

Loans, Interest Rates and Guarantees: Is There a Link?¹

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1. Introduction

This paper aims at shedding light on the influence of guarantees on the loan pricing (banking interest rates), by focusing on three different types of customers: firms, producer households and consumer households. The relevance of guarantees in lending activity is widespread acknowledged, and their role is recognized in the New Basel Capital Accord (Basel II) that foresees a specific regulation for secured loans.

While the existence of a positive relationship between interest rates and the riskiness of borrowers (in this paper approximated by bad loans) is well established in the literature, the role of guarantees is less clear. Economists' instinct and conventional wisdom in the banking community would support the idea that secured loans are less risky and, therefore, should carry lower interest rates. However, some papers find an unexpected positive relationship between interest rates and guarantees (see, for example, Barro, 1976, Berger and Udell, 1990): "This result has two major implications: that secured loans are typically made to borrowers considered *ex-ante* riskier by banks, and that the presence of warranties is insufficient to offset such higher credit-risk" (Pozzolo, 2004). The higher interest rates applied to loans backed by guarantees may also be due to the effects of asymmetric information. On the one hand, banks might ask for guarantees when they need to distinguish *ex-ante* the risk of different types of borrowers (adverse selection). Alternatively, banks may use guarantees as an incentive mechanism to reduce the possibility of opportunistic behavior of borrowers after the transaction occurred (moral hazard).

It is important to distinguish between real and personal guarantees. Personal guarantees are contractual obligations of a third party, and they act as if they were external collateral. However, they do not give the lender a specific claim on particular assets, and change the actions he could take in the case of the borrower's bankruptcy. Consequently, only empirical analysis may help

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distinguish which of the two types of guarantees (real and personal) has a stronger impact on the loan interest rate.²

In this paper, we aim at analysing whether:

- the conventional wisdom that secured loans are less risky (and, thus, they carry lower interest rates) is supported by empirical evidence. We will also look at the differential effect of real and personal guarantees on interest rates;
- collateral reduces the screening activity of banks and increases the risk of moral hazard. This “lazy” behaviour may affect allocation of funds in favour of projects that have lower returns.³

Our work is in the same line as Pozzolo’s (2004). However, while Pozzolo mainly focuses on the relationship between guarantees and the likelihood of obtaining loans, our paper studies the relationship between bank interest rates and guarantees.

Our analysis refers to the Italian credit market and uses aggregated and individual statistics drawn from the ESCB (European System of Central Banks) harmonized data, the Prudential Statistical Return, and the Central Credit Register.

Our main results is that the role played by guarantees in setting interest rates differs according to the type and size of borrowers. In the case of firms, more collateral means higher interest rates in the case of small-sized firms and lower interest rates in the case of larger firms, respectively; the role of guarantees signals that the screening activity is not “lazy”. As for consumer households, results are unclear; they are affected by the large share of real-estate loans, which have to be assisted by collateral, according to Italian law. As regards producer households, individual data at bank and firm level show that both real and personal guarantees help to solve adverse selection problems, while the personal wealth of entrepreneurs mitigate moral hazard problems.

The paper is organized as follows. Section 2 reviews the economic literature on guarantees and bank interest rates, while Section 3 describes data used and provides some descriptive statistics; Section 4 reports econometric exercises and discusses results. Finally, Section 5 summarizes the findings.

2. A review of the literature

² As for the distinction between inside collateral and outside collateral, inside collateral is physical assets owned by the borrower, and it is mainly used to order creditors priority in the case of default. Outside collateral is assets posted by external grantors, and it increases the potential loss of the borrower in the case of bankruptcy. Therefore, the relationship between risk and guarantees should be stronger in the case of outside collateral, given that inside collateral does not provide additional losses to the borrower if he defaults. However, given the lack of detailed information on inside and outside collateral, this paper does not distinguish between different types of collateral.

³ Here, and in the rest of the paper, we name a bank “lazy” if, as in Manove, Padilla, and Pagano (2001), a bank may voluntarily choose loan contracts that specify a high level of posted collateral without screening projects, even though the latter would efficient.

In countries like Italy, whose economy is largely dominated by small companies, the provision of real and personal guarantees has always played a major role in facilitating the flow of credit to borrowers.

The role of collateral and guarantees in lending relationship has been widely discussed, and different conclusions have been reached. Under perfect information, the bank can distinguish between different types of borrowers, has perfect knowledge about the riskiness of their investment projects, therefore there is no need for guarantees. Under asymmetric information, however, collateral and personal guarantees play a role in solving different problems that may arise (Ono and Uesugi, 2006).

First of all, there are problems linked to the riskiness of the borrower. A hidden information-adverse selection problem arises in situations in which banks cannot discern the *ex-ante* riskiness of the entrepreneur. Without guarantees, the average loan rate would be higher than the rate that is optimal for safe borrowers, and only riskier borrowers would apply for banks loans. In these situations collateral and personal guarantees act as a screening device to distinguish the *ex-ante* riskiness of the entrepreneur, and lower risk borrowers will choose the contract with guarantees in order to take advantage of the lower interest rate (Bester, 1985 and 1987).⁴

A hidden action-moral hazard problem arises when banks cannot observe the borrower's behaviour after the loan is granted. In these situations guarantees are used as an incentive device, and reduce the debtor incentive to strategically default. As Boot *et al.* (1991) showed, if there is substitutability between the borrower quality and action, i.e. bad applicants have a higher return from effort, the bank requires to pledge more guarantees in order to limit moral hazard problems.

Moreover, there are studies that analyze the association between the length of the bank-borrower relationship and guarantees requirements in both adverse selection and moral hazard settings. Among others, Boot and Thakor (1994) analyzed repeated moral hazard in a competitive credit market. They found that a long term banking relationship benefits the borrowers: borrowers pay higher interest rates and pledge guarantees early in the relationship, but, once their first project is successful, they are rewarded with unsecured loans and lower loan rates.

In a principal-agent setting, John *et al.* (2003) find that guarantees decrease the riskiness of a given loan, and that collateralized debt has higher yield than general debt, after controlling for credit rationing.

⁴ However, in the presence of debt renegotiation, renegotiation might undermine the later role of collateral as a screening device in the sense that if collateralization becomes attractive also for high risk entrepreneurs, the low risk entrepreneurs can no longer distinguish themselves by posting collateral (Bester, 1994).

Guarantees influence the screening and monitoring activities of banks. Given the role of banks as information providers, different results are found in the economic literature on the impact of collateral and personal guarantees on bank's screening and monitoring activities. According to the "lazy bank hypothesis" (Manove, Padilla, and Pagano, 2001), the presence of a high level of guarantees weakens the bank's incentive to evaluate the profitability of a planned investment project. In this case guarantees and screening are substitutes for bank's monitoring, but they are not equivalent from a social standpoint. Indeed, the authors find that putting an upper bound on the amount of guarantees relative to the project value is efficient in competitive credit markets. Rajan and Winton (1995), on the other hand, argue that a high level of collateralization might be considered as a sign that the borrower is not sound, given that the bank usually has a greater incentive to ask for guarantees when the borrowers prospects are poor. Therefore, the monitoring activity should be higher in the presence of higher debt securitization. Longhofer and Santos (2000) argue that guarantees and monitoring are complements when banks take senior positions on their small business loans.

Collateral and personal guarantees requirements might be affected by credit market competition. Besanko and Thakor (1987) analyze the role of credit market structures in the presence of asymmetric information. The authors find that in a competitive market guarantees are useful in solving adverse selection problems: low-risk borrowers choose a contract with a high level of guarantees and a low loan rate, whereas high-risk borrowers choose a contract with a low level of guarantees and a high loan rate. In a monopolistic setting, however, collateral and personal guarantees play no role unless their value is high enough to make the loan riskless for banks. Inderst and Mueller (2006) discuss a model with different types of lenders: local lenders, who have soft and non contractable information advantages, and transaction lenders (lenders located outside local markets). They show that local lenders should reduce the loan rate and increase guarantees requirements to maintain their competitive advantage, until the information advantage narrows and the competitive pressure from transaction lenders increases.

Theoretical models on the relationship between guarantees and competition predict a positive correlation between bank competition and guarantees requirements. Similarly the empirical analysis of Jiménez, Salas-Fumás and Saurina (2006) find that the use of collateral is less likely in more concentrated markets. Petersen and Rajan (1995) analyze the effect of credit market competition on lending relationship and find that firms in the most concentrated credit markets are the least credit rationed, and that banks in more concentrated markets charge lower than competitive interest rates on young firms, and higher than competitive interest rates on older firms. Empirical results on the impact of collateral and personal guarantees on the loan rate are not homogeneous either. Indeed, on

the one hand, there should be a negative correlation between guarantees and the risk premium if collateral and personal guarantees are used as a screening device to solve the adverse selection problem. On the other hand, the correlation should be positive if guarantees are used as an incentive device to reduce moral hazard, and the *ex-ante* risk of the borrower is observed. Berger and Udell (1990) find that guarantees are most often associated with riskier borrowers, riskier loans, and riskier banks, supporting the idea that observably riskier borrowers are asked to pledge more guarantees to mitigate the moral hazard problem. Ono and Uesugi (2006), who analyze the small business loan market in Japan, reach similar results. They find that guarantees are more likely to be pledged by riskier borrowers. Pozzolo (2004) argues that, when testing the relationship between risk and collateralization, it is important to distinguish between inside collateral and outside collateral, and between real and personal guarantees. He finds that real guarantees are not statistically related to the borrower risk. He interprets this finding as potentially consistent with the hypothesis that inside collateral is used as a screening device to solve the adverse selection problem. On the other hand, he finds that personal guarantees are more likely to be requested when the borrower is *ex-ante* riskier. However, once the borrower's riskiness is controlled for, both real and personal guarantees reduce the interest rate charged on loans. Jiménez, Salas-Fumás and Saurina (2006) find direct evidence of a negative association between collateral and the borrower's risk.

Some authors investigate the influence of other variables on the probability that guarantees will be requested. Berger and Udell (1995) and Jiménez, Salas-Fumás and Saurina (2006) find that borrowers with longer banking relationships pay lower interest rates and are less likely to pledge guarantees. More specifically, Berger and Udell (1995) find, that the older a firm is and the longer its banking relationship, the less often the firm will pledge guarantees. This result is seen as consistent with the idea that requiring guarantees early in a relationship may be useful in solving moral hazard situations. Berger and Udell (1995) also find a positive relationship between the total assets value of the borrowing firms, which is a measure of firm size, and the probability to get a loan that has to be assisted by guarantees.

As for the effects of guarantees on screening and monitoring activities of banks, empirical implications of the above theoretical models are mixed. According to the lazy bank hypothesis, a higher screening activity should be observed when borrowers post low guarantees. Further, the average debt default should be higher when creditors rights are more strictly enforced given that fewer projects will be screened in this case. On the other hand, Rajan and Winton (1995) predict that secured debt should be observed more often in firms that need monitoring, and that changes in guarantees should be positively correlated with the onset of financial distress. Jiménez, Salas-Fumás

and Saurina (2006) discuss how the use of collateral as a substitute to the screening activity of the bank depends on lenders characteristics.

Summing up, the review of the literature shows that there is no clear agreement about the link between guarantees and interest rates. Some researchers find that guarantees reduce the riskiness and this implies lower interest rates; others that lenders ask for guarantees when borrowers are more risky and, thus, interest rates are higher.

3. Data and summary statistics

This paper uses aggregated and individual Italian bank and firm data drawn from several sources.

Aggregated time series on interest rates are drawn from harmonized MIR (Monetary Financial Institution Interest Rates) statistics, collected by the Eurosystem since January 2003; this information is provided by a representative sample of banks, made up of about 120 Italian banks (which cover about 75 per cent of total assets of Italian banking system).⁵ Aggregated data on real and personal guarantees are drawn from bank supervision reports and are available for the whole banking industry.

Individual information on firms and producer households⁶ comes from Central Credit Register and regards a sample made up of 60 large Italian banks (which cover more than 50 per cent of total assets of Italian banking system); the data set with individual customer information includes more than 300,000 firms and about 200,000 producer households, which received from Italian banks loans equal to or larger than € 75,000.

Time series on loans mostly start from 1999 and refer to the whole banking system. Time series on interest rates start from 2003, the first year of the MIR statistics, and refer to a sample of banks.

Our analysis mainly focuses on real and personal guarantees pledged by non-financial corporations (firms), producer households and consumer households. Information on producer households and consumer households is provided by prudential statistics.

Table 1 shows the distribution of loan by type of guarantees and customers. It appears that producer households are more similar to firms than to consumer households: loan shares to producer households assisted by real and personal guarantees are similar to those of firms than to those of consumer households.

⁵ For further details, see Regulation ECB/2001/18, and Battipaglia and Bolognesi (2003).

⁶ The term "firms" used in banking statistics is equivalent to the ESA 95 sector "non-financial corporations and quasi-corporations"; producer households include sole proprietorships and small partnerships without independent legal status which are market producers.

The increase in the share of collateral reflects the growth of mortgages. For the three types of customers as a whole, the value of mortgage loans is about twice as large in 2005 as in 1999 (see Table 2).

More specifically, the share of consumer households loans assisted by real security is more than twice as large as that of firms; this mainly reflects the fact that a high percentage of loans to consumer households are for house purchase (about two third of total loans), a large part of which is granted against mortgage. The large increase of the share of mortgages implies a growing share of real guarantees and a decreasing share of personal guarantees in loan to consumer households: the latter was almost 10% in 1999, but it dropped to around half of it in 2005. Finally, the share of loans with no guarantees averaged around 24% between 1999 and 2005, but they show a negative trend over the years.

As for firms, consistently with the observed increase in mortgages (Table 2), collateralized loans grew from 24% in 1999 to 32% in 2005 (Table1). Unsecured loans are the most important loan category: they are almost half of firms' total loans. This result likely depends upon the better quality information of firms in comparison with households'.

Differently, but not surprising, the share of personal guarantees is higher for firms than for consumer households, the reasons being the higher riskiness of firms versus consumer households, the need for lenders to ask for personal guarantees when they cannot request collateral or, in other cases, because of specific legal requirements (e.g. for public works credit).

Figures for producer households seem more similar to firms than to consumer households. The main difference with firms is the lower value of unsecured loans: again, this could be explained with the higher opacity of producer households compared to firms.

As for the composition of bad loans by type of guarantees, the larger share of bad loans originates among unsecured loans (Table 3). This share is largest in the case of consumer households and smallest in the case of firms, in spite of the smaller shares of unsecured loans granted to consumer households (see Table 1). The distribution of bad loans among secured loans mirrors the relative weight of the different types of loans. This is especially true in the case of consumer households which show a larger share of bad loans against mortgages (see Table 3).

A clearer picture of the risk associated with different customers and type of loans is provided by the analysis of the overall bad loan-to-loan ratio, a measure of credit risk (see Table 4). The ratio is higher for households than for non-financial corporations; producer households turns out as the riskiest customer especially for unsecured loans.⁷ With the only exception of firms, the default risk

⁷ There has been a general improvement of the overall bad loan-to-loan ratio between 1999 and 2005; however this result has been influenced by extraordinary securitization operations and write-offs carried out, especially in 2005 (see

is higher for collateralized than unsecured loans. It is likely that the low default risk associated with collateralized loans depends on the type of investment undertaken with the mortgage, i.e. the purchase of property, in a period of increasing house prices.

4. Model Specification and Results

We estimate two empirical interest rate models. The first makes use of average data at bank level and is estimated for three types of customers: consumer households, firms, and producer households. The second makes use of information at bank-customer level and is only estimated for firms and producer households.

A description of variables and descriptive statistics is reported in Appendixes 1 and 2.

4.1 Model 1 – data at bank level

The first model relates the interest rate spread (average loan rate–overnight rate) to loan size, customer riskiness, presence of guarantees, average length of the lending relationship, plus additional control variables:

$$\begin{aligned}
 InterestRateSpread_{i,t} = & \beta_0 + \beta_1(Average\ Loan\ Size)_{i,t} + \beta_2\left(\frac{Bad\ Loans}{Loans}\right)_{i,t} + \beta_3\left(\frac{Collateral}{Loans}\right)_{i,t} \\
 & + \beta_4\left(\frac{Personal\ Guarantees}{Loans}\right)_{i,t} + \beta_5(Average\ Loan\ Life)_{i,t} + \beta_6(Time\ Dummies)_t \\
 & + \beta_7(Regional\ Dummy)_i + \beta_8(Bank\ Size\ Dummy)_{i,t} + \varepsilon_{i,t}
 \end{aligned} \tag{1}$$

where the subscript i refers to banks, the subscript t to the time period, and $\varepsilon_{i,t}$ is a composite error term that contains unobserved factors (λ_i , fixed or random), plus a Normally distributed error ($u_{i,t} \sim N(0, \sigma_u^2)$).

We estimate equation [1] by means of a panel dataset for three different types of borrowers: firms, consumer households, and producer households. We run both fixed effects and random effects specifications, but only report results for the latter on the basis of the Hausman Test.

Table 5 shows two specifications of equation [1] for each customer type, the difference being the replacement of the *Time Dummies* variables, which controls for the business cycle, by the

Bank of Italy (2006), pp. 232 and 315-316). In the same year, producer households showed the highest overall bad loan-to-loan ratio.

Market Concentration variable⁸. Indeed, these variables turned up to be strongly collinear given that the latter is calculated for each sector (firms, customer households and producer households) and each time-period. Therefore, for each type of sector the *Market Concentration* variable only shows time variability.

Firms. As for firms, results in column (1) show that the *Average Loan Size* coefficient is negative and statistically significant. Moreover, larger loans are a proxy for averagely larger firms that have stronger bargaining power and, therefore, are expected to pay lower interest rates. As expected, we find that *Bad Loans*⁹ have a positive and significant impact on the interest rate spread, i.e., riskier customers are charged with higher interest rates. The coefficient on *Collateral* is positive and significant. As already noted above, collateral does not increase the potential loss suffered by the borrower, but it is mainly used to order creditors' priority. Therefore, *ex-ante*, the expected sign of its coefficient is not clear. The fact that the coefficient on *Collateral* is positive may be taken to mean that collateral is mainly linked to a higher risk, i.e., observably riskier borrowers are asked to pledge more collateral. *Personal Guarantees* also have a positive and significant coefficient. This result is in line with the prevailing literature according to which riskier borrowers are asked to pledge personal guarantees (outside collateral) to avoid strategic default. The estimated coefficient of the *Regional Dummy* is not statistically significant, meaning that interest rates charged by banks located in the Southern regions are not different from those charged by banks located in the rest of Italy. Indeed, it is possible that, controlling for other factors, Southern banks provide loans also to firms located in other regions, and/or that other variables (bad loans and guarantees) already capture the differences in customers riskiness in different regional areas. The *Average Loan Life* coefficient is negative and statistically significant. This variable is a proxy for the length of the lending relationship; therefore, a decrease in the interest rate is expected with an increase in the length of the lending relationship. This finding is common to other empirical studies (among others, Berger and Udell, 1995; Jiménez, Salas and Saurina, 2006). As long as the length increases, the lender's information about the borrower increases, and the moral hazard problem due to information asymmetries becomes less important (Boot and Thakor, 1994). As for the *Bank Size Dummy*, the estimated negative coefficient means that larger banks charge lower interest rates, a result found in other studies. According to Manove and Padilla (1999), and Manove, Padilla and Pagano (2001) banks with larger resources devoted to evaluating the risk of a loan should have a lower incentive to substitute the screening activity with collateral. On the same direction, Jiménez, Salas and Saurina (2006), argue that larger banks should have a comparative advantage in terms of borrower risk

⁸ Market concentration is measured by the Herfindhal index at the national level. This variables, therefore, only captures the overall concentration of the banking system and not the concentration at local level.

⁹ As in many others papers, we use the bad loans-loans ratio as a proxy of riskiness (see Piazza and Stacchini, 2007).

evaluation. Therefore, these banks should have fewer moral hazard problems, and charge lower interest rates. Another interpretation is that customer characteristics may differ systematically between large and small banks; this is borne out by the result of model 2, where, after accounting for customer fixed effects, the coefficient of *bank size* changes sign.

Estimates in column (2) are similar to those in column (1). The only change is that in column (2) we have an explicit variable measuring the degree of market competition. Specifically, the coefficient of *Market Concentration* is positive and statistically significant, meaning that higher loan rates are associated with greater market concentration.¹⁰ Our result also support the view of Inderst and Mueller (2006) who claim that an increase in bank competition should increase the demand for collateral and decrease loan rates.

Consumer households. As for consumer households, results for the two specifications of equation [1] are shown in columns (3) and (4), respectively. Unlike in the case of firms, the coefficient of *Bad Loans* is not statistically significant, though still negative. Therefore, interest rates seem not to be influenced by households riskiness if the latter is measured by the share of *Bad Loans*. The coefficient of *Collateral* is negative and statistically significant. In this case, therefore, collateral is used by safer borrowers to screening their consumer type and take advantage of lower loan rates, as expected in an adverse selection setting (Bester, 1985 and 1987). On the other hand, the estimated coefficient of *Personal Guarantees* is not statistically significant. This finding may be interpreted as a signal that banks behave lazily by replacing their screening activity (which should imply different loan rates to different borrower types) with personal guarantees. For consumer households, it turns out that banks located in the South of Italy charge higher loan rates than in the rest of Italy. Indeed, the coefficient of the *Regional Dummy* is positive and significant; it is likely that the level of competition in local credit markets for consumer households is not fully captured by the *Market Concentration* variable; thus it seems that Southern credit markets may be less competitive than Central and Northern credit markets and, consequently, charge higher interest rates. Finally, the coefficient of *Bank Size* is not statistically significant: consumer loans are usually offered in standardized formats in a competitive market, and there seems to be no systematic differences between the loan rate of small- and large-sized banks.

As in the case of firms, the *Market Concentration* coefficient is still positive and significant in the second specification (column (4)), highlighting the fact that banks in more concentrated credit markets charge higher interest rates. Moreover, differently from the previous specification, the coefficient of *Personal Guarantees* is also positive and significant. As for firms, therefore, *Personal*

¹⁰ Petersen and Rajan (1995) find that the impact of market concentration is different according to the age of the firm, negative for young firms, positive for older firms. We cannot disentangle these effects due to the lack of information on firms' age.

Guarantees are asked to riskier borrowers to reduce strategic defaults, and some screening activity seem to be performed by banks. However, it is worth noting that loans secured by personal guarantees are a small share of the total amount of loans to consumer households.

Producer households. Columns (5) and (6) show results for producer households, with the *Time Dummies* and *Market Concentration* variables, respectively. Also in this case the positive and statistically significant coefficient of *Bad Loans* signals that higher interest rates are associated with higher risks. As for consumer households, *Collateral* and *Personal Guarantees* are used to mitigate adverse selection and moral hazard problems, respectively. Indeed, the estimated coefficients are of opposite signs (negative and positive, respectively), but these findings are robust only when we control for *Market Concentration* (see Column (6)). As explained above, this result may indicate that bank are “lazier” with producer households and consumer households than with firms. Banks require secured loans, but higher guarantees are not necessarily associated with riskier customers and higher interest rates.

Again, the coefficient of the *Regional Dummy* is positive and statistically significant just in the specification with no *Market Concentration* variable (column (5)), while this dummy is not significant when *Market Concentration* is included in the equation. As observed in the case of consumer households, even for producer households the *Regional Dummy* variable seems to captures the market concentration at local level: Southern producer households are either riskier or they are operating in less competitive credit markets. Finally, for more concentrated credit markets, the cost of loans, captured by the loan rate, is higher.

Summary. The distinction between firms, consumer households, and producer households is empirically important. Our results show that:

- for firms, both real and personal guarantees have a positive relationship with interest rates, supporting the idea that guarantees help solving moral hazard problems; the positive relationship between interest rates and personal guarantees seems to suggest that banks do not behave “lazily”;
- for consumer and producers households, collateral is mainly used as a screening device against adverse selection, so that safer borrowers take advantage of lower interest rates; there seems to be a weak relationship between interest rates and personal guarantees. As for “lazy bank hypothesis”, in the case of these two sectors cannot be reached clear and robust outcomes.

4.2 Model 2 – data at bank-customer level

Our second interest rate model is estimated for firms and producer households, but not for consumer households because loans to consumer households are mainly mortgages that, as said, have to be assisted by real collateral; in addition, the estimate could be biased due to the threshold of € 75,000 in the collection of data for the Central Credit Register. Therefore, data on loans to consumer households could be incomplete because a large share of their loans are smaller than € 75,000. This second model differs from model [1] because it makes use of loan information at the customer level. Because of the lack of data on bad loans and interest rates at customer level, we have to approximate the riskiness of the customer using the bad loan-to-loan ratio of the branch of activity of the borrower. However, the existence of a (fixed or random) customer effects may capture individual risk characteristics that are observed by banks. For firms a binary dummy private vs. public firms is included.

Our empirical model is:

$$\begin{aligned}
InterestRateSpread_{i,j,t} = & \beta_0 + \beta_1(Loan\ Size)_{i,j,t} + \beta_2\left(\frac{Bad\ Loans}{Loans}\right)_{i,s,t} + \beta_3\left(\frac{Collateral}{Loans}\right)_{i,j,t} \\
& + \beta_4\left(\frac{Personal\ Guarantees}{Loans}\right)_{i,j,t} + \beta_5(Average\ Loan\ Life)_{i,j,t} + \beta_6(Time\ Dummies)_i \\
& + \beta_7(Regional\ Dummies)_i + \beta_8(Type\ of\ Company\ Dummy)_{i,j,t} + \varepsilon_{i,j,t}
\end{aligned} \tag{2}$$

where the subscript i refers to banks, j to firms, t to time periods, and s to the firm industry. $\varepsilon_{i,j,t}$ is a composite error term.

We estimate equation [2] by running both fixed effects and random effects estimators, but only report results for the former on the basis of the Hausman Test. Estimates of equation [2] are shown in Table 6.

Firms. As for firms, the estimated coefficient of *Collateral* is statistically significant, but this time it is negative while it was positive in the case of equation [1]. This difference likely reflects the presence of individual fixed effects in equation [2] that may account for customer characteristics, among which riskiness is the most important. In other words, once we control for individual customer riskiness, more collateral appears to be an extra screening device that helps banks solving adverse selection problems and, therefore, in lower interest rates.

As is the case of equation [1], the coefficient of *Personal Guarantees* is positive and statistically significant; the value of coefficient is however very small. This could be influenced by the presence of individual fixed effects that account for customer characteristics; thus, individual data strengthen the evidence that riskier borrowers are asked to pledge additional warranties (personal guarantee) and, consequently, banks ask for higher interest rates.

The estimated coefficients of the main control variables confirm our previous conclusions. The estimated coefficients of *Bad Loans*, *Loan Size* and *Loan Life* are all statistically significant and have the same signs as in the case of equation [1]. *Bad Loans* has a positive effect on interest rates confirming that a higher default probability (approximated by the ratio bad loans/loans per branch) implies higher interest rates. *Loan Size* and *Loan Life* both have a negative impact on interest rates, strengthening the importance of borrowers' contractual power and of asymmetric information problems in setting interest rates, respectively.

Data at firm level also permit to distinguish between private and state owned firms. The binary *Private Firm Dummy*, that takes value 1 when firms are private, has a significant and positive coefficient. In other words, private firms are seen as riskier than state owned firms.¹¹

The binary *Bank Size Dummy*, that takes value 1 for large banks, has a significant and positive coefficient; this implies that larger banks carry higher interest rates. This outcome differs from that in equation [1] and could signal the presence of market power of larger banks, once we account for customer characteristics.¹²

Finally, *Regional Dummies* coefficients are not statistically significant. This result could support the interpretation of a homogeneous bank loan market, once we control for customer characteristics.

Producer households. As for producer households, the *Collateral* coefficient is negative and statistically significant reflecting, as in the case of firms, the role of real guarantees as a signalling device in an adverse selection context.

The coefficient of *Personal Guarantees* is also statistically significant but, unlike in the case of firms, it is negative. This difference can be explained with the different nature of personal guarantees in the case of firms and producer households. Firms are, almost always, limited companies¹³; thus, the personal wealth of the entrepreneur is not involved in firms' obligations and this can increase the concerns about moral hazard problems. On the other hand, producer households are unlimited companies and the personal wealth of the entrepreneur is always, therefore by definition, pledged against the loan; this should mitigate moral hazard risk and, thus, personal guarantees pledge by third parties are further external guarantees, and, similarly to collateral, solve adverse selection problems; this implies a negative sign of the coefficient and lower interest rates.

¹¹ It is worth noting that this dummy could include information on the firm size, given that public firms are almost entirely large firms.

¹² This outcome can also influence by differences in types of products.

¹³ Just a small fraction of firms is unlimited company.

As expected, *bad loans* show a positive and significant relation with interest rates, while *loan size* has a negative and significant effect on the level of interest rates. The latter result confirms that larger borrowers among producer households are assessed as better customers. The *Loan life* variable has a non-significant.

The binary *Bank Size Dummy* has a significant and positive coefficient. As above, this outcome could signal the presence of market power of larger banks, once we account for customer characteristics. As in the estimated model for firms, *Regional dummies* are not significant and, again, this seems to support the presence of an integrated credit market, once we control for customer characteristics.

5. Conclusion

This paper analyzed the relationship between guarantees and interest rates in Italy, paying a special attention to the distinction between real and personal guarantees.

We attempted to answer two main questions :

- does the empirical evidence support the conventional wisdom that secured loans are less risky and, thus, they carry lower interest rates?
- does the empirical evidence support the hypothesis that collateral reduces the screening activity of banks (so called “lazy bank hypothesis”) and increases moral hazard risks?

First, we carried out our analysis by breaking down Italian banks’ customers in three categories (firms, consumer households and producer households), and using a sample of bank data drawn from the Statistical Return. Secondly, we repeated the exercise by means of a large sample with individual customer data drawn from the Central Credit Register. In this case firms and producer households were included in the sample.

A first empirical result based on the distribution of loans and guarantees is that the three sectors are different: producer households behave more similarly to firms than to consumer households. The latter ask for loans mainly for house purchases and, thus, pledge a large share of collateral while the share of personal guarantees pledged by firms and producer households is larger.

The lack of homogeneity suggests that a different econometric analysis must be carried out for each sector.

In the case of consumer households our econometric analysis provides unclear, or not significant estimates about the relationship between guarantees and interest rates. In addition, the

large share of real-estate loans assisted by collateral reduces the concern about the “lazy bank hypothesis” for consumer households.

As for firms, aggregated data at bank level show that both real and personal guarantees have a positive effect on interest rates, thus supporting the idea that guarantees help solving moral hazard problems and that banks’ screening activity is not “lazy”. The picture for firms is somewhat richer when we used a more detailed dataset containing information at firm and bank level. In this model, the presence of individual fixed effect allows us to account for customer characteristics. Interest rates are still significantly affected by guarantees. However, collateral has a negative effect and, thus, appears to be a device that helps banks solving adverse selection problems, while personal guarantees show a positive coefficient and are still used to reduce the possibility of opportunistic behavior of borrowers after the transaction occurred (moral hazard).

As for producer households, aggregated data at bank level show weak results, while information at firm and bank level provides more robust estimates. In the latter, both real and personal guarantees have a negative effect on interest rates, thus supporting the idea that guarantees help solving adverse selection problems, once customer riskiness is controlled for.

At this stage, the link between guarantees and interest rates is not robust; future developments will include an analysis with income and cost variables and information on financial products to manage credit risk (i.e., credit derivatives).

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Table 1

Composition of Loans by type of guarantee
(percent)

	1999	2000	2001	2002	2003	2004	2005
	<i>All customers</i>						
Collateral	28.3	29.5	29.9	31.7	35.6	38.7	42.7
Personal Guarantees	20.8	20.4	19.1	18.8	17.6	17.8	15.7
Unsecured	50.9	50.1	51.0	49.4	46.8	43.5	41.6
	<i>Consumer households</i>						
Collateral	63.7	65.9	66.1	67.5	71.1	72.4	72.6
Personal Guarantees	9.8	8.4	7.6	7.0	6.2	5.8	5.4
Unsecured	26.4	25.8	26.3	25.6	22.6	21.8	22.0
	<i>Producer households</i>						
Collateral	33.7	35.6	36.2	38.2	43.1	46.1	45.4
Personal Guarantees	39.3	38.6	36.3	34.6	30.8	30.2	28.0
Unsecured	27.0	25.8	27.4	27.2	26.1	23.7	26.6
	<i>Firms</i>						
Collateral	24.0	24.9	24.6	26.6	29.7	32.0	32.2
Personal Guarantees	27.1	27.4	25.2	25.6	24.1	24.3	23.6
Unsecured	48.8	47.7	50.2	47.8	46.2	43.7	44.2

Table 2

Loans by sectors
(millions of euros and percent)

	CONSUMER HOUSEHOLDS						PRODUCER HOUSEHOLDS						FIRMS			
	Consumer credit		Lending for house purchase		Other lending		Consumer credit		Lending for house purchase		Other lending		Total		of which : mortgages	
	stocks	growth rate %	stocks	growth rate %	stocks	growth rate %	stocks	growth rate %	stocks	growth rate %	stocks	growth rate %	stocks	growth rate %	stocks	growth rate %
1999	16285		76110		52573		1178		5224		41551		389420		120021	
2000	18835	15.7	90437	18.8	56165	6.8	1330	12.8	5869	12.4	44320	6.7	449792	8.8	133474	10.4
2001	22172	17.7	101907	12.7	56145	0.0	1494	12.3	6386	8.8	45655	3.0	489564	5.2	147364	12.1
2002	27160	22.5	120452	18.2	51499	-8.3	1813	21.4	9157	43.4	46855	2.6	514827	7.4	165143	18.1
2003	30607	12.7	139598	15.9	51447	-0.1	1713	-5.5	11871	29.6	49460	5.6	552775	4.4	195087	10.4
2004	35609	16.3	168515	20.7	52654	2.3	1674	-2.3	13560	14.2	52333	5.8	577264	6.1	215299	9.6
2005	41729	17.2	198906	18.0	54856	4.2	1756	12.8	15828	12.4	55136	6.7	612695	15.5	235968	11.2

Table 3

Composition of Bad Loans by type of guarantee
(percent)

	1999	2000	2001	2002	2003	2004	2005
	<i>All customers</i>						
Collateral	24.2	21.5	23.4	24.4	25.8	27.2	24.0
Personal Guarantees	21.1	22.6	23.5	25.2	24.0	26.1	26.7
Unsecured	54.7	55.9	53.1	50.4	50.2	46.7	49.3
	<i>Consumer households</i>						
Collateral	24.8	18.8	22.2	25.5	29.4	31.5	28.5
Personal Guarantees	9.9	11.0	10.7	10.1	9.7	10.1	10.3
Unsecured	65.3	70.2	67.1	64.4	61.0	58.4	61.3
	<i>Producer households</i>						
Collateral	18.7	16.8	18.3	19.6	22.8	24.3	21.0
Personal Guarantees	22.8	23.4	22.9	24.2	23.7	26.4	26.4
Unsecured	58.5	59.9	58.8	56.2	53.4	49.3	52.6
	<i>Firms</i>						
Collateral	26.3	24.5	26.2	26.1	26.0	26.9	23.5
Personal Guarantees	25.0	27.1	28.9	31.7	29.1	31.9	33.0
Unsecured	48.7	48.5	44.9	42.3	44.9	41.3	43.5

Table 4

Bad Loans to loans ratios by type of guarantee
(percent)

	1999	2000	2001	2002	2003	2004	2005
	<i>All customers</i>						
Collateral	6.6	4.3	3.8	3.7	3.6	3.6	2.1
Personal Guarantees	7.8	6.6	5.9	6.4	6.8	7.4	6.2
Unsecured	8.3	6.6	5.0	4.9	5.4	5.4	4.3
	<i>Consumer households</i>						
Collateral	3.3	1.9	1.8	2.1	2.1	2.1	1.4
Personal Guarantees	8.6	8.9	7.8	8.1	7.8	8.2	6.6
Unsecured	21.2	18.4	14.0	14.0	13.5	12.7	9.7
	<i>Producer households</i>						
Collateral	11.1	8.0	7.2	6.8	6.8	6.5	3.7
Personal Guarantees	11.6	10.3	9.0	9.3	9.9	10.8	7.6
Unsecured	43.4	39.4	30.7	27.5	26.1	25.7	15.9
	<i>Firms</i>						
Collateral	9.6	6.5	5.5	5.1	4.9	4.8	3.4
Personal Guarantees	8.1	6.5	5.9	6.4	6.8	7.6	6.4
Unsecured	8.7	6.7	4.6	4.6	5.5	5.4	4.5

Table 5

REGRESSION ANALYSIS [1]

DATA AT BANK LEVEL

Random Effects Estimates

Dependent Variable: Spread (Interest Rate – Overnight Rate)

EXPLANATORY VARIABLES	FIRMS		CONSUMER HOUSEHOLDS		PRODUCER HOUSEHOLDS	
	(1)	(2)	(3)	(4)	(5)	(6)
Bad loans/loans	2.34 *** (0.73)	2.38 *** (0.76)	-1.56 (1.06)	-1.40 (1.04)	2.10 *** (0.72)	2.82 *** (0.77)
Collateral/loans	0.67 *** (0.25)	0.61 ** (0.24)	-0.51 * (0.29)	-0.64 ** (0.30)	-0.41 (0.26)	-0.88 *** (0.27)
Personal guarantees/loans	0.82 ** (0.25)	0.81 ** (0.39)	1.39 (0.87)	1.61 * (0.87)	0.05 (0.35)	0.69 ** (0.34)
Average loan life	-0.20 ** (0.08)	-0.17 ** (0.07)				
Average loan size	-0.13 ** (0.07)	-0.13 ** (0.07)				
Market concentration		34.84 ** (14.17)		45.16 *** (8.96)		-28.61 (23.17)
Regional dummy (South=1)	-0.10 (0.11)	-0.10 (0.11)	0.81 *** (0.19)	0.79 *** (0.19)	0.32 ** (0.13)	0.18 (0.14)
Bank size dummy (large bank=1)	-0.19 * (0.10)	-0.18 * (0.10)	-0.01 (0.17)	-0.01 (0.17)	-0.05 (0.14)	-0.06 (0.14)
Constant	✓	✓	✓	✓	✓	✓
Time dummies	✓		✓		✓	
Hausman Test	0.83	0.25	1.00	1.00	1.00	0.97
No. of Obs.	704	704	663	663	541	541
No. of Banks	108	108	105	105	94	94

Robust Standard Errors are shown in parentheses; * p<0.10, ** p<0.05, *** p<0.01 significance levels, respectively

Table 6

REGRESSION ANALYSIS [2]

DATA AT FIRMS AND BANK LEVEL

Fixed Effects Estimates

Dependent Variable: Spread (Interest Rate – Overnight Rate)

EXPLANATORY VARIABLES	FIRMS	PRODUCER HOUSEHOLDS
Bad loans/loans per branch	2.15*** (0.178)	2.76 *** (0.339)
Collateral/loans	-1.87*** (0.009)	-2.54*** (0.016)
Personal guarantees/loans	0.02*** (0.006)	-0.17 *** (0.015)
Loan life	-0.02*** (0.004)	0.00 (0.010)
Firm size dummy	-0.55*** (0.008)	-0.71 *** (0.048)
Private firms dummy	0.55** (0.190)	
Bank size dummy	0.32*** (0.004)	0.40 *** (0.014)
North dummy	0.02 (0.037)	0.19 (0.138)
South dummy	-0.02 (0.044)	0.16 (0.148)
Constant	✓	✓
Time dummies	✓	✓
Hausman test (p-value)	0.00	0.00
No. of observations	1411015	455926
No. of firms	306553	195049

Robust Standard Errors are shown in parentheses; * p<0.10, ** p<0.05, *** p<0.01 significance levels, respectively

Appendix 1

Data at Bank Level

Summary Statistics

Variable	Mean	Standard deviation	Min	Max
<u>Firms</u>				
Spread				
(interest rate – overnight rate)	1.55385	0.49343	-0.05043	5.81174
Bad Loans/ Loans	0.04693	0.07107	0.00102	0.80954
Collateral/ Loans	0.33885	0.15871	0.00021	1.00278
Personal guarantees/ Loans	0.26367	0.11400	0.00021	1.01054
Average Loan Life	3.01209	0.55327	1.00000	4.00000
Herfindhal Index	0.03321	0.00115	0.03186	0.03531
Average Loan Size (log)	6.439886	0.99403	4.043051	11.33795
<u>Consumer Households</u>				
Spread				
(interest rate – overnight rate)	2.39922	0.86539	0.13627	6.80369
Bad Loans/ Loans	0.03990	0.05267	0.00000	0.42781
Collateral/ Loans	0.68330	0.19187	0.00010	1.00325
Personal guarantees/ Loans	0.07108	0.05652	0.00000	0.37049
Herfindhal Index	0.04187	0.00283	0.03874	0.04811
<u>Producer households</u>				
Spread				
(interest rate – overnight rate)	2.40445	0.53415	0.93664	4.77367
Bad Loans/ Loans	0.07697	0.07734	0.00000	0.53959
Collateral/ Loans	0.40970	0.16942	0.00001	1.00026
Personal guarantees/ Loans	0.31058	0.13152	0.00012	0.73091
Herfindhal Index	0.03658	0.00054	0.03549	0.03730

Variable definition

Bank Interest Rates. Time series on interest rates are drawn from harmonized MIR (Monetary Financial Institution Interest Rates) statistics, collected by the Eurosystem since January 2003, primarily as a support to monetary policy. However MIR statistics are also suitable for economic analysis at national level. This information is collected and compiled by the Eurosystem; it is based on a representative sample of banks, made up of about 120

Italian banks. Interest rates on loans to firms is the weighted average of new businesses up to and over € 1 million; interest rates on loans to consumer households and producer households is the weighted average of new businesses granted for consumer credit, house purchases and other purposes. Overnight interest rates are the arithmetic mean of the weighted average rates daily traded on the Interbank Deposit Market.

Guarantees. Real guarantees are mainly mortgages granted by borrowers to the bank; personal guarantees are guarantees granted by third parties in favor of borrowers. Data are drawn from Statistical Return.

Loans and Bad Loans. Data are drawn from Statistical Return.

Average Loan Life. This information is the average length (in years) of customer relationship for each bank in the sample; it is figured out for firms, using individual data and refers to a period of five years prior each reference date. Data are drawn from Central Credit Register. Given that the Central Credit Register records borrowers with loans larger than € 75,000, *Average Loan Life* has only been calculated for firms.

Regional Dummy. Binary dummy variable equal to 1 for banks with headquarter in Southern Italy and 0 otherwise.

Bank Size. Binary dummy variable equal to 1 for banks which are classified as “major” or “large”, according to Banca d'Italia's classification by size (see Bank of Italy, 2006), and 0 otherwise.

Market Concentration. Herfindhal index on new loans to firms and households. This variable is calculated for each time period of our sample.

Average Loan Size. This variable is the ratio between total loans and the number of customers, i.e., the average loan size granted by each bank to customers. It is calculated by using individual data drawn from the Central Credit Register. As in the case of *Average Loan Life*, this variable is calculated only for firms.

Appendix 2

Data at Firm and Bank Level

Summary Statistics

Variable	Mean	Standard deviation	Min	Max
Firms				
Spread (interest rate – overnight rate)	3.832	2.849	-1.270	17.950
Bad Loans/ Loans per branch	0.058	0.027	0.002	0.161
Collateral/ Loans	0.173	0.347	0	1
Personal guarantees/ Loans	0.556	0.479	0	1
Loan Life	2.531	0.704	1	3
Producer households				
Spread (interest rate – overnight rate)	3.679	2.735	-1.270	17.949
Bad Loans/ Loans per branch	0.120	0.045	0.047	0.210
Collateral/ Loans	0.538	0.452	0	1
Personal guarantees/ Loans	0.425	0.475	0	1
Loan Life	2.371	0.756	1	3

Variable definition

Bank Interest Rates. Time series at firms level on interest rates are drawn from Central Credit Register and refer to the years 2003-2005; data are annual and are provided by a representative sample of about 60 Italian banks. This dataset includes customers with loans over € 75,000. Overnight interest rates are the arithmetic mean of the weighted average rates daily traded on the Interbank Deposit Market.

Guarantees. Real guarantees are mainly mortgages granted by borrowers to the bank; personal guarantees are guarantees granted by third parties in favor of borrowers and include those given for guarantee commitments. Data are drawn from Central Credit Register.

Loans and Bad Loans per branch. Data are drawn from Statistical Return; this aggregate represents a proxy of customer's risky.

Loan Life. The number of years of customer relationship refers to the period included in dataset at firm level. Data are drawn from Central Credit Register.

Regional Dummies. Three binary dummy variables equal to 1 for banks with headquarter in the Northern, Central and Southern Italian regions, respectively, and 0 otherwise.

Firm Size. Binary dummy variable equal to 1 for loans over € 1,000,000, and 0 otherwise.

Bank Size. Binary dummy variable equal to 1 for banks which are classified as "major" or "large", according to Banca d'Italia's classification by size (see Bank of Italy, 2006), and 0 otherwise.

Type of Company Dummy. Binary dummy variable equal to 1 for private firms, and 0 otherwise.