (0.0549)	1.018 (1.084)	-0.0468*** (0.0130)
Relationship duration <sub>t-1</sub> *D(Post 2011)	-0.208 (0.340)	-0.489 (0.337)	-0.0143 (0.0679)	-0.221 (0.944)	0.0237 (0.0152)
Log credit granted <sub>t-1</sub>	-14.41*** (0.431)	-13.05*** (0.591)	-0.242*** (0.0299)	-9.049*** (0.788)	-0.0715*** (0.00656)
Drawn/granted <sub>t-1</sub>	0.0434*** (0.00496)	0.0987*** (0.00897)	0.000293 (0.000530)	0.00125 (0.0321)	-0.00086*** (0.000203)
Share revolving credit lines <sub>t-1</sub>	0.0552*** (0.00489)	-0.610*** (0.0277)	-0.0103*** (0.000992)	0.416*** (0.0230)	0.00126*** (0.000254)
Interest rate on revolving credit lines <sub>t-1</sub>			-0.473*** (0.0114)		
Interest rate on term loans <sub>t-1</sub>					-0.311*** (0.00794)
D(New term loan granted=1)	0.942*** (0.270)	0.204 (0.348)	0.0442 (0.0281)	0.673 (0.615)	0.0671*** (0.0102)
Bank*Time fixed effects	Yes	Yes	Yes	Yes	Yes
Firm*Time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	314649	268953	199820	138698	103185
R-squared	0.401	0.382	0.567	0.397	0.800

Note: The table shows OLS estimates of regressions for annual changes in credit granted by banks to Italian non-financial firms between 2002 and 2013. The estimation is based on a random sample of 10% of firms reporting in the Italian Credit Register for which we have information on credit quantity. Control variables are: duration, the number of years since the bank and the firm have a relationship, counting back from September 2008; D(Post 2008): dummy variable taking the value of one for years 2008 onwards and zero elsewhere; D(Post 2011): dummy variable taking the value of 1 for years 2011 onwards and zero elsewhere; Log credit granted: logarithm of total credit (revolving credit lines, loans backed by accounts receivable, term loans) granted by the bank to the firm; drawn/granted: the ratio of the drawn (used) credit to granted credit from the revolving credit lines granted by the bank to the firm; Share revolving credit lines: the share of revolving credit lines over total loans. The dummy for new term loan granted equals one if the firm received a new term loan by the bank in the year. Further details on the dependent and control variables are in the appendix. Robust standard errors in parentheses (double clustered at the bank and firm level). The symbols \*, \*\* and \*\*\* indicate significance at the 10%, 5% and 1% level respectively.

Table A4: Subsample of relationship which are important to the firm

	(1)	(2)	(3)	(4)	(5)
	$\Delta\text{Log}$ (Total credit)	$\Delta\text{Log}$ (Revolving credit lines)	$\Delta(\text{Interest}$ rate on revolving credit lines)	$\Delta\text{Log}$ (Term loans)	$\Delta(\text{Interest}$ rate on term loans)
Relationship duration <sub>t-1</sub>	-0.938** (0.387)	-0.0448 (0.462)	0.324*** (0.0849)	-0.829 (1.071)	0.0174 (0.0107)
Relationship duration <sub>t-1</sub> *D(Post 2008)	1.745*** (0.443)	1.902*** (0.650)	-0.133 (0.0811)	0.548 (1.211)	-0.0316* (0.0168)
Relationship duration <sub>t-1</sub> *D(Post 2011)	-0.0353 (0.457)	-0.815 (0.586)	-0.0414 (0.0784)	0.495 (1.328)	0.0163 (0.0191)
Log credit granted <sub>t-1</sub>	-12.44*** (0.451)	-12.23*** (0.610)	-0.174*** (0.0474)	-7.459*** (1.035)	-0.0727*** (0.00741)
Drawn/granted <sub>t-1</sub>	0.0149 (0.0128)	0.200*** (0.0211)	-0.00341** (0.00139)	0.0553* (0.0331)	- 0.00150*** (0.000375)
Share revolving credit lines <sub>t-1</sub>	0.0675*** (0.00704)	-0.608*** (0.0267)	- 0.00998*** (0.00117)	0.417*** (0.0256)	0.00144*** (0.000381)
Interest rate on revolving credit lines <sub>t-1</sub>			-0.462*** (0.0131)		
Interest rate on term loans <sub>t-1</sub>					-0.277*** (0.00778)
Bank*Time fixed effects	Yes	Yes	Yes	Yes	Yes
Firm*Time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	162840	132146	113771	82373	69503
R-squared	0.434	0.417	0.575	0.427	0.805

Note: The table shows OLS estimates of regressions for annual changes in credit granted by banks to Italian non-financial firms between 2002 and 2013. The estimation is based on a random sample of 10% of firms reporting in the Italian Credit Register for which we have information on credit quantity. We limit our analysis to a subsample of relationships where the drawn credit is greater than 50% of the total credit granted from revolving credit lines. Control variables are: duration, the number of years since the bank and the firm have a relationship, counting back from September 2008; D(Post 2008): dummy variable taking the value of one for years 2008 onwards and zero elsewhere; D(Post 2011): dummy variable taking the value of 1 for years 2011 onwards and zero elsewhere; Log credit granted: logarithm of total credit (revolving credit lines, loans backed by accounts receivable, term loans) granted by the bank to the firm; drawn/granted: the ratio of the drawn (used) credit to granted credit from the revolving credit lines granted by the bank to the firm; Share revolving credit lines: the share of revolving credit lines over total loans. Further details on the dependent and control variables are in the appendix. Robust standard errors in parentheses (double clustered at the bank and firm level). The symbols \*, \*\* and \*\*\* indicate significance at the 10%, 5% and 1% level respectively.

Table A5: Bank firm relationships controlling for past due loans

	(1)	(2)	(3)	(4)	(5)
	$\Delta\text{Log}$ (Total credit)	$\Delta\text{Log}$ (Revolving credit lines)	$\Delta(\text{Interest}$ rate on revolving credit lines)	$\Delta\text{Log}$ (Term loans)	$\Delta(\text{Interest rate on}$ term loans)
Relationship duration <sub>t-1</sub>	-0.332 (0.291)	0.667** (0.308)	0.258*** (0.0495)	-0.675 (0.818)	0.0219** (0.00906)
Relationship duration <sub>t-1</sub> *D(Post 2008)	1.144*** (0.345)	0.923** (0.430)	-0.0581 (0.0550)	1.098 (1.079)	-0.0441*** (0.0129)
Relationship duration <sub>t-1</sub> *D(Post 2011)	-0.181 (0.342)	-0.476 (0.336)	-0.0148 (0.0680)	-0.180 (0.946)	0.0249 (0.0151)
Log credit granted <sub>t-1</sub>	-14.33*** (0.427)	-13.04*** (0.606)	-0.237*** (0.0308)	-9.015*** (0.798)	-0.0688*** (0.00655)
Drawn/granted <sub>t-1</sub>	0.0468*** (0.00510)	0.0995*** (0.00851)	0.000375 (0.000516)	0.00391 (0.0318)	-0.000833*** (0.000203)
Share revolving credit lines <sub>t-1</sub>	0.0550*** (0.00489)	-0.610*** (0.0274)	-0.0104*** (0.000984)	0.417*** (0.0231)	0.00125*** (0.000253)
Interest rate on revolving credit lines <sub>t-1</sub>			-0.473*** (0.0114)		
Interest rate on term loans <sub>t-1</sub>					-0.310*** (0.00807)
Past due loans <sub>t-1</sub>	12.77*** (1.433)	5.947*** (1.222)	-0.211 (0.147)	12.23*** (2.203)	-0.0525* (0.0278)
Bank*Time fixed effects	Yes	Yes	Yes	Yes	Yes
Firm*Time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	232820	232820	232820	201579	201579
R-squared	0.385	0.429	0.429	0.408	0.408

Note: The table shows OLS estimates of regressions for annual changes in credit granted by banks to Italian non-financial firms between 2002 and 2013. The estimation is based on a random sample of 10% of firms reporting in the Italian Credit Register for which we have information on credit quantity. Control variables are: duration, the number of years since the bank and the firm have a relationship, counting back from September 2008; D(Post 2008): dummy variable taking the value of one for years 2008 onwards and zero elsewhere; D(Post 2011): dummy variable taking the value of 1 for years 2011 onwards and zero elsewhere; Log credit granted: logarithm of total credit (revolving credit lines, loans backed by accounts receivable, term loans) granted by the bank to the firm; drawn/granted: the ratio of the drawn (used) credit to granted credit from the revolving credit lines granted by the bank to the firm; Share revolving credit lines: the share of revolving credit lines over total loans. Further details on the dependent and control variables are in the appendix. Robust standard errors in parentheses (double clustered at the bank and firm level). The symbols \*, \*\* and \*\*\* indicate significance at the 10%, 5% and 1% level respectively.

Table A6: Firm heterogeneity: Leverage

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	$\Delta\text{Log}$ (Total credit)		$\Delta\text{Log}$ (Revolving credit lines)		$\Delta$ (Interest rate on revolving credit lines)		$\Delta\text{Log}$ (Term loans)		$\Delta$ (Interest rate on term loans)	
	low leverage	high leverage	low leverage	high leverage	low leverage	high leverage	low leverage	high leverage	low leverage	high leverage
Relationship duration <sub>t-1</sub>	0.257 (0.404)	-0.666 (0.409)	1.082** (0.430)	0.494 (0.501)	0.176** (0.0678)	0.322*** (0.0651)	-0.785 (1.144)	-0.445 (1.063)	0.0144 (0.0131)	0.0250** (0.0122)
Relationship duration <sub>t-1</sub> *D(Post 2008)	1.022** (0.452)	1.196** (0.505)	0.393 (0.618)	1.252** (0.613)	0.00269 (0.0796)	-0.107 (0.0685)	0.811 (1.486)	1.487 (1.568)	-0.0326* (0.0190)	-0.0471** (0.0204)
Relationship duration <sub>t-1</sub> *D(Post 2011)	-0.241 (0.406)	-0.282 (0.503)	0.109 (0.483)	-1.212** (0.508)	0.0275 (0.0951)	-0.0441 (0.0754)	0.760 (1.201)	-1.658 (1.694)	0.0356* (0.0194)	0.0121 (0.0245)
Log credit granted <sub>t-1</sub>	-13.96*** (0.502)	-14.92*** (0.392)	-13.09*** (0.675)	-13.07*** (0.597)			-9.774*** (0.818)	-8.144*** (1.008)		
Drawn/granted <sub>t-1</sub>	0.0364*** (0.00597)	0.0572*** (0.00574)	0.0924*** (0.0101)	0.109*** (0.00835)			-0.0216 (0.0279)	0.0359 (0.0388)		
Share revolving credit lines <sub>t-1</sub>	0.0600*** (0.00591)	0.0446*** (0.00619)	-0.590*** (0.0292)	-0.639*** (0.0271)			0.412*** (0.0291)	0.422*** (0.0286)		
Bank * Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm * Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	163925	150376	140945	127725	93770	105808	76050	62380	55059	47865
R-squared	0.396	0.414	0.377	0.395	0.581	0.563	0.393	0.413	0.812	0.791

Note: The table shows OLS estimates of regressions for annual changes in credit granted by banks to Italian non-financial firms between 2002 and 2013. The estimation is based on a random sample of 10% of firms reporting in the Italian Credit Register for which we have information on credit quantity. Control variables are: duration, the number of years since the bank and the firm have a relationship, counting back from September 2008; D(Post 2008): dummy variable taking the value of one for years 2008 onwards and zero elsewhere; D(Post 2011): dummy variable taking the value of 1 for years 2011 onwards and zero elsewhere; Log credit granted: logarithm of total credit (revolving credit lines, loans backed by accounts receivable, term loans) granted by the bank to the firm; drawn/granted: the ratio of the drawn (used) credit to granted credit from the revolving credit lines granted by the bank to the firm; Share revolving credit lines: the share of revolving credit lines over total loans. Further details on the dependent and control variables are in the appendix. Robust standard errors in parentheses (double clustered at the bank and firm level). The symbols \*, \*\* and \*\*\* indicate significance at the 10%, 5% and 1% level respectively.

Table A7: Firm heterogeneity: Profitability (return on equity)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	$\Delta\text{Log}$ (Total credit)		$\Delta\text{Log}$ (Revolving credit lines)		$\Delta$ (Interest rate on revolving credit lines)		$\Delta\text{Log}$ (Term loans)		$\Delta$ (Interest rate on term loans)	
	low profitability	high profitability	low profitability	high profitability	low profitability	high profitability	low profitability	high profitability	low profitability	high profitability
Relationship duration <sub>t-1</sub>	-0.150 (0.379)	-0.180 (0.369)	0.586 (0.480)	0.630 (0.537)	0.295*** (0.0634)	0.220** (0.0870)	-0.0578 (1.109)	-0.735 (1.202)	-0.00545 (0.0136)	0.0506*** (0.0146)
Relationship duration <sub>t-1</sub> *D(Post 2008)	1.270** (0.531)	0.775* (0.418)	1.388* (0.718)	0.559 (0.676)	-0.0780 (0.0741)	-0.0397 (0.0924)	0.716 (1.439)	1.043 (1.626)	-0.00173 (0.0182)	-0.0801*** (0.0186)
Relationship duration <sub>t-1</sub> *D(Post 2011)	-0.830 (0.512)	0.390 (0.385)	-1.198** (0.594)	0.186 (0.425)	0.0360 (0.0811)	-0.0662 (0.0673)	-1.301 (1.369)	0.890 (1.236)	0.0392* (0.0233)	0.00207 (0.0240)
Log credit granted <sub>t-1</sub>	-13.32*** (0.394)	-15.67*** (0.522)	-13.23*** (0.568)	-12.91*** (0.697)			-7.555*** (0.978)	-11.03*** (0.910)		
Drawn/granted <sub>t-1</sub>	0.0575*** (0.00628)	0.0354*** (0.00586)	0.107*** (0.00863)	0.0932*** (0.0111)			0.0256 (0.0335)	-0.0158 (0.0318)		
Share revolving credit lines <sub>t-1</sub>	0.0486*** (0.00789)	0.0576*** (0.00697)	-0.613*** (0.0257)	-0.618*** (0.0309)			0.422*** (0.0258)	0.425*** (0.0322)		
Bank * Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm * Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	148398	159176	126093	137141	104116	90947	67031	68491	51892	48828
R-squared	0.400	0.404	0.385	0.384	0.562	0.580	0.403	0.401	0.799	0.806

Note: The table shows OLS estimates of regressions for annual changes in credit granted by banks to Italian non-financial firms between 2002 and 2013. The estimation is based on a random sample of 10% of firms reporting in the Italian Credit Register for which we have information on credit quantity. Control variables are: duration, the number of years since the bank and the firm have a relationship, counting back from September 2008; D(Post 2008): dummy variable taking the value of one for years 2008 onwards and zero elsewhere; D(Post 2011): dummy variable taking the value of 1 for years 2011 onwards and zero elsewhere; Log credit granted: logarithm of total credit (revolving credit lines, loans backed by accounts receivable, term loans) granted by the bank to the firm; drawn/granted: the ratio of the drawn (used) credit to granted credit from the revolving credit lines granted by the bank to the firm; Share revolving credit lines: the share of revolving credit lines over total loans. Further details on the dependent and control variables are in the appendix. Robust standard errors in parentheses (double clustered at the bank and firm level). The symbols \*, \*\* and \*\*\* indicate significance at the 10%, 5% and 1% level respectively.