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 Lehman Brothers' default shock and Europe's sovereign debt crisis. We use a large data set that merges the comprehensive Italian Credit and Firm Registers. We find that following Lehman's default, banks offered more favourable continuation lending terms to firms with which they had stronger relationships. Such favourable conditions enabled firms to maintain higher levels of investment and employment. The insulation effects of tighter bank-firm relationships proved slightly stronger after the European sovereign debt crisis but only for well capitalised banks.

JEL Codes: E44, G21

Key words: relationship banking, real effects of credit, credit supply

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 (Petersen and Rajan (1994), and Berger and Udell (1992)). The repeated personal interactions from lending relationships facilitates the acquisition of soft information by the lender that can mitigate informational asymmetries. The effectiveness of relationship lending in smoothing fluctuations in credit and in providing liquidity insurance to firms, even during crises, is now well established (Sette and Gobbi (2016), and Bolton et al (2016)). By contrast, the extent to which relationship lending has real effects, by allowing borrowers with strong relationships to maintain higher investment and employment utilisation rates than other borrowers during crises, is still an important open question.

In this paper, we study whether firms with longer banking relationships experienced stronger investment and greater labour utilisation rates than other firms during the crisis, thus providing first-hand evidence of the real effects of relationship lending. After establishing that banks provide more credit to borrowers with longer relationships (relationship borrowers) in a crisis, we show the way this support operates. In particular, we study whether longer bank-firm relationships affect to a greater extent the quantity and price of credit. Next, we test whether this translates into real activity through the higher investment and employment.

An additional important question we explore is whether the support provided by banking relationships is different when the banking system faces a systemic (existential) shock. We study this by comparing the effects of relationship lending after the European sovereign debt crisis and the Lehman default shock. The former represented a systemic shock to both the Italian economy and the banking system, threatening the very survival of banks, while the latter only indirectly affected the Italian banking system largely through the interbank market.

A priori, it is not clear how a systemic shock to the banking system would affect relationship lending. On one hand, in a period of heighted macroeconomic uncertainty private information derived from banking relationships could be especially valuable in assessing the quality of loans. This would increase credit supply to firms with strong banking relationships. On the other hand, when the probability of bank default increases, the future value of continuing relationships will be more heavily discounted as the bank may not be around to reap the benefits. This would erode the insulation effects of relationship banking. The relative importance of these effects is an empirical question.

Our results show that following the Lehman default shock, banks insulated credit supply to firms with which they had longer banking relationships. They also provided that credit at a lower cost. After the European sovereign debt crisis, we find some evidence that the insulation effects of tighter bank-firm relationships increased further. Firms used the insulation to maintain stronger investment and employment than firms with weaker relationships.

We find evidence that during the financial crisis, banks directed credit to relationships which had the greatest pre-crisis value. In particular, we find that in the cross-section of banking relationships, firms provided more insulation to firms which paid higher pre-crisis interest rates on credit. Thus firms which paid more to maintain relationships before the financial crisis were rewarded with more insulation to their credit supply during the crisis. This additional insulation supported both investment and employment.

In terms of the durability of relationships during a systemic banking shock, we find that only relationships with well capitalised banks insulated firms. We find no evidence that poorly capitalised banks insulated credit supply to firms with stronger relationships, which is consistent with the heavy discounting in the value of relationships in banks fighting for their survival.

There is an underlying concern that stronger bank-firm relationships may encourage the evergreening of loans to weaker firms and thus be negative for the real economy. Overall, we find little evidence that stronger relationships encourage such an evergreening. We find that bank-firm relationships with past due loans experienced stronger credit growth, which is consistent with evergreening, but that this effect was largely orthogonal to the duration of the relationship. Moreover, we find almost no heterogeneity in the insulation effects of longer relationships by firm leverage and profitability.

Because banks may be willing to act as relationship lenders only if borrowers are sound – and that such borrowers may obtain more credit during a financial crisis because their probability of default is lower – this may induce a spurious correlation between relationship lending and credit supply. Our data from the Italian Credit Register enables us to improve on the identification of the effects of relationship lending in a crisis by focusing on firms borrowing from at least two banks. Thus we can include firm fixed effects in all regressions (Khwaja and Mian (2008)), effectively comparing the change in credit granted to the same firm by banks with relationships of different durations.

In addition to the "Firm*Time" fixed effects identification strategy of Khwaja and Mian (2008), the strength of bank-firm relationships varies by relationship, which means that we can also include "Bank*Time" fixed effects to control for bank-level time-varying unobservables. This takes care of the possibility that banks relying more on relationship lending may have been differentially exposed to the financial crisis.

To estimate the real effects of relationship lending, we compare the quantity and price of credit in firms to that of investment and employment. As the latter two variables are only identified at the firm level, econometric identification is more complex. To address endogeneity concerns, we perform several checks between the propensity of firms to engage in relationship borrowing and the characteristics of such firms.

We test whether firms with significant existing relationships with banks demonstrate systematically different characteristics. 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. We therefore also conduct

instrumental variable (IV) estimation. In Italy, there was a wave of mergers and acquisitions (M&As) between 2004 and 2006 as the fragmented banking industry experienced a period of consolidation. When banks merge or are subject to takeovers, existing relationships 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 bank profitability, the breaking of existing relationships were likely to be independent of the characteristics of individual firms. We use the exogenous breaks in bank-firm relationships from this wave of M&A activity to instrument the average duration of relationships.

Our findings contribute to the large literature on the effects of relationship lending on credit supply (surveyed in Degryse et al (2009)). 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 by using survey data of bank CEOs and firms. They infer bank-firm relationships from the propensity of a firm to be located close to bank branches that specialise in relationship lending. They find that relationship lending alleviates credit constraints during a cyclical downturn but not during a boom. Following the Lehman default shock, they find that firms located nearer relationship banks were less likely to report credit constraints and experienced stronger asset growth, sales and employment. By contrast to Beck et al (2015), our credit registry data allows us to directly observe lending relationships, loan volumes, types and costs. We are therefore able to draw a tighter link between banking relationships credit and real firm activity.

Shocks to the balance sheets of banks can have effects at the firm level via credit supply (Bernanke (1983), Holmstrong and Tirole (1997), Diamond and Rajan (2006), Adrian and Shin (2011), and Stein (1998 and 2011)). The empirical evidence relating to this issue is large (Kashyap and Stein (2000), Gambacorta and Mistrulli (2004), Peydrò et al (2012), Peydrò et al (2013), Iyer et al (2014), and Amiti and Weinstein (2013)). In this context, 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, which was arguably more systemic in nature than the external funding shock that followed 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 of switching lenders. Some studies determine bank-firm relationships by using data on syndicated loans. Chodorow-Reich (2014) shows that following the Lehman default shock, firms which had syndicated loan relationships with banks that had experienced a greater deterioration in their financial health had a lower likelihood of obtaining a loan, paid a higher interest rates and reduced employment by more than firms that had enjoyed relationships with healthier lenders. Acharya et al (2015) find that firms which had syndicated loan relationships with banks with higher exposure to euro area sovereign debt, experienced a

greater contraction in lending following the European sovereign debt crisis (which depressed investment, job creation and sales growth).

Other studies, follow a similar identification strategy but use credit registry data. Cingano et al (2013) identify a credit shock by exploiting firm relationships with banks that had greater exposure to interbank market funding around the Lehman default shock, finding a negative effect on investment, employment and value added at Italian firms. Bentolila et al (2016) find that firms with relationships with the weakest banks in Spain, experienced reduced credit supply and weaker employment between 2006 and 2010. Bofondi et al (2013) measure the impact on credit supply of shocks to Italian sovereign debt around the European sovereign debt crisis by exploiting heterogeneity in the location of banks' headquarters. Finally, Bottero et al (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 the duration of the relationship itself could have real effects in a crisis, rather than looking at differences in relationships with lenders with heterogeneous exposures to financial stress.

The paper is structured as follows. Section 2 discusses the empirical strategy and how we tackle the main identification challenges in identifying relationship lending and loan supply shifts. Section 3 describes the data set. Section 4 examines the effects of relationship banking on credit supply and the cost of firms' financing. Section 5 examines real effects of relationship banking on firm investment and employment. Section 6 verifies the robustness of the results. The last section presents our main conclusions.

2. EMPIRICAL STRATEGY

2.1 Measures of lending relationships

Banking relationships reduce information asymmetries between borrowers and lenders, and thus mitigate credit rationing that can occur due to these frictions. To run our tests, we proxy the amount of borrower information accumulated by the bank as the log duration of the relationship between the bank and the firm. The longer the relationship is, the greater is the ability of the lender to accumulate information capital about the borrower (Boot (2000)) with marginal information declining by duration. Longer relationships may also signal a long-term implicit contract between the bank and the borrower in which the bank provides liquidity insurance (Elsas and Krahnen (1998)). This measure has been commonly used in the literature to capture how relationships affect credit supply (Degryse et al (2009) and 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 et al (1998), Harhoff and Körting (1998)) but also during a crisis (Sette and Gobbi (2015)). However, their effects on the cost of credit are mixed. Berger and Udell (1995), Brick and Palia (2007), and Bharath et al (2011) find that relationship banks charge a

lower interest rate than transactional banks, but 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 paid lower interest rates after the Lehman default shock.

2.2 Identifying the effect of lending relationships 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 quality borrowers, so that longer relationships are observed only if borrowers are of high quality. In turn, better quality 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. This means that better firms may experience a lower reduction in output and thus a stronger demand for credit during a financial crisis, especially when that crisis is followed by a significant downturn in economic activity. Finally, the characteristics of banks and the impact of the financial crisis on them (such as the increase in the cost of funding) are likely to be correlated with their lending policies before the financial crisis and thus with the characteristics of lending relationships.

We address these identification challenges by estimating the effect of bank-firm relationships on credit supply on the sample of firms that have multiple relationships. We include both Firm*Time and Bank*Time fixed effects, allowing us to control 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 observed and unobserved firm 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 observed and unobserved bank heterogeneity in each period. This is particularly important after the financial crisis due to its heterogeneous impact on banks, on the strategies bank followed in building relationships with customers and on the lending policies they adopted 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 the characteristics of individual bank-firm relationships to attenuate concerns about the violation of this assumption.

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

$$Y_{ijt} = \beta_1 \, relationship \; duration_{ijt-1}$$
$$+\beta_2 \log(relationship \; duration)_{ijt-1} * D(post \; 2008)$$

$$+\beta_3 \log(relationship\ duration)_{ijt-1} * D(post\ 2011)$$
$$+ \gamma X_{ijt-1} + \alpha_{it} + \delta_{jt} + \varepsilon_{ijt} \tag{1}$$

where the dependent variable Y_{ijt} is either the change in the 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, Y_{ijt} is either the annual interest rate on revolving credit lines or on term loans granted by bank j to firm i in year t. The log(*relationship duration*)$_{i,j,t}$ is the log duration of the relationship between bank j and firm i in years counting back from year t+1. *D*(post *2008*) and *D*(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) find that the amount of lending did not decline in the US during the first quarters of the crisis. This was not because of "new" lending but mainly because of the more intensive use of existing loan commitments and lines of credit and a return to securitisation activity.

We include Bank*Time fixed effects, δ_{jt} and firm* time fixed effects, α_{it} that control for bank-specific and firm-specific unobserved shocks. In addition, we also include a vector of bank-firm level control variables, X_{ijt-1}, dated in period t-1 to further limit endogeneity issues. The vector includes: i) log credit granted by bank j to firm i to capture size effects that 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 on existing credit lines from a bank are less likely to apply for credit extension; and iii) the share of total credit (revolving credit lines, loans backed by accounts receivable and term-loans) granted by bank j to firm i.

2.3 Identifying the effect of lending relationships on firm investment and employment

Identifying the causal effect of relationship lending on firm activity poses even greater challenges than identifying the 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 in a number of ways: we test for the presence of sorting in bank-firm relationship duration, we fix relationship duration to that prevailing before the financial crisis and we estimate IV regressions.

2.3.1 OLS regressions

For our baseline estimates, we use information on bank relationships as of 2006. In particular, we measure the intensity of relationship lending as the credit-weighted average duration of credit relationships since that year. This measure is less affected by the endogenous selection of relationships during the crisis. We use it to evaluate the effect of relationship lending on firm

credit, investment and employment in all subsequent years. We interact it with two crisis dummy variables and include firm fixed effects. The latter help controlling for systematic differences in (time-invariant) unobservable firm characteristics.

Our OLS regressions estimate the following OLS model:

$$\Delta Z_{it} = \beta_1 Creditweightedrelationship\ duration_{i,2006} * D(post\ 2011)$$
$$+ \beta_2 Creditweightedrelationshipduration_{i,2006} * D(post\ 2008) + \gamma Y_{it-1}$$
$$+ \theta_i + \mu_t + \varepsilon_{it}$$

$$(2)$$

where, the dependent variables considered, ΔZ_{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 $Creditweightedrelationshipduration_{i,2006}$ is defined as $\sum_j \log(relationship\ duration)_{ij,2006} * credit_{ij,2006}$ and measures the share of credit from bank j to firm i in 2006 weighted by the log duration in years of the relationship between bank j and firm i fixed in 2006.

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 amortisation (EBITDA) over the book value of total assets;[1] ii) firm leverage, the ratio of total debt divided by the book value of assets; iii) the ratio of EBITDA to interest expenses, as firms with lower debt servicing costs have higher internal funds to finance additional expenditures; iv) the log of total assets to capture size effects and diminishing marginal productivity of either capital or labour; and vii) the z-score of the firm. In our robustness tests, we also include estimated Firm*Time fixed effects from the relationship level regression (1) on credit supply to control for unobserved credit demand as in Jimenez et al (2015), and Bonaccorsi di Patti and Sette (2012).

While fixing the relationship duration to 2006 addresses concerns about any endogenous breaking and forming of relationships in response to the financial crisis, this definition does not allow us to identify the pre-crisis effect of relationship lending as these are absorbed by the firm fixed effects θ_i. The fixing of relationships in 2006 results in an attrition of new relationships from our sample. The omission of newly formed relationships reduces the variance in our measure of relationships. This weakens the precision of our estimates but the sign of the bias is less clear. The omission of newly formed relationships may create a downward bias in our estimates because we compare the differences in relationship length of firms with relatively long relationships, especially in the latter part of our sample period. But it could also cause an upward bias to our estimates as weaker firms exit the market (although our additional firm level vector of control variables should deal with this).

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[1] 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)).

2.3.2 IV regressions

We estimate IV regressions to further address potential endogeneity concerns. Between 2004 and 2006, the fragmented Italian banking system experienced a wave of M&As. 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 et al (2011) for Belgium.

Because there is a higher probability of relationship termination for firms that had entered into relationships with merged banks, the strength of relationships for firms more exposed to merged banks should be weakened (all else equal). Thus, we instrument the credit-weighted duration of relationships at the start of 2006 with the change in credit-weighted relationships due to M&A activity in 2006. In total, there were 11 bank mergers in 2006 out of around 125 banking groups. These mergers resulted in the formation of the two largest banking groups in Italy.

Our instrument is defined as:

$$Relationship\ instrument = \sum_j \log(relationship\ duration)_{ij2006} * credit_{ij2006}$$

$$- \sum_j \log(relationship\ duration)_{ij2006}^{merger} * credit_{ij2006}^{merger}$$

where $relationship\ duration_{ij2006}^{merger}$ is the duration of existing relationships with banks that experienced a merger in 2006 and $credit_{ij2006}^{merger}$, is the share of credit in that relationship in 2006.

Instruments need to be both relevant and exogenous. For the instrument relevance condition to be satisfied, we need the relatively mild condition that the strength of bank-firm relationships were weakened by M&As. For instrument exogeneity, the bank M&A decision must be uncorrelated with the activity of the firms having a relationship with 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 of other European countries, the mergers are likely to be independent of the characteristics of relationships these banks had with firms.[2] 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

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[2] The wave of M&As in the Italian market in the mid-2000s was not related to the rescue of weak banks. It was rather a reaction of banks to the need to create larger players to compete in the progressively more integrated European market (IMF (2006)).

motivation for the mergers was not related to repairing bank balance sheets. Nevertheless, we formally test for sorting between firm types and their propensity to have relationships with merged banks.

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 and collects, from all intermediaries operating nationwide, information on individual borrowers with an outstanding exposure (credit commitments, drawn credits and guarantees) of over €75,000 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 the banks operating in Italy and the non-financial Italian firms included in the Cerved and CADS databases between 2003 and 2014. Although our data set starts in 2003, to reduce the risk of censoring the duration of bank-firm relationships, we measure the duration as the number of years since 1998 that a firm has a relationship with a bank. We aggregate credit to a given firm from all banks belonging to the same banking group. This is because both lending and funding policies are decided at the banking group level, and a separate consideration of individual banks that are members of the same group might 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 et al (1998), Detragiache et al (2000), and Gobbi and Sette (2014)). It is also more common than in other countries (Ongena and Smith (2000) and Degryse et al (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 to the Italian Loan Interest Rate Survey has been selected following a stratification procedure – by size and geographical areas – that allows for a high representativeness of each product.[3]

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[3] In particular, the sample has been selected following the principles of Regulation 63/2002 (ECB/2001/18) of the European Central Bank which ensure a high quality of interest rate statistics. More details are available at: http://www.bancaditalia.it/statistiche/quadro_norma_metodo/metodoc/en_suppl_57_03.pdf.

Overall, the sample we use in the baseline regressions includes 314,649 credit relationships between 20,325 non-financial firms and 125 Italian banks. Our data is at annual frequency and is time-stamped at the end of year (end December) as the recourse to available credit is strongly seasonal (Jimenez et al (2009)). This is particularly important for the analysis of the cost of credit because, if in a given month a credit 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. Over the sample period, mean annual growth in total credit was negative at 0.5% per annum while median annual growth was unchanged. 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 were equal to 9.2% while median interest rates on term loans were equal to 4.4%. We tracked the duration of relationships since 1998. The median duration of bank-firm relationships was 6 years. In our distribution of relationships, there was a slight positive skew with the 25th percentile around three years and the 75th percentile around eight years, resulting in a mean relationship slightly shorter than the median at 5.7 years. The mean log level of credit granted stood at 12.95 (corresponding to €420,000), around €70,000 greater than the median. On average around 60% of credit granted was drawn and around 20% of revolving credit lines were used.

Table 2 reports firm-level summary statistics. At the firm level, our data set has more than 82,000 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 the median investment rate (-0.5% per year).

In contrast to the investment rate, 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), which is 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, the total assets of the mean firm in our data set amount to about €3 million. Total assets at the 25th percentile are €1.2 million and at the 75th percentile €6.5 million.

4. THE EFFECTS OF LENDING RELATIONSHIPS AT THE BANK-FIRM LEVEL

4.1 Credit quantity at the relationship level

Our analysis of lending relationships starts at the bank-firm relationship level. Here we can include both Firm*Time and Bank*Time fixed effects to control for heterogeneous firm- and bank-level shocks so as to examine variables that vary by relationship, such as the quantity and cost of bank credit. Table 3 examines the effect of longer bank-firms relationships on the quantity of credit from the estimation of equation (1) between bank j and firm i. 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 is, the stronger credit growth is. However, column (2) shows that prior to 2008 credit growth was not statistically linked to relationship duration. Rather, the average positive coefficient over the sample was 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) that relationship banks increased loan supply during bad times.

This insulation of relationship borrowers continued almost unchanged during the European sovereign debt crisis. Although the coefficient on relationship duration interacted with 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 European sovereign debt crisis, banks protected the volume of credit with relationship borrowers in a way that was similar to the post-Lehman default shock.

The remaining control variables show that relationships with a larger stock of existing credit experienced weaker credit growth. 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 was, the higher the growth in revolving credit lines was as well. Column (4) shows that this effect was also present before the Lehman default shock, consistent with the view that lines of credit are loan contracts where bank-firm relationships are important in solving asymmetric information problems (as argued by Berger and Udell (1995)). Indeed, revolving credit lines are granted neither for specific purposes, as is the case for mortgages, nor for specific transactions, as is the case for advances against trade credit receivables.

Following the Lehman default shock, the coefficient on the interaction term between the relationship duration and the post-2008 dummy variable is also positive and significant, showing that for firms with longer relationships, revolving credit lines provide additional insulation to loan supply during financial shocks. Similar to the results for total credit, following the European sovereign debt crisis, 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 relationships 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 that there is no 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 was, the higher the interest rates on revolving credit lines were. 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 (to some extent) the European sovereign debt crisis, our estimates indicate that this premium was reduced in the downturn. 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 so as to enjoy enhanced credit supply and a reduction in the cost of credit during downturns.

The pricing of term loans in relationships displayed a similar dynamic to that of revolving credit with a greater decline during the European sovereign debt crisis. Column (4) shows that prior to the crisis, the longer the relationship between banks and firms was, the higher the average change in interest rates on term loans turned out to be. However, the negative coefficient on the interaction between the relationship duration and post-2008 dummy variable shows that, following the Lehman default shock, relationships insulated firms from the rise in the cost of longer-term funding. The size of the coefficients is more than half of the pre-crisis premium paid to maintain the relationship. Moreover, following the European sovereign debt crisis, banks still insulated relationship borrowers from a rise in the cost of term loans and to a stronger extent than during the 2008–2010 period. This is consistent with borrowers paying an insurance premium to maintain relationships in good times which insulated credit supply during the crisis. Our results indicate that the overall reduction in the costs of term loans from longer relationships was 12 basis points (an effect higher than the insurance premium of eight basis points paid in the pre-crisis period).

4.3 Effects of bank and firm heterogeneity on relationship lending

The results above show that, on average, relationships insulated both the quantity and price of credit following the Lehman default shock and the systemic European sovereign debt crisis. However, differences in the health of banks and firms may influence decisions about whether to grants loans based on the private information derived from banking relationships. Banks facing a higher probability of default may heavily discount the future value of relationships as the bank may not be around to reap the benefits. This would cause an erosion of the insulation

effects of relationship banking. Similarly, in a crisis banks may judge it imprudent to extend relationship credit to firms that are highly leveraged and poorly profitable.

Table 5 examines the effect of bank heterogeneity on relationship lending. It uses sample split regressions that compare the effect of relationship lending between banks with Tier 1 capital ratios above the 75th and below the 25th percentiles. In terms of the quantity of credit, point estimates in Columns (1) and (2) indicate that following the Lehman default shock, longer relationships where associated with stronger credit supply. However, the coefficient is only significant for banks with high Tier 1 capital ratios. Following the European sovereign debt crisis, there is no significant change in the insulation effects of relationship lending but point estimates suggest that the insulation effects were reduced in banks with low Tier 1 capital ratios.

Columns (3) and (4) examine the effect of relationship lending on the interest rate on revolving credit lines. Banks with high and low Tier 1 capital ratios charged lower interest rates to firms with longer relationships following the Lehman default shock. However, following the European sovereign debt crisis, there was a divergence of behaviour between strongly and weakly capitalised banks. Weakly capitalised banks reduced insulation to the interest rate on revolving credit lines while banks with higher Tier 1 capital ratios actually increased insulation. Columns (5) and (6) show a similar dynamic for interest rates on term loans.

Table 6 examines the effects of firm heterogeneity on relationship lending. Columns (1) to (6) compare firms with above- and below-median leverage. In term of credit quantities, Columns (1) and (2) do not indicate different effects of relationship lending between firms with high and low leverage. However, in terms of the interest rate on revolving credit lines (Columns (3) and (4)), longer relationships insulated firms with high leverage. This suggests that soft information from relationships made banks more willing to provide cheaper credit to highly indebted firms. The degree of insulation from relationships increased with the European sovereign debt crisis. Columns (5) and (6) show a similar relationship for the cost of long-term loans.

Columns (7) to (12) test for heterogeneity in the effect of banking relationships for firms with above- or below-median profitability. Point estimates suggest that longer relationships were more useful for firms with below median profitability (Column 7 and 8). There is little heterogeneity in the effects of relationship on the cost of revolving credit lines but column (12) indicates that longer relationships eased the cost of longer-term loans to more profitable firms and that this effect strengthened during the European sovereign debt crisis.

It has been argued that large banks have a disadvantage in the processing of soft information (eg Stein (2002), and Berger and Udell (2002)). In appendix Table A1, we consider the effect of bank size on the effect of relationship lending. Overall, we do not find strong evidence that bank size influences the effect of bank-firm relationships on the quantity and price of credit. That said, the size of firms may influence the availability of hard information with small firms being less able to provide hard information on firm performance. In Table A2, we test the effects of relationship lending by firm size and find almost no difference in the importance of the duration of relationships on the quantity and price of credit.

5. THE REAL EFFECTS OF LENDING RELATIONSHIPS ON FIRMS

5.1 Testing for sorting of bank-firm relationships

To assess the real effects of relationship lending, ie the effect of relationships on firm activity, we need to leave the realm of Firm*Time fixed effects that control for heterogeneous firm demands and types. The potential endogeneity in the formation and breaking up of band-firm relationships with firm specific demands or types presents a serious identification challenge. We address this concern in three ways: we test for the presence of sorting in bank-firm relationships; we instrument our measure of relationship lending; and we include relationship-level fixed effects as additional controls (as proposed by Cingano et al (2016)).

Our test for the presence of sorting in bank-firm relationships follows Imbens and Wooldridge (2009), and compares the distribution of relationship durations across different firm characteristics. Table 7 presents tests for the presence of sorting by comparing the normalised difference of (observable) firm-specific characteristics at different quartiles of the distribution of the relationship duration. In particular, the statistic presents the normalised difference between the average observable firm characteristic in a particular quartile of the distribution relative 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. An exception is the share of tangible investments in total investment. In particular, firms with longer relationships tend to invest more in tangible assets, while firms with longer relationships a greater share in intangible assets. This suggests that longer banking relationships may have helped firms secure credit for less collateralisable intangible investment such as R&D (Hombert and Matray (2016)).There is also some weaker evidence of sorting by firm leverage. Table 7 indicates that highly leveraged firms tended to have shorter credit-weighted relationship durations. This is driven by the fact that large firms have higher leverage on average but also tend to have a lower share of credit from long-term relationships – possibly reflecting weaker information asymmetries in larger firms. As this 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. Measures potentially correlated with growth opportunities such as growth in credit demand, investment and labour costs do not indicate the presence of sorting.

5.2 Relationships and total credit at the firm level

Columns (1) and (2) of Table 8 examine the effects of relationship duration on total credit at the firm level by estimating equation (2) by using OLS. Our 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.[4] Following the Lehman default shock, the positive coefficient on the credit-weighted relationship duration interacted with the post-2008 dummy

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[4] We include firm fixed effects, which absorb the relationship duration measure when it is kept fixed at 2006. These are important in controlling for time-invariant firm unobservable characteristics that may correlate with the intensity of bank-firm relationships.

variable shows that firms with longer relationships had stronger credit growth. The insulating effects of relationships on total credit increased further during the European sovereign debt crisis, as shown by the marginally significant positive coefficient on the interaction of relationship duration 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 25th to the 75th percentile increases annual credit growth by 3.4 percentage points after 2008 and by around 4% after 2011, relative to an annual average credit growth of 2% per annum.

The control variables show that firms with a higher return on assets and a higher operating profit-to-interest expense ratio experienced stronger credit growth while larger firms and firms with higher leverage faced weaker credit growth. Overall, firms with higher default probability, as measured by the Z-scores, received less credit and such credit was granted at a higher cost.

Columns (3) and (4) estimate the effect of relationships on the average interest rate on total credit. Following the European sovereign debt crisis, the average interest rate on total credit was lower for firms with longer relationships. In economic terms, moving the credit-weighted relationship duration from the 25th to the 75th percentile reduced the average interest rate by nearly 30 basis points following the European sovereign debt crisis. Illes et al (2005) estimate that the average spread between Italian bank funding costs and average interest rates on loans to non-financial corporates was around 150 basis points for short-term loans and around 100 basis point for term loans. Therefore, the reduction in the average interest rates given to relationship borrowers was sizeable relative to the average spread on loans to non-financial corporates.

5.3 Relationships and investment

The results from estimating equation (2) on the investment rate are presented in columns (5) and (6) of Table 8. The positive and significant coefficient on the credit-weighted relationship duration 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. Regression (6) 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. Importantly, following the European sovereign debt crisis, the coefficient on the firm's credit-weighted relationship duration interacted with the post-2011 dummy variable is still positive and marginally significant. Therefore, longer relationships provided additional insulation to firm investment during the European sovereign debt crisis. Quantitatively the size of the effect on investment broadly matches that of relationship lending on credit. The control variables show that firms with a higher return on assets, higher leverage, higher profits relative to interest expenses and lower Z-score 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. For example, following the Lehman default shock, moving from the 25th to the 75th percentile of credit-weighted relationship duration increases the investment rate by 4.8 percentage points. This is sizeable given that the median investment rate over the sample period is -0.45 percent.

5.4 Relationships and employment

Columns (7) and (8) of Table 8 present 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 related to better data availability, in several respects it may be preferable because it can better capture changes in part-time work, overtime and differences in the human capital of employees. Following the Lehman default shock, firms with longer weighted relationship duration experienced stronger employment growth. This indicates that the insulation from the financial shock resulting from longer banking relationships helped smooth employment (similar to that for credit supply and investment). During the European sovereign debt crisis, the insulation effects of longer banking relationships on employment remained unchanged.

5.5 Instrumental variable regressions

Although our tests showed little evidence of systematic sorting between credit-weighted relationship duration and other observable firm characteristics, there remains a residual possibility of unobserved correlations affecting our results. Therefore, to address these endogeneity concerns between the formation of banking relationships and firm type in OLS estimation, we also estimate IV 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 M&As. Nevertheless, it is possible that bank mergers were correlated with firm opportunities, therefore, in Table 9, we test for the presence of sorting between firm type and our M&A instrument. Overall, we find little evidence for the presence of sorting, with the exception of firms with high leverage (in the 4th quartile) and Z-scores.

Table 10 presents first-stage estimates from regressing our instrument on the weighted relationship duration interacted with both the post-2008 and post-2011 dummy variables. There is a negative correlation between our instrument and the weighted relationship duration indicating that following bank M&As in 2006, firms which had longer relationship experienced smaller falls in their log relationship lengths than those with shorter relationships. The instrument is strong: the Kleibergen-Paap test statistics is very large in all four regressions (Table 11).

The IV estimates presented in Table 11 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 estimates may suffer

from some downward bias. Similarly, the IV estimates suggest a larger insulating effect of relationship duration on the average interest rate on total credit. In economic terms, the IV results suggest that moving the credit-weighted relationship duration from the 25th to the 75th percentile reduced the average interest rate by around 90 basis points. The enhanced insulation from relationships following the Lehman default shock resulted in a higher investment rate (column 3). While the point estimates of the additional insulation effect following the sovereign debt crisis are similar to the OLS estimates, the IV coefficient is not statistically significant.

Similar to investment, Column (3) shows that relationships insulated employment. Again, the IV coefficients are larger than for the OLS regressions. Following the European sovereign debt crisis in 2011, the insulation effect of relationship lending remained practically unchanged.

5.6 Valuable relationships and insulation effects

Do banks direct credit in a crisis to relationships which have the greatest value to the bank – and does this have any real effects? Table 4 showed that before the financial crisis, the interest rate on relationships with longer durations was higher. Bolton et al (2016) argue that this reflects the insurance role of banking relationships. In Table 12, we exploit the cross-section of pre-crisis interest rates on borrowing to test whether firms which paid greater insurance premiums (in terms of interest rates on relationship borrowing) before the crisis received more credit during the crisis. In particular, the triple interaction between the interest rate on pre-crisis borrowing interacted with relationship duration and the crisis dummy identifies whether firms which paid more for pre-crisis borrowing received more credit during the crisis. Column (1) shows that this was indeed the case. Columns (2) and (3) shows that this had concurrent real effects on employment, while having real effects on investment after the European sovereign debt crisis. These results indicate that banks did indeed direct credit to their most valuable relationships.

5.7 Bank and firm heterogeneity

5.7.1 Bank heterogeneity

The strength of bank balance sheets is a likely constraint on the ability of banks to insulate relationship clients. Table 13 examines how the real effects of relationship lending vary depend on the health of the bank. As documented above at the bank-firm relationship level, banks with low leverage did not insulate credit supply to firms with stronger relationships. Columns (1) and (2) confirm this at the firm level. Within the set of relationships that firms had with banks that had leverage ratios below the 25th percentile, longer relationships did not provide any insulation to firms, both following the Lehman default shock and the European sovereign debt crisis (Column (1)). By contrast, column (2) shows that longer relationships with better capitalised banks following the Lehman default shock did insulate credit supply, and this insulation actually increased significantly during the European sovereign debt crisis. Relative to our baseline results, the level of significance increases from the 10% level to the 5% level. Columns (3) and (4) show that the insulation (or absence) of credit supply by strongly (weakly) capitalised banks translate into firm investment decisions. The difference between the two types of bank is particularly stark during the European sovereign debt crisis.

5.7.2 Firm heterogeneity

The analysis of firm heterogeneity allows us to better understand which firms were supported by relationship lending during different stages of the financial crisis. Table 14 re-estimates our baseline regressions on subsamples of firms split by above- and below-median leverage, and profitability (measured by the return on assets) respectively. Overall, there is little evidence that firm heterogeneity affected the usefulness of relationships differed by firm heterogeneity. Although point estimates in columns (1)-(2) and (7)-(8) show that the insulation effects of relationship lending on credit were larger for firms with higher leverage but also with higher profitability, the differences are not statistically significant..

Comparing the other columns of Table 14, a coherent insulation effect can be detected on the dynamics of fixed assets and labour costs, with investment and employment of highly leveraged firms better protected.

5.8 Aggregate effects

To assess the aggregate effects of relationship banking following the Lehman default shock, we estimate equation (2) using weighted least squares and weighting the firm-level observations by the log of firm value added. It is possible that relationships are more important for smaller firms about which there is less hard information. This means that aggregating the results to the overall economy would suggest that the effects of relationships would be smaller the greater the number of small firms in the economy and that OLS estimates place an equal weight on all firms irrespective of size. However, the weighting of observations by firm value added would also bias results to just a handful of very large firms. Table 15 presents our results. Overall, the estimated effects weighted by the log of firm value added are so close to our baseline estimates in Table 8 that they are not statistically distinguishable. This is consistent with results in Table A2, which show little difference in the effect of relationship lending by firm size using estimates from sample splits of regression (1). This result is partially consistent with Berger and Black (2011) who find that the soft informational advantage for small banks is strongest for lending to the largest firms in the United States. To illustrate the large aggregate economic effects of relationships if we reduce each bank-firm relationship by one year, our estimates suggest that during the European sovereign debt crisis the annual growth rate of total credit would have been around 1.5 percentage points lower, the interest rate on total loans would have been 11 basis points higher. Turning to the effect on the real economy, firm investment rates would have been around 1.7 percentage points lower and employment cost growth 1 percentage point lower.

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 comprised information on interest rates, as the latter were only available for a representative sample of banks (about 100 bank holding companies, including all major banking groups). Table A3 re-estimates our baseline regressions on a homogenous sample for which information was available at the relationship-level for 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 particular mention because, in the homogenous sample, the coefficient on the relationship duration and the post-2008 dummy variable is larger and significant at the 10% level. This indicates that the insulation effect of relationships may also be present in term loans.

Table A4, 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 the total borrowing of firms from the Lehman default shock. Column (2) confirms that the initial insulation was evident for revolving credit lines following the Lehman default shock. But, in contrast to the baseline specification, the inclusion of all crisis interactions shows a statistically significant and complete loss of insulation for revolving credit lines following the European sovereign debt crisis. In column (3) and (5), the insulation effect on interest rates attached to revolving credit lines and term loans remains unchanged (or even slightly increased during the European sovereign debt crisis period).

The estimated effects on interest rates are based on the average interest rate on existing and new loans. Composition effects could affect our results, especially after the financial crisis when spreads on interest rates changed dramatically. In Table A5, we focus our estimation on the effect of the duration of relationships on the interest rates on new loans. Qualitatively, our results are unchanged, although we no longer find a significant effect of relationship duration on the interest rates on revolving credit lines. Moreover, we do not find a significant fall in the interest rates on new terms loans after the European sovereign debt crisis.

6.2 Relationship specific demands

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 first demand credit from banks with which they have stronger relationships, anticipating that lenders with weaker relationships 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 A6 formally tests for this by including a control variable that indicates whether a firm received a new term loan from the bank. Overall, the results are very similar and the insulation effects of relationship lending in a crisis are unaffected.

Another formal test of bank-specific demand shocks is whether the effect of relationship duration is still present in a subsample of relationships that are important to the firm. Table A7

presents estimates of our baseline regressions on a subsample of relationships where drawn credit is greater than 50% of total credit granted from revolving credit lines. Again, the point estimates of the effect of relationships during the two crisis periods are barely changed.

Relationships with non-viable zombie firms may influence the decision to provide credit to firms with longer relationships, resulting in an evergreening of existing loans. We test this by including a dummy variable for relationships where loans are past due by at least 90 days and an interaction of relationship duration with past due loans. Table A7 shows that our baseline results of insulation are very similar. We do however, find that credit growth was higher in the case of relationships with borrowers with past due loans. For term loans, this effect decreases with the duration of the relationship.

6.3 Additional firm demand control variables in firm level regressions

Jimenez et al (2015) and Bonaccorsi di Patti and Sette (2012) show that including the estimated Firm*Time fixed effects from regression (1) as a control in the firm-level regression (2) corrects for the bias resulting from firm-specific demand shocks on credit demand. In Table A9, we present our baseline results including this additional control variable. We find that the estimated Firm*Time fixed effects are indeed positively correlated with credit received, indicating the prevalence of firm-specific demand shocks. Nevertheless, the inclusion of this additional control variable does not materially alter the baseline results presented in Table 8.

An alternative way to control for firm-level demand shocks is through the use of firm-level survey data on expected demand. Merging data from the Bank of Italy Survey of Industrial and Service Firms significantly reduces our sample size from around 62,000 observations to just under 1,900, which reduces sharply the precision of our estimates. Qualitatively, our estimates are of a similar magnitude but they are no longer significant, potentially due to the much reduced sample size.

6.4 Triple interactions

Triple interactions tests confirm our baseline results on the effects of bank and firm heterogeneity derived from sample split regressions in section 5.7. Table A10 includes a triple interaction between credit-weighted relationship duration, bank leverage, and the post-2008 and post-2011 time dummies. Qualitatively these regressions confirm our baseline finding that following the Lehman default shock and the European sovereign debt crisis, only banks with higher capital ratios were able to insulate credit supply for borrowers with longer relationships (column 1). We find a corresponding effect on employment (column 3) but the triple interaction for investment is not significant (column 2).

To test the effects of firm heterogeneity, Table A11, uses a triple interaction between relationship duration, the post-2008 and post-2011 time dummies and a dummy variable indicating below median firm profitability or leverage. Overall, the generally insignificant triple interactions terms is consistent with the sample split regressions in Table 14, which found that relationship lending is little affected by firm heterogeneity. However, triple interaction term indicate that relationships insulated credit supply to firms with higher leverage.

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7. CONCLUSIONS

The role of relationship lending in shielding borrowers' lending conditions from idiosyncratic shocks has been extensively investigated in academic studies. Conversely, much less is known about how such insulation effects are of use to firms in a crisis, in particular whether they translate into higher investment and employment.

This paper tries to fill this gap in the literature by analysing in a comprehensive way the various steps in the mechanism. We first analyse how banking relationships affect the supply of lending and the cost of firm's funding. We then subsequently investigate how such insulation effects influence firms' investment and employment decisions. To this end, we merge detailed information at the bank-firm level from the Italian Credit Register, supervisory reports of the Bank of Italy and financial statements of firms. The richness of the database allows us to take into account bank, firm and bank-firm relationship characteristics.

We contribute to the literature by analysing two recent crises: the period after Lehman's default shock (2008–2010), when the Italian banking system was relatively unaffected, and the period that followed the European sovereign debt crisis (2010–2013), when Italian banks faced much graver risks.

We find that following the Lehman default shock, firms that had enjoyed longer relationships with banks experienced stronger credit growth and lower interest rates on both revolving credit lines and term loans. The insulation effects of relationship lending was still present during the European sovereign debt crisis. In terms of the real effects, we find that following the Lehman default shock, firms that had maintained longer banking relationships used the insulation to maintain stronger investment and employment growth. However, longer-term relationships only insulated firms that maintained close relationships with better capitalised banks. We also find evidence that banks provided more insulation towards their most valuable relationships which had real effects of investment and employment.

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Table 1: Descriptive Statistics: Bank-firm relationship level

	ΔLog (Total credit)	ΔLog (Revolving credit lines)	ΔLog (Term loans)	Interest rate on revolving credit lines	Interest rate on term loans	Relationship duration (in years)	Log (relationship duration)	Log credit granted	Drawn credit /credit granted	Share of revolving credit lines used
Mean	-0.490	0.281	-8.771	10.89	4.459	5.740	1.704	12.95	56.78	23.90
Median	0	0	-9.245	9.235	4.377	6	1.946	12.77	60.09	13.22
Standard deviation	36.08	43.44	67.97	7.609	1.805	3.625	0.717	1.091	32.42	27.66
25th percentile	-11.84	0	-37.94	6.939	3.010	3	1.386	12.13	30.81	5.245
75th percentile	7.891	0	11.57	12.57	5.789	8	2.197	13.59	85.11	31.03
No. of observations	314649	278883	169803	204030	136484	314649	314649	314649	314649	314649

Table 2: Descriptive Statistics: Firm level

	ΔLog (Total credit)	Average interest rate on total credit	Investment Rate (growth rate of fixed assets)	ΔLog (Employment costs)	Credit weighted log relationship duration in 2006	Credit weighted log relationship duration	Return on assets	Leverage (Debt / total assets in %)	EBITDA/ Interest expense	Log (total assets)
Mean	2.019	12.96	17.98	4.039	1.400	1.461	0.550	80.26	6.717	8.042
Median	0	12.37	-0.775	3.574	1.479	1.512	0.432	84.33	3.354	7.885
Standard deviation	31.14	6.388	75.82	24.45	0.511	0.583	4.923	16.59	13.92	1.264
25th percentile	-12.49	8.817	-9.442	-5.082	1.062	1.060	-0.281	70.97	1.652	7.149
75th percentile	16.70	15.89	15.62	12.41	1.811	1.900	1.869	93.11	6.972	8.788
No. of observations	82692	81092	82314	79420	65398	82692	80551	82633	82294	82689

Table 3: Effects of lending relationships on credit

	(1) ΔLog (Total credit)	(2) ΔLog (Total credit)	(3) ΔLog (Revolving credit lines)	(4) ΔLog (Revolving credit lines)	(5) ΔLog (Term loans)	(6) ΔLog (Term loans)
Relationship duration$_{t-1}$	0.493**	-0.245	1.189***	0.702**	0.151	-0.549
	(0.200)	(0.292)	(0.195)	(0.306)	(0.336)	(0.823)
Relationship duration$_{t-1}$*D(Post 2008)		1.111***		0.906**		1.038
		(0.348)		(0.429)		(1.087)
Relationship duration$_{t-1}$*D(Post 2011)		-0.208		-0.489		-0.215
		(0.341)		(0.337)		(0.944)
Log credit granted$_{t-1}$	-14.33***	-14.33***	-13.03***	-13.03***	-9.018***	-9.018***
	(0.427)	(0.427)	(0.605)	(0.606)	(0.799)	(0.800)
Drawn/granted$_{t-1}$	0.0452***	0.0453***	0.0991***	0.0992***	0.00247	0.00262
	(0.00500)	(0.00500)	(0.00850)	(0.00850)	(0.0315)	(0.0315)
Share revolving credit lines$_{t-1}$	0.0534***	0.0534***	-0.610***	-0.610***	0.416***	0.416***
	(0.00485)	(0.00487)	(0.0274)	(0.0274)	(0.0230)	(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: Relationship duration, the log number of years the bank and the firm have a relationship since 1998 ; 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 text. 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 lending relationships on interest rates

	(1) Interest rate on revolving credit lines	(2) Interest rate on revolving credit lines	(3) Interest rate on term loans	(4) Interest rate on term loans
Relationship duration$_{t-1}$	0.913***	1.180***	0.0143	0.0830***
	(0.0742)	(0.0917)	(0.0110)	(0.0135)
Relationship duration $_{t-1}$*D(Post 2008)		-0.322***		-0.0586***
		(0.0821)		(0.0192)
Relationship duration $_{t-1}$*D(Post 2011)		-0.0968		-0.0688***
		(0.0861)		(0.0222)
Log credit granted $_{t-1}$	-0.742***	-0.742***	-0.185***	-0.185***
	(0.0442)	(0.0441)	(0.0134)	(0.0135)
Drawn/granted$_{t-1}$	0.00397***	0.00392***	-0.00284***	-0.00286***
	(0.00100)	(0.00101)	(0.000299)	(0.000297)
Share revolving credit lines $_{t-1}$	-0.0359***	-0.0359***	0.00314***	0.00313***
	(0.00291)	(0.00292)	(0.000346)	(0.000347)
Bank*Time fixed effects	Yes	Yes	Yes	Yes
Firm*Time fixed effects	Yes	Yes	Yes	Yes
Observations	219763	219763	125791	125791
R-squared	0.555	0.555	0.719	0.719

Note: The table shows OLS estimates of regressions for annual 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. 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*. Control variables are: Relationship duration, the log number of years the bank and the firm have a relationship since 1998; 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 text. 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: Effects of bank heterogeneity on relationship lending at the relationship level

VARIABLES	(1) ΔLog (Total credit) low tier 1 ratio	(2) ΔLog (Total credit) high tier 1 ratio	(3) Interest rate on revolving credit lines low tier 1 ratio	(4) Interest rate on revolving credit lines high tier 1 ratio	(5) Interest rate on term loans low tier 1 ratio	(6) Interest rate on term loans high tier 1 ratio
Relationship duration$_{t-1}$	-0.750	-0.0153	1.348***	1.144***	0.0325	0.0770***
	(1.127)	(0.342)	(0.362)	(0.0986)	(0.0610)	(0.0173)
Relationship duration$_{t-1}$*D(Post 2008)	1.074	0.776*	-0.901**	-0.217***	-0.0811	-0.0615***
	(1.494)	(0.444)	(0.377)	(0.0746)	(0.0861)	(0.0222)
Relationship duration$_{t-1}$*D(Post 2011)	-0.514	0.0207	0.400*	-0.170*	0.0301	-0.0639**
	(1.103)	(0.431)	(0.224)	(0.0994)	(0.0801)	(0.0252)
Log credit granted$_{t-1}$	-13.97***	-14.40***	-0.785***	-0.693***	-0.169***	-0.174***
	(0.935)	(0.472)	(0.118)	(0.0421)	(0.0355)	(0.0135)
Drawn/granted$_{t-1}$	0.0472***	0.0475***	-0.000250	0.00433***	-0.00197*	-0.00287***
	(0.0138)	(0.00627)	(0.00294)	(0.00104)	(0.000962)	(0.000402)
Share revolving credit lines$_{t-1}$	0.0560***	0.0565***	-0.0338***	-0.0365***	0.00245	0.00310***
	(0.0155)	(0.00541)	(0.00441)	(0.00342)	(0.00149)	(0.000469)
Bank * Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm * Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	23487	238179	16195	164448	7455	93552
R-squared	0.529	0.428	0.615	0.580	0.711	0.749

Note: The table shows OLS estimates of regressions for annual changes in credit granted (and interest rates) 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. High (low) sample splits defined as Tier 1 capital ratio above 75th (below 25th) percentile. Control variables are: Relationships duration, the log number of years the bank and the firm have a relationship since 1998; 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 text. 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: Effects of firm heterogeneity on relationship lending at the relationship level

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	ΔLog (Total credit)		Interest rate on revolving credit lines		Interest rate on term loans		ΔLog (Total credit)		Interest rate on revolving credit lines		Interest rate on term loans	
VARIABLES	low leverage	high leverage	low leverage	high leverage	low leverage	high leverage	low profitability	high profitability	low profitability	high profitability	low profitability	high profitability
Relationship duration$_{t-1}$	0.257	-0.666	0.908***	1.392***	0.0686***	0.0962***	-0.150	-0.180	1.274***	1.088***	0.0730***	0.0885***
	(0.404)	(0.409)	(0.126)	(0.106)	(0.0204)	(0.0177)	(0.379)	(0.369)	(0.123)	(0.130)	(0.0186)	(0.0172)
Relationship duration$_{t-1}$*D(Post 2008)	1.022**	1.196**	-0.130	-0.471***	-0.0536*	-0.0547**	1.270**	0.775*	-0.366***	-0.309**	-0.0401*	-0.0667**
	(0.452)	(0.505)	(0.109)	(0.110)	(0.0271)	(0.0254)	(0.531)	(0.418)	(0.102)	(0.135)	(0.0225)	(0.0259)
Relationship duration$_{t-1}$*D(Post 2011)	-0.241	-0.282	-0.0257	-0.161*	-0.0440	-0.0960***	-0.830	0.390	-0.0849	-0.0994	-0.0461	-0.0930***
	(0.406)	(0.503)	(0.124)	(0.0876)	(0.0308)	(0.0345)	(0.512)	(0.385)	(0.106)	(0.0938)	(0.0317)	(0.0299)
Log credit granted$_{t-1}$	-13.96***	-14.92***					-13.32***	-15.67***				
	(0.502)	(0.392)					(0.394)	(0.522)				
Drawn/granted$_{t-1}$	0.0364***	0.0572***					0.0575***	0.0354***				
	(0.00597)	(0.00574)					(0.00628)	(0.00586)				
Share revolving credit lines$_{t-1}$	0.0600***	0.0446***					0.0486***	0.0576***				
	(0.00591)	(0.00619)					(0.00789)	(0.00697)				
Bank * Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm * Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	163925	150376	105237	114272	66347	59214	148398	159176	112224	102376	62567	60237
R-squared	0.396	0.414	0.535	0.565	0.734	0.701	0.400	0.404	0.561	0.550	0.711	0.733

Note: The table shows OLS estimates of regressions for annual changes in credit granted (and interest rates) 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. High (low) sample splits defined as above (below) median. Leverage: debt/total assets, Profitability: return on assets. Control variables are: Relationship duration, the log number of years the bank and the firm have a relationship, since 1998; 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 text. 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 7: 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	83.15	81.66	80.34	15.74
	(0.32)	(0.20)	(0.11)	(0.03)	
Return on assets	0.53	0.60	0.72	0.75	5.19
	(0.06)	(0.07)	(0.10)	(0.10)	
EBITDA/Value added	40.57	36.88	35.98	34.26	48.92
	(0.14)	(0.07)	(0.06)	(0.02)	
Z-score	5.71	5.42	5.24	5.13	1.63
	(0.28)	(0.1)	(-0.01)	(-0.08)	
ΔLog (Total credit)	15.58	9.53	7.04	5.27	32.21
	(0.4)	(0.24)	(0.17)	(0.11)	
Investment rate	39.9	28.69	24.64	23.73	61.36
	(0.17)	(-0.01)	(-0.08)	(-0.09)	
ΔLog (Labour costs)	14.8	8.34	6.93	5.17	24.23
	(0.4)	(0.18)	(0.13)	(0.05)	
Tangible investment/ Total	52.39	53.08	50.85	49.41	44.75
investment	(-0.35)	(-0.33)	(-0.38)	(-0.41)	

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. Return on assets: earnings before interest, tax, depreciation and amortization (EBITDA) over the book value of total assets; Firm leverage: ratio of total debt divided by the book value of assets.

Table 8: Real effects of relationship lending at the firm level

VARIABLES	ΔLog (Total credit)		Average interest rate on total credit		Investment Rate		ΔLog (Labour costs)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Weighted relationship duration*D(Post 2008)	4.435***	4.260***	-0.115	-0.0918	3.893***	4.440***	4.314***	4.289***
	(0.661)	(0.661)	(0.111)	(0.111)	(1.267)	(1.282)	(0.514)	(0.507)
Weighted relationship duration*D(Post 2011)	1.158*	1.011*	-0.303***	-0.364***	1.811	2.015*	0.457	0.531
	(0.616)	(0.611)	(0.108)	(0.108)	(1.172)	(1.163)	(0.499)	(0.497)
Return on assets		0.301***		-0.00413		0.245***		0.455***
		(0.0435)		(0.00653)		(0.0817)		(0.0351)
Firm leverage		-0.135***		0.0197***		-0.0910**		-0.0515***
		(0.0193)		(0.00330)		(0.0388)		(0.0160)
EBITDA/interest expenses		0.149***		-0.0127***		0.280***		0.0395***
		(0.0191)		(0.00367)		(0.0358)		(0.0104)
Log (firm total assets)		-10.73***		0.0527		-28.98***		-4.436***
		(0.628)		(0.104)		(1.357)		(0.506)
Z-Score		-2.695***		0.314***		-1.872**		-0.229
		(0.451)		(0.0700)		(0.854)		(0.360)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	62995	62797	61759	61563	62837	62644	61110	60987
R-squared	0.194	0.194	0.549	0.547	0.245	0.244	0.275	0.274

Note: The table shows OLS estimates of regressions for credit granted by banks, average interest rates on total credit, investment rates and labour costs of 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 log of the number of years that the bank and the firm have a relationship between 1998 and 2006 weighted by the share of credit in each relationship in 2006; 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 totaldebt divided by the book value of assets. Further details on the dependent and control variables are in the text. 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 9: A test for the presence of sorting in lending relationships with banks that merged in 2006

	1st Quartile	2nd Quartile	3rd Quartile	4th Quartile	Standard deviation
Leverage	79.32	81.92	84.08	84.97	15.74
(Total debt/Total assets)	(-0.03)	(0.12)	(0.26)	(0.30)	
Return on assets	0.82	0.78	0.64	0.36	5.19
	(0.11)	(0.11)	(0.08)	(0.03)	
EBITDA/Value added	35.33	33.96	36.6	41.81	48.92
	(0.04)	(0.02)	(0.07)	(0.16)	
Z-score	5.02	5.23	5.51	5.75	1.63
	(-0.15)	(-0.02)	(0.16)	(0.30)	

Note: The number in parentheses is the normalized difference of the share of credit from banks which merged in 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. Return on assets: earnings before interest, tax, depreciation and amortization (EBITDA) over the book value of total assets; Firm leverage: ratio of total debt divided by the book value of assets.

Table 10: Instrumental variable: First stage estimates

	(1) Weighted relationship duration*D(Post 2008)	(2) Weighted relationship duration*D(Post 2011)
Change in 2006 weighted relationship duration due to M&As in 2006*D(Post 2008)	-0.00136***	0.000075***
	(3.50e-05)	(6.86e-06)
Change in 2006 weighted relationship duration due to M&As in 2006*D(Post 2011)	1.92e-05*	-0.00151***
	(1.09e-05)	(0.000342)
Return on assets	0.000054	-0.0001711
	(0.000358)	(0.000343)
Firm leverage	-0.000929***	-0.000571***
	(0.000223)	(0.000209)
EBITDA/interest expenses	0.000496***	0.000398***
	(0.000163)	(0.000153)
Log (firm total assets)	-0.0954***	-0.0613***
	(0.00722)	(0.00681)
Z-Score	0.0121***	0.0097***
	(0.00410)	(0.00374)
Observations	62,797	62,797
R-squared	0.936	0.921

Note: The table shows first stage estimates of regressing the Weighted ons for 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. Weighted relationship duration: the log of the number of years between 1998 and 2006 that the bank and the firm had a relationship weighted by the share of credit to the firm in each in each relationship in 2006. 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 debt divided by the book value of assets. Further details on the dependent and control variables are in the text. 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 11: Instrumental variable estimates of the real effects of relationship lending

	(1) ΔLog (Total credit)	(2) Average interest rate on total credit	(3) Investment rate	(4) ΔLog (Labour costs)
Weighted relationship duration*D(Post 2008)	8.914***	-0.139	8.920***	6.430***
	(1.551)	(0.267)	(2.874)	(1.166)
Weighted relationship duration*D(Post 2011)	-1.780	-1.278***	2.646	0.613
	(1.364)	(0.268)	(2.532)	(1.069)
Time fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	62797	61563	62644	60987
R-squared	0.193	0.546	0.244	0.274
Kleibergen-Paap weak identification F-statistic	743.39	772.21	738.58	703.22

Note: The table shows IV estimates of regressions for credit granted, average interest rates on total credit, investment rates and labour costs of 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 log of the number of years between 1998 and 2006 that the bank and the firm had a relationship weighted by the share of credit to the firm in each in each relationship in 2006. This is instrumented by the difference between the credit-weighted log length of relationships and the log length of relationships affected by M&As in 2006. 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. Additional control variables included: Return on assets: earnings before interest, tax, depreciation and amortization (EBITDA) over the book value of total assets; Firm leverage: ratio of total debt divided by the book value of assets, EBITDA/interest expenses, log(total assets) and Z-score. Further details on the dependent and control variables are in the text. 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 12: The real effects of relationship lending in the cross-section of pre-crisis interest rates

	(1) ΔLog (Total credit)	(2) Investment rate	(3) ΔLog (Labour costs)
Average interest rate on credit in 2006 *D(Post 2008)	-0.0137*	-0.0246	-0.0168**
	(0.00825)	(0.0224)	(0.00683)
Average interest rate on credit in 2006 *D(Post 2011)	-0.000760	-0.0235**	-0.0157***
	(0.00677)	(0.0118)	(0.00567)
Weighted relationship duration*D(Post 2008)	2.119*	1.999	2.892***
	(1.218)	(2.847)	(0.905)
Weighted relationship duration*D(Post 2011)	1.346	0.300	0.0175
	(1.087)	(2.022)	(0.789)
Average interest rate on credit in 2006 *Weighted relationship duration*D(Post 2008)	0.00955*	0.00751	0.00717*
	(0.00506)	(0.0135)	(0.00410)
Average interest rate on credit in 2006 *Weighted relationship duration*D(Post 2011)	-0.00120	0.0159**	0.00518
	(0.00429)	(0.00749)	(0.00346)
Return on assets	0.339***	0.172*	0.435***
	(0.0521)	(0.0959)	(0.0397)
Firm leverage	-0.170***	-0.109**	-0.0716***
	(0.0217)	(0.0443)	(0.0172)
EBITDA/interest expenses	0.163***	0.318***	0.0452***
	(0.0254)	(0.0492)	(0.0140)
Log (firm total assets)$_1$	-11.68***	-28.21***	-4.399***
	(0.724)	(1.492)	(0.566)
Z-score	-2.436***	-1.409	-0.0903
	(0.498)	(0.908)	(0.390)
Time fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Observations	48770	48700	47562
R-squared	0.196	0.236	0.269

Note: The table shows OLS estimates of regressions for credit granted, investment rates and labour costs of 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: Average interest rate on credit in 2006: Credit weighted average interest rate on total credit in 2006 inclusive of fees and commissions; Weighted relationship duration: the log of the number of years between 1998 and 2006 that the bank and the firm had a relationship weighted by the share of credit to the firm in each in each relationship in 2006; 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; Bank leverage: total debt/total assets; Return on assets: earnings before interest, tax, depreciation and amortization (EBITDA) over the book value of total assets; Firm leverage: ratio of total debt divided by the book value of assets. Further details on the dependent and control variables are in the text. 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 13: Real effects of bank heterogeneity on relationship lending at the firm level

VARIABLES	(1) ΔLog (Total credit) High leverage banks	(2) ΔLog (Total credit) Low leverage banks	(3) Investment rate High leverage banks	(4) Investment rate Low leverage banks	(5) ΔLog (Labour costs) High leverage banks	(6) ΔLog (Labour costs) Low leverage banks
Weighted relationship duration*D(Post 2008)	1.758	3.500***	3.255	5.087***	3.865***	5.247***
	(2.012)	(0.813)	(3.244)	(1.708)	(1.352)	(0.679)
Weighted relationship duration*D(Post 2011)	0.0615	1.832**	-0.550	3.132**	1.286	1.124*
	(1.689)	(0.722)	(2.908)	(1.472)	(1.124)	(0.650)
Return on assets	0.244**	0.292***	0.348*	0.178*	0.508***	0.444***
	(0.107)	(0.0473)	(0.205)	(0.0949)	(0.0772)	(0.0425)
Firm leverage	-0.216***	-0.104***	-0.241**	-0.0700	-0.0513	-0.0586***
	(0.0521)	(0.0215)	(0.107)	(0.0442)	(0.0452)	(0.0183)
EBITDA/interest expenses	0.158***	0.0942***	0.217***	0.308***	0.00150	0.0506***
	(0.0461)	(0.0221)	(0.0757)	(0.0462)	(0.0208)	(0.0130)
Log (firm total assets)$_1$	-10.37***	-10.56***	-36.48***	-27.22***	-3.482***	-4.776***
	(1.612)	(0.724)	(3.803)	(1.579)	(1.324)	(0.586)
Z-score	-2.875**	-2.679***	1.677	-2.520**	0.413	-0.119
	(1.161)	(0.502)	(2.026)	(0.990)	(0.825)	(0.422)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13442	46775	13395	46685	13149	45332
R-squared	0.287	0.238	0.345	0.273	0.367	0.298

Note: The table shows OLS estimates of regressions for credit granted, investment rates and labour costs of 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. High (low) bank leverage defined the ratio of debt liabilities to total assets being above 75th (below 25th) percentile. Dependent variables are: Weighted relationship duration: the log of the number of years between 1998 and 2006 that the bank and the firm had a relationship weighted by the share of credit to the firm in each in each relationship in 2006; 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 debt divided by the book value of assets. 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 14: Real effects of firm heterogeneity on relationship lending at the firm level

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	ΔLog (Total credit)		Investment rate		ΔLog (Labour costs)		ΔLog (Total credit)		Investment rate		ΔLog (Labour costs)	
VARIABLES	Low leverage	high leverage	low leverage	high leverage	low leverage	high leverage	low profitability	high profitability	low profitability	high profitability	low profitability	high profitability
Weighted relationship duration*D(Post 2008)	3.007***	4.982***	2.760	5.016**	3.198***	5.458***	3.843***	4.687***	2.331	3.700*	4.289***	3.945***
	(1.011)	(0.990)	(1.750)	(2.003)	(0.702)	(0.815)	(1.031)	(1.024)	(1.743)	(2.128)	(0.776)	(0.735)
Weighted relationship duration*D(Post 2011)	2.362**	-0.0295	1.164	3.579*	-0.244	0.449	1.114	1.007	4.195**	0.508	0.124	0.626
	(0.921)	(0.924)	(1.604)	(1.858)	(0.663)	(0.804)	(0.982)	(0.924)	(1.695)	(1.879)	(0.775)	(0.711)
Return on assets	0.232***	0.316***	0.324***	0.337**	0.343***	0.524***	0.358***	0.0725	-0.141	0.682***	0.514***	0.159**
	(0.0641)	(0.0712)	(0.108)	(0.140)	(0.0494)	(0.0593)	(0.0660)	(0.0933)	(0.122)	(0.184)	(0.0553)	(0.0650)
Firm leverage	-0.124***	-0.213***	-0.231***	-0.0205	-0.0468**	-0.130**	-0.169***	-0.114***	-0.131**	-0.0188	-0.0759***	-0.0211
	(0.0288)	(0.0679)	(0.0523)	(0.135)	(0.0211)	(0.0569)	(0.0296)	(0.0318)	(0.0555)	(0.0650)	(0.0254)	(0.0222)
EBITDA/interest expenses	0.139***	0.232***	0.221***	0.371***	0.0217**	0.138***	0.0528	0.167***	0.0635	0.259***	0.0950***	0.0422***
	(0.0228)	(0.0468)	(0.0411)	(0.0979)	(0.0104)	(0.0337)	(0.0515)	(0.0222)	(0.0794)	(0.0451)	(0.0325)	(0.0121)
Log (firm total assets)$_1$	-7.994***	-12.60***	-26.37***	-30.66***	-2.350***	-6.135***	-12.42***	-9.924***	-27.58***	-29.76***	-5.203***	-4.572***
	(0.955)	(1.032)	(1.956)	(2.198)	(0.731)	(0.838)	(1.076)	(0.982)	(2.116)	(2.189)	(0.830)	(0.743)
Z-score	-1.190	-2.650***	-2.677*	-1.910*	-1.797**	1.081**	-1.974***	-2.537***	-0.346	-4.625**	0.616	0.571
	(0.967)	(0.571)	(1.418)	(1.141)	(0.753)	(0.475)	(0.593)	(0.917)	(1.104)	(1.848)	(0.468)	(0.772)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	32373	28759	32314	28667	31561	27824	29933	29832	29857	29756	29017	29046
R-squared	0.202	0.251	0.291	0.277	0.304	0.314	0.258	0.247	0.309	0.303	0.344	0.335

Note: The table shows OLS estimates of regressions for credit granted, investment rates and labour costs of 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. High (low) sample splits defined as above (below) median. Weighted relationship duration: the log of the number of years between 1998 and 2006 that the bank and the firm had a relationship weighted by the share of credit to the firm in each in each relationship in 2006; 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 debt divided by the book value of assets. 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 15: Real effects of Relationship lending at the firm level: Weighted by log value added.

	(1) ΔLog (Total credit)	(2) Average interest rate on total credit	(3) Investment rate	(4) ΔLog (Labour costs)
Weighted relationship duration*D(Post 2008)	4.114***	-29.79***	3.879***	3.715***
	(0.684)	(2.847)	(1.233)	(0.477)
Weighted relationship duration*D(Post 2011)	1.191*	-13.59***	2.007*	0.693
	(0.630)	(2.883)	(1.128)	(0.469)
Return on assets	0.339***	-0.756***	0.337***	0.450***
	(0.0495)	(0.207)	(0.0879)	(0.0339)
Firm leverage	-0.137***	0.276***	-0.0829**	-0.0459***
	(0.0201)	(0.103)	(0.0386)	(0.0147)
EBITDA/interest expenses	0.150***	-0.200**	0.264***	0.0350***
	(0.0205)	(0.0993)	(0.0342)	(0.00969)
Log (firm total assets)	-10.41***	-5.585*	-28.74***	-4.393***
	(0.634)	(3.100)	(1.329)	(0.478)
Z-Score	-2.719***	4.435***	-2.025**	-0.335
	(0.464)	(1.711)	(0.826)	(0.337)
Time fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	62335	41696	62199	60638
R-squared	0.191	0.707	0.245	0.270

Note:. The table shows WLS estimates of regressions, weighted by the logarithm of value-added for credit granted, average interest rates on total credit, investment rates and labour costs of 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. Weighted relationship duration: the log of the number of years between 1998 and 2006 that the bank and the firm had 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 debt divided by the book value of assets. 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.

Appendix A: Robustness tests

Table A1: Effects of bank size on relationship lending at the relationship level

VARIABLES	(1) ΔLog (Total credit)	(2)	(3) Interest rate on revolving credit lines	(4)	(5) Interest rate on term loans	(6)
	Small banks	Large banks	Small banks	Large banks	Small banks	Large banks
Relationship duration$_{t-1}$	-2.407***	0.129	0.734***	1.340***	0.104***	0.0660***
	(0.747)	(0.329)	(0.242)	(0.113)	(0.0364)	(0.0179)
Relationship duration$_{t-1}$*D(Post 2008)	2.176**	1.240**	0.0624	-0.457***	-0.109**	-0.0112
	(0.899)	(0.484)	(0.209)	(0.0849)	(0.0516)	(0.0219)
Relationship duration$_{t-1}$*D(Post 2011)	-0.125	-0.519	0.0259	-0.0988	-0.0815	-0.104***
	(0.943)	(0.480)	(0.148)	(0.102)	(0.0617)	(0.0298)
Log credit granted$_{t-1}$	-11.21***	-15.69***	-0.676***	-0.765***	-0.0940***	-0.203***
	(0.681)	(0.406)	(0.0874)	(0.0584)	(0.0313)	(0.0148)
Drawn/granted$_{t-1}$	0.0292**	0.0531***	0.00423*	0.00394***	-0.00225***	-0.00318***
	(0.0133)	(0.00506)	(0.00217)	(0.00109)	(0.000831)	(0.000347)
Share revolving credit lines$_{t-1}$	0.0613***	0.0455***	-0.0265***	-0.0396***	0.00388***	0.00266***
	(0.0134)	(0.00518)	(0.00304)	(0.00344)	(0.00112)	(0.000445)
Bank * Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm * Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	37500	220340	24460	154456	12052	85583
R-squared	0.522	0.433	0.662	0.567	0.787	0.730

Note: The table shows OLS estimates of regressions for 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. High (low) sample splits defined as above 75th (below 25th) percentile. Control variables are: Relationship duration, the log number of years since the bank and the firm have a relationship, counting from 1998; 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: Effects of firm size on relationship lending at the relationship level

	(1)	(2)	(3)	(4)	(5)	(6)
	ΔLog (Total credit)		Interest rate on revolving credit lines		Interest rate on term loans	
VARIABLES	Small firms	Large firms	Small firms	Large firms	Small firms	Large firms
Relationship duration$_{t-1}$	-0.505	-0.0227	1.045***	1.250***	0.0805***	0.0851***
	(0.387)	(0.429)	(0.0981)	(0.121)	(0.0255)	(0.0183)
Relationship duration$_{t-1}$*D(Post 2008)	1.050**	1.177**	-0.381***	-0.305***	-0.0760*	-0.0467*
	(0.510)	(0.474)	(0.108)	(0.106)	(0.0385)	(0.0251)
Relationship duration$_{t-1}$*D(Post 2011)	-0.582	-0.184	-0.0992	-0.121	-0.0470	-0.0848***
	(0.429)	(0.444)	(0.106)	(0.103)	(0.0456)	(0.0244)
Log credit granted$_{t-1}$	-16.95***	-13.77***				
	(0.376)	(0.475)				
Drawn/granted$_{t-1}$	0.0393***	0.0495***				
	(0.00477)	(0.00635)				
Share revolving credit lines$_{t-1}$	0.0561***	0.0512***				
	(0.00539)	(0.00619)				
Bank * Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm * Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	120024	194481	85591	134041	36125	89481
R-squared	0.488	0.371	0.606	0.532	0.722	0.718

Note: The table shows OLS estimates of regressions for 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. High (low) sample splits defined as above (below) median. Leverage: debt/total assets, Profitability: return on equity. Control variables are: Relationship duration, the log number of years since the bank and the firm have a relationship, counting from 1998; 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: Homogeneous sample for credit quantity and interest rates

	(1)	(2)	(3)	(4)	(5)
	ΔLog (Total credit)	ΔLog (Revolving credit lines)	Interest rate on revolving credit lines	ΔLog (Term loans)	Interest rate on term loans
Relationship duration$_{t-1}$	-0.324	0.748**	1.190***	-1.462	0.0843***
	(0.339)	(0.346)	(0.0885)	(0.889)	(0.0151)
Relationship duration $_{t-1}$*D(Post 2008)	1.685***	0.956*	-0.338***	2.092*	-0.0607***
	(0.448)	(0.495)	(0.0829)	(1.130)	(0.0212)
Relationship duration $_{t-1}$*D(Post 2011)	-0.0902	-0.699	-0.118	0.0533	-0.0460*
	(0.407)	(0.422)	(0.0963)	(0.969)	(0.0256)
Log credit granted $_{t-1}$	-17.53***	-13.39***	-0.725***	-6.266***	-0.181***
	(0.422)	(0.596)	(0.0462)	(0.651)	(0.0148)
Drawn/granted$_{t-1}$	0.0774***	0.105***	0.00418***	-0.0233**	-0.00289***
	(0.00530)	(0.00794)	(0.000901)	(0.0109)	(0.000326)
Share revolving credit lines $_{t-1}$	0.0670***	-0.602***	-0.0356***	0.361***	0.00277***
	(0.00703)	(0.0266)	(0.00283)	(0.0220)	(0.000431)
Bank*Time fixed effects	Yes	Yes	Yes	Yes	Yes
Firm*Time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	208134	199820	199820	103185	103185
R-squared	0.429	0.396	0.572	0.409	0.736

Note: The table shows OLS estimates of regressions for 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: Relationship duration, the log number of years since the bank and the firm have a relationship, counting from 1998; 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 A4: All interactions

	(1) ΔLog (Total credit)	(2) ΔLog (Revolving credit lines)	(3) Interest rate on revolving credit lines	(4) ΔLog (Term loans)	(5) Interest rate on term loans
Relationship duration$_{t-1}$	0.0738	0.787**	1.124***	-0.0674	0.0745***
	(0.308)	(0.345)	(0.0921)	(0.773)	(0.0134)
Relationship duration$_{t-1}$*D(Post 2008)	0.754**	1.037**	-0.266***	0.370	-0.0594***
	(0.331)	(0.462)	(0.0822)	(1.068)	(0.0192)
Relationship duration$_{t-1}$*D(Post 2011)	-0.433	-1.098***	-0.0485	-0.276	-0.0431*
	(0.330)	(0.329)	(0.0785)	(0.963)	(0.0224)
Log credit granted$_{t-1}$	-16.10***	-13.81***	-0.551***	-12.45***	-0.134***
	(0.563)	(0.817)	(0.0697)	(1.085)	(0.0162)
Log credit granted$_{t-1}$*D(Post 2008)	2.096***	-0.311	-0.186**	4.015***	0.00244
	(0.596)	(0.977)	(0.0760)	(1.037)	(0.0153)
Log credit granted$_{t-1}$*D(Post 2011)	1.056*	3.331***	-0.176**	1.909**	-0.164***
	(0.557)	(1.062)	(0.0834)	(0.932)	(0.0250)
Drawn/granted$_{t-1}$	0.0378***	0.115***	0.00965***	-0.0289	-0.000725*
	(0.00823)	(0.0101)	(0.00149)	(0.0243)	(0.000369)
Drawn/granted$_{t-1}$*D(Post 2008)	0.00212	-0.0306***	-0.00633***	0.0424*	-0.000867
	(0.00811)	(0.00847)	(0.00162)	(0.0250)	(0.000572)
Drawn/granted$_{t-1}$*D(Post 2011)	0.0208**	0.0121	-0.00603***	0.0106	-0.00538***
	(0.00888)	(0.0125)	(0.00160)	(0.0340)	(0.000766)
Share revolving credit lines$_{t-1}$	0.0589***	-0.647***	-0.0426***	0.469***	0.000626
	(0.00769)	(0.0353)	(0.00469)	(0.0315)	(0.000494)
Share revolving credit lines$_{t-1}$*D(Post 2008)	-0.00934	-0.0310	0.0101***	-0.0155	0.00199**
	(0.0109)	(0.0530)	(0.00288)	(0.0480)	(0.000770)
Share revolving credit lines$_{t-1}$*D(Post 2011)	0.00200	0.191***	0.000773	-0.133***	0.00415***
	(0.00986)	(0.0519)	(0.00236)	(0.0392)	(0.00105)
Bank*Time fixed effects	Yes	Yes	Yes	Yes	Yes
Firm*Time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	314649	268953	219763	138698	125791
R-squared	0.402	0.383	0.555	0.398	0.721

Note: The table shows OLS estimates of regressions for 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: Relationship duration, the log number of years since the bank and the firm have a relationship, counting from 1998; 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: Interest rate on new term loans

	(1) Interest rate on new revolving credit lines	(2) Interest rate on new term loans
Relationship duration$_{t-1}$	1.385***	0.108***
	(0.212)	(0.0159)
Relationship duration$_{t-1}$*D(Post 2008)	-0.193	-0.0596**
	(0.229)	(0.0249)
Relationship duration$_{t-1}$*D(Post 2011)	-0.304	-0.0332
	(0.208)	(0.0357)
Log credit granted$_{t-1}$	-0.716***	-0.206***
	(0.131)	(0.0184)
Drawn/granted$_{t-1}$	0.000674	-0.00163***
	(0.00324)	(0.000485)
Share revolving credit lines$_{t-1}$	-0.0640***	0.00320***
	(0.00642)	(0.000692)
Bank*Time fixed effects	Yes	Yes
Firm*Time fixed effects	Yes	Yes
Observations	26330	37140
R-squared	0.595	0.775

Note: The table shows OLS estimates of regressions for 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. The regressions in column 2 are run on a sample of bank-firm relationships for which we observe interest rates on term loans. Control variables are: Relationship duration, the log number of years since the bank and the firm have a relationship, counting from 1998; 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 text. 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: Relationship lending, controlling for the granting of new term loans

	(1)	(2)	(3)	(4)	(5)
	ΔLog (Total credit)	ΔLog (Revolving credit lines)	Interest rate on revolving credit lines	ΔLog (Term loans)	Interest rate on term loans
Relationship duration$_{t-1}$	-0.222	0.704**	1.181***	-0.498	0.0896***
	(0.292)	(0.305)	(0.0917)	(0.823)	(0.0136)
Relationship duration$_{t-1}$*D(Post 2008)	1.101***	0.905**	-0.323***	1.018	-0.0605***
	(0.347)	(0.428)	(0.0821)	(1.084)	(0.0193)
Relationship duration$_{t-1}$*D(Post 2011)	-0.208	-0.489	-0.0966	-0.221	-0.0699***
	(0.340)	(0.337)	(0.0860)	(0.944)	(0.0225)
Log credit granted$_{t-1}$	-14.41***	-13.05***	-0.752***	-9.049***	-0.191***
	(0.431)	(0.591)	(0.0438)	(0.788)	(0.0135)
Drawn/granted$_{t-1}$	0.0434***	0.0987***	0.00369***	0.00125	-0.00303***
	(0.00496)	(0.00897)	(0.00102)	(0.0321)	(0.000305)
Share revolving credit lines$_{t-1}$	0.0552***	-0.610***	-0.0356***	0.416***	0.00327***
	(0.00489)	(0.0277)	(0.00292)	(0.0230)	(0.000353)
New term-loan dummy	0.942***	0.204	0.105***	0.673	0.102***
	(0.270)	(0.348)	(0.0399)	(0.615)	(0.0183)
Bank*Time fixed effects	Yes	Yes	Yes	Yes	Yes
Firm*Time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	314649	268953	219763	138698	125791
R-squared	0.401	0.382	0.555	0.397	0.719

Note: The table shows OLS estimates of regressions for 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: Relationship duration, the log number of years since the bank and the firm have a relationship, counting from 1998; 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 text. 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: Subsample of relationship which are important to the firm

	(1)	(2)	(3)	(4)	(5)
	ΔLog (Total credit)	ΔLog (Revolving credit lines)	Interest rate on revolving credit lines	ΔLog (Term loans)	Interest rate on term loans
Relationship duration$_{t-1}$	-0.938**	-0.0448	1.493***	-0.829	0.0805***
	(0.387)	(0.462)	(0.127)	(1.071)	(0.0173)
Relationship duration $_{t-1}$*D(Post 2008)	1.745***	1.902***	-0.545***	0.548	-0.0620***
	(0.443)	(0.650)	(0.105)	(1.211)	(0.0232)
Relationship duration $_{t-1}$*D(Post 2011)	-0.0353	-0.815	-0.150	0.495	-0.0590**
	(0.457)	(0.586)	(0.104)	(1.328)	(0.0281)
Log credit granted $_{t-1}$	-12.44***	-12.23***	-0.715***	-7.459***	-0.219***
	(0.451)	(0.610)	(0.0499)	(1.035)	(0.0174)
Drawn/granted$_{t-1}$	0.0149	0.200***	0.00775***	0.0553*	-0.00417***
	(0.0128)	(0.0211)	(0.00182)	(0.0331)	(0.000533)
Share revolving credit lines $_{t-1}$	0.0675***	-0.608***	-0.0409***	0.417***	0.00442***
	(0.00704)	(0.0267)	(0.00286)	(0.0256)	(0.000497)
Bank*Time fixed effects	Yes	Yes	Yes	Yes	Yes
Firm*Time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	162840	132146	121859	82373	79576
R-squared	0.434	0.417	0.581	0.427	0.723

Note: The table shows OLS estimates of regressions for 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: Relationship duration, the log number of years since the bank and the firm have a relationship, counting from 1998; 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 text. 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 A8: Bank firm relationships controlling for past due loans

	(1) ΔLog (Total credit)	(2) ΔLog (Revolving credit lines)	(3) Interest rate on revolving credit lines	(4) ΔLog (Term loans)	(5) Interest rate on term loans
Relationship duration$_{t-1}$	-0.332	0.661**	1.175***	-0.616	0.0833***
	(0.296)	(0.308)	(0.0905)	(0.815)	(0.0136)
Relationship duration $_{t-1}$*D(Post 2008)	1.144***	0.922**	-0.322***	1.098	-0.0589***
	(0.345)	(0.430)	(0.0819)	(1.078)	(0.0192)
Relationship duration $_{t-1}$*D(Post 2011)	-0.182	-0.473	-0.0942	-0.211	-0.0688***
	(0.342)	(0.336)	(0.0852)	(0.941)	(0.0223)
Log credit granted $_{t-1}$	-14.33***	-13.05***	-0.743***	-9.012***	-0.185***
	(0.426)	(0.606)	(0.0443)	(0.796)	(0.0135)
Drawn/granted$_{t-1}$	0.0468***	0.0995***	0.00394***	0.00400	-0.00287***
	(0.00509)	(0.00851)	(0.00100)	(0.0318)	(0.000297)
Share revolving credit lines $_{t-1}$	0.0550***	-0.610***	-0.0359***	0.417***	0.00312***
	(0.00489)	(0.0274)	(0.00291)	(0.0231)	(0.000347)
Past due loans $_{t-1}$	12.85***	3.513	-0.745	25.57***	-0.154
	(3.093)	(3.871)	(0.682)	(7.246)	(0.108)
Relationship duration $_{t-1}$ * Past due loans $_{t-1}$	-0.0455	1.299	0.525	-7.100**	0.0469
	(1.954)	(1.863)	(0.373)	(3.416)	(0.0536)
Bank*Time fixed effects	Yes	Yes	Yes	Yes	Yes
Firm*Time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	314649	268953	219763	138698	125791
R-squared	0.402	0.382	0.555	0.398	0.719

Note: The table shows OLS estimates of regressions for 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: Relationship duration, the log number of years since the bank and the firm have a relationship, counting from 1998; 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; Past due loans: a dummy variable for relationships where loans are past due by at least 90 days. Further details on the dependent and control variables are in the text. 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 A9: Real effects of relationship lending at the firm level: including estimated firm fixed effects from relationship level regressions

	(1) ΔLog (Total credit)	(2) Average interest rate on total credit	(3) Investment rate	(4) ΔLog (Labour costs)
Weighted relationship duration*D(Post 2008)	5.911***	-30.22***	4.783***	4.426***
	(0.519)	(2.856)	(1.275)	(0.503)
Weighted relationship duration*D(Post 2011)	1.785***	-12.56***	2.180*	0.602
	(0.478)	(2.958)	(1.155)	(0.494)
Return on assets	0.0579*	-0.500***	0.195**	0.435***
	(0.0323)	(0.188)	(0.0814)	(0.0350)
Firm leverage	-0.0739***	0.267***	-0.0783**	-0.0464***
	(0.0148)	(0.100)	(0.0386)	(0.0159)
EBITDA/interest expenses	0.0882***	-0.230**	0.268***	0.0343***
	(0.0163)	(0.104)	(0.0352)	(0.0103)
Log (firm total assets)	-8.781***	-6.819**	-28.58***	-4.278***
	(0.472)	(3.087)	(1.344)	(0.501)
Z-Score	-0.710**	4.058**	-1.464*	-0.0604
	(0.336)	(1.735)	(0.852)	(0.358)
Estimated firm*time fixed effects from relationship level regression	0.0118***	0.0433***	0.00242***	0.000988***
	(7.33e-05)	(0.00273)	(0.000176)	(6.81e-05)
Time fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	62797	42375	62644	60987
R-squared	0.536	0.712	0.249	0.278

Note: The table shows OLS estimates of regressions for 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 log of the number of years between 1998 and 2006 that the bank and the firm had 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 debt divided by the book value of assets; Estimated firm*time fixed effects from relationship level regression: estimated firm*time fixed effects estimated in Table 3, column (1). 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 A10: Real effects of bank leverage on relationship lending at the firm level: triple interaction

	(1) ΔLog (Total credit)	(2) Investment rate	(3) ΔLog (Labour costs)
Weighted relationship duration $_1$*D(Post 2008)	-3.021	5.319	1.784
	(2.326)	(3.876)	(1.596)
Weighted relationship duration *D(Post 2011)	0.262	-2.346	2.212
	(2.343)	(3.796)	(1.653)
Tier 1 ratio	-0.0502***	0.0128	0.00927***
	(0.00478)	(0.00805)	(0.00326)
D(Post 2008) * Bank leverage	-0.0167***	-0.00603	-0.0102***
	(0.00513)	(0.00871)	(0.00380)
D(Post 2011) * Bank leverage	0.00839*	-0.00968	0.00175
	(0.00484)	(0.00769)	(0.00359)
Weighted relationship duration * Leverage	0.00728**	-0.00834	-0.00292
	(0.00323)	(0.00529)	(0.00214)
Weighted relationship duration *D(Post 2008) * Bank leverage	0.00974***	-0.000485	0.00515**
	(0.00339)	(0.00578)	(0.00244)
Weighted relationship duration *D(Post 2011) * Bank leverage	-0.00246	0.00707	-0.00244
	(0.00321)	(0.00532)	(0.00236)
Return on assets	0.385***	0.293***	0.450***
	(0.0421)	(0.0791)	(0.0350)
Firm leverage	-0.147***	-0.108***	-0.0534***
	(0.0190)	(0.0380)	(0.0157)
EBITDA/interest expenses	0.126***	0.273***	0.0423***
	(0.0186)	(0.0357)	(0.0104)
Log (firm total assets)$_1$	-11.41***	-28.91***	-4.440***
	(0.633)	(1.340)	(0.509)
Observations	62995	62837	61110
R-squared	0.219	0.244	0.275

Note: The table shows OLS estimates of regressions for 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. Weighted relationship duration: the log of the number of years between 1998 and 2006 that the bank and the firm had 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; Bank leverage: total debt/total assets; Return on assets: earnings before interest, tax, depreciation and amortization (EBITDA) over the book value of total assets; Firm leverage: ratio of total debt divided by the book value of assets. 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 A11: Real effects of firm heterogeneity on relationship lending: triple interaction

	(1) ΔLog (Total credit)	(2) Investment rate	(3) ΔLog (Labour costs)	(4) ΔLog (Total credit)	(5) Investment rate	(6) ΔLog (Labour costs)
Relationship duration $_{t-1}$*D(Post 2008)	4.948***	4.950**	4.076***	4.886***	4.802**	5.209***
	(0.944)	(1.939)	(0.694)	(0.943)	(1.927)	(0.773)
Relationship duration $_{t-1}$*D(Post 2011)	1.008	0.234	0.655	-0.271	3.280*	0.762
	(0.871)	(1.723)	(0.680)	(0.889)	(1.774)	(0.776)
D(Low return on assets)	-5.812***	-7.503**	-2.831**			
	(1.778)	(3.153)	(1.304)			
Relationship duration$_{t-1}$ * D(Low return on assets)	2.372**	1.855	0.589			
	(1.104)	(1.993)	(0.816)			
D(Post 2008) * D(Low return on assets)	1.889	3.554	-1.572			
	(2.180)	(3.987)	(1.576)			
D(Post 2011) * D(Low return on assets)	-1.238	-5.706	-0.490			
	(1.998)	(3.598)	(1.594)			
Relationship duration $_{t-1}$*D(Post 2008) * D(Low return on assets)	-1.449	-1.229	0.515			
	(1.382)	(2.554)	(0.999)			
Relationship duration $_{t-1}$*D(Post 2011) * D(Low return on assets)	-0.0791	3.528	-0.376			
	(1.300)	(2.352)	(1.010)			
Firm leverage	-0.150***	-0.105***	-0.0781***			
	(0.0190)	(0.0380)	(0.0160)			
EBITDA/interest expenses	0.161***	0.281***	0.0688***	0.157***	0.288***	0.0419***
	(0.0186)	(0.0348)	(0.0101)	(0.0190)	(0.0357)	(0.0102)
Log (firm total assets)$_1$	-2.767***	-1.510*	-0.757**	-2.916***	-2.794***	-0.433
	(0.446)	(0.845)	(0.358)	(0.451)	(0.857)	(0.359)
Return on assets				-10.78***	-29.27***	-4.465***
				(0.631)	(1.360)	(0.507)
Relationship duration$_{t-1}$ *D(Low leverage)				0.334***	0.302***	0.475***
				(0.0429)	(0.0804)	(0.0349)
D(Post 2008) * D(Low leverage)				0.326	0.607	2.189**
				(1.254)	(2.497)	(0.987)
D(Post 2011) * D(Low leverage)				3.699*	3.471	3.291**
				(2.157)	(4.011)	(1.620)
Relationship duration $_{t-1}$*D(Post 2008) * D(Low leverage)				-3.927**	5.355	2.036
				(1.979)	(3.609)	(1.587)
Relationship duration $_{t-1}$*D(Post 2011) * D(Low leverage)				-1.381	-0.892	-1.843*
				(1.374)	(2.565)	(1.041)
D(Low leverage)				2.591**	-2.695	-0.626
				(1.282)	(2.384)	(1.023)
Observations	62797	62644	60987	62797	62644	60987
R-squared	0.194	0.245	0.274	0.193	0.243	0.274

Note: The table shows OLS estimates of regressions for 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. Weighted relationship duration: the log of the number of years between 1998 and 2006 that the bank and the firm had 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; Low return on assets: dummy variable indicating below median earnings before interest, tax, depreciation and amortization (EBITDA) over the book value of total assets; Low leverage: dummy variable indicating below median ratio of total debt divided by the book value of assets. 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.