Bank lending technologies and credit availability in Europe. What can we learn from the crisis?

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Abstract

Using a unique sample of European manufacturing firms, we empirically investigate how differences in main banks' lending technology and use of soft information affected firms' credit availability during the 2007-2009 crisis. We find that the probability of credit rationing was higher for firms matching with transactional – i.e., using transactional lending technologies – banks. However, we show that soft information marginally reduced that probability in those firm-bank matches. Soft information would benefit most the small and medium enterprises and firms relating with large banks. Thus, reducing credit exclusion during crises requires either relationship lending or enticing transactional banks to use soft information.

Keywords: Lending technologies, Credit rationing, Financial crisis, Soft information

JEL codes: G21, D82, G30, O16

1 Introduction

Firms' access to credit is a topic of significant research interest among academics and a crucial issue for policy makers (Berger and Udell, 2006). During the last years, the global financial crisis has significantly affected firms' credit availability, thus consistently depressing economic growth. This phenomenon was particularly relevant in Continental Europe (Campello et al., 2010), where immature capital markets and negligible corporate bond finance have made banks the main providers of external funds for European firms (Popov and Udell, 2012). The uniqueness of the recent financial collapse has led many economists to analyze different features of the crisis: the international transmission of the financial shock (De Haas and Van Horen, 2012; Jeon et al., 2013; Claessens and Van Horen, 2015; De Haas et al., 2015), the effects on the real economy (Amiti and Weinstein, 2011; Aiyar, 2012; Chodorow-Reich, 2014; Cingano et al., 2016), the behavior of financing constrained firms (Campello et al., 2010; Campello et al., 2011; Chava and Purnanandam, 2011), and bank lending decisions (Jiangli et al., 2008; Ivashina and Scharfstein, 2010; Santos, 2011; Jiménez et al., 2012; D'Aurizio et al., 2015; Bolton et al., 2016).

The aim of this work is to contribute to this last strand of literature by investigating whether the probability of firms experiencing credit restrictions during the crisis was affected by the type of bank lending technologies and the production of soft information. Several studies indicate that information asymmetries magnify during deep recessions, such as that of 2007-2009 (De Haas and Van Horen, 2013; Kremp and Sevestre, 2013). However, the extent to which banks are able to overcome this problem may depend on their lending technologies (Uchida et al., 2006). Although banks could lend through a variety of lending techniques, the prevailing view distinguishes two main classes of lending technologies: transactional lending, primarily based on hard quantitative information, and relationship lending, usually relying on soft qualitative data about borrowers' repayment ability (Elyasiani and Golberg, 2004; Berger and Udell, 2006; Bartoli et al., 2013). While transactional lending techniques and hard data are more appropriate for transparent firms and during tranquil periods, relationship lending technologies and soft information are employed with opaque borrowers suffering from more intense information asymmetries (Stein, 2002; Bartoli et al., 2013) and may become especially valuable towards the generality of borrowers when a

systemic crisis magnifies information asymmetries (Beck et al., 2015; Ferri et al., 2001).[1] In fact, hard information is less reliable in predicting firm risk profile under uncertainty, whereas continuously updated soft information is better targeted to borrowers' characteristics (Rajan, 1992; Stein, 2002; Berger and Udell, 2006; Rajan et al., 2015).

Given these premises, we expect that firms matching with transactional main banks will more likely suffer credit restrictions during a crisis, while the extent of credit rationing is lower for firms coupling with a relational financial intermediary. As some recent studies highlight the possibility of hardening soft information by incorporating soft qualitative data into transactional lending techniques (Berger, 2015; Udell, 2015; Filomeni et al., 2016), we also expect that credit availability reduces less if transactional main banks engage in gathering and processing soft information.

To test these predictions, we draw information on firms' access to credit, bank lending technologies and soft information production from the EU-EFIGE Bruegel-UniCredit survey, covering approximately 16,000 manufacturing firms in seven European countries: Austria, France, Germany, Hungary, Italy, Spain and UK (Altomonte and Aquilante, 2012). To all the surveyed firms we attach balance-sheet data provided by Bvd-Amadeus, the most comprehensive and widely used source of financial information for public and private enterprises in Europe.

By way of preview, estimation results indicate that during the crisis firms matching with transactional main banks had a larger probability of experiencing credit restrictions, while relational lending technologies did not significantly affect firms' access to credit. Consistently with the current literature (Uchida et al., 2012; Bartoli et al., 2013; D'Aurizio et al., 2015), we also find that soft information production had a negative and significant impact on credit rationing during the crisis. By mitigating asymmetric information problems, the adoption of soft information improved firms' access to credit. With regard to the hardening of soft information process, estimation results indicate that the extent of credit rationing increased less for firms matching with transactional main banks that managed to adopt soft information during the crisis. While firms coupling with transactional main banks not relying on soft information were positively associated with the probability of experiencing credit restrictions, this probability marginally reduced when the firm matched with a transactional main bank employing soft qualitative data.

[1] If some authors – e.g., Füss et al. (2016) – find that the 2007-2008 financial crisis boosted risk perceptions even for publicly traded bonds, one can imagine a more dramatic amplification of information asymmetries in credit markets.

To get additional insights about the impact of lending technologies and soft information production on credit availability during the crisis, we also investigate whether our findings change with firm and bank size. Estimation results indicate that transactional lending technologies increased the probability of firms experiencing credit restrictions during the crisis at both local and national banks, but only for the subsample of SMEs. The credit rationing status of large firms, instead, was unaffected by bank lending techniques. Moreover, we find that hardening of soft information was effective in alleviating firms' financing constraints only for the subsamples of national banks and small firms. As larger banks are the most concerned with the problems associated to the production and transmission of information and the most able to manage complex credit scoring models, they had the greatest incentive to efficiently combine transactional lending techniques and soft qualitative data during the crisis. In contrast, small local banks, usually relying on relational lending technologies, did not effectively exploit the benefits associated with the combined adoption of transactional lending techniques and soft information.

In providing these findings, this study contributes to different fields of the banking literature. First, by analyzing the impact of relational lending technologies on firms' access to credit during the crisis, we complement the recent evidence provided by Bartoli et al. (2013) and Cenni et al. (2015): while relational main banks reduce the likelihood of firms experiencing credit restrictions in non-crisis periods (Bartoli et al., 2013; Cenni et al., 2015), relational lending technologies did not affect credit availability during the recent financial crisis. Second, to the best of our knowledge, this is the first study indicating an adverse effect of transactional lending technologies on firms' access to credit during a crisis. In this way, we contribute to Bolton et al. (2016) who analyze whether transactional and relational banks have behaved differently before and during the last financial downturn. Third, by showing that soft information production reduces credit rationing in Continental Europe, we corroborate D'Aurizio et al. (2015)'s results. Fourth, through the analysis of the combined effect of soft information production and transactional lending technologies on credit availability, we add to the current literature on hardening of soft information (Berger, 2015; Udell, 2015; Filomeni et al., 2016). Finally, and more generally, we contribute to the finance literature studying credit availability and banks behavior during the crisis (Jiangli et al., 2008; Ivashina and Scharfstein, 2010; Santos, 2011; Jiménez et al., 2012).

The remainder of the paper is organized as follows. Section 2 reviews the current literature on bank lending technologies and soft information production and presents our theoretical hypotheses.

In Section 3, we describe the dataset, the variables employed in the regression analysis and the econometric model used to test our hypotheses. In Section 4, we discuss the empirical results. Section 5 provides some concluding remarks.

2 Related literature and testable hypotheses

2.1 *Lending technologies*

Berger and Udell (2006) define a lending technology as a unique combination of primary information source, screening and underwriting policies, loan contract structure and monitoring mechanisms. As different banks use different lending technologies, the choice of the main bank is a strategic choice for any firm, in particular for those firms that usually depend on bank financing as a source of external funding (Rajan, 1992; Ferri and Murro, 2015). Although banks lend through a variety of lending technologies, the literature has thus far focused on two classes of lending techniques: transaction-based lending and relationship lending (Berger and Udell, 2006; Bartoli et al., 2013). According to the prevailing view, large banks hold a comparative advantage in transactional lending, while small-sized and local banks have an edge in relationship lending (Stein, 2002).

The empirical literature has tried to test the results derived from the theory. In particular, several papers have analyzed the impact of relationship lending on firms' access to credit. On data for Italy, Angelini et al. (1998) find that the intensity of relationship banking reduces the probability of rationing, even though lending rates increase as the firm-bank relationship lengthens. For the same country, Cenni et al. (2015) show that longer banking relationships make it easier for a firm to obtain credit, while the number of banking relationships the firm maintains is positively linked to the probability of experiencing credit restrictions. For the US, Cole (1998) finds that lenders are less likely to grant credit when the customer relationship has lasted for less than one year or the firm deals with other financial counterparts. Considering Belgian firms, Degryse and Van Cayseele (2000) distinguish the role of relationship banking along two different dimensions: borrowing rates increase with the length of the firm-bank relationship, while borrowing rates decrease when the scope of the bank-firm relationship - defined as the purchase of additional information intensive services (other than the loan) - increases. Dewatripont and Maskin (1995) find that the presence of

a significant number of creditors complicates the refinancing process and makes lending less profitable for banks. Focusing on the recent financial crisis, Bartoli et al. (2011) and Hainz and Wiegand (2013) provide additional results. First, Italian banks tended to support borrowers characterized by more intense informational tightness. Second, both the cost of credit and collateral requirements were reduced when a main bank relationship existed.

Recently, both the theoretical and the empirical literatures have started to analyze also the transaction lending technologies. Often, the transaction lending label has been used for any type of loan based on easily verifiable information. However, several authors argue that transactional lending is not a single homogeneous technique but a set of distinct transaction technologies used by financial institutions. For example, Berger and Udell (2006) underline that transactions technologies include financial statement lending, small business credit scoring, asset-based lending, factoring, fixed-asset lending, and leasing. They define and describe each of these lending technologies, highlight its distinguishing features, and show how the technology addresses the opacity problem. Also the empirical literature tries to explain the determinants and effects of transaction-based lending technologies. Berger and Frame (2007) study the use of credit scoring for SMEs and its effects on credit availability, Klapper (2006) tests the role of factoring for financing SMEs, while Udell (2004) focuses on asset-based lending.

2.2 *Hard and soft information*

The two classes of lending technologies discussed in the previous section are normally distinguished by the type of information the bank uses in granting and monitoring the loan: transactional lending technologies are primarily based on hard quantitative information (Berger and Udell, 2006); relationship lending techniques, instead, assign a key role to soft qualitative information (Rajan, 1992).

Thus far, only few papers have tried to study in detail what is meant by hard and soft information. According to Petersen (2004), hard information is quantitative, easy to store and transmit, and its content is independent of the collection process. Conversely, soft information is qualitative, often communicated in words, and not easy to store and transmit to other parties. Also, soft information content is significantly affected by the collection process and the collector (bank) characteristics. Scott (2004) indicates that soft information production is significantly higher for firms borrowing from small community financial institutions and when loan officers do not rotate

over time. Agarwal and Hauswald (2010) suggest that more independent branches produce more soft information. Ogura and Uchida (2014) find that small regional banks are perceived to put greater emphasis on soft information than large national financial intermediaries.

A number of studies have also analyzed whether the production of soft information about borrowers improves firms' access to credit and firms' investments. For Italy, Bartoli et al. (2013) provide evidence that the use of soft information decreases the probability of firms experiencing credit restrictions. Similarly, D'Aurizio et al. (2015) indicate that during the last financial crisis, those banks increasing the adoption of soft information in the screening process cut credit supply less than other financial institutions. For Europe, Cosci et al. (2015) and Cucculelli et al. (2016) find that firms providing soft information in their lending relationships are less likely to be credit rationed and more likely to innovate. Finally, Jiangli et al. (2008) and De Mitri et al. (2010) show that soft information production mitigates the repercussions of aggregate credit contractions. While hard information is less reliable in predicting firm risk profile during a crisis, soft information, which is continuously updated and better targeted to the characteristics of the borrower, can reduce such uncertainty.

Recently, the academic literature has also suggested the possibility that technological innovation, by hardening soft information, may improve the ability of banks to lend to opaque borrowers at a greater distance (Petersen and Rajan, 2002; Berger, 2015; Udell, 2015). By incorporating soft qualitative data into transactional lending technologies, such as credit scoring models, the problems associated with transmitting this information through the hierarchical layers of large banking organizations diminish, with beneficial effect on credit availability (Stein, 2002; Filomeni et al., 2016).

2.3 *Testable hypotheses*

Starting from this literature, as information asymmetries magnify during deep recessions and financial crises, in this paper we test the following three hypotheses:

Hypothesis 1: Firms matching with a transactional main bank have a larger probability of experiencing credit restrictions during the crisis.

Hypothesis 2: The extent of credit rationing is lower for firms coupling with a relational main bank.

***Hypothesis 3* (*Hardening of soft information hypothesis*)**: The probability of experiencing credit restrictions might increase less if transactional main banks engage in gathering and processing soft information.

3 Data and method

3.1 *Datasets*

In order to perform our empirical investigation, we draw information from two main sources: the EU-EFIGE Bruegel-UniCredit survey on "European Firms in a Global Economy" and the BvD-Amadeus database. The EFIGE survey, coordinated by the Bruegel Institute, collects information for a representative sample (at the country and industry level) of almost 15,000 manufacturing firms in seven European countries: Austria, France, Germany,[2] Hungary, Italy, Spain and UK. As the survey was run in 2010, information is mostly collected as a cross-section for the period 2007-2009[3]. The questionnaire submitted to the surveyed firms covers different broad areas: firm ownership structure and governance systems, workforce characteristics, innovation and internationalization activities, market structure and competition, financial conditions and bank-firm relationships[4]. To all the surveyed firms, we attach balance-sheet information provided by BvD-Amadeus, the most comprehensive and widely used source of financial information for public and private firms in Europe.

Table 1 reports some descriptive statistics. At the average, the surveyed firms have been in business for 26 years; beyond 60 percent of them have fewer than 50 employees (below 5 percent

[2] In the empirical estimation, the number of German firms has been drastically reduced because of several missing information about question F16.

[3] To ensure standard statistical representativeness of the collected data, the dataset was built so as to fulfill two main criteria: (i) the availability of an adequately large target sample of firms, initially set around 3,000 firms for large countries (France, Germany, Italy, Spain and UK), and some 500 firms for smaller countries (Austria and Hungary); (ii) a proper stratification of the sample for each country, considering three dimensions: sector composition, regions and size class.

[4] For more information about the EU-EFIGE survey, see Altomonte and Aquilante (2012).

of the firms have more than 500 workers); 10 percent of them are foreign owned, while 22 percent belong to a group. Moving on to their financial setup, on average firms do business with three banks and the average length of the relationship with the main bank is 16 years. The majority of firms are located in Germany, Italy and Spain (80 percent of the total), while 14 percent of the firms operate in UK, 3.3 percent in Hungary and 3 percent in Austria; alternatively, 82.7 percent of the firms belong to the Eurozone.

3.2 *Variable definitions*

3.2.1 *Lending technology indicators*

In question F16 of the EFIGE survey firms are required to indicate the type of information they normally provide to their main bank in the screening and monitoring processes. The question reads out as follows:

> F16. *Which type of information does the bank normally use/ask to assess your firm's creditworthiness? (a) collateral (0/1); (b) balance sheet information (0/1); (c) interviews with management on firm's policy and prospects (0/1); (d) business plan and firms' targets (0/1); (e) historical records of payments and debt service (0/1); (f) brand recognition (0/1); (g) other (0/1).*

Starting from this categorization, following Berger and Udell (2006) and Bartoli et al. (2013), we build two indicators of lending technology: (i) transactional lending (TRANS LENDING), computed as the average of collateral, balance sheet information and historical records dummies (alternatives a, b and e); (ii) relational lending (RELAT LENDING), computed as the average of interviews and business plan dummies (alternatives c and d)[5]. In the baseline regression, we exclude the categories "brand recognition" and "other" from the definition of the two types of lending technology, because they are not clearly described in the survey. However, to the extent that brand recognition captures the firm's reputational capital, as robustness we add category f to the relational lending indicator (RELAT LENDING 2). Moreover, as further robustness test, as

[5] The advantage of using two average indicators, ranging from 0 to 1, is that they can be directly compared (Bartoli et al., 2013).

suggested by Cucculelli and Peruzzi (2016) and Cucculelli et al. (2016), we exclude collateral guarantees from the definition of transactional lending (TRANS LENDING 2).

As shown in Table 1, transactional lending is the most employed lending technology: while the average value of the relational lending indicator is 0.52, the average of the transactional lending index is 0.60[6].

3.2.2 *Soft information*

In order to construct a proxy variable for the production of soft information, we employ a methodology similar to that used in Scott (2004) and Uchida et al., (2012). We use the following question of the EFIGE survey:

> F12. *Which factors are key in the choice of a main bank? (a) the bank offers competitive services and funding (0/1); (b) the bank offers efficient internet services (0/1); (c) the bank's lending criteria is clear and transparent (0/1); (d) the bank is conveniently located (0/1); (e) the bank has an extensive international network (0/1); (f) the bank offers also a consultancy on strategic financial decisions (0/1); (g) the bank has a long-lasting relationship with the firm (0/1); (h) the bank has flexible procedures/not constrained by red tape (0/1); (i) it was the Group's main bank (0/1).*

Considering the proposed alternatives, we build our indicator (SOFT INFORMATION) as the average of the following dummy variables: the bank offers a consultancy on strategic financial decisions (alternative f); the bank has a long-lasting relationship with the firm (alternative g).

Descriptive statistics indicate that 43 percent of firms have a long-lasting relationship with their lenders, while 15 percent take advantage from the consultancy services offered by their banks. As a result, the average value of our soft information indicator is 0.29 (Table 1).

3.2.3 *Credit rationing*

[6] Regarding the specific factors included in the definition of lending technologies, 55 percent of firms state to pledge collateral guarantees, 84 percent use to provide balance-sheet information, 56 percent are subject to managers' interviews, 48 percent are requested for business plans, 40 percent are required to provide historical records of payments and debt services, and 15 percent are evaluated through brand recognition.

To define our credit rationing indicators, we rely on the following questions of the EFIGE survey:

> F13. *During the last year, was the firm willing to increase its borrowing at the same interest rate of its current credit line? (i) yes; (ii) no*.
> F14. *During the last year, did the firm apply for more credit? (i) yes, applied for it and it was successful; (ii) yes, applied for it and was not successful; (iii) no, did not apply for it*.
> F15. *To increase its borrowing, would the firm have been prepared to pay a higher rate of interest? (i) yes; (ii) no*.

In particular, by following Minetti and Zhu (2011) and Ferri and Murro (2015), we classify firms as being credit rationed (RATIONING=1) if they respond (ii) to question F14, and non-rationed (RATIONING=0) if they respond (i) or (iii) to question F14, or (ii) to question F13. Since firms desiring additional borrowing but not applying for it are discouraged from applying in anticipation of a more likely credit denial, we also employ a second definition of credit rationing, which includes discouraged borrowers in the rationed ones. More precisely, we build the dummy variable WIDE RATIONING that takes the value one if the firm responds (ii) or (iii) to question F14, and zero if it responds (ii) to question F13 or (i) to question F14. Finally, by relying on question F15 of the EFIGE survey, which provides information about the cost of borrowing, we classify as strong rationed firms (STRONG RATIONING=1) those firms answering (ii) to question F14 and (i) to question F15[7].

As reported in Table 1, 9 percent of firms result to be rationed in the bank lending market during the crisis; 19 percent are wide rationed and 5 percent are strong rationed. The majority of rationed firms are located in Spain and Italy (respectively, 41 and 39 percent), while 8 percent operate in Germany, 7 percent in France, 2 percent in Hungary and UK and 1 percent in Austria. The univariate tests presented in Table 2 indicate that rationed firms are on average younger, more indebted, less profitable and productive. From a financial point of view, they borrow from a larger number of banks and enjoy a shorter relationship with their main banks. Regarding the adoption of lending technologies and the production of soft information, univariate tests seem to preliminarily

[7] The variable STRONG RATIONING takes the value zero if firms respond (ii) to question F13, (i) or (iii) to question F14, or (ii) to question F14 and (ii) to question F15.

confirm our theoretical hypotheses: the transactional lending indicator is significantly higher for the subsamples of rationed (simple, wide and strong) borrowers, while the production of soft information is larger for non-rationed firms.

3.2.4 *Control variables*

In order to correctly identify the impact of bank lending technologies and soft information production on firms' access to credit and to mitigate the omitted variable concern associated with the cross sectional structure of our dataset, we control for a large set of possible confounding effects.

First of all, we consider the following standard firm-specific characteristics and balance-sheet indicators[8]: (i) firm's age, measured by the number of years from its inception (AGE); (ii) number of employees as proxy for firm's size (SIZE, expressed in logarithm); (iii) the firm's level of indebtedness, proxied by the debt ratio, computed as total debt over total assets (DEBT RATIO); (iv) the firm's liquidity indicator, measured as current assets over current liabilities (LIQUIDITY RATIO); (vi) the differential profitability of the firm (DIFFERENTIAL ROS) measured by the difference between firm's return on sales and the median return on sales of its industry (Villalonga, 2004); (vii) firm's capital intensity (CAPITAL INTENSITY), computed as the ratio between firm's fixed assets and number of employees; (viii) the firm's level of labour productivity (LABOUR PRODUCTIVITY), measured by value added per worker; (ix) a dummy variable indicating whether the firm belongs to a business group (GROUP); the foreign ownership of the firm (FOREIGN).

Then, we control for a number of bank-firm relationship characteristics, by including the number of bank relationships enjoyed by the firm (NUMBER OF BANKS), and the length of the main bank-firm relationship (DURATION).

Finally, in order to fully account for industry- and country-specific effects, we include country and industry dummies.

3.3 *Econometric specification*

[8] As our dependent and independent variables refer to the three-year period 2007-2009, all the balance-sheet indicators are computed as average values for the same period.

To test our hypotheses, we start building an empirical model that estimates firms' probability of being rationed in the bank lending market. Denote y_i^d as firm i's desired amount of credit and y_i^a as the actual amount of credit given to firm i, the firm is rationed any time $y_i^* = \left(y_i^d - y_i^a\right) > 0$.

Thus, we can model the probability of rationing as:

$$y_i = \begin{cases} 1 & if \quad y_i^* > 0 \\ 0 & otherwise \end{cases} \qquad (1)$$

$$y_i^* = \alpha X_i + \beta Z_i + u_i \qquad (2)$$

where y_i denotes, alternatively, one of the credit rationing variables described in section 3.2.3 (RATIONING, WIDE RATIONING or STRONG RATIONING); X_i is the set of lending technologies presented in section 3.2.1; Z_i is a vector of exogenous covariates; u_i is the residual[9].

As we are interested in investigating the impact of lending technologies and soft information on the probability of being credit rationed during the crisis, we first estimate whether firms coupling with transactional and relational main banks have different likelihood of experiencing credit restrictions. Then, in order to assess the role played by the production of soft information, we estimate the interaction effects between the lending technologies and the adoption of soft information by banks.

4 Results

4.1 *Baseline results: Lending technologies and credit rationing*

Estimation results about the impact of lending technologies on the probability of firms experiencing credit restrictions are displayed in Table 4. In particular, whereas columns 1-3 report the marginal effects of the explanatory variables considering our main indicators of lending technologies (i.e. TRANS LENDING and RELAT LENDING), columns 4-6 present the estimation results obtained

[9] As our dependent variables are dummy variables taking values zero and one, we estimate Equation (2) by maximum likelihood probit regressions.

by employing the two alternative measures presented in Section 3.2.1 (i.e. TRANS LENDING 2 and RELAT LENDING 2).

Starting with the transactional lending technology index (TRANS LENDING), our main results indicate that firms matching with transactional main banks are significantly more likely to end up rationed during a crisis. More specifically, a one-unit increase in the transactional lending technology indicator increases by 11.4 percent the probability of rationing, by 12.3 percent the probability of wide rationing, and by 6.5 percent the probability of experiencing a strong credit restriction, all statistically significant at 99 percent level (columns 1-3). This result indicates that during recession periods, due to asymmetric information problems, banks employing more impersonal and standardized lending techniques are more likely to reduce credit availability. Hence, Hypothesis 1 is confirmed. When we turn to the relational lending technology index (RELAT LENDING), however, our main results show that the probability of experiencing credit restrictions is not reduced when the firm couples with a relational main bank. The estimated marginal effects reported in columns 1-3 are always not statistically different from zero. Hence, contrary to Hypothesis 2, the adoption of relational lending techniques by financial intermediaries does not improve credit availability during a crisis. These findings complement the ones of Bartoli et al. (2013) and Cenni et al. (2015), who find that relational main banks reduce the likelihood of firms experiencing credit rationing in non-crisis periods.

Looking at the other firm-specific characteristics, in line with the current literature (Petersen and Rajan, 1994; Bartoli et al., 2013; Ferri and Murro, 2015; Minetti et al., 2016), we find that financially stable firms holding a higher share of liquid assets (LIQUID RATIO) and displaying a lower indebted financial structure (DEBT RATIO) are less likely to be rationed at 99 percent level of significance. Similarly, also more profitable (DIFF ROS) and productive firms (LABOUR PROD) are associated with a reduced probability of experiencing credit restrictions.

Finally, moving on to our bank-firm relationship controls, estimation results indicate that while multiple credit relationships (NUMBER OF BANKS) increase the probability of being credit rationed, the creation of longer bank-firm relationships (DURATION) is likely to have beneficial effects on firms' access to credit.

As we said in Section 3.2.1, our main measures of lending technologies consider collateral guarantees among transactional lending techniques and exclude brand recognition from relational lending technologies. In columns 4-6 of Table 4, we check the robustness of our findings to the

inclusion of two alternative definitions of lending techniques, which account for this issue. In particular, we consider the variables TRANS LENDING 2, computed as the average of balance sheet information and historical records dummies (alternatives b and e of question F16), and RELAT LENDING 2, computed as the average of interviews, business plan and brand recognition dummies (alternatives c, d and f of question F16). Estimation results broadly reproduce our main findings. The marginal effects of the transactional lending technology index are positive and statistically significant (TRANS LENDING 2), although with lower magnitudes. More specifically, a one-unit increase in the transactional lending technology indicator increases by 4.6 percent the probability of rationing, by 2.8 percent the probability of wide rationing, and by 2.6 percent the probability of experiencing strong rationing. Conversely, the relational lending technology indicator is not statistically significant (RELAT LENDING 2). Overall these results confirm our main findings: while firms coupling with transactional main banks are more likely to be credit restricted, relational lending technologies do not significantly affect firms' access to credit. Thus, we confirm Hypothesis 1 and reject Hypothesis 2.

4.2 *The role and production of soft information*

In the previous section, we analyzed whether different lending technologies affect firms' access to credit during the crisis; here, we investigate how the production of soft information enters in this picture. More specifically, we first estimate whether soft information production reduces the probability of experiencing credit restrictions, as demonstrated by the current literature (Bartoli et al., 2013; D'Aurizio et al., 2015; Cucculelli et al., 2016). Then, in order to test the *hardening of soft information hypothesis* (Hypothesis 3), we analyze the combined effect of bank lending technologies and soft information production on firms' rationing status. Estimation results are presented in Table 5.

Starting with the production of soft information, estimation results indicate that soft information has a negative and significant impact on credit rationing. More specifically, a one-unit increase in the soft information indicator (SOFT INFORMATION) reduces by 1.8 percent the probability of rationing and by 1.5 percent the probability of experiencing strong credit restrictions, both statistically significant at 90 percent level (columns 1-3). This result is even stronger when the lending technology indicators are included in the econometric specification. In this case, a one-unit increase in the soft information indicator reduces by 2.9 percent the probability of experiencing

credit restrictions and by 2 percent the probability of being strong credit rationed, both statistically significant at 99 percent level (columns 4-5). These findings seem to confirm previous empirical results: both during crisis (D'Aurizio et al., 2015; Cucculelli et al., 2016) and non-crisis (Uchida et al., 2012; Bartoli et al., 2013) periods, soft information production mitigates asymmetric information problems thus improving firms' access to credit.

Regarding our lending technology indicators, the estimated marginal effects reported in columns 4-6 confirm that transactional lending technologies are positively associated with the credit rationing status. In particular, a one-unit increase in the TRANS LENDING variable increases by 11.6 percent the probability of rationing, by 12.6 percent the probability of wide rationing, and by 6.7 percent the likelihood of experiencing strong credit restrictions (all statistically significant at 99 percent level, columns 4-6). Conversely, in line with our previous estimation results, the relational lending technology indicator (RELAT LENDING) is never statistically significant in explaining firms' access to credit. Hence, we further confirm the validity of Hypothesis 1 and the irrelevance of Hypothesis 2.

Moving on to the *hardening of soft information hypothesis* (Hypothesis 3), in columns 7-9 of Table 5 we estimate the combined effect of bank lending technologies and soft information production. According to our hypothesis, the extent of credit rationing might increase less for firms matching with a transactional main bank that is able to adopt soft information during a crisis. The reported marginal effects support this view. While firms coupling with transactional main banks not relying on soft information (SOFT INFO=0) are positively associated with the probability of experiencing credit restrictions, this likelihood reduces when the firm matches with a transactional main bank employing soft qualitative data (SOFT INFO>0). These results are statistically significant and economically sizeable for all the credit rationing proxies: transactional banks improving the adoption of soft information reduce by 8 percent the probability of rationing (statistically significant at the 99 percent level), and by 6.6 percent the probability of experiencing both wide rationing (statistically significant at the 90 percent level) and strong credit restrictions (statistically significant at the 99 percent level). Conversely, transactional main banks not investing in soft information production increase by 17.9 percent the probability of firms being credit rationed, by 16.4 percent the likelihood of wide rationing and by 13.3 percent the probability of strong credit restrictions (all statistically significant at 99 percent level). Hence, the *hardening of soft information hypothesis* (Hypothesis 3) is confirmed.

Looking at relational main banks, estimation results indicate that soft information production does not significantly affect the lending outcome of these financial intermediaries. The interaction effect between the RELAT LENDING variable and the soft information indicator is never statistically significant. Hence, the production of soft information seems to be efficient in reducing credit rationing only for those firms coupling with banks employing transactional lending techniques.

Regarding the other firm-specific characteristics, as before, we find that more indebted (DEBT RATIO), less liquid (LIQUID RATIO) and less profitable (DIFF ROS) firms are significantly more likely to be rationed by banks during the crisis. Moreover, as indicated by the bank-firm relationship controls, both the exclusivity (NUMBER OF BANKS) and the longevity (DURATION) of the bank-firm relation slightly reduce the probability of experiencing credit restrictions.

4.3 *The effect of bank type and firm size*

In order to get additional insights about the hardening of soft information, in this section we investigate whether the ability of transactional banks to improve firms' access to credit through the production of soft information is affected by some bank- and firm- specific characteristics. In particular, we first analyze whether national and local banks have a different approach to the hardening of soft information. Then, we investigate how bank lending technologies and the production of soft information differently affect large and small firms rationing status. The related estimation results are reported in Table 6.

Starting with the nature of bank (Panel A), the estimated marginal effects provide several intuitions. First, the adoption of transactional lending technologies is positively associated with the probability of experiencing credit restrictions, both for firms matching with local banks and firms coupling with national financial intermediaries. The TRANS LENDING marginal effects are always positive and statistically significant at the 99 percent level in all the credit rationing specifications (i.e. rationing, wide rationing and strong rationing). Second, consistently with our previous findings (Sections 4.1 and 4.2), relational lending technologies do not affect the rationing status of our sample firms during the crisis, as the RELAT LENDING estimated marginal effects are never statistically significant. Finally, the production of soft information improves firms' access to credit when the firm deals with a national transactional main bank. The marginal effects of the

SOFT x TRANS LENDING interaction term are negative and statistically significant at the 90 percent level in both the rationing (column 2) and strong rationing (column 6) specifications. Conversely, soft information production in local transactional main banks does not affect the probability of firms experiencing credit restrictions (columns 1, 3, 5). These findings are consistent with the emerging literature on the hardening of soft information (Berger, 2015; Udell, 2015; Filomeni et al., 2016): as larger banks are the most concerned with the problems associated to the production and transmission of information and the most able to manage complex credit scoring models, during a financial crisis they have the greatest incentive to efficiently combine transactional lending techniques and soft qualitative data in order to assess borrowers' creditworthiness. On the contrary, small local banks, usually relying on relational lending technologies, are not able to efficiently exploit the benefits associated with the combined adoption of transactional lending techniques and soft information. These results are also consistent with the anecdotal evidence that during the crisis large banks partially changed their business model by relying more on soft information and increasing the degree of autonomy of local loan officers (see, e.g., Rotondi, 2013).

Moving on to the role of firm size, estimation results are presented in Panel B of Table 6. As indicated by the estimated marginal effects, the transactional lending indicator has a different impact on the probability of experiencing credit restrictions in large and small firms. While increasing transactional lending technologies do not affect the rationing status of large firms (except for the strong rationing specification), they always increase the probability of small businesses of being credit rationed. More specifically, in the subsample of SMEs, a one-unit increase in the TRANS LENDING variable increases by 17.8 percent the probability of rationing (column 2), by 15.7 percent the probability of wide rationing (column 4), and by 12.6 percent the probability of strong rationing (column 6), all statistically significant at the 99 percent level. These findings, consistently with Ferri and Murro (2015), suggest that while large firms benefit from coupling with transactional main banks, small businesses should enjoy stronger lending relationships with relational financial intermediaries in order to reduce (or at least to not increase) the probability of experiencing credit restrictions, especially during a financial crisis. Consistently with our previous results, also in this case, the relational lending indicator does not affect the probability of experiencing credit restrictions, as the RELAT LENDING variable is never statistically significant.

With regard to the hardening of soft information process, our estimation results indicate that only small firms benefit from the combination of transactional lending technologies and soft information production. The marginal effects of the SOFT x TRANS LENDING variable are negative and statistically significant for all the credit rationing specifications (rationing, wide rationing and strong rationing). More specifically, an increase in both the soft information and transactional lending indicator reduces by 8.7 percent the probability of rationing (column 2), by 6.6 percent the probability of wide rationing (column 4), and by 6.9 percent the likelihood of experiencing strong credit restrictions (column 6). On the contrary, the production of soft information, whether combined with transactional or relational lending technologies, is found to not affect the rationing status of large firms. Consistently with Berger and Udell (2006) and Bartoli et al. (2013), these results support the idea that soft information production is more useful with small and more opaque borrowers, than with large and more transparent firms. Hence, during the crisis, the exacerbation of SMEs' information asymmetries have led transactional banks to adopt soft qualitative information to better assess small borrowers' creditworthiness and try to ease their access to bank lending.

5 Conclusions

This paper examined the impact of lending technologies and soft information on firms' credit availability during the global financial crisis. By using a detailed questionnaire on European manufacturing firms, we found that the use of transactional lending technologies increased the probability of credit rationing. On the contrary, we uncovered no significant evidence of a supposed positive role of relationship lending on credit availability. Estimation results also revealed that the production of soft information reduced the probability of firms experiencing credit restrictions. Moreover, the adoption of soft qualitative data marginally but significantly reduced the negative effect of transactional lending technologies. By augmenting those models with soft information, transactional banks may have improved their ability to assess borrowers' creditworthiness thus mitigating their borrowers' financing difficulties. In the last part of the paper, we also examined whether firm and bank characteristics played a role in the interaction between soft information and lending technologies. SMEs are found to benefit more when their transactional main banks use soft

information. Correspondingly, by bank type, large banks were more effective at incorporating soft information in transactional technologies, partially healing the credit crunch.

Overall, our findings support prior literature indicating that, also during a deep recession such as that of 2007-2009, lending technologies play an important role in determining firms' access to credit (Berger and Udell, 2006; Bartoli et al., 2013). In a policy perspective, these results suggest that during a financial crisis regulations enabling banks to increase the discretionary power of loan officers could favor firms' access to liquidity. This might be achieved by either relying more on relationship lending technologies or incorporating soft information in credit scoring models.

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Tables

Table 1
Summary statistics

	Mean	Median	St. dev.	Obs.
Firm characteristics:				
AGE	26.50	21.00	22.58	14,759
NUMBER EMPLOYEES	71.63	26.00	142.92	11,442
DEBT RATIO	66.16	66.45	27.69	13,844
LIQUIDITY RATIO	1.54	1.04	1.73	13,322
DIFFERENTIAL ROS	0.00	0.00	0.08	9,827
CAPITAL INTENSITY	38.37	18.88	53.72	10,884
LABOUR PRODUCTIVITY	51.31	45.75	27.67	9,645
GROUP	0.22	0.00	0.41	14,759
FOREIGN	0.10	0.00	0.29	14,302
NUMBER OF BANKS	3.10	2.00	2.65	14,655
DURATION	15.85	12.00	13.81	6,757
Countries:				
AUSTRIA	0.03	0.00	0.17	14,759
GERMANY	0.20	0.00	0.40	14,759
FRANCE	0.20	0.00	0.40	14,759
HUNGARY	0.03	0.00	0.18	14,759
ITALY	0.20	0.00	0.40	14,759
SPAIN	0.20	0.00	0.39	14,759
UNITED KINGDOM	0.14	0.00	0.35	14,759
Lending technologies:				
TRANS LENDING	0.60	0.67	0.30	6,875
RELAT LENDING	0.52	0.50	0.43	6,868
TRANS LENDING 2	0.62	0.50	0.33	6,875
RELAT LENDING 2	0.40	0.33	0.34	6,870
SOFT INFORMATION	0.29	0.00	0.35	8,910
Credit rationing:				
RATIONING	0.09	0.00	0.28	6,837
WIDE RATIONING	0.19	0.00	0.39	6,837
STRONG RATIONING	0.05	0.00	0.23	6,605

Notes: Balance-sheet indicators refer to the period 2007-2009. Extreme values are recoded at the 1st and 99th percentiles because of outliers.

Table 2
Univariate tests

	RATIONING			WIDE RATIONING			STRONG RATIONING		
	Yes	No	*t-statistics*	Yes	No	*t-statistics*	Yes	No	*t-statistics*
Lending technologies:									
TRANS LENDING	0.72	0.59	-11.78***	0.67	0.59	-9.22***	0.73	0.59	-9.55***
RELAT LENDING	0.51	0.52	0.67	0.53	0.52	-1.29	0.52	0.52	-0.09
TRANS LENDING 2	0.69	0.62	-5.76***	0.67	0.62	-5.03***	0.70	0.62	-4.72***
RELAT LENDING 2	0.38	0.40	0.97	0.41	0.40	-1.24	0.40	0.40	0.03
SOFT INFORMATION	0.36	0.39	2.30**	0.35	0.40	4.56***	0.35	0.39	2.30**
Firm characteristics:									
AGE	22.49	25.47	4.00***	24.12	25.47	2.34**	22.13	25.47	3.66***
NUMBER EMPLOYEES	59.38	64.91	1.01	68.24	63.60	-0.99	71.35	64.91	-0.83
DEBT RATIO	81.49	69.23	-12.86***	75.60	69.06	-8.40***	82.68	69.23	-11.23***
LIQUIDITY RATIO	0.77	1.18	12.51***	0.96	1.18	7.61***	0.73	1.18	15.67***
DIFFERENTIAL ROS	-0.02	0.00	5.22***	-0.01	0.00	5.24***	-0.02	0.00	4.31***
CAPITAL INTENSITY	47.79	44.01	-1.37	46.04	44.02	-0.96	44.06	44.01	-0.02
LABOUR PRODUCTIVITY	41.79	49.44	7.85***	45.16	49.44	4.83***	40.70	49.44	7.96***
GROUP	0.19	0.19	0.31	0.19	0.19	0.03	0.20	0.19	-0.10
FOREIGN	0.05	0.07	1.60	0.07	0.06	-0.92	0.06	0.07	0.65
NUMBER OF BANKS	4.69	3.63	-7.96***	3.67	3.74	0.75	5.11	3.63	-7.89***
DURATION	13.43	16.07	5.27***	15.11	16.01	2.06**	13.06	16.07	4.76***

Notes: The table reports univariate statistics. All of the variables are defined in Table A1. Accounting figures are expressed in thousands of Euros. Balance-sheet indicators refer to the period 2007-2009. Extreme values are recoded at the 1st and 99th percentiles because of outliers. Three, two and one star (*) mean, respectively, 99, 95 and 90 percent level of significance.

Table 3
Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
RATIONING	1.000																		
WIDE RATIONING	0.633	1.000																	
STRONG RATIONING	1.000	0.544	1.000																
TRANS LENDING	0.128	0.109	0.107	1.000															
RELAT LENDING	-0.008	0.016	0.001	0.286	1.000														
TRANS LENDING 2	0.066	0.060	0.056	0.839	0.246	1.000													
RELAT LENDING 2	-0.012	0.015	0.000	0.320	0.939	0.286	1.000												
SOFT INFORMATION	-0.027	-0.054	-0.028	-0.041	0.072	-0.027	0.074	1.000											
AGE	-0.044	-0.028	-0.039	-0.032	0.060	-0.028	0.068	-0.067	1.000										
SIZE (ln)	-0.016	0.016	0.019	-0.028	0.211	0.003	0.216	-0.121	0.170	0.807									
DEBT RATIO	0.142	0.105	0.126	0.124	0.041	0.069	0.036	-0.044	-0.112	0.001	1.000								
LIQUIDITY RATIO	-0.107	-0.079	-0.095	-0.062	-0.022	-0.036	-0.016	-0.162	0.103	-0.020	-0.458	1.000							
DIFFERENTIAL ROS	-0.083	-0.076	-0.073	-0.034	-0.030	-0.015	-0.024	0.002	0.010	0.001	-0.260	0.150	1.000						
CAPITAL INTENSITY	0.019	0.013	0.000	0.019	-0.017	0.051	-0.022	-0.024	0.056	0.081	-0.017	-0.100	0.116	1.000					
LABOUR PRODUCTIVITY	-0.091	-0.065	-0.085	-0.103	0.049	-0.035	0.051	-0.050	0.119	0.106	-0.210	0.212	0.353	0.367	1.000				
GROUP	-0.004	0.000	0.001	-0.074	0.101	-0.069	0.108	0.019	-0.014	0.321	-0.016	-0.018	-0.003	0.080	0.198	1.000			
FOREIGN	-0.018	0.012	-0.008	-0.016	0.064	-0.011	0.074	-0.046	-0.009	0.230	-0.021	0.023	-0.009	0.033	0.156	0.469	1.000		
NUMBER OF BANKS	0.095	-0.008	0.107	-0.047	-0.020	0.007	-0.028	0.124	0.031	0.203	0.057	-0.094	0.026	0.212	0.113	0.070	-0.026	1.000	
DURATION	-0.054	-0.026	-0.049	-0.032	0.001	-0.033	0.020	0.110	0.380	0.008	-0.107	0.093	0.001	-0.001	0.057	-0.077	-0.069	-0.051	1.000

Table 4
Baseline Estimates

	Main results			Robustness checks		
	RATIONING	WIDE RATIONING	STRONG RATIONING	RATIONING	WIDE RATIONING	STRONG RATIONING
	(1)	(2)	(3)	(4)	(5)	(6)
TRANS LENDING	0.114***	0.123***	0.065***			
	[0.013]	[0.019]	[0.009]			
RELAT LENDING	-0.002	-0.013	-0.003			
	[0.009]	[0.014]	[0.006]			
TRANS LENDING 2				0.046***	0.028	0.026***
				[0.013]	[0.018]	[0.009]
RELAT LENDING 2				0.008	0.005	0.006
				[0.012]	[0.019]	[0.008]
AGE	0.000	-0.000	0.000	0.000	-0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
SIZE (ln)	0.001	-0.003	0.005*	-0.002	-0.007	0.004
	[0.004]	[0.007]	[0.003]	[0.004]	[0.007]	[0.003]
DEBT RATIO	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
LIQUID RATIO	-0.057***	-0.044***	-0.037***	-0.062***	-0.046***	-0.041***
	[0.010]	[0.012]	[0.007]	[0.010]	[0.012]	[0.007]
DIFF ROS	-0.143***	-0.200**	-0.060	-0.151***	-0.202**	-0.066*
	[0.055]	[0.084]	[0.038]	[0.057]	[0.084]	[0.040]
CAPIT INTENSITY	0.012*	0.022**	0.003	0.014*	0.024**	0.004
	[0.007]	[0.011]	[0.005]	[0.007]	[0.011]	[0.005]
LABOUR PROD	-0.066***	-0.098***	-0.048***	-0.079***	-0.110***	-0.058***
	[0.021]	[0.031]	[0.015]	[0.022]	[0.031]	[0.016]
GROUP (0,1)	0.011	0.013	0.004	0.011	0.012	0.004
	[0.011]	[0.016]	[0.007]	[0.011]	[0.016]	[0.008]
FOREIGN (0,1)	0.015	0.026	0.005	0.013	0.027	0.005
	[0.019]	[0.026]	[0.012]	[0.019]	[0.027]	[0.013]
NUMBER OF BANKS	0.002*	0.003	0.003***	0.002*	0.003	0.003***
	[0.001]	[0.002]	[0.001]	[0.001]	[0.002]	[0.001]
DURATION	-0.001**	-0.001**	-0.000*	-0.001**	-0.001**	-0.001**
	[0.000]	[0.001]	[0.000]	[0.000]	[0.001]	[0.000]
Country fixed effects	Y	Y	Y	Y	Y	Y
Industry fixed effects	Y	Y	Y	Y	Y	Y
Observations	4,570	4,595	4,396	4,570	4,595	4,396
Pseudo R^2	0.141	0.072	0.160	0.121	0.064	0.141

Notes: The table reports marginal effects. The dependent variables are reported at the top of each column. Three, two and one star (*) mean, respectively, a 99, 95 and 90 percent level of significance. Robust standard errors are in brackets. The regressions are estimated by Probit. All of the variables are defined in Table A1. Balance-sheet indicators refer to the period 2007-2009.

Table 5
The role of soft information

	RATIONING	WIDE RATIONING	STRONG RATIONING	RATIONING	WIDE RATIONING	STRONG RATIONING	RATIONING	WIDE RATIONING	STRONG RATIONING
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SOFT INFORMATION	-0.018*	-0.004	-0.015*	-0.029***	-0.014	-0.020***			
	[0.011]	[0.016]	[0.008]	[0.010]	[0.016]	[0.007]			
TRANS LENDING				0.116***	0.126***	0.067***	0.179***	0.164***	0.133***
				[0.013]	[0.020]	[0.009]	[0.022]	[0.027]	[0.019]
RELAT LENDING				0.002	-0.010	-0.000	0.002	-0.015	0.003
				[0.009]	[0.014]	[0.006]	[0.018]	[0.022]	[0.016]
SOFT x TRANS LENDING							-0.080***	-0.066*	-0.066***
							[0.030]	[0.037]	[0.025]
SOFT x RELAT LENDING							0.006	0.016	-0.000
							[0.025]	[0.034]	[0.021]
AGE	0.000	-0.000	0.000	0.000	-0.000	0.000	0.000	-0.000	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
SIZE (ln)	-0.002	-0.007	0.004	0.001	-0.004	0.005*	0.001	-0.004	0.008
	[0.005]	[0.007]	[0.003]	[0.004]	[0.007]	[0.003]	[0.006]	[0.007]	[0.005]
DEBT RATIO	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.002***	0.002***	0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
LIQUID RATIO	-0.062***	-0.046***	-0.041***	-0.057***	-0.044***	-0.037***	-0.012***	-0.017***	-0.006**
	[0.010]	[0.012]	[0.007]	[0.010]	[0.012]	[0.007]	[0.004]	[0.005]	[0.003]
DIFF ROS	-0.160***	-0.206**	-0.075*	-0.144***	-0.199**	-0.062*	-0.227***	-0.229***	-0.150**
	[0.058]	[0.084]	[0.040]	[0.054]	[0.083]	[0.037]	[0.078]	[0.089]	[0.070]
CAPIT INTENSITY	0.015**	0.025**	0.004	0.011	0.022**	0.002	0.020**	0.026**	0.008
	[0.007]	[0.011]	[0.005]	[0.007]	[0.011]	[0.005]	[0.010]	[0.012]	[0.008]
LABOUR PROD	-0.080***	-0.110***	-0.059***	-0.065***	-0.098***	-0.047***	-0.069***	-0.094***	-0.052***
	[0.023]	[0.031]	[0.016]	[0.021]	[0.031]	[0.015]	[0.019]	[0.026]	[0.014]
GROUP (0,1)	0.010	0.013	0.003	0.011	0.014	0.003	0.016	0.015	0.007
	[0.011]	[0.016]	[0.008]	[0.011]	[0.016]	[0.007]	[0.012]	[0.015]	[0.010]
FOREIGN (0,1)	0.013	0.028	0.005	0.016	0.028	0.006	0.011	0.029	0.007
	[0.019]	[0.027]	[0.013]	[0.019]	[0.026]	[0.012]	[0.020]	[0.025]	[0.017]
NUMBER OF BANKS	0.003**	0.003*	0.003***	0.002*	0.003	0.002***	0.003	0.003	0.005***
	[0.001]	[0.002]	[0.001]	[0.001]	[0.002]	[0.001]	[0.002]	[0.002]	[0.002]
DURATION	-0.001**	-0.001**	-0.000*	-0.001*	-0.001*	-0.000	-0.000	-0.001*	-0.000
	[0.000]	[0.001]	[0.000]	[0.000]	[0.001]	[0.000]	[0.000]	[0.000]	[0.000]
Country fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	4,570	4,594	4,396	4,570	4,594	4,396	4,599	4,599	4,425
Pseudo R^2	0.116	0.063	0.136	0.144	0.073	0.163	0.081	0.062	0.069

Notes: The table reports marginal effects. The dependent variables are reported at the top of each column. Three, two and one star (*) mean, respectively, a 99, 95 and 90 percent level of significance. Robust standard errors are in brackets. The regressions are estimated by Probit. All of the variables are defined in Table A1. Balance-sheet indicators refer to the period 2007-2009.

Table 6
The effect of bank type and firm size

Panel A: The nature of bank

	RATIONING		WIDE RATIONING		STRONG RATIONING	
	Local	National	Local	National	Local	National
	(1)	(2)	(3)	(4)	(5)	(6)
TRANS LENDING	0.171***	0.170***	0.167***	0.163***	0.121***	0.127***
	[0.027]	[0.025]	[0.033]	[0.030]	[0.023]	[0.021]
RELAT LENDING	0.006	0.007	-0.031	-0.016	-0.004	0.009
	[0.023]	[0.020]	[0.028]	[0.024]	[0.020]	[0.017]
SOFT x TRANS LENDING	-0.055	-0.056*	-0.062	-0.060	-0.048	-0.050*
	[0.036]	[0.033]	[0.045]	[0.040]	[0.031]	[0.027]
SOFT x RELAT LENDING	-0.012	-0.007	0.029	0.022	-0.001	-0.016
	[0.030]	[0.028]	[0.041]	[0.037]	[0.025]	[0.023]
Control variables	Y	Y	Y	Y	Y	Y
Country fixed effects	Y	Y	Y	Y	Y	Y
Industry fixed effects	Y	Y	Y	Y	Y	Y
Observations	3,082	3,799	3,082	3,799	2,967	3,658
Pseudo R^2	0.080	0.083	0.060	0.065	0.069	0.071

Panel B: The type of firm

	RATIONING		WIDE RATIONING		STRONG RATIONING	
	Large	SMEs	Large	SMEs	Large	SMEs
	(1)	(2)	(3)	(4)	(5)	(6)
TRANS LENDING	0.186	0.178***	0.222	0.157***	0.236**	0.126***
	[0.113]	[0.023]	[0.136]	[0.028]	[0.113]	[0.020]
RELAT LENDING	0.045	-0.002	0.006	-0.017	-0.005	0.001
	[0.066]	[0.019]	[0.090]	[0.023]	[0.059]	[0.016]
SOFT x TRANS LENDING	0.060	-0.087***	-0.049	-0.066*	-0.006	-0.069***
	[0.178]	[0.030]	[0.195]	[0.038]	[0.175]	[0.025]
SOFT x RELAT LENDING	-0.064	0.010	0.109	0.011	0.001	0.001
	[0.110]	[0.026]	[0.139]	[0.035]	[0.097]	[0.022]
Control variables	Y	Y	Y	Y	Y	Y
Country fixed effects	Y	Y	Y	Y	Y	Y
Industry fixed effects	Y	Y	Y	Y	Y	Y
Observations	245	4,354	245	4,354	241	4,184
Pseudo R^2	0.192	0.079	0.184	0.060	0.195	0.067

Notes: The table reports marginal effects. The dependent variables are reported at the top of each column. Local is a dummy variable equal to one if the firm's main bank is a local bank, and zero otherwise. National is a dummy variable equal to one if the firm's main bank is a national bank, and zero otherwise. Large is a dummy variable equal to one if the firm has more than (i) 250 employees and, (ii) 50 millions of turnover or (iii) 43 millions of total assets. SMEs is a dummy variable equal to one if the firm has less than (i) 250 employees and, (ii) 50 millions of turnover or (iii) 43 millions of total assets. Three, two and one star (*) mean, respectively, a 99, 95 and 90 percent level of significance. Robust standard errors are in brackets. The regressions are estimated by Probit. All of the variables are defined in Table A1. Balance-sheet indicators refer to the period 2007-2009.

Table A1
Variable definitions

Variable	Definition
RATIONING	Dummy variable equal to one if the firm unsuccessfully applied for credit, and zero otherwise. Source: EU-EFIGE survey
WIDE RATIONING	Dummy variable equal to one if the firm was willing to increase its borrowing, and zero otherwise. Source: EU-EFIGE survey
STRONG RATIONING	Dummy variable equal to one if the firm unsuccessfully applied for credit and was willing to pay a higher rate of interest, and zero otherwise. Source: EU-EFIGE survey
TRANS LENDING	Average of collateral, balance sheet information and historical records dummies. Source: EU-EFIGE survey
RELAT LENDING	Average of interviews with management and business plan dummies. Source: EU-EFIGE survey
TRANS LENDING 2	Average of balance sheet information and historical records dummies. Source: EU-EFIGE survey
RELAT LENDING 2	Average of interviews with management, business plan and brand recognition dummies. Source: EU-EFIGE survey
SOFT INFORMATION	Average of consultancy service and long-lasting relationship dummies. Source: EU-EFIGE survey
AGE	Number of years from firm's inception. Source: EU-EFIGE survey
SIZE	Logarithm of the number of workers employed in the firm. Source: Bvd-Amadeus
DEBT RATIO	Ratio of total debt to total assets. Source: Bvd-Amadeus
LIQUIDITY RATIO	Ratio of current assets to current liabilities. Source: Bvd-Amadeus
DIFFERENTIAL ROS	Difference between firm i return on sales and the median return on sales of its industry (at the size class and regional level). Source: Bvd-Amadeus
CAPITAL INTENSITY	Ratio of tangible fixed assets to number of employees. Source: Bvd-Amadeus
LABOUR PRODUCTIVITY	Ratio of value added to number of employees. Source: Bvd-Amadeus
GROUP	Dummy variable equal to one if firm i is part of a group, and zero otherwise. Source: EU-EFIGE survey

FOREIGN	Dummy variable equal to one if the main shareholder of the firm i is foreign. Source: EU-EFIGE survey
NUMBER OF BANKS	Total number of firm's banking relationships. Source: EU-EFIGE survey
DURATION	Length (in number of years) of the bank-firm relationship. Source: EU-EFIGE survey