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Why Do Banks Ask for Collateral and Which Ones ?

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Abstract

This paper aims at testing empirically the three major theoretical reasons why banks resort to collateral: reduction of loan loss in the event of default, adverse selection, and moral hazard. This investigation is performed by testing whether the reasons vary according to the type of collateral. We use a unique dataset of bank loans granted to French distressed firms, which contains the full information on debt contract characteristics, including the cause of default, the type and the value of all collaterals.

Our work suggests that information asymmetries are not of prime importance in the decision of the bank to secure a loan, as no type of collateral helps to solve adverse selection and moral hazard problems. The reduction of the loan loss and the observed-risk hypothesis may however explain the use of collateral.

JEL Codes: G21

Keywords*:* Collateral, Bank, Credit Risk.

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Abstract

This paper aims at testing empirically the three major theoretical reasons why banks resort to collateral: reduction of loan loss in the event of default, adverse selection, and moral hazard. This investigation is performed by testing whether the reasons vary according to the type of collateral. We use a unique dataset of bank loans granted to French distressed firms, which contains the full information on debt contract characteristics, including the cause of default, the type and the value of all collaterals.

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JEL Codes: G20, O5

Keywords*:* Collateral, Bank, Asymmetric information, Institutions.

I. Introduction

There is widespread evidence regarding the massive use of collateral by banks for firm loans. In European countries, Davydenko and Franks (2005) observe that 75.7% of firm loans in France and 88.5% in Germany are secured, whereas Gonas et al. (2004) point out that 73% of loans are secured for US firm loans, which is similar to the order of magnitude provided by Berger and Udell (1990).

It is therefore of interest to know why banks use collateral. Theoretical literature on this topic can be broadly summarized in three arguments. First, collateral allows a reduction of the loan loss for the bank in the event of default of the loan. Indeed it provides the bank with a prior title on specific assets. Second, collateral helps solve the problem of adverse selection borne by the bank when lending, as it constitutes a signalling instrument providing the bank with some valuable information. Collateral helps the bank obtain private information owned by the borrower, as high-quality borrowers are more induced to accept to provide collateral in compensation of a low loan rate than low-quality borrowers are. Third, collateral helps solve the problem of moral hazard after the loan is granted. Namely, the borrower is not inclined to provide the optimal effort or the optimal level of investment. This mechanism is rooted in the binding role of collateral on the borrower which favors the alignment of his interests on the bank's.

We can however inquire about the empirical relevance of these theoretical arguments. Indeed, collateral triggers monitoring and legal costs, which might be large enough to offset the advantages of requiring a collateral for a bank. More important, while both arguments based on information asymmetries intimate a negative relationship between risk of default and collateral, there is a commonly accepted view among bankers that riskier loans would be associated with more collateral. The rationale is that banks would be able to sort the borrowers from information they have on their quality. As a result, they would charge riskier borrowers with higher loan rates and require higher collateral from these borrowers. Theories on the use of collateral would then fail to explain its widespread use.

The empirical validation of these theories is therefore a major issue to understand why banks ask for collateral in lending decisions. However, only a few empirical studies have tested the relevance of these arguments. Berger and Udell (1990) focused on the role of collateral as a signalling instrument in an investigation

of the link between the presence of collateral and the risk premium on US loans. Jimenez and Saurina (2004) analyzed the influence on the collateral of the probability of default on Spanish bank loans. Finally, several works tested determinants of collateralization to study firm and loan characteristics with which the presence of a collateral is associated (e.g. Leeth and Scott, 1989; Gonas et al., 2004).

The aim of this paper is to provide new empirical evidence on the three theoretical reasons of the use of collateral by banks. This evidence is based on a dataset of 564 bank loans from French distressed firms. This unique dataset supplies detailed information on the type and the value of each collateral, but also the reasons of the default. The dataset comes from three major French commercial banks, and was collected manually from their internal recovery unit. It enables three major contributions to the empirical literature on the use of collateral.

First, we investigate the influence of the collateral type. Indeed, one can expect that all types of collateral are not equivalent for banks. It seems notably intuitive that an outside collateral – namely an asset outside the borrowing firm – is more binding than an inside collateral. As a consequence, outside collaterals should have a greater contribution than inside collaterals for the resolution of adverse selection and moral hazard problems. This is therefore a fundamental issue in the analysis of the use of collateral, as results may differ according to the collateral type. However, no study has ever analyzed thoroughly this question, as most works content themselves to test the fact that the loan is secured or not.

Second, we provide a complete empirical framework to test on a common sample the three theoretical arguments explaining the use of collateral by banks. While some papers have tested one of these arguments, none has ever investigated simultaneously all these arguments, which makes it hard to compare their relevance to explain the use of collateral.

Third, we perform an exceptional investigation of the role of collateral on moral hazard problems. Our database on loans from distressed companies includes qualitative information on the causes of default. As a consequence, our study is the first one defining the occurrence of moral hazard according to the real causes of default. This is a major contribution in the understanding of the role of collateral to solve moral hazard problems.

As a consequence, our work constitutes a fundamental contribution to the empirical literature on the use of collateral by banks. The paper is organized as

follows. Section 2 presents the theoretical and empirical background on the use of collateral by banks. Section 3 describes the data and variables. In section 4, we develop the methodology and the empirical results. We finally provide some concluding remarks in section 5.

II. Background

This section first explains thoroughly the theoretical arguments of the use of collateral by banks. We then tackle the question of knowing whether these arguments are empirically validated.

II.1 Theoretical background

Theoretical literature gives three major reasons for the use of collateral by banks. This subsection is designed to develop each of them. We must first define what an inside and an outside collateral are, as some of the theoretical arguments on the role of collateral deal with this definition. An inside collateral is an asset owned by the firm, which is granted the loan. It can be among other things: account receivables, inventories or fixed assets. In opposition, an outside collateral is an asset, the firm does not own. It is typically a guarantee from firm owners or from the firm group.

First, a bank is inclined to ask for collateral as it reduces loan loss in the event of default. Indeed collateral confers the bank a title on specific assets. An inside collateral is useful for the bank as it increases its priority if the firm defaults. An outside collateral suspends the limited liability of the firm, as it gives the bank property on an asset outside the firm. It has to be stressed that this intuitive reason is independent of information asymmetries between the borrower and the bank. This is a major difference with both other reasons for the use of collateral.

Second, collateral may solve the problem of adverse selection thanks to the better information owned by the borrower in comparison to the bank before the lending decision. This private information may lead to credit rationing because of the inability of the bank to price the loan according to the borrower's quality (Stiglitz and Weiss, 1981). Therefore, high-quality borrowers have incentives to show their quality, using a credible signal, meaning a signal that can not be provided by low-quality borrowers. Collateral is such a signal, as it is more costly for low-quality borrowers since they have a higher chance of defaulting and hence of losing the collateral (Bester, 1985; Chan and Kanatas, 1985; Besanko and Thakor, 1987). Consequently,

as collateral acts as a signalling device, it conveys valuable information on the borrower to the bank, which can then screen borrowers by offering the choice between a secured loan with a low interest rate and an unsecured loan with a high interest rate. A high-quality borrower will be inclined to choose the loan with a collateral as its low risk of default means a low probability to lose collateral and a high probability to repay interest.

This argument is particularly relevant in the case of outside collateral, since the cost for the borrower of providing such collateral is obvious. Its role is however by no means insignificant for inside collateral because of their costs. Indeed, an inside collateral is costly for a borrower as its use makes subsequent loans more expensive by reducing the assets available for future collateralisation.

Third, collateral can reduce the problem of moral hazard after the borrower has obtained the loan, by putting down his incentives to invest in riskier projects or to minimize his effort to ensure the success of the project for which loan was granted (Boot, Thakor and Udell, 1991). Indeed the bank can align the borrower's interest with its own using collateral, as it imposes a greater loss on the borrower in case of default. It is all the more valid in the case of outside collateral, since this kind of collateral extends the limited liability of the borrower to external assets.

Therefore, both latter arguments suggest a negative link between collateral and credit risk, as a secured loan would be associated with a higher quality of borrowers and a lower probability of ex post moral hazard behavior. However, the fact that collateral is associated with greater credit risk has gone mainstream among bankers as mentioned by Berger and Udell (1990) and Jimenez and Saurida (2004). The rationale underlying this argument is that banks can sort the borrowers from information they have on their quality. Consequently they charge riskier borrowers with higher rates, and simultaneously require more collateral from these borrowers following the first theoretical reason for the use of collateral: since collateral reduces its loss, the bank would be more inclined ceteris paribus to demand collateral to clients with a higher credit risk. This argument is commonly called the observed-risk hypothesis.

II.2 Empirical background

In spite of the substantial amount of empirical literature devoted to banking issues, studies accounting for the reasons of the use of collateral are impressively scarce. A likely reason for this deficit might be the difficulties to find loan-level data

on collateral. Furthermore, it must be emphasized that only a very limited set of these studies have directly tested some of the three theoretical arguments regarding the use of collateral.

Berger and Udell (1990) investigate the relationship between collateral and credit risk on a sample of 1 million loans from US banks. In a first part, these authors test the hypothesis that adverse selection matters for the use of collateral by regressing the risk premium on a set of loan characteristics including a dummy variable considering whether the loan is collateralized or not. The conclusion does not corroborate the adverse selection argument, as a positive and significant relationship is observed between collateral and risk premium. This result may be explained by the fact that banks require more collateral from riskier borrowers who are also charged with higher loan rates.

In a second part, several ex post measures of risk, including net charge-offs to loans and loan payments past due to loans, are regressed on a set of borrower characteristics aggregating information by loan, so that this regression is performed at the borrower's level. They observe that collateral is associated with credit risk. As a consequence, this work concludes in favor of a positive relationship between collateral and credit risk, which prompts banks to ask more collateral from riskier companies, and consequently to charge them with higher loan rates.

Jimenez and Saurina (2004) focus on the determinants of the probability of default of bank loans on a wide set of 3 million loans provided by Spanish banks. Probability of default is considered as an ex post credit risk measure. Therefore they test whether both arguments of the use of collateral based on information asymmetries are validated, namely whether the presence of collateral brings down the probability of default. The probability of default is explained by a set of loan characteristics including some information on the collateral. Three dummy variables depending on the collateralized share of the loan are jointly taken into account in the model. They find a greater probability of default for secured loans.

A few papers focus on a closely related issue, relationship lending. First of all, Berger and Udell (1995)'s work is remarkable as it constitutes the only one to our knowledge taking in a limited way the type of collateral into account. Namely, dummy variables are included for receivables and inventories, other firm assets or outside collateral. This work analyzes the associations among collateral, banking relationship and risk premium on a sample of 1 million loans from US banks. It

provides some support on the positive association between collateral and risk premium, and clear evidence that firms with longer banking relationships are less likely to pledge collateral. Consequently, this work tends to support the view that collateral is associated with greater risk. Both papers explaining a dummy variable considering whether the loan is collateralized or not, Harhoff and Körting (1998) conclude similarly on 994 loans from German banks, while Degryse and van Cayseele (2000)'s work on 18 000 loans from one important Belgian bank provides mixed evidence on this issue.

A couple of works investigating the determinants of collateralization need also to be mentioned, as they analyze the link between the use of collateral and the risk perceived by the bank. Most of these studies explain whether the loan is secured or not with loan-based data. The seminal paper on this topic is Leeth and Scott (1989), testing several determinants of the binary decision of the bank to secure the collateral or not on a sample of 2000 US loans. Notable results are the negative influence of age on the presence of a collateral and the non-significance of size. Similarly, Cowling (1999) investigates the determinants of collateralization on a sample of 272 firm loans in the United Kingdom. The tested hypothesis is the link between risk and collateral, and consequently tested determinants proxy risk (age, size, limited liability). The author concludes to a positive effect of risk on loan collateralization.

In a broader perspective, Gonas et al. (2004) investigate the determinants of collateralization on a sample of 7600 US loans by proxying each of the three theoretical reasons of the use of collateral. The presence of adverse selection problems is expected to be lower either when the firm has a rating, is listed, larger, or domestic. Moral hazard problems are assumed to increase with the loan maturity. Finally, credit risk should be inversely related to the quality of the firm rating. The nature of the proxies for each theoretical argument need to be stressed, given the interpretations of the paper. However, the conclusions of the paper are rather mixed with some evidence in favor of each theory, with the expected sign for all variables related to adverse selection, moral hazard and risk reduction of the loan loss, even if there are some ambiguous elements.

Hulburt and Scherr (2003) also analyze the determinants of the collateralization, with a notable exception: the dependent variable is defined by the ratio of secured debt to total debt at the firm level. The work is performed on a sample of two yearly samples of about 4000 small companies each. The explaining variables tested are then

also defined as firm characteristics which constitute a major limitation to the study for our focus. Most notable results include the positive sign of age and the negative sign of size. As both variables proxy the risk of the company, these results show mixed evidence regarding the link between risk and collateralization.

Finally, the recent study from Jimenez et al. (2006) takes a broader perspective by analyzing a wide range of determinants of the presence of collateral. Tested determinants include the characteristics of the borrower with credit quality, but also the characteristics of the lender, the competition on the loan market and the macroeconomic conditions. Credit quality is related to the theories of the use of collateral by banks. It is proxied by a dummy variable taking into account the fact that the borrower had recently a loan in default. The authors then observe that the credit quality of the borrower is the main determinant of the use of collateral.

This survey on the empirical literature on the motives of the use of collateral can be summarized in three points. First, it appears that empirical evidence is rather in favor of the observed-risk hypothesis according to which riskier borrowers are required to provide more often collateral, in accordance with the common opinion of bankers. This element tends to invalidate the theoretical arguments on the use of collateral dealing with information asymmetries. Second, studies investigating directly these arguments are very scarce. Furthermore, no study provides a complete framework allowing to test successively the three theoretical assumptions on the same sample of loans. Third, all works only consider the fact that the loan is secured or not, if we except two works considering in a limited way the type and the value of collateral (Berger and Udell, 1995; Jimenez and Saurida, 2004). This is a major limitation of these works, as the characteristics of the collateral can likely influence the results. Our empirical work is fitted to improve the former literature relative to these drawbacks.

III. Data and variables

We collect a sample of 735 credit lines attached to 386 French distressed firms, whose debt exposure exceeds 100 thousand euros. The year of default lies between 1993 and 2003. Loans were granted from 1984 to 2001. The sample comes from a larger database we collected between 2004 and 2005 under S&P Risk Solution supervision. The “default” event follows the Basel II definition: a firm defaults as soon as delays on its financial commitments exceed 90 days. Data come from three

major French commercial banks, and were collected manually from their internal recovery unit.

We focus our analysis on distressed firms in order to take two major issues into account. First, we aim at investigating the recovery power of each collateral after the event of default of the borrower.[1] However collateral is only recovered by the bank in the event of default. Second, we also analyze the influence of collateral to solve moral hazard issues. However moral hazard behavior can only be discovered following an audit procedure implemented by the bank, and such verification only takes place in the event of default.

We classify collaterals in six types. Two types are outside collaterals: guarantees from individuals, and guarantees from companies. The four other types are inside collaterals: mortgage, long-term assets other than mortgage, short-term assets, other kinds of collateral.

After we dropped credit lines with missing information for our study, we keep 564 credit lines which constitute the sample of the estimations. Table 1 summarizes our sample structure, focusing respectively on firms and on credit lines. The list of all variables used is described in table A.1 in the Appendix. The sample is composed of a majority of small and medium companies. French firms massively use overdraft, and discount for their short-term financial needs. Investment relies on long-term fixed interest rates. Let's notice that the share of collateralized loans is rather high (74.5%) whereas final recovered amounts on such collateral never exceed 40%. Moreover, banks concentrate their collateralization policy on a few types of collateral: guarantees from individuals (43.6%) and to a lesser degree mortgage (18.6%). Kinds of collateral on long-term (15.2%) and short-term (14.4%) assets are of second importance. We shall see later that such banks' behavior may traduce inappropriate choices: guarantees from individuals and mortgages are associated to a higher individual risk and are less efficient, taking into account the legal environment and the volatility of some economic assets which support the collateral.

[1] It has to be stressed that all collaterals are pledged to the loan when the credit line is granted.

IV. Methodology and results

This section is organized so as to investigate each reason of the use of collateral in turn. Namely the first subsection analyzes the role of collateral to reduce loan loss in the event of default, while the second and third subsections respectively study the influence of collateral to solve the adverse selection and moral hazard problems.

IV.1 Does collateral reduce loan loss in the event of default?

An intuitive motivation for the use of collateral in the loan contracts is that it permits a reduction of the loan loss in the event of the default of the loan. However, one can wonder whether the presence of a collateral in a loan contract significantly reduces loan loss. Furthermore, the impact of collateral in terms of reduction of the loan loss is likely to be influenced by the type and value of collateral. Namely not all collateral provides the same titles to the bank.

We therefore provide several estimations to investigate the assumed impact of collateral on the loan loss ratio. This ratio is defined as the ratio of loan loss to loan amount.[2] We include several dummy variables to control for various effects: one if the legal status of the borrower includes limited liability (*LimitedLiability*), one if the borrower is part of a group (*Group*), one if the last internal rating estimated by the bank before the default of the borrower is unknown because of the lack of satisfactory information (*UnknownRating*), one if the last internal rating estimated by the bank before the default considers the borrower as solvent (*GoodRating*). Exposure at default is also considered, including all the due amounts plus the discounted commitments (*EAD*).[3] A measure of the excessive use of the credit line is also included: the ratio of used amount to the initial amount granted (Excess).

Finally, we include some dummy variables for the type of loan: *Overdraft*, *STFixed*, *STVariable*, *LTFixed*, *LTVariable*, *Discount* represent dummy variables equal to one respectively if the loan is an overdraft, a short-term loan with fixed rate, a short-term loan with variable rate, a long-term loan with fixed rate, a long-term loan with variable rate, a discount. The dummy variable *Overdraft* is dropped in order to avoid collinearity between complementary dummies.

[2] Loan loss is built using both actual recovered amounts and discounted expected amounts: the discount rate varies with the maturity and date of lending. Expectations use probabilities of recovery which take into account qualitative information (written remarks from the recovery unit regarding the client) and the nature of the assets pledged as collaterals.
[3] The discount rate varies with the maturity and date of lending.

We first test whether the fact that the loan is secured reduces significantly the loan loss ratio, defined as loan loss divided by loan amount. In this goal, we perform a regression of this ratio on a dummy variable (*Collateral*) equal to one whether the loan is secured or to zero else. The results are described in table 2. Based upon the value of the adjusted R^2 statistic, the fit of the equations is rather satisfactory. We used the condition index of Besley, Kuh and Welsch (1980) to assess the collinearity of the model.[4] The multicollinearity of the regressions appears satisfactory.

We observe a negative coefficient for *Collateral* which is significant at the 1% level. This intuitive result supports the expectation that a secured loan reduces the loan loss in the event of default of the company. Turning to the control variables, it is of interest to point out the significant and negative sign of *EAD* and *Excess*. These results suggest the role of the effort of the bank in the recovery process. Namely, the bank supplies a greater effort in this process when the exposure at default and the excessive use of the credit line are greater. We also observe a significant and positive sign for LimitedLiability, which is in accordance with the intuition.

These estimations have then shown that the presence of collateral reduces the loan loss of the bank in the event of default. However a major issue for a bank is also to know how much it can recover from each type of collateral. In this aim, we have to provide a model linking the recovered value of a collateral to its initial value. Consequently, we now present a model on secured loans explaining the recovered value of each collateral. Furthermore, we want to take into account simultaneous effects between recovered amounts on every collateral. A competition might indeed happen between types of collateral which are used to secure a loan, notably because the bank might choose to concentrate its efforts on the recovery of one collateral to the detriment of the others. Therefore, we model six simultaneous equations so that we have one equation per collateral. The variable explained is the logarithm of the recovered value for each collateral (*IndivRecovered* for guarantees from individuals and so on), while the main explaining variable is the logarithm of the initial value of the collateral at the time of the lending decision (*IndivInitial* for guarantees from

[4] According to these authors, the multicollinearity is considered as very weak for an index below 10, moderate when the index ranges from 10 and 30, excessive and biasing the estimations if the index is above 30.

individuals and so on). We use a Three-Stage Least Squares estimation method for the global estimation of the model.[5]

The results of this model are displayed in table 3. As expected, the initial value of collateral has a significantly positive influence on the recovered value of collateral, whatever the type of collateral. The initial and recovered values of each collateral are in logarithm, meaning that their coefficients can be interpreted as elasticities. A greater coefficient of the initial value of a collateral means therefore a greater recovery power. Thus, when we consider the coefficients of the initial value so as to measure the sensitivity of the recovered value to the initial value, a hierarchy of the kinds of collateral dawns. In descending order, the "best" collateral is guarantees from companies with a coefficient of 0.391. This can be explained by the fact that this collateral is based on the wealth of other companies than the distressed one. The other kinds of collateral have a coefficient of 0.349, which may result from the high legal protection associated with leasing and the French-specific "privilège de prêteur de deniers immobilier". This latter collateral deals with the real estate loans. It gives a higher position in the absolute priority order and is based on the complete assets of the company. Leasing guarantees to the bank that there is no property transfer until the bank is fully repaid.

Then, the third "best" collateral is mortgage, namely a collateral on a non-volatile asset. The following collateral is short-term assets, which includes volatile assets such as receivables and stocks but also the non-volatile cash. Finally, both "worst" kinds of collateral in terms of the recovered value in comparison to the initial value are guarantees from individuals and long-term assets other than mortgage.

Their relatively weak power of recovery may be accounted as follows. Even if a guarantee from an individual is an outside collateral which appears particularly satisfactory for a bank, it can be provided to cover several bank loans. Consequently the wealth of the guarantor can be shared between several banks. An additional argument is that a distressed firm may have already contributed to reduce the personal wealth of its managers, as the increasing difficulties of the firm urge managers or other possible providers of guarantees to increase their invested funds in the firm. The

[5] Following the Three-Stage OLS method, we first use a Double-Stage OLS method (i.e. we use the reduced form of the model to regress exogenous instruments on endogenous variables : predicted values are taken back to the right side of the initial model, which can be estimated using simple OLS method). Then, first-stage residuals are used for the estimation of the relationship between random effects attached to each equation. Then, we use GLS method for the estimation of the whole model.

weakness of the coefficient of long-term assets other than mortgage may come from the poor recovered value on intangible fixed assets.

When we analyze the coefficients of the recovered values of the other kinds of collateral, we observe negative signs which are significant in many cases. Two explanations may be provided on this result. On the one hand, the presence of a collateral tends to reduce the presence and therefore the recovered value of other kinds of collateral. On the other hand, a greater value of one collateral incites the bank to concentrate its efforts on the recovery of this collateral to the detriment of other kinds of collateral. Both effects traduce a competition between different types of collateral.

We conclude here that collateral exerts a positive and significant role to reduce the loan loss of the bank in the event of default of the loan. However important differences remain between the types of collateral in terms of recovered value for a given initial value. Namely, guarantees from companies, other kinds of collateral, and mortgage are in descending order the types of collateral which provide the greatest value recovered. It has to be stressed that the differences between the kinds of collateral do not follow the distinction between outside and inside collateral. This results notably from the legal differences among collateral.

IV.2 Does collateral mitigate adverse selection problems?

This subsection aims at analyzing the role of collateral to solve adverse selection problems. Theoretical literature suggests that collateral may constitute a signalling instrument and consequently it may help the bank obtain private information owned by the borrower. According to this argument, we should observe a negative link between the presence of collateral and the risk premium, as high-quality firms would be inclined to provide a collateral in exchange of a lower risk premium.

To test this hypothesis, we estimate a simultaneous equations model incorporating interdependencies between risk premium and the collateral values. Indeed, the relationship between collateral values and risk premium is assumed to be bidirectional, meaning that collateral values influence risk premium and vice versa. The rationale underlying this argument comes from Bester (1985) who considers a relationship between presence of collateral and risk premium, without assuming any direction for this link.

Furthermore, considering separately each type of collateral allows investigating the potential differences between collaterals in their role to mitigate adverse selection problems. Consequently, we model seven simultaneous equations so that we have one equation for each of the six collateral values and one equation for risk premium. The variables explained are therefore the ratio of the initial value of each type of collateral on the loan amount (*IndivValue* for guarantees from individuals and so on) and the risk premium. *Risk premium* is defined as the difference between the loan rate and a prime rate. The definition of prime rates is debatable. A first choice would be the use of all available prime rates for all maturities, and then to consider that the prime rate of a loan would be the one corresponding to the maturity of this loan. However practical evidence indicates that this view does not square with the reality of French bankers. Indeed, it is notably argued that French bankers use some reference rates for short-term and long-term loans as pointed out by practitioners (Galesne, 1999; Les Echos, 2004). Therefore, we choose to use as prime rate either the rate provided by the database, when the loan is based on a variable rate, or a reference rate depending on the maturity of the loan: the TBB ("taux de base bancaire") for short-term loans, the TME ("taux mensuel des emprunts d'Etat") for long-term loans.

Control variables include information on loan size (*LoanSize*), on the length of the relationship between the bank and the borrower (*RelationshipLength*), the duration of the loan (*Duration*), and dummy variables for the type of loan (we drop the dummy variable for overdraft. Furthermore, we include the sum of the initial values of all other types of collateral than the one explained to the loan amount (*AllOtherCollValue*) in each equation explaining each of the six collateral values to take into account the fact that a type of collateral obtained exerts an influence on the other obtained types of collateral.

The results of the simultaneous equations model are displayed in table 4. In the first equation explaining *Risk premium*, we observe that all collateral variables are positive and significant at the 1% level. Furthermore, in the equations explaining collateral variables, the coefficient for the risk premium is always positive and significant at the 1% level. As a consequence, our results tend to support a positive relationship between collateral and risk premium. This evidence does not support the theoretical argument according to which collateral helps solve the problem of adverse selection. In contrast, it corroborates the observed-risk hypothesis according to which banks would ask for more collateral from riskier companies, which are already

charged with higher loan rates. We then support the empirical evidence provided by Berger and Udell (1990), who also observe a positive link between the presence of collateral and risk premium on US companies. This finding is observed for all kinds of collateral. We notably observe no difference between inside collaterals and outside collaterals. Therefore, no type of collateral helps to solve adverse selection problems.

Turning to the control variables, a striking result is the negative and significant coefficient of *AllOtherCollValue* which shows that the value of each type of collateral is reduced by the other obtained types of collateral as expected.

In summary, our tests do not support the hypothesis of a collateral helping banks solve adverse selection problems, whatever the collateral. They rather provide evidence in favor of the observed-risk hypothesis according to which banks charge greater loan rates and ask for collateral to riskier companies.

IV.3 Does collateral solve moral hazard?

In this subsection, we concentrate on the possible role of collateral to alleviate moral hazard problems. The reasoning behind this theoretical argument is that collateral favors the alignment of the interests of the borrower on the interests of the bank. It has to be stressed that this argument is particularly relevant in the case of outside collateral, since this collateral extends the limited liability of the borrower to assets outside the firm.

Our dataset allows us to have very sharp information on the presence of moral hazard. Indeed, it includes only distressed firms and provides exhaustive information on the causes of default. Consequently, we do not need to use some uncertain proxies for moral hazard but we rather define the occurrence of moral hazard according to the real causes of default.

To test the role of collateral in reducing the probability of moral hazard, we rely on a binomial logit model. The explained variable is a dummy variable equal to one if moral hazard lies among the causes of default, and zero else. This variable is built from full qualitative information on the causes of default, which is included in our database. Indeed, when a firm enters into the recovery unit of the bank, an investigation is performed in order to discover the causes of default. This literal information written by the bank employee in charge of the recovery was classified in 49 codes to allow a systematic analysis of the causes of default. Following theoretical literature on moral hazard, this controversial definition includes underinvestment,

asset substitution and weak managerial effort. Consequently, we consider all the causes linked to these three items as a moral hazard case. Namely, we then take all the causes connected to the internal reasons of faulty management. These causes include fraud, firm strategy, and managerial underperformance, which correspond to 9 codes in our classification. All information on the codes for the causes of default and the definition of moral hazard is displayed in Appendix A.2.

The estimations are performed at the firm level, unlike former tests at the loan level, since we explain the causes of default of the firms. We include several control variables defined before: *RelationshipLength*, *LimitedLiability*, *UnknownRating*, *GoodRating*. We also take some variables for the type of loans into account. As we focus now on the firm level rather than on the loan level, we consider the share of each type of loan in the total of loans of the company. Namely *ShareOverdraft*, *ShareSTFixed*, *ShareSTVariable*, *ShareLTFixed*, *ShareLTVariable*, *ShareDiscount* respectively represent dummy variables equal to one if overdrafts, short-term loans with fixed rate, short-term loans with variable rate, long-term loans with fixed rate, long-term loans with variable rate, discounts, represent more than 50% of the total loans of the company.

We present two models testing respectively the presence, and the type of collateral. The explanatory power of both logit models estimated here is quite satisfactory, with a percentage of concordant observations between 66.8% and 71.1%.

The first model tests whether the presence of at least one secured loan reduces the probability of moral hazard, by including a dummy variable (*TCollateral*) equal to one whether at least one loan to the firm is secured or zero else. The results displayed in table 5 show no significant sign for *TCollateral*, meaning that there is no significant impact on the occurrence of moral hazard when the loan is secured. This conclusion supports the role of both opposing arguments with respect to the relationship between moral hazard and the use of collateral. On the one hand, collateral is expected to reduce the problem of moral hazard by aligning borrower's interest on bank's. On the other hand, banks can sort borrowers thanks to the information they have on their quality and consequently they require higher collateral from the borrowers considered as risky. Moral hazard and observed-risk effects would then cancel each other out.

The second model deals with the type and the value of collateral. As estimations take now place at the firm level, we sum collateral per type for each firm (*TotalIndivValue* for guarantees from individuals and so on). The results are described in table 6. No variable accounting for collateral is significant, except *TotalIndivValue*, which is positive. It may appear as a surprising finding, as we could have expected that the moral hazard effect would dominate the observed-risk effect for outside collaterals. Indeed outside collaterals extend the limited liability of the borrower to external assets.

However, we showed above in the model explaining risk premium that only three types of collateral are positively linked to risk premium, including guarantees from individuals. This result substantiates the observed-risk hypothesis, supporting the view that banks request the most attractive types of collateral from the riskiest borrowers to cover its risk. Therefore, following this line of reasoning, it is no surprise that if the presence of guarantees from individuals is positively associated to riskier borrowers, it is also linked with a greater probability of moral hazard.

Turning to the control variables, we observe only two significant variables in all three models. First, *LimitedLiability* has a positive and significant sign, which result not surprisingly from the fact that firms with limited liability have more incentives to adopt moral hazard behavior. Second, the sign of *UnknownRating* is significantly positive, which is unsurprising as a borrower considering that his bank is short of information on him is more inclined to adopt moral hazard behavior.

Therefore, our estimations do not tend to support the role of collateral to solve moral hazard problems, whatever the collateral. Indeed secured loans are not associated with a lower probability of moral hazard. Furthermore, moral hazard behavior is positively linked with loans secured with guarantees from individuals. The fact that moral hazard behavior is not positively associated with secured loans suggests nonetheless that an influence partly offsets the observed-risk effect. We can not compare precisely these results to any other study, as we are not aware of any work on this specific topic. Nevertheless, on a closely related issue, Jimenez and Saurina (2004) observed a greater probability of default for secured loans, supporting the observed-risk hypothesis.

V. Concluding remarks

This research has analyzed empirically the motives of the use of collateral by banks provided by the theoretical literature. It is indeed of utmost importance to assess these motives, as there is a notable opposition between the effects expected by the theories based on information asymmetries and the common opinion of the bankers. Furthermore, a lack of empirical evidence still exists on this topic owing notably to the deficit of satisfactory data.

We use an exceptional dataset of bank loans granted to French distressed firms to test the three theoretical motives of the use of collateral. Unlike former empirical studies, this dataset allows to test the influence of the collateral type on the motives of the use of collateral by banks. Furthermore, qualitative information on the causes of default defining the occurrence of moral hazard allows innovative investigation of the impact of collateral to solve moral hazard problems.

Our main conclusions are as follows. First, collateral undoubtedly reduces loan loss in the event of default. Nonetheless, we show differences between types of collateral in terms of recovered value for a given initial value. Second, our findings suggest that any type of collateral does not solve adverse selection problems, in opposition with the theoretical argument of the collateral as a signalling instrument. Indeed, while this latter argument implies a trade-off between risk premium and collateral, we show a positive relationship between collateral and risk premium. This supports the observed-risk hypothesis according to which banks can sort borrowers thanks to the information they have on their quality. As a consequence, riskier companies would be charged with greater loan rates and asked more often to provide collateral. Third, we rather support the view that any type of collateral does not solve moral hazard. Secured loans are associated neither positively nor negatively with moral hazard behavior, suggesting that moral hazard and observed-risk effects cancel each other out.

In summary, our work provides two major conclusions. First, two reasons seem to motivate the request of banks for collateral: to reduce loan loss in the event of default, to secure loans granted to risky borrowers following the observed-risk hypothesis. Second, information asymmetries in favor of the borrower do not tend to play a significant role in the decision of the bank to secure a loan. This latter conclusion may seem all the stronger as it contrasts with the results of many theoretical works on the use of collateral (e.g. Bester, 1985; Boot, Thakor and Udell,

1991). It supports however the rare empirical works on this topic (Berger and Udell, 1990; Jimenez and Saurina, 2004). Furthermore, as notably mentioned by these latter works, it is in accordance with the perception of bankers linking the requirement of collateral with greater credit risk.

Our results should however be considered with care, as their innovative aspects make them hard to compare to former works. To check the robustness of our findings on other datasets opens an avenue for further research.

Appendix

A.1 List of variables

Variable	Description
Dependent variables	
Loan loss ratio	Loan loss divided by loan amount
Risk premium	Risk premium, defined as the difference between the loan rate and a prime rate
Moral hazard	Dummy variable equal to 1 if moral hazard is one of the causes of default
Collateral variables	
Collateral	Dummy variable equal to 1 if the loan is secured
IndivValue	Initial value of guarantees from individuals to the loan amount
FirmValue	Initial value of guarantees from companies to the loan amount
OtherValue	Initial value of other kinds of collateral to the loan amount
STAssetsValue	Initial value of short-term assets to the loan amount
LTAssetsValue	Initial value of long-term assets other than mortgage to the loan amount
MortgageValue	Initial value of mortgage to the loan amount
AllOtherCollValue	Sum of the initial values of all other types of collateral divided by the loan amount (this variable varies with the type of collateral adopted as the explained variable in the estimation)
IndivInitial	Log of the initial value of guarantees from individuals
FirmInitial	Log of the initial value of guarantees from companies
OtherInitial	Log of the initial value of other kinds of collateral
STAssetsInitial	Log of the initial value of short-term assets
LTAssetsInitial	Log of the initial value of long-term assets other than mortgage
MortgageInitial	Log of the initial value of mortgage
IndivRecovered	Log of the recovered value of guarantees from individuals
FirmRecovered	Log of the recovered value of guarantees from companies
OtherRecovered	Log of the recovered value of other kinds of collateral
STAssetsRecovered	Log of the recovered value of short-term assets
LTAssetsRecovered	Log of the recovered value of long-term assets other than mortgage
MortgageRecovered	Log of the recovered value of mortgage
TCollateral	Dummy variable equal to 1 if at least one loan to the firm is secured
TotalIndivValue	Log of the initial value of total guarantees from individuals
TotalFirmValue	Log of the initial value of total guarantees from companies
TotalOtherValue	Log of the initial value of total guarantees from other kinds of collateral
TotalSTAssetsValue	Log of the initial value of total guarantees from short-term assets
TotalLTAssetsValue	Log of the initial value of total guarantees from long-term assets other than mortgage
TotalMortgageValue	Log of the initial value of total guarantees from mortgage
Control variables	
LoanSize	Log of the loan amount
RelationshipLength	Log of the length of the relationship bank-borrower
Duration	Log of the duration of the loan
LimitedLiability	Dummy variable equal to 1 if the legal status of the company includes limited liability
Excess	Used amount to the initial granted amount of loan
EAD	Log of exposure at default (all the due amounts plus the discounted commitments)
Group	Dummy variable equal to 1 if the company is part of a group
UnknownRating	Dummy variable equal to 1 if the last internal rating estimated by the bank before the default of the borrower is unknown because of the lack of satisfactory information
GoodRating	Dummy variable equal to 1 if the last internal rating estimated by the bank before the default of the borrower considers the borrower as solvent
Overdraft	Dummy variable equal to 1 if the loan is an overdraft
STFixed	Dummy variable equal to 1 if the loan is short-term with fixed rate

STVariable	Dummy variable equal to 1 if the loan is short-term with variable rate
LTFixed	Dummy variable equal to 1 if the loan is long-term with fixed rate
LTVariable	Dummy variable equal to 1 if the loan is long-term with variable rate
Discount	Dummy variable equal to 1 if the loan is discount
ShareOverdraft	Share of overdrafts in the total of loans of the company
ShareSTFixed	Share of short-term loans with fixed rate in the total of loans of the company
ShareSTVariable	Share of short-term loans with variable rate in the total of loans of the company
ShareLTFixed	Share of long-term loans with fixed rate in the total of loans of the company
ShareLTVariable	Share of long-term loans with variable rate in the total of loans of the company
ShareDiscount	Share of discounts in the total of loans of the company

A.2 Codes for causes of default

Moral hazard is measured, depending on the causes of default of the firm. Our dataset includes full qualitative information on these causes of default. This literal information, which is written in the credit file by the bank employee in charge of the recovery process, was classified in 49 codes. The codes are the following ones, gathered in 7 categories:

Prospect problems: sudden loss of clients, default of major clients, wrong evaluation of the market, sale prices too low, obsolete products, loss of market share (underlying reduction of the demand).

Firm strategy: firm youth (lack of experience), voluntary dissolution, failure of major projects, conscious acceptance of nonprofitable markets.

Cost and production structure: overcapacities or overinvestment, asset depreciation, excessive operating costs, excessive personnel expenses, sudden loss of a supplier or refusal to accept terms of payment, obsolete production process, underinvestment.

Financial difficulties: extension of the terms of payment of clients, contagion of subsidiaries'loss, reduction of the terms of payment required by suppliers, speculation of the firm, exchange issues, end of support by mother company, deficit in equity, refusal of loan (to the company), end of subsidies, excessive interest rates.

Problems with information and management: deficient accounting system or deficient information system, competence problems (lack of competence), disagreement between managers, excessive withdrawals, insufficient provisioning, misappreciation of production costs, wrong evaluation of stocks, difficulties in the transfer of the firm / difficult merger or acquisition.

Accidental causes: fraud, extension of a bankruptcy process, lawsuit with public partners, lawsuit with private partners, death / disease / escape of the manager, accident, social problems in the firm, other.
Macroeconomic factors of fragility: unfavorable evolution of the exchange rate, increase in competition, reduction in industry demand, exceptional event (war, natural disaster,…), public policy less favorable to the industry, period with credit rationing, macroeconomic increase of operating costs (raw materials, …).

Following theoretical literature on moral hazard, we consider as moral hazard all the causes linked to underinvestment, asset substitution and weak managerial effort. Namely, we then take all the causes connected to the internal reasons of faulty management, which include fraud, firm strategy, and managerial underperformance. Moral hazard behavior is then assumed for each firm for each at least one of the following 9 codes in our classification is mentioned as one cause of default: conscious acceptance of nonprofitable markets, overcapacities and overinvestment, underinvestment, deficient accounting system / deficient information system, competence problems (lack of competence), disagreement between managers, excessive withdrawals, insufficient provisioning, fraud.

REFERENCES

Berger, Allen, and Gregory Udell. (1990). "Collateral, Loan Quality, and Bank Risk." Journal of Monetary Economics 25, 21-42.

Berger, Allen, and Gregory Udell. (1995). "Relationship Lending and Lines of Credit in Small Firm Finance." Journal of Business 68, 351-382.

Besanko, David, and Anjan Thakor. (1987). "Collateral and Rationing: Sorting Equilibria in Monopolistic and Competitive Credit Markets." International Economic Review 28, 671-689.

Besley, D., Kuh E. and Welsch, R. (1980). Regression Diagnostics: Identifying Influential Data and Sources of Collinearity, Wiley, New York.

Bester, Helmut. (1985). "Screening vs. Rationing in Credit Markets with Imperfect Information." American Economic Review 25, 21-42.

Boot, Arnoud, Thakor, Anjan, and Gregory Udell. (1991). "Secured Lending and Default Risk: Equilibrium Analysis, Policy Implications and Empirical Results." Economic Journal 101, 458-472.

Chan, Yuk-Shee, and George Kanatas (1985). "Asymmetric Valuation and the Role of Collateral in Loan Agreements." Journal of Money, Credit and Banking 17, 85-95.

Cowling, Marc. (1999). "The Incidence of Loan Collateralization in Small Business Lending Contracts." Applied Economics Letters 6, 291-293.

Davydenko, Sergei, and Julian Franks. (2005). "Do Bankruptcy Codes Matter? A Study of Defaults in France, Germany and the UK." EFA 2005 Moscow Meetings Paper.

Degryse, Hans and van Cayseele, P. (2000). "Relationship Lending Within a Bank-Based System: Evidence from European Small Business Data." Journal of Financial Intermediation 9 , 90-109.

Galesne, Alain. (1999). Le Diagnostic Financier de l'Entreprise, CEREFIA, Rennes.

Gonas, John, Highfield, Michael, and Donald Mullineaux. (2004). "When are Commercial Loans Secured." The Financial Review 39, 79-99.

Harhoff, Dietmar, and Timm Körting. (1998). "Lending Relationships in Germany – Empirical Evidence from Survey Data." Journal of Banking and Finance 22, 1317-1353.

Hulburt, Heather, and Frederick and Scherr. (2003). "Determinants of the Collateralization of Credit by Small Firms." Managerial and Decision Economics 24, 483-501.

Jimenez, Gabriel, Salas, Vicente, and Jesus Saurina. (2006). "Determinants of Collateral." Journal of Financial Economics, 255-281.

Jimenez, Gabriel, and Jesus Saurina. (2004). "Collateral, Type of Lender and Relationship Banking as Determinants of Credit Risk." Journal of Banking and Finance 28, 2191-2212.

Leeth, John, and Jonathan Scott. (1989). "The Incidence of Secured Debt: Evidence from the Small Business Community." Journal of Financial and Quantitative Analysis 24, 3, 379-393.

Les Echos (2004). "Crédit: Le Retour en Grâce des PME." p.33.

Stiglitz, Joseph, and Andrew Weiss. (1981). "Credit Rationing in Markets with Imperfect Information." American Economic Review 71, 393-410.

Table 1
Means and frequencies for main variables

The table below provides means and frequencies computed on our full dataset of 564 loans.. Definition of variables appear in the appendix A.1.

Firm characteristics (mean)	
Turnover (thousand €)	11,970.9
Relationship Length (years)	6.65
Moral hazard	26.59%
Characteristics of credit line (mean)	
LoanSize (thousand €)	436.3
LossRatio	55.07%
Risk premium	1.62%
Collateral	74.5%
Type of credit line (frequency)	
Overdraft	20.92%
STFixed	6.56%
STVariable	4.26%
LTFixed	37.23%
LTVariable	8.16%
Discount	13.65%
Other credit lines	9.22%

Type of collateral (frequency)	
Guarantees from individuals	43.6%
Guarantees from companies	13.7%
Other kinds of collateral	8.7%
Short-term assets	14.4%
Long-term assets other than mortgage	15.2%
Mortgage	18.6%
Recovery rate (mean)	
Guarantees from individuals	10%
Guarantees from companies	39%
Other kinds of collateral	32%
Short-term assets	21%
Long-term assets other than mortgage	11%
Mortgage	21%

Table 2
Collateral and reduction of loan loss: secured or not (OLS)

Definitions of variables appear in the Appendix A.1. The dependent variable is *Loan loss ratio*. *, **, *** denote an estimate significantly different from 0 at the 10%, 5% or 1% level. N=564.

Variable	Coefficient	t-statistic
Intercept	0.983***	7.30
Collateral	-0.156***	2.57
LimitedLiability	0.162*	1.92
Group	0.039	0.74
UnknownRating	0.039	0.61
GoodRating	0.048	0.73
STFixed	0.312***	2.76
STVariable	0.405***	3.00
LTFixed	0.232***	3.41
LTVariable	0.163	1.57
Discount	0.129	1.54
EAD	-0.073***	4.20
Excess	-0.272***	20.09
Adjusted R^2	0.4890	
Condition Index	15.67	

Table 3
Collateral and reduction of loan loss (Three Stage Least Squares)

Definitions of variables appear in the Appendix A.1. The dependent variable is on the top of the column. *, **, *** denote an estimate significantly different from 0 at the 10%, 5% or 1% level. Adjusted R^2=0.3432. N=420.

	IndivRecovered		FirmRecovered		OtherRecovered		STAssetsRecovered		LTAssetsRecovered		MortgageRecovered	
	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.
Intercept	0.090	0.23	0.431	1.47	0.172	0.43	0.617**	2.41	0.193	0.71	0.173	0.34
IndivInitial	0.113**	2.91										
FirmInitial			0.391***	7.51								
OtherInitial					0.349***	5.96						
STAssetsInitial							0.222***	4.93				
LTAssetsInitial									0.111***	3.98		
MortgageInitial											0.244***	4.33
IndivRecovered			-0.191	0.81	-0.550*	1.96	-0.174	0.84	-0.329*	1.75	-0.728**	2.35
FirmRecovered	-0.211*	1.67			-0.277*	1.91	-0.030	0.25	-0.228***	2.62	-0.352**	2.11
OtherRecovered	-0.167	1.28	-0.087	0.75			0.031	0.26	-0.149	1.61	-0.334**	2.10
STAssetsRecovered	-0.348*	1.70	-0.206	1.03	-0.451	1.84			-0.240	1.46	-0.649**	2.51
LTAssetsRecovered	-0.257	0.81	-0.180	0.70	-0.563*	1.81	-0.003	0.01			-0.602	1.60
MortgageRecovered	-0.220*	1.72	-0.016	0.12	-0.299**	2.04	-0.092	0.84	-0.152	1.53		
LimitedLiability	-0.221	0.93	-0.259	1.38	-0.312	1.27	-0.259	1.60	-0.177	1.03	-0.455	1.57
Group	-0.084	0.55	-0.153	1.29	-0.099	0.62	-0.248**	2.46	-0.038	0.35	-0.119	0.59
UnknownRating	-0.010	0.06	-0.201	1.61	0.008	0.05	-0.147	1.30	-0.011	0.10	-0.045	0.21
GoodRating	0.294	1.57	0.122	0.76	0.366*	1.84	-0.075	0.46	0.271**	2.13	0.414*	1.67
STFixed	-0.247	0.80	0.387	1.52	-0.222	0.70	-0.009	0.04	-0.138	0.65	-0.521	1.32
STVariable	-0.428	1.05	-0.727**	2.36	-0.658	1.55	-0.355	1.23	-0.540**	1.98	-0.727	1.38
LTFixed	-0.204	1.09	-0.009	0.06	-0.328*	1.69	-0.149	1.12	-0.242*	1.83	-0.391	1.62
LTVariable	-0.002	0.01	0.460**	2.25	-0.169	0.58	-0.406*	1.89	0.077	0.41	0.106	0.30
Discount	-0.650**	2.29	-0.343	1.21	-0.645*	1.82	-0.507**	2.26	-0.451**	2.01	-0.976**	2.50
EAD	0.165*	1.90	0.024	0.26	0.236**	2.37	0.026	0.31	0.119*	1.75	0.326***	3.19
Excess	-0.019	0.58	0.026	0.96	-0.040	1.22	-0.005	0.20	-0.023	1.04	-0.043	1.04

Table 4
Collateral and risk premium (Three Stage Least Squares)

Definitions of variables appear in the Appendix A.1. The dependent variable is on the top of the column. *, **, *** denote an estimate significantly different from 0 at the 10%, 5% or 1% level. Adjusted R^2=0.3391. N=303.

	Risk Premium		IndivValue		FirmValue		OtherValue		STAssetsValue		LTAssetsValue		MortageValue	
	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.
Intercept	0.038***	9.17	-10.589***	5.40	-6.760***	7.23	-3.145***	5.24	-7.466***	8.05	-10.417***	6.37	-10.145***	5.95
IndivValue	0.004***	4.80	-		-		-		-		-		-	
FirmValue	0.004***	18.25	-		-		-		-		-		-	
OtherValue	0.003***	14.70	-		-		-		-		-		-	
STAssetsValue	0.004***	9.41	-		-		-		-		-		-	
LTAssetsValue	0.004***	4.22	-		-		-		-		-		-	
MortgageValue	0.004***	4.88	-		-		-		-		-		-	
Risk Premium			269.589***	6.65	170.95***	8.44	79.315***	5.71	190.313***	9.67	266.738***	7.86	259.865***	7.35
AllOtherCollValue			-1.132***	37.89	-0.675***	15.45	-0.314***	6.92	-0.763***	22.80	-1.082***	37.39	-1.046***	38.57
LoanSize	-0.460E-3	0.74	0.133	1.09	0.081	1.55	0.046*	1.84	0.091*	1.69	0.132	1.29	0.125	1.18
RelationshipLength	-0.002***	2.68	0.610***	3.34	0.383***	4.71	0.205***	4.73	0.426***	5.17	0.601***	3.96	0.581***	3.67
Duration	-0.970E-3	1.16	0.268*	1.68	0.181***	2.65	0.074**	2.19	0.195***	2.78	0.263**	1.99	0.255*	1.85
STFixed	-0.019***	4.98	5.096***	4.85	3.281***	6.77	1.518***	5.12	3.557***	7.30	4.992***	5.70	4.863***	5.33
STVariable	-0.018***	4.37	4.697***	4.64	2.983***	6.41	1.432***	5.16	3.279***	7.02	4.595***	5.45	4.477***	5.10
LTFixed	-0.019***	6.32	5.180***	5.61	3.285***	7.48	1.550***	5.51	3.619***	8.31	5.060***	6.58	4.941***	6.16
LTVariable	-0.020***	5.38	5.414***	5.40	3.418***	7.24	1.778***	6.15	3.769***	8.03	5.259***	6.30	5.158***	5.92
Discount	-0.020***	4.81	5.479***	4.98	3.459***	6.73	1.582***	4.98	3.889***	7.63	5.390***	5.88	5.247***	5.49
LimitedLiability	-		0.112	1.39	0.137**	2.28	0.014	0.28	0.163***	2.96	0.128*	1.75	0.137*	1.93
Group	-0.003**	2.03	0.825***	2.67	0.572***	4.31	0.227***	3.23	0.552***	4.01	0.787***	3.07	0.764***	2.86

Table 5
Collateral and moral hazard: at least one loan to the firm is secured (Logit)

Definitions of variables appear in the Appendix A.1. The dependent variable is the dummy variable *Moral hazard*, taking the value of 1 when moral hazard is one of the causes of default, and 0 else. *, **, *** denote an estimate significantly different from 0 at the 10%, 5% or 1% level. N=197.

Variable	Coefficient	Chi-Square
Intercept	-2.987***	6.91
TCollateral	0.539	0.93
RelationshipLength	-0.010	0.01
LimitedLiability	1.563**	5.63
UnknownRating	0.705*	2.90
GoodRating	0.082	0.03
ShareOverdraft	0.056	0.01
ShareSTFixed	-5.534	2.51
ShareSTVariable	0.333	0.17
ShareLTFixed	0.064	0.01
ShareLTVariable	-0.419	0.30
ShareDiscount	-0.656	0.52
-2 log likelihood	209.550	
Association of prediction probabilities and observed responses		
Concordant	66.8	
Tied	1.6	

Table 6
Collateral and moral hazard: types and values of collateral (Logit)

Definitions of variables appear in the Appendix A.1. The dependent variable is the dummy variable *Moral hazard*, taking the value of 1 when moral hazard is one of the causes of default, and 0 else. *, **, *** denote an estimate significantly different from 0 at the 10%, 5% or 1% level. N=197.

Variable	Coefficient	Chi-Square
Intercept	-2.703**	5.88
TotalIndivValue	0.118*	2.95
TotalFirmValue	0.013	0.02
TotalOtherValue	-0.027	0.08
TotalSTAssetsValue	-0.155	1.88
TotalLTAssetsValue	-0.002	0.01
TotalMortgageValue	0.036	0.23
RelationshipLength	0.030	0.02
LimitedLiability	1.605**	5.25
UnknownRating	0.823*	3.63
GoodRating	0.130	0.07
ShareOverdraft	-0.223	0.06
ShareSTFixed	-5.901	2.43
ShareSTVariable	0.135	0.03
ShareLTFixed	-0.228	0.11
ShareLTVariable	-0.648	0.63
ShareDiscount	-0.875	0.86
-2 log likelihood	204.013	
Association of prediction probabilities and observed responses		
Concordant	71.1	
Tied	0.4	

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