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

- Giorgio Calcagnini, (U. Urbino)
- Fabio Farabullini, (Banca d'Italia)
- Germana Giombini, (U. Urbino)

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Abstract

This paper aims at shedding light on the influence of guarantees on the loan pricing. After reviewing the literature on the role of guarantees in bank lending decisions, we estimate a bank interest rate model that explicitly includes collateral and personal guarantees as explanatory variables. We show that banks follow different lending policies according to the type of customer. In the case of firms banks seem to efficiently screen and monitor customers, and guarantees (real and personal) are used to reduce moral hazard problems. In the case of consumer households and sole proprietorships banks behave "lazily" by replacing screening and monitoring activities with personal guarantees. Collateral, instead, is used to separate good from bad customers (i.e., to mitigate adverse selection problems).

Keywords: Determination of Interest Rates, Banks, Asymmetric and Private Information.
JEL Classification: E43, G21, D82.

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

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, sole proprietorships and consumer households. The relevance of guarantees in lending activity is widespread acknowledged, and their role is even recognized in the New Basel Capital Accord (Basel II) that foresees a specific regulation for secured loans.

As for guarantees, it is important to distinguish between inside collateral and outside collateral, and between real and personal guarantees. 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.

Personal guarantees are contractual obligations of a third party, and they act as they were external collateral. However, they do not give the lender a specific claim on particular assets, and restrict the actions he could take in the case of the borrower's bankruptcy. Consequently, only empirical analysis may help to distinguish which of the two types of guarantees (real and personal) has a larger impact on the loan interest rate.

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,

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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 the *ex-ante* 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). In addition, the right to repossess collateral gives lenders an essential threat to ensure that borrowers have an incentive to use the money borrowed productively.

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 on interest rates of real or personal guarantees;
- collateral reduces the screening activity of banks and increases the risk of moral hazard. This "lazy" screening activity may affect allocation of funds in favour of projects with lower returns but that provide more collateral.

Our work is in the same line as Pozzolo's (2004). However, while the latter is mainly focused 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 Statistical Return, and the Central Credit Register. Aggregated data at bank level are semi-annual and refer to the period June 2003 - June 2006; individual data at the bank-customer level are annual. Information refer to three types of customers (firms, consumer households and sole proprietorships), consistent with the ESA95 definition.

Our main results show differences in the role played by guarantees in the setting of interest rates. In the case of firms, banks require collateral to reduce the possibility of opportunistic behavior of small-sized borrowers after the transaction occurred (moral hazard), while they are used as a signalling device to solve the adverse selection problem by larger companies. Therefore, more collateral means higher interest rates in the case of small-sized firms and lower interest rates in the case of larger firms, respectively. As for consumer households and sole proprietorships results are less clear-cut: only collateral seems to play a positive impact on interest rates, even though results are not very robust. Indeed, banks behave "lazily" by replacing screening and monitoring activities with personal guarantees.

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

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. Theoretically, 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 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 the lower risk borrower will choose the contract with guarantees in order to take advantage of the lower interest rate (Bester, 1985 and 1987).[2]

A hidden action-moral hazard problem arises when banks cannot observe the borrower 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, the riskier borrower pledges more guarantees, while the good borrower gets an unsecured loan.

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

[2] However, in the presence of debt renegotiation, renegotiation might undermine the 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).

pay higher interest rates and pledge guarantees early in the relationship, but, once their first project is successful, they are awarded 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.

Guarantees influence the screening and monitoring activities of banks. Given the role of banks as information providers, different findings 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 a bank, but they are not equivalent from a social standpoint. Indeed, the authors find that putting an upper bound threshold 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 in difficult, 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 the monopolistic setting, instead, collateral and personal guarantees play no role unless it is sufficiently valuable to the bank to make the loan riskless. Inderst and Mueller (2006) analyze 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). The authors show that local lenders should reduce the loan rate and increase guarantees requirements to maintain their competitive advantage, as long as the information advantage narrows and the competitive pressure from transaction lenders increases.

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 risk premium if collateral and personal guarantees are used as a signalling 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. The authors 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. The author 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 signalling device to solve the adverse selection problem. Differently, he finds that personal guarantees are more likely to be asked for 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. Jimènez, Salas-Fumàs and Saurina (2006) find direct evidence of a negative association between collateral and the borrower's risk.

Some authors investigate the relationship of other variables on the probability for a loan to be secured. Berger and Udell (1995) and Jimènez, Salas-Fumàs and Saurina (2006) find that borrowers with longer banking relationships pay lower interest rates and are less likely to pledge guarantees. Particularly, Berger and Udell (1995) find that the older a firm is and the longer its banking relationship is, the less often the firm will pledge guarantees. The 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 value of total assets of the borrowing firms, that is a measure of firm size, and the probability to get a secured loan.

As for the impact of the bank-firm relationship on the loan rate, Chakravarty and Yilmazer (2005) assert that the overall granting process is a sequential process given by three stages: application, decision and rate setting. The authors find that the lending relationship matters only in the first and second stages, i.e.: conditional on being approved, relationships are not important in determining the loan rate. Similarly, Petersen and Rajan (1994) do not find statistical evidence that the strength of the lender-borrower relationship is correlated with cheaper credit. The authors also find that firms that borrow from multiple banks are charged a significantly higher rate.

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 the creditors rights are more strictly enforced given that fewer projects will be screened in this case. Differently, 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. Jimènez, Salas-Fumàs and Saurina (2006) discuss how the use of collateral as a substitute to the screening activity of the bank depends on lenders characteristics.

Finally, the theoretical models on the relationship between guarantees and competition predict a positive correlation between bank competition and guarantees requirements. Similarly the empirical analysis of Jimènez, Salas-Fumàs 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.

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 represent about 75 per cent of total assets of Italian banking system).[3] Aggregated data on real and personal guarantees are drawn from bank supervision reports and refer to the whole banking industry.

Individual information comes from Central Credit Register and regards a sample made up of 60 large Italian banks (which represent more than 50 per cent of total assets of Italian banking system); the data set with individual customer information includes more than 300,000 borrowers, who received from Italian banks loans equal 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), sole proprietorships and consumer households. Information on sole

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

proprietorships and consumer households does not come from the MIR statistics but it is provided by Italian banks.

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

The increase in the share of collateral reflects the growth of mortgages, given that the Italian Regulation requires that mortgage loans have to be assisted by real guarantees. For the three types of customers as a whole, the 2005 value of mortgage loans is about twice as large as the 1999 value (see Table 2).

More specifically, the loan share of consumer households assisted by real security is more than twice as large as that of non-financial corporations; this result 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 magnitude of real guarantees influences the trend of loan shares to consumer households with personal guarantees: it was almost 10% in 1999, but it dropped to around half of it in 2005. Finally, the loan shares 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 32.2% 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 given that the share of mortgage granted to consumer households have to be assisted by collateral, the share of personal guarantees is higher for non-financial corporations than for consumer households, the reasons being the higher riskiness of firms versus consumer households, the need for the lenders to ask for personal guarantees when they cannot request collateral (for example because of supervisory rules) or, in other cases, because of specific legal requirements (e.g. for public works credit).

Figures for sole proprietorships seem more similar to firms than to consumer households. The main difference with non-financial corporations is the lower value of unsecured loans: again, this could be explained with the higher opacity of sole proprietorships 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 the largest in the case of consumer households and the smallest in the case of firms, in spite of the smaller shares of unsecured loans

granted to consumer households (see Table 1). Moreover the share of bad loans associated with unsecured loans declined between 1999 and 2005 for all three types of customers.

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 who show a larger share of bad loans against mortgages (see Table 3). In the most recent years the distribution of bad loans between sole proprietorships and firms became more similar.

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, that is traditionally used as a measure of credit risk (see Table 4). The ratio is higher for households than for non-financial corporations; sole proprietorships turns out as the riskiest customer especially when unsecured loans are taken into account. There has been a general improvement of the overall bad loan-to-loan ratio between 1999 and 2005; however this result is has been determined by extraordinary securitization operations and write-offs carried out, especially in 2005.[4] In the same year, sole proprietorships showed the highest overall bad loan-to-loan ratio. With the only exception of firms, the default risk increases going from collateralized loans to unsecured loans. It is likely that the low default risk associated with collateralized loans depends on the type of investment undergone with the mortgage, i.e. the purchase of houses and apartments in a period of time characterized by increasing prices.

4. Data, Model Specification, and Results

We estimate two empirical models. The first one makes use of average data at bank level and it is estimated for three types of customers: consumer households, firms, and sole proprietorship. The second one makes use of information at bank-customer level and it is only estimated for firms. A description of variables and descriptive statistics are reported in Appendix 1 and 2.

The first model relates the interest rate spread (average loan rate-overnight rate) the banks charge to different types of borrowers to a set of variables that capture the customer riskiness, the presence of guarantees, the length of the lending relationship, the loan size, and the degree of market competition plus additional control dummy variables:

$$InterestRateSpread_{i,t} = \beta_0 + \beta_1\left(\frac{Bad\ Loans}{Loans}\right)_{i,t} + \beta_2\left(\frac{Collateral}{Loans}\right)_{i,t} + \beta_3\left(\frac{PersonalGuarantees}{Loans}\right)_{i,t}$$
$$+ \beta_4\left(Average\ Loan\ Life\right)_{i,t} + \beta_5\left(Average\ Loan\ Size\right)_{i,t} + \beta_6\left(TimeDummies\right)_t$$
$$+ \beta_7\left(RegionalDummy\right)_i + \beta_8\left(Bank\,Size\,Dummy\right)_{i,t} + \varepsilon_{i,t} \qquad [1]$$

[4] see Bank of Italy (2006), pp. 232 and 315-316.

where the subscript *i* refers to banks, *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] for three different types of borrowers: firms, consumer households, and sole proprietorships. We run both fixed effects and random effects specifications, but only report results for the latter on the base of the Hausman Test.

Table 5 shows two specifications of equation [1] for each customer type.

As for firms, in column (1) we control for the business cycle by adding *Time Dummies*. We find that *Bad Loans* 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, inside 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 C*ollateral* is positive means that collateral is mainly used to reduce the moral hazard problem, i.e., observably riskier borrowers are asked to pledge more collateral. *Personal Guarantees* have also 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 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; Jimènez, 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. According to Manove and Padilla (1999), and Manove, Padilla and Pagano (2001) banks with larger resources devoted to evaluate the economic risk of a loan should have a lower incentive to substitute the screening activity with collateral. On the same direction, Jimènez, Salas and Saurina (2006), argue that larger banks should have a comparative advantage in terms of the borrower's risk evaluation.

Therefore, these banks should have fewer moral hazard problems, and charge lower interest rates. The *Average Loan Size* coefficient is negative and statistically significant. Boot *et al.* (1991) argue that a higher loan dimension reduce the collateral requirement. Moreover, larger loans are a proxy for larger firms that have stronger contractual power and, therefore, are expected to pay lower interest rates.

Estimates in column (2) refer to equation [1] when *Time Dummies* are replaced by *Market Concentration*.[5] The coefficient of *Market Concentration* is positive and statistically significant, meaning that higher loan rates are associated with a higher market concentration. 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 this effect due to the lack of information on firms' age. However, our result also finds theoretical support in the work of Inderst and Mueller (2006) who show that an increase in bank competition increases the demand for collateral and decreases loan rates.

As for consumer households, we have two specifications, one with *Time Dummies* and one with the *Market Concentration* index (columns (3) and (4), respectively). Differently from firms' estimates, the coefficient of *Bad Loans* is negative but not statistically significant, meaning that interest rate is not influenced by households riskiness as 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 signal 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 of a possible lazy behaviour of banks that replace the screening activity (i.e.: different loan rates to different borrowers type) 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. Given that consumer households markets are local (local banks serve local households) the interpretation is twofold. On one side, Southern consumer households may be recognized riskier. On the other side, Southern credit markets may be less competitive than Central and Northern credit markets. Finally, *Bank Size* is not significant in determining the loan rate.

As for firms, the *Market Concentration* coefficient is still positive and significant, underlining that banks in more concentrated credit markets charge higher rates (Column (4)). Moreover, differently from the previous specification, the coefficient of *Personal Guarantees* is still positive but significant. As for firms, therefore, *Personal Guarantees* are asked to riskier borrowers to

[5] *Time Dummies* and *Market Concentration* are collinear because the latter is calculated for each market (firms, customer households and sole proprietorships) and each time-period.

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 (Table 2).

Columns (5) and (6) show results for sole proprietorships, with *Time Dummies* and *Market Concentration*, respectively. The positive and statistically significant coefficient of *Bad Loans* signals that also in this case higher interest rates are associated with higher risks. As for consumer households, *Collateral* and *Personal Guarantees* are asked to mitigate two different kind of problems: adverse selection and moral hazard, 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 the lazy bank behaviour is more relevant in the case of sole proprietorships than in the cases of firms and consumer households. Banks require secured loans, but not necessarily higher guarantees are associated with riskier customers and higher interest rates. Again, the positive and statistically significant coefficient of the *Regional Dummy*, means that credit markets for sole proprietorships are local, as observed in the case of consumer households: Southern sole proprietorships are either riskier or they are operating in less competitive credit markets. Finally, for more concentrated credit markets, the cost of loan, captured by the loan rate, is higher.

It is worth noting that the distinction between firms, consumer households, and sole proprietorships is empirically important, given the findings are not unique. Our results are:

- as expected in adverse selection situations, collateral is mainly used by consumer households and sole proprietorships to signal themselves as safer borrowers and take advantage of lower interest rates;
- there seems to be no robust relationship between interest rates and personal guarantees. Banks behave "lazily", i.e., they simply replace screening and monitoring activities with personal guarantees. Therefore, interest rates do not reflect differences in customers' riskiness.

The second model relates the interest rate spread the banks charge to firms to the bad loan-to-loan ratio, collateral, personal guarantees, the length of the lending relationship, the loan size,

$$Interest\,Rate\,Spread_{i,j,t} = \beta_0 + \beta_1\left(\frac{Bad\ Loans}{Loans}\right)_{i,s,t} + \beta_2\left(\frac{Collateral}{Loans}\right)_{i,j,t} + \beta_3\left(\frac{Personal Guarantees}{Loans}\right)_{i,j,t}$$
$$+ \beta_4\left(Average\ Loan\ Life\right)_{i,j,t} + \beta_5\left(Loan\ Size\right)_{i,j,t} + \beta_6\left(Time Dummies\right)_t$$
$$+ \beta_7\left(Regional Dummies\right)_i + \beta_8\left(Type of\ Company Dummy\right)_{i,j,t} + \varepsilon_{i,j,t} \qquad [2]$$

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 base of the Hausman Test. This exercise is only carried out for firms because the Italian Central Credit Register starts recording loan information from the minimum value of €75,000 and larger. Therefore, data on loans to consumer households and sole proprietorships could be incomplete because a large share of their loans are smaller than 75,000 euros.

The coefficient of *Collateral* is significant and negative while it was positive in the former specification (equation [2]) with data at the bank level. The opposite sign of the estimated coefficients of *Collateral* in equations [1] and [2] likely depends on the different composition of the variables. The first model uses aggregated data at bank level and this means that the variable is a weighted mean for each bank in the sample; obviously, in this case large customers have a larger impact on final statistics at bank level. Instead, the variable at firm and bank level used in this second exercise is not a weighted mean and each customer has the same weight; in other words, the value of loan does not affect the estimate, while the condition applied to each customer are relevant. Thus, in the first model prevails the effect "size of loan", while in the second model prevails the effect "condition of loans", given that small and medium customers are more than large customers. Our results indicate that borrowers that provide collateral are a mix of firms affected both by moral hazard and adverse selection problems. According to the remarks on the different variables, the group affected by moral hazard problems are firms with small-sized loans; these firms are mostly excluded from the Central Credit Register data and, therefore, estimates of equation [2] are dominated by firms affected by adverse selection problems. Hence, the negative sign of the estimated coefficient of *Collateral*. The opposite is true with data at the bank level. This consideration seems to be confirmed by the outcomes of *Loan Size* dummy variable, which is negative in both estimates.

As is the case of equation [1], the coefficient of *Personal Guarantees* is positive and significant; in this case the different composition of variable in the equations does not affect the results. Individual data strengthen the evidence that riskier borrowers are asked to pledge more outside collateral (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* S*ize* 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 that confirms that a higher default probability (approximated by the ratio bad

loans/loans per branch) implies higher interest rates. Loan size and life have both 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 recognized riskier than state owned firms.

Finally, *Regional Dummies* are positive, but not statistically significant. This result could supports the interpretation of a single bank loan market, once we control for customer characteristics, as a result of the increase in competition in the Italian banking industry that followed the financial liberalization of the Nineties.

5. Conclusion

This paper analyzed the relationship between guarantees and interest rates in Italy, paying a special attention to the distinction between real guarantees (or inside collateral) and personal guarantees (outside collateral).

We attempted to answer to two main questions :

- does empirical evidence support the conventional wisdom that secured loans are less risky and, thus, they carry lower interest rates?
- does 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 sole proprietorships), 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 only firms were included in the sample.

A first empirical result based on the distribution of loans and guarantees is that sole proprietorships 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 a very small fraction of loans is assisted by personal guarantees. Differently, the share of personal guarantees pledges by firms and sole proprietorships is larger.

In the case of consumer households our econometric analysis provides unclear, or not significant estimates about the relationship between guarantees and interest rates. However, this result is likely influenced by the existence of the Italian Regulation that requires that real-estate

loans have to be assisted by real guarantees. A similar result is obtained in the case of sole proprietorships.

As for firms, 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". It is worth noting that consumer households and sole proprietorships are more opaque than firms due to the lack of detailed information. The latter makes it difficult to efficiently implement a screening activity.

The picture for firms is somewhat richer when we used a more detailed dataset containing information at the firm level. Interest rates are still significantly affected by guarantees. However, while collateral appears to be a device that helps banks solving adverse selection problems, personal guarantees are still used to reduce the possibility of opportunistic behavior of borrowers after the transaction occurred (moral hazard).

This paper is a first attempt to shed light on the relationship between guarantees and interest rates; future developments will include an analysis with data at the bank-customers level even for consumer households and sole proprietorships, income and cost variables and information on financial products to manage credit risk (i.e., credit derivates).

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Table 1

Composition of Loans by type of guarantee

(percent)

Loans							
	1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
	All customers						
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
	Consumer households						
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
	Sole proprietorships						
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
	Firms						
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

Source: Calculations based on Bank of Italy data.

Table 2

Loans by sectors

(millions of euros and percent)

	Consumer households						Sole proprietorships						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*

Composition of Bad Loans by type of guarantee

(percent)

	Bad Loans						
	1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
	All customers						
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
	Consumer households						
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
	Sole proprietorships						
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
	Firms						
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

Source: Calculations based on Bank of Italy data.

Bad Loans to loans ratios by type of guarantee

(percent)

	1999	2000	2001	2002	2003	2004	2005
	All customers						
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
	Consumer households						
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
	Sole proprietorships						
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
	Firms						
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

Source: Calculations based on Bank of Italy data.

Table 5

REGRESSION ANALYSIS (1)
Interest Rate Spread Model – Random Effects Estimates
Dependent Variable: Spread (Interest Rate – Overnight Rate)

EXPLANATORY VARIABLES	FIRMS		CONSUMER HOUSEHOLDS		SOLE PROPRIETORSHIPS	
	(1)	(2)	(3)	(4)	(5)	(6)
Bad loans/loans	2.34 ***	2.38 ***	-1.56	-1.40	2.10 ***	2.82 ***
	(0.73)	*(0.76)*	*(1.06)*	*(1.04)*	*(0.72)*	*(0.77)*
Collateral/loans	0.67 ***	0.61 **	-0.51 *	-0.64 **	-0.41	-0.88 ***
	(0.25)	*(0.24)*	*(0 .29)*	*(0.30)*	*(0 .26)*	*(0.27)*
Personal guarantees/loans	0.82 **	0.81 **	1.39	1.61 *	0.05	0.69 **
	(0.25)	*(0.39)*	*(0.87)*	*(0.87)*	*(0.35)*	*(0.34)*
Average loan life	-0.20 **	-0.17 **				
	(0.08)	*(0.07)*				
Average loan size	-0.13 **	-0.13 **				
	(0.07)	*(0.07)*				
Market concentration		34.84 **		45.16 ***		-28.61
		(14.17)		*(8.96)*		*(23.17)*
Regional dummy (South=1)	-0.10	-0.10	0.81 ***	0.79 ***	0.32 **	0.18
	(0.11)	*(0.11)*	*(0.19)*	*(0.19)*	*(0.13)*	*(0.14)*
Bank size dummy (large bank=1)	-0.19 *	-0.18 *	-0.01	-0.01	-0.05	-0.06
	(0.10)	*(0.10)*	*(0.17)*	*(0.17)*	*(0.14)*	*(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

REGRESSION ANALYSIS (2)
FIRMS
Fixed Effects Estimates

Dependent Variable: Spread
(Interest Rate –Overnight Rate)

Explanatory Variables	Coefficient *(std. error)*	p-value
Collateral/loans	-1.83 ** *(0.008)*	0.00
Personal guarantees/loans	0.02 ** *(0.001)*	0.00
Loan size	-0.59 ** *(0.007)*	0.00
Bad loans/loans per branch	1.53 ** *(0.167)*	0.00
Private firms dummy	0.42 * *(0.179)*	0.02
Loan life	-0.03 ** *(0.003)*	0.00
North dummy	0.01 *(0.035)*	0.87
South dummy	0.01 *(0.042)*	0.72
Constant	✓	
Time dummies	✓	
Hausman test (p-value)	0.00	
No. of observations	1,425,129	
No. of firms	307,611	

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

Appendix 1

Data at Bank Level

Summary Statistics

Variable	Mean	Standard deviation	Min	Max
Firms				
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
Loan Size (log)	14.20851	1.83523	6.51026	17.72952
Average Loan Size (log)	6.439886	0.99403	4.043051	11.33795
Consumer Households				
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
Loan Size (log)	13.33072	1.80825	2.99573	17.16740
Sole Proprietorships				
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
Loan Size (log)	12.35439	1.29635	6.87109	15.87353

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 sole proprietorships 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. Indeed, a large share of loans to households are smaller than € 75,000 and, therefore, *Average Loan Life* would be uninformative.

Regional Dummy. Binary dummy variable that has a value of 1 for banks with headquarter in Southern Italy and 0 otherwise.

Bank Size. Binary dummy variable that has a value of 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 loan and 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 on for firms, because of the bias due to the threshold of € 75,000 in the case of households.

Appendix 2

Data at Firm and Bank Level

Summary Statistics

Variable	Mean	Standard deviation	Min	Max
Spread (interest rate – overnight rate)	3.863	2.883	-1.767	17.950
Bad Loans/ Loans per branch	0.058	0.027	0.002	0.161
Collateral/ Loans	0.170	0.345	0	1
Personal guarantees/ Loans	0.808	1.948	0	99.930
Average Loan Life	2.536	0.702	1	3

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.

Average 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 variable for North, Centre and South Italy that has a value of 1 for banks with headquarter in respective area and 0 otherwise.

Firm Size. Binary dummy variable that has a value of 1 for firms which have loans over € 1,000,000 and 0 otherwise.

Type of Company Dummy. Binary dummy variable that has a value of 1 for private firms and 0 otherwise.