The impact of the recent financial crisis on bank loan interest rates and guarantees. The case of Italian small-sized firms.[♣]

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PRELIMINARY DRAFT

Abstract. The paper analyzes the role of guarantees on interest rates before and during the recent financial crisis on small-sized firm financing. The novelty of this work is the distinction between real and personal guarantees, and the potential different role they could have played in the bank-borrower relationship as the recent financial crisis is taken into account.
This paper uses individual Italian bank and producer households data drawn from the Central Credit Register at the Bank of Italy over the period 2006-2009.
Our analysis shows that collateral and personal guarantees affect the cost of credit of small business by reducing systematically the spread of secured loans, once we control for borrower and loan riskiness, and that this effect is amplified during the crisis.

Keywords: small firms, financial crisis, asymmetric information, collateral.

JEL classification: E43, G21, D82

[♣] We are indebted to F. Farabullini with whom we continuously shared ideas and discussed our empirical results, and for providing us with valuable data.

1 Introduction

The importance of guarantees in bank lending activity is widespread acknowledged, and their role is even recognized in the Basel Capital Accords that foresee a specific regulation for secured loans. Moreover, there is an extensive literature that deals with the role of guarantees in determining the cost and the availability of credit, and borrower characteristics that more affect collateral requirements. In the presence of informational opacity, collateral and guarantees are powerful tools useful for mitigating adverse selection problems that may arise at the loan origination, and moral hazard risk that arises after credit has been granted (Berger and Udell, 1990). This paper aims at analyzing the role played by collateral and personal guarantees on bank-loan interest rates granted to Italian small-sized firms by means of a large dataset drawn from the Central Credit Register for the period 2006-2009. The Central Credit Register is an information system on the debt of the customers of the banks and financial companies supervised by the Bank of Italy. By means of the Central Credit Register the Bank of Italy provides intermediaries with a service intended to improve the quality of the lending of the credit system and ultimately to enhance its stability. The purpose of this paper is twofold. Firstly, to model and estimate a bank-loan supply function to understand the role and the relative weights of the two types of guarantees in the setting of bank interest rates. Secondly, to understand if and how Italian bank behavior changed during the recent economic and financial crisis.[1]

Pozzolo (2004) studied the effects of secured and unsecured loans on interest rates. In his work he controlled for the presence of guarantees by means of two dummy variables (one for collateral and one for personal guarantees). The novelty of our paper is a) the use of a larger database than Pozzolo's, spanned from 2006 to 2009; b) the focus on producer households companies for which the provision of real and personal guarantees has always been facilitating bank credit access, especially during economic crises (Cowling, 2010);[2] c) the use of the guarantee-loan ratio as explanatory variables. Indeed, we expect that interest rates depend upon the relative value of guarantees with respect to the size of the granted loan, and not only upon the presence of guarantees; d) we deal with a single-nested panel in which firms may be grouped by banks, and estimate a "mixed effects" model in which fixed-effects are analogous to standard regression coefficients and are estimated directly. The random effects are not directly estimated but are summarized according to their estimated variances and covariances. We assume random effects vary across banks and may take the form of either random intercepts or random coefficients.

The distinction between real guarantees (hereinafter collateral) and personal guarantees, and their potential different role in bank-borrower relationships, plays an important theoretical role in models of bank interest rates.[3] Moreover, it would also help distinguishing between inside collateral and outside collateral. The former is physical assets owned by the borrower, and is mainly used to order creditors priority in case of borrower's default. The latter is assets posted by external grantors: in case of default, outside collateral enhances the claim of a single creditor by recurring against additional assets external to the debtor. Therefore, by exposing the grantor to the potential losses of the entrepreneurial activity, outside collateral should be more powerful. Personal guarantees are instead contractual obligations of a third party, and

[1] Panetta and Signoretti (2010) show that, during recent economic and financial turmoil, the deceleration of Italian bank loans has been affected both by demand and supply factors. As for firms, they show that loan demand declined following the investment contraction, while lower levels of bank loan supply were the joint result of the increase in borrowers' risk and in the degree of bank risk aversion.

[2] Producer households are partnerships or sole proprietorships with a number of employees less than or equal to 5.

[3] See Pozzolo (2004) for a review of the theoretical and empirical literature.

they act as external collateral. However, they do not give the lender a specific claim on particular assets, and restrict the actions (s)he could take in case of borrowers' bankruptcy (Berger and Udell, 2000).
The Central Credit Register database does not provide information on inside and outside collateral. Therefore, this paper will only discuss empirical results concerning the role of collateral and guarantees on bank loan interest rates charged to Italian small-sized firms.
This paper uses unbalanced sample data on 197 individual Italian bank and 326,534 firm data drawn from the Central Credit Register at the Bank of Italy over the period 2006-2009.
Firstly, we estimate a multilevel model in which the dependent variable, i.e. the spread between bank loan and overnight interest rates, is regressed on loan-contract, individual-firm and -bank characteristics, and on time dummies. Our results show that collateral helps reducing loan interest rates of Italian producer households, and that this effect is amplified during the crisis. As for personal guarantees, we find that their impact on loan cost is overall negative and statistically significant once we account for the crisis. These findings may be consistent with the different role of collateral and guarantees in mitigating adverse selection and moral hazard problems.
Secondly, we estimate two probit models (one for guarantees and one for collateral) to capture how the crisis, together with the borrower *ex-ante* riskiness and other variables, influenced the probability of observing secured loans. The probit analysis seems to confirm the idea that high quality borrower tend to post collateral, while guarantees are associated with riskier borrowers.
The paper is organized as follows. Section 2 describes the data used and provides some descriptive statistics; Section 3 describes the empirical model, the estimation strategy and discusses the findings. Section 4 concludes.

2 Data and Summary Statistics

The empirical analysis uses information on lines of credit to a large sample of Italian nonfinancial small firms (producer households). Data are taken from two sources: the Banks' Supervisory Reports to the Bank of Italy (Segnalazioni di Vigilanza) and the Central Credit Register (Centrale dei Rischi). The first source is used for data on banks' balance sheets. The second contains information on single bank loans, the interest rates charged and the value of the assets posted as guarantees (distinguished between real and personal).[4] [5]

[4] The Central Credit Register is regulated by the resolution adopted by the Credit Committee on 29 March 1994 pursuant to Articles 53, 67 and 107 of the Banking Law. The following participate in this centralized service:
– banks entered in the register referred to in Article 13 of the Banking Law;
– financial intermediaries entered in the register of banking groups and/or the special register referred to in, respectively, Articles 64 and 107 of the Banking Law that engage exclusively or primarily in financing activity. Financial intermediaries more than 50 per cent of whose financing activity consists of consumer credit are exempted. Consequently, the group of financial intermediaries reporting to the Central Credit Register is not identical to the group that transmits supervisory returns.
Participating intermediaries also report the exposures of foreign branches to borrowers resident in Italy. All the statistical distributions take such loans into account.
Once a month intermediaries are required to report each customer's debtor position, comprising both individual and joint liabilities (joint accounts and partnerships).
The whole position relative to a given customer must be reported where even one of the following conditions applies:
the sum of credit granted or used for all loans and guarantees granted to the customer is at least 30,000 euros;
the total value of personal guarantees provided by the customer is at least 30,000 euros;
the customer's position is classified among bad debts or is written off during the reference month, regardless of the amount;
the face value of factoring claims the intermediary has acquired from the customer is at least 30,000 euros;
the value of the transactions carried out by the intermediary on behalf of third parties is at least 30,000 euros;

We use data on producer households for the period 2006-2009 for a total of 326,534 small-sized firms and 197 banks.
Table 1 shows the distribution (%) of producer households' loans by type of guarantees for the period 1999-2009. On one side, the share of loans granted by collateral (mainly mortgages) has been constantly increasing until 2007 due to the growth of the Italian real estate market. Instead, from 2007 this share was constant, likely reflecting lower investments following the economy slowdown and the decreasing return of the real estate industry (Panetta and Signoretti, 2010). On the other side, the share of loans granted by personal guarantees has been constantly decreasing since 1999 as a result of changes in bank preferences that favored loans granted by collateral. Indeed, personal guarantees are potentially riskier than collateral as they represent a generic claim on the wealth of the grantor, who has therefore a large degree of freedom and could possibly default on it.
As expected, the financial crisis negatively affected the number of loans. In our sample, the latter showed a 37.83% decrease from 2008 to 2009, while the average loan size increased of 1.27% (see Table 2).[6] If we distinguish between loans secured by collateral and by personal guarantees descriptive statistics show a) a decrease in the number and average size of loans granted by personal guarantees (-20.26% and -1.83%, respectively); b) a large drop in the number of loans granted by collateral (-44.52%), but an increase in their average size (+7.08%) (see Table 3). This dynamics can be mainly explained by a negative demand effect (less investments, less mortgages and less collateralized loans), but also by a bank tightening of credit, and a higher bank risk aversion.
During the crisis, following the official rate trends, the cost of credit decreased significantly and in 2009 interest rates were 3.9 percent points lower than 2008 levels for variable interest rate contracts, and of 3.1 percent points than fixed interest rate contracts (Panetta and Signoretti, 2010). As for producer households, interest rates on secured loans decreased more than interest rate on unsecured loans (see Table 4). However, interest rate spreads charged to producer households has been increasing since 2006, and they have been higher for unsecured loans than for loans secured by guarantees, especially for collateralized loans (see Table 5).
Therefore, descriptive statistics already show an impact of guarantees on loan interest rates. To disentangle the direct effect of real and personal guarantees - and their interaction with the crisis - on the cost of credit, we estimated an empirical multilevel model relating interest rate spreads to loan contracts, firm, and bank characteristics.

3 Model specification and estimation strategy

Our model relates interest rate spreads (SPD) charged to producer households bank loans to:
- a vector $X_{i,j,t}$ containing the characteristics of each loan contract: the relative (to the loan size) amount of collateral (COLL) and personal guarantees (PERS) posted; the contemporaneous presence of both types of guarantees posted (DOUBLEG); the loan size (LOAN_S), and the length of the lending relationship (LEND_REL);

Where a report is made because one of the above conditions applies, it must cover all the outstanding positions of the customer in question (Bank of Italy, 2010, p.117).
[5] Before 2009 the threshold was 75,000 euros. Once we account for this change, the findings shown in Table 2, 3, and 4 are actually reinforced.
[6] The large drops of the number of contracts in the sample could be partially due to statistical factors of anagraphical and sector reclassifications that occurred in 2009. However, our sample data is consistent with the total population data. Indeed, from 2008 to 2009, the total number of lending contract in Italy decreased of the 20.47%. See http://bip.bancaditalia.it/4972unix/homebipita.htm

- a vector $F_{i,t}$ containing firm characteristics: two measures of *ex-ante* borrowers' risk (L.SUBST and L.RISK); the number of lending relationships in each year (NUM_REL) and the firm size (FIRM_S);
- a vector B_j containing bank characteristics: bank size (BANK_S); bank type (LOCAL) and bank location (NORTH, CENTRE and SOUTH).

Further, our model includes time dummies (TIME) and two interaction variables that are expected to capture the impact of the financial crisis on personal and real guarantee requirements (CRISPERS and CRISCOLL).
The empirical equation takes the following form

$$\begin{aligned} \text{SPD}_{i,j,t} = \beta_0 + \beta_1^{'} X_{i,j,t} + \beta_2^{'} F_{i,t} + \beta_3^{'} B_{j,t} + \beta_4^{'} TIME_{\text{t}} + \\ + \beta_5 CRISPERS_{i,j,t} + \beta_6 CRISCOLL_{i,j,t} + u_{i,j,t} \end{aligned} \qquad (1)$$

The subscript i refers to firms, j to banks, t to time periods. $u_{i,j,t}$ is a disturbance with a multiway error-components structure:

$$u_{i,j,t}=\alpha_i + \lambda_{i,j} + \varepsilon_{i,j,t}$$

Where α_i, $\lambda_{i,j}$ and $\varepsilon_{i,j,t}$ are assumed to be i.i.d., and are mutually independent.
Antweiler (2001) derived the maximum likelihood estimator for panel with unbalanced hierarchies. We deal with a single-nested panel in which firms may be grouped by banks, and we estimate a "mixed effects" model in which a fixed-effects approach is used to estimate regression coefficients and a random-effects approach is used for the low-level group, bank.
Table (6) displays summary statistics of regression variables.
Table (7) shows estimated coefficients. In columns (1) and (2) we estimate model (1) without the interaction terms CRISPERS and CRISCOLL. Specifically, column (1) shows the estimated coefficients of the model under the assumption that the intercept is random; column (2) shows the estimated coefficients under the assumption that the slope is also random, i.e. the impact of guarantees and collateral on the loan interest rate varies across banks. Testing the two specifications by means of the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC), according to which "small is better", specification (2) is preferred to specification (1).
Our results show that the presence of collateral (COLL) decreases the interest rate, while the presence of personal guarantees (PERS) is not statistically significant, both in column (1) and (2). These findings are consistent with the idea that once banks control for the borrower risk, collateral decreases interest rates. Moreover, producer households, being of small size, suffer of informational opacity more than larger firm, and collateral might act as a positive signaling device (Berger and Udell, 1998). However, the estimated coefficient of DOUBLEG is positive and statistically significant: riskier borrowers are requested to post both types of guarantees.
Loan size (LOAN_S) and interest rates show an inverse relationship: larger firms seem to have bargaining power that more than compensate the expected positive relationship between loan size and interest rates.
As for firm characteristics, the longer the lending relationship (LEND_REL) is, the higher the interest rate. The estimated coefficient, however, is not robust to all specifications. Moreover, our dataset composition contains different types of loans for which reputation and relationship effects may be less important (Berger and Udell, 1995). Therefore, the length of the lending relationship may capture not only the strength of the bank-borrower relationship, but also a stronger bank market power that implies higher interest rates.
The *ex-ante* (or observed) firm riskiness is captured by the two variables L.SUBST and L.RISK whose estimated coefficients are positive and statistically significant. Furthermore, the number of lending relationships (NUM_REL), which may be also interpreted as a measure of

borrower riskiness, increases interest rates. However, the latter finding is not robust to all specifications.
As for firm and bank size, our results show that the former has no influence on interest rates, but this result may be due to how the FIRM_S variable was constructed. Indeed, FIRM_S is a binary dummy variable which takes a value of 1 when the loan value is equal or greater €1,000,000 and 0 when the loan value is less than €1,000,000.[7] Producer households are normally of small size; therefore their number is small and in our sample they account for less than 0.5% of the whole sample. Further, firm size may be more efficiently captured by the LOAN_S.
Diversely, bank size shows a positive (and statistically significant) impact on interest rates. In other words, large banks charge higher interest rates due to their stronger bargaining power with respect to small firms.
As expected, loans provided by local banks (LOCAL) are associated to lower interest rates. Indeed, local banks have generally informational advantages over large and national banks, and can better respond to small firm requests. Banks located in the Centre and the South of Italy charge a higher interest rate, than bank in the North. Finally, time dummies account for the effects of the financial crisis on interest rates. Their coefficients are highly statistically significant and positive reflecting the increase in interest rates between 2006-2009.
To account for the potential interaction of the crisis with the presence of collateral and guarantees, columns (3) and (4) show estimated coefficients of the full model (1). Testing the two specifications (3) and (4) by means of the AIC and BIC criterions gives the model specification shown in column (4) as the preferred one. Therefore, the impact of collateral and guarantees on loan interest rate varies across banks.
Estimates shown in columns (3) and (4) confirm the previous findings of columns (1) and (2), with the notable exception that the estimated coefficient of personal guarantees (PERS) is now positive and statistically significant. This finding shows that personal guarantees are potentially riskier than collateral as they represent a generic claim on the wealth of the grantor, who has therefore a large degree of freedom and could possibly default on it. Further, it confirms previous studies according to which personal guarantees are associated to a higher observed borrower risk that might not be fully captured by the two variables L.SUBST and L.RISK (Pozzolo, 2004).
However, the estimates show that during the crisis loans secured by personal guarantees or collateral systematically pay a lower interest rate, as the coefficients of both CRISCOLL and CRISPERS are negative and statistically significant at 1 percent level. Moreover, during the crisis, the marginal impact of personal guarantees, calculated as partial derivative of (1) with respect to PERS, is negative. The result, together with the negative estimated coefficients of both collateral (COLL) and of the interaction term CRISCOLL, underlines that collateral and guarantees contribute not only to avoid credit rationing (as shown by descriptive statistics of the previous section) but also to reduce loan interest rate.

3.1 Probit specification

Estimates of model (1) show a different impact of collateral and personal guarantees on loan interest rate. As stated, a possible explanation of this finding is the different role they may play in solving adverse selection and moral hazard problems (Pozzolo, 2004). Particularly, while collateral may be used as a signal of high quality debtor, personal guarantees may be posted by riskier borrowers as incentive device to solve moral hazard problems.

[7] This threshold is used in the statistics of European Central Bank and in several Bank of Italy papers.

Therefore, to test the hypothesis of the different role of the two types of guarantees in solving informational problems, we estimate two probit models, one for the determinants of personal guarantees and one for the determinants of collateral. We assume that the conditional probability of the firm to post guarantees, Pr(*GUAR=1|X*), given a cumulative distribution function $\Phi = (.)$, depends on a set of independent variables as follows:

$$p_{ij} = \Pr(GUAR_{ij,t} = 1 \mid X) = \Phi(X'\beta)$$

with

$$X'\beta = \beta_0 + \beta_1 SUBST_{i,j,t-1} + \beta_2 RISK_{ijt-1} + \beta_3 LOAN\_S_{ijt} + \beta_4 LEND\_REL_{ijt}$$
$$+ \beta_5 BANK\_S_j + \beta_6 LOCAL_j + \beta_7 CENTRAL_j + \beta_8 SOUTH_j + \beta_9 NUM\_REL_{it}$$
$$+ \beta_{10} CRISIS_t + \beta' INTERAC_{ijt} + \varepsilon_{ijt} \qquad (2)$$

where *INTERAC* is a vector that contains the interactions between the dummy variable "CRISIS" and the other explanatory variables of model (2).

Table (8) shows the estimated marginal effects of model (2) for personal guarantees and collateral in column (1) and (2), respectively. Results support the hypothesis that personal guarantees are associated to higher risk borrowers. Indeed, the positive and statistically significant coefficient of L.RISK confirms that *ex ante* borrower risk increases the probability of small-size firms to post guarantees, while the estimated coefficient of L.SUBST is not statistically significant.

Diversely, there is not a clear impact of observed risk on collateral: while L.SUBST increases the probability of loans to be secured, the marginal effect of L.RISK is negative.

Loan size (LOAN_S) increases the probability of loans to be secured both in column (1) and in column (2). In column (1), the higher probability of posting guarantees is due to the larger credit risks borne by banks for large loans. In column (2), the result is mainly driven by the presence of real estate loans that, by the Italian code, have to be collateralized.

The stronger bargaining power of large firms (FIRM_S) with respect to firms of smaller size is captured by the negative marginal effect on the probability of posting both personal guarantees and collateral.

Bank regional location plays a significant role on the likelihood of posting both personal guarantees and collateral. Compared to banks located in the North of Italy, loans provided by banks in Central Italy (CENTRAL) show a higher probability of requiring guarantees or collateral. Banks located in the South (SOUTH) show a negative marginal effect on personal guarantees, likely due to the riskiness of this type of guarantees in regions affected, among others, by high criminal rates, and a positive marginal effect on collateral.

If banks are local (LOCAL), or in the case of long-term lending relationships (LEND_REL) between banks and customers, the probability of posting guarantees is higher and the probability of posting collateral is lower. Both these findings seem to confirm the hypothesis that high quality borrowers tend to post collateral as a signaling device, while personal guarantees are associated with riskier borrowers. Indeed, local banks (typically, cooperative banks) should have an information advantage over national banks, as well as long-term lending relationships imply that banks posses better quality information on their pool of borrowers.

Further, an increasing multiple lending relationships (NUM_REL) affects negatively the probability of posting collateral and has no impact on personal guarantees. The result is '*consistent with the hypothesis that banks are unwilling to require a guarantee on their loans if this has the side effect of making implicitly available to competing lenders the result of their screening activity*' (Pozzolo, 2004 p.14).

When we consider the impact of the economic and financial crisis on the probability of obtaining secured loans, and the interaction between the crisis variable and the other explanatory variables of model (2), we find that estimated coefficients differ with the type of

guarantee we use as dependent variable. Indeed, the estimated coefficient of L.RISK*CRISIS is negative in column (1) and positive in column (2). However, the total marginal effect of L.RISK, calculated as $\partial\Phi(\bullet)/\partial_{L.RISK}$, is positive for personal guarantees and negative for collateral, respectively. The marginal effect of the interaction LOCAL*CRISIS is negative for guarantees and positive for collateral but, the total marginal effect of LOCAL is positive for guarantees and negative for collateral.
During the crisis, long-term lending relationships (LEND_REL*CRISIS) increase the probability of posting both guarantees and collateral, while multiple lending relationships (NUM_REL*CRISIS) and larger banks (BANK_S*CRISIS) decrease the probability of obtaining secured loans.
Finally, we calculated the marginal effect of the event "crisis" on the probability of loans to be secured by deriving model (2) with respect to the variable "CRISIS". Then, we run an F test to assess whether this partial derivative is equal to 0. Table 6, bottom row, shows the F test p-values. The test reject the null hypothesis of no impact of the crisis on the probability of loans to be secured, at 10 percent and 1 percent level, respectively.

4 Conclusions

This paper analyzes the role of guarantees on loan interest rate of producer households, before and during the recent financial crisis. The focus on small businesses is motivated by the fact that informational opacity is expected to be one negatively correlated with firm size. Therefore, once a small-sized firm applies for a line of credit, the result is either credit rationing or a higher interest rate. These two phenomena typically exacerbate during financial crises. Recently, the number of loans to small businesses decreased more than 30 percent.
Our analysis shows that collateral helps reducing loan interest rates charged to small-sized businesses, once we control for borrower and loan riskiness. This effect is larger during economic and financial crises. As for personal guarantees, our findings show that banks consider them riskier than collateral, and that they are typically associated to riskier borrowers. However, the overall marginal effect of personal guarantees on loan interest rates during the recent crisis is negative. Therefore, both collateral and guarantees play an important role to set interest rates charged to small-sized firms, especially during economic and financial crises.
Finally, our probit analysis shows that during financial crises the probability of loans to be secured increases. However, while high-quality borrowers tend to post collateral, personal guarantees are associated with riskier borrowers.

5 Data Appendix

SPD is the spread between the interest rate applied on loan by each bank and the interest rates on overnight interbank deposits. Both interest rates are the average of last quarter of each year.
COLL is the share of each loan guaranteed by real guarantees. Loans are mainly mortgages granted by banks to the borrower. This variable is a proxy for inside collateral.
PERS is the share of each loan guaranteed by personal guarantees. Personal guarantees are granted by third parties in favour of borrowers. This variable acts as outside collateral.
DOUBLEG is a binary dummy variable that takes a value of 1 when both personal and real guarantees are posted and 0 otherwise.
LOAN_S is the ratio between the amount of loan granted to the firm by each bank in the sample and the average size of loan granted to firms of the same sector. It represents a proxy for loan size.

FIRM_S is a binary dummy variable which takes a value of 1 when the amount of loan is equal or greater €1,000,000 and 0 when the value of loan is less than €1,000,000.
SUBST is "substandard" loan of the firm in temporary difficulty. Therefore taken at time t-1, this variable is a measure of *ex ante* (observed) credit risk of the firm.
RISK is the difference between the interest rate applied to a firm by each bank and the average interest rate applied to firms of the same sector. It captures the riskiness of the firm as perceived by banks. Therefore taken at time t-1, this variable is a measure of *ex ante* credit risk of the firm.
LEND_REL is a binary dummy variable that takes a value of 1 in the case of a firm bank relationship three or more years long and a value of 0 in the other cases.
NUM_REL is the number of lending relationship for each firm in each year.
NORTH is a binary geographical dummy variable that has a value of 1 for customers with headquarter in Northern Italy and 0 otherwise.
CENTRAL is a binary geographical dummy variable that has a value of 1 for customers with headquarter in Central Italy and 0 otherwise.
SOUTH is a binary geographical dummy variable that has a value of 1 for customers with headquarter in Southern Italy and 0 otherwise.
BANK_S is a binary dummy variable that has a value of 1 for banks which are classified as "major" or "large" according to the classification of Bank of Italy by size; 0 otherwise (Bank of Italy, 2008).
LOCAL is a binary dummy variable that takes a value of 1 when the bank is a cooperative bank and 0 in the other cases; it is a proxy for local (1) and non-local (0) banks.
CRISIS is a dummy variable that takes value equal to 1 if year is 2008 or 2009 and 0 otherwise.
CRISCOLL represents the interaction between real guarantees (COLL) and a dummy that is equal to1 in every year of the financial crisis period (2008 and 2009); it is 0 in the pre-crisis years (2006 and 2007).
CRISPERS represents the interaction between personal guarantees (PERS) and a dummy that is equal to1 in every year of the financial crisis period (2008 and 2009); it is 0 in the pre-crisis years (2006 and 2007).

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Table 1 *Producer households' loans by type of guarantees (% distribution).*

	1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Collateral	33.7	35.6	36.2	38.2	43.1	46.1	48.6	47.7	51.6	51.5	51.9
Personal Guarantees	39.3	38.6	36.3	34.6	30.8	30.2	28.6	29.0	25.1	24.7	23.3
Unsecured	27.0	25.8	27.4	27.2	26.1	23.7	22.9	23.3	23.3	23.7	24.9

Source: Supervision reports - Bank of Italy.

Table 2 *Number of loans and average loan size*

	Total loans			
	Number of Loans	Variation	Average Loan Size	Variation
2006	245028		152287.8	
2007	261746	6.82%	157617.8	3.50%
2008	253404	-3.19%	165106.7	4.75%
2009	157543	-37.83%	167236.6	1.29%

Source: Our calculations on Bank of Italy data.

Table 3 *Number of loans and average loan size by type of guarantee*

	Loans secured by Personal Guarantees				**Loans secured by Collateral**			
	Number of contracts	and yearly variations	Average Loan Size	and yearly variations	Number of contracts	and yearly variations	Average Loan Size	and yearly variations
2006	108835		154498.6		166746		169630.4	
2007	114417	5.13%	160444.9	3.85%	180308	8.13%	175248.8	3.31%
2008	116830	2.11%	168722.1	5.16%	171418	-4.93%	184409.7	5.23%
2009	93166	-20.26%	165636.1	-1.83%	95102	-44.52%	197473.7	7.08%

Source: Our calculations on Bank of Italy data.

Table 4 *Interest rate charged and yearly variation by type of guarantee*

	Loans secured by personal guarantees		**Loans secured by collateral**		**Unsecured loans**	
	Average interest rate charged	and yearly variations	Average interest rate charged	and yearly variations	Average interest rate charged	and yearly variations
2006	6.00		5.32		6.70	
2007	6.80	0.80	6.22	0.90	7.33	0.63
2008	7.00	0.20	6.42	0.20	7.46	0.13
2009	4.72	-2.28	4.10	-2.32	5.47	-1.98

Source: Our calculations on Bank of Italy data.

Table 5 *Spread charged and loan size by type of guarantee.*

	Total loans		**Loans secured By Personal Guarantees**		**Loans secured by Collateral**		**Unsecured loans**	
	Spread charged and yearly variations		Spread charged and yearly variations		Spread charged and yearly variations		Spread charged and yearly variations	
2006	2.41		2.62		1.98		3.21	
2007	2.62	0.208	2.82	0.199	2.28	0.294	3.26	0.045
2008	3.68	0.408	3.89	0.382	3.34	0.470	4.27	0.309
2009	4.48	0.216	4.52	0.161	3.94	0.179	5.27	0.236

Source: Our calculations on Bank of Italy data.

Table 6 *Summary statistics of the sample variables*

Variable	Observations	Mean	Median	SD	Min	Max
Interest Rate	596034	6.22	6.20	1.75	1.94	124.504
Loan	596034	168436	121113	156211.7	5161	1700000
SPD	596034	3.49	3.13	1.72	0	12.12
COLL	385411	0.86	0.99	0.22	1.16e-06	1
PERS	296478	.96	1	0.37	2.15e-06	2
LOAN_S	596034	0.94	0.71	0.77	.0395295	5.78
LEND_REL	596034	0.67	1	0.47	0	1
SUBST	596034	0.04	0	0.19	0	1
RISK	596034	0.04	-0.21	1.42	-4.014.698	11.46
FIRM_S	596034	0	0	0.07	0	1
LARGE	596034	0.15	0	0.36	0	1
NUM_REL	596034	1.57	1	1.02	1	20

Source: Our calculations on Bank of Italy data.

Table 7 *The determinants of bank loan interest rates: multilevel models.*

	(1) Random Effect: Intercept	(2) Random Effect: Intercept and Slope	(3) Random Effect: Intercept	(4) Random Effect: Intercept and Slope
VARIABLES	Spd	Spd	spd	Spd
COLL	-0.835***	-0.667***	-0.703***	-0.539***
	(0.005)	(0.028)	(0.006)	(0.028)
PERS	-0.004	-0.001	0.044***	0.046***
	(0.004)	(0.008)	(0.005)	(0.009)
DOUBLEG	0.086***	0.075***	0.091***	0.079***
	(0.005)	(0.005)	(0.005)	(0.005)
LOAN_S	-0.127***	-0.128***	-0.128***	-0.129***
	(0.002)	(0.002)	(0.002)	(0.002)
LEND_REL	0.013***	0.003	0.014***	0.004
	(0.003)	(0.003)	(0.003)	(0.003)
L.SUBST	0.100***	0.097***	0.102***	0.099***
	(0.010)	(0.010)	(0.010)	(0.010)
L.RISK	0.575***	0.566***	0.576***	0.567***
	(0.001)	(0.001)	(0.001)	(0.001)
NUM_REL	0.006***	0.002	0.007***	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
FIRM_S	0.009	0.011	0.014	0.016
	(0.022)	(0.022)	(0.022)	(0.022)
BANK_S	0.102**	0.012	0.098*	0.005
	(0.052)	(0.034)	(0.052)	(0.034)
LOCAL	-0.072*	0.016	-0.073**	0.019
	(0.037)	(0.026)	(0.037)	(0.026)
CENTRAL	0.091***	0.088***	0.091***	0.089***
	(0.006)	(0.006)	(0.006)	(0.006)
SOUTH	0.192***	0.183***	0.188***	0.181***
	(0.005)	(0.005)	(0.005)	(0.005)
CRISCOLL			-0.221***	-0.213***
			(0.007)	(0.007)
CRISPERS			-0.081***	-0.080***
			(0.006)	(0.006)
Y_2007	0.207***	0.204***	0.174***	0.173***
	(0.007)	(0.007)	(0.007)	(0.007)
Y_2008	1.252***	1.245***	1.386***	1.375***
	(0.007)	(0.007)	(0.008)	(0.008)
Y_2009	1.825***	1.811***	1.954***	1.937***
	(0.007)	(0.007)	(0.009)	(0.009)
Constant	2.928***	2.856***	2.862***	2.790***
	(0.019)	(0.030)	(0.019)	(0.030)
Observations	596,034	596,034	596,034	596,034
Number of groups	197	197	197	197
AIC	1886752	1881623	1885721	1880687
BIC	1886966	1881894	1885958	1880981

Table 8 *The determinants of personal and real guarantees requirements. Marginal effects.*

VARIABLES	(1) Personal Guarantees	(2) Collateral
L.SUBST	0.002	0.132***
	(0.008)	(0.006)
L.RISK	0.041***	-0.093***
	(0.001)	(0.001)
LOAN_S	0.018***	0.197***
	(0.001)	(0.002)
FIRM_S	-0.064***	-0.305***
	(0.016)	(0.020)
CENTRAL	0.034***	0.051***
	(0.002)	(0.002)
SOUTH	-0.095***	0.144***
	(0.001)	(0.001)
BANK_S	-0.010***	0.000
	(0.002)	(0.002)
LOCAL	0.068***	-0.074***
	(0.005)	(0.005)
LEND_REL	0.051***	-0.023***
	(0.002)	(0.002)
NUM_REL	-0.000	-0.167***
	(0.001)	(0.001)
L.RISK*CRISIS	-0.004***	0.012***
	(0.001)	(0.001)
L.SUBST*CRISIS	-0.006	0.005
	(0.009)	(0.010)
LOAN_S*CRISIS	-0.003*	0.000
	(0.002)	(0.002)
FIRM_S*CRISIS	0.015	0.114***
	(0.020)	(0.020)
LOCAL*CRISIS	-0.049***	0.038***
	(0.006)	(0.006)
LEND_REL*CRISIS	0.013***	0.056***
	(0.003)	(0.003)
BANK_S*CRISIS	-0.006**	-0.071***
	(0.003)	(0.003)
NUM_REL*CRISIS	-0.015***	-0.003**
	(0.001)	(0.002)
CRISIS	0.079***	-0.034***
	(0.004)	(0.004)
Observations	596,028	596,028
CRISIS Marginal impact: F test (p-value)	0.10	0.00

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1