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Collateral and its Determinants: Evidence from Vietnam

By

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Abstract

This paper analyses the determinants of collateral in loans granted to entrepreneurs and consumers. We use cross-sectional data on more than 39,000 bank loans raised by Vietnamese borrowers between 2006 and 2009. Our data set is unique because it contains information about the bank's assessment of the borrower's ex ante risk and the borrowers' wealth including pledged as well as unpledged assets. We find that observationally riskier borrowers, as measured by the bank through the ex ante risk score, are more likely to pledge collateral. At the same time, wealthier borrowers are more likely to pledge collateral in order to benefit from a reduction in their interest costs. We also present evidence on other determinants of collateral such as borrower-lender relationship, credit market competition, and institutions.

Keywords: Collateral, retail lending, observed risk hypothesis, loan pricing, emerging markets.

JEL-Code: G21.

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1. Introduction

Collateralization is believed to be a useful tool in resolving problems associated with both adverse selection and moral hazard in business and consumer lending. However what determines the use of collateral in credit contracts? Drawing from current theories, we examine this question empirically by modeling the use of collateral as a function of borrower characteristics such as credit quality, age, or wealth, loan characteristics such as loan amount and duration, the scale and scope of the borrower-lender relationship, credit market characteristics and regional governance conditions. We test this comprehensive model for the determinants of collateral using cross-sectional data on more than 39,000 loans granted between 2006 and 2009 to Vietnamese retail borrowers for a wide range of purposes including commercial investment, consumer spending, and purchase of real-estate.

We find that the likelihood of pledging collateral is higher among borrowers who are observed by the bank as ex ante riskier borrowers. The bank uses a list of criteria to assess a loan application; these criteria are quantified into a risk score that can be used to distinguish risky borrowers from the safe ones. We find that the lower the risk score, the higher the probability of using collateral. This result confirms that observed risk matters in decisions about the term of a loan. We also find that among borrowers with the same level of observed risk, borrowers with higher wealth are more often using collateral. When adding interest rates to the analysis, our results suggest that borrowers reduce their funding costs by pledging collateral.

Our paper makes three main contributions. First, we use data on retail loans for which the borrowers' liability is unlimited. Thereby, we can obtain new insights that differ from those papers that study corporate loans to borrowers with limited liability. Second, we use an ex ante credit risk variable which directly reflects how the bank observes a borrower's credit profile. This allows us to better test the observed risk hypothesis than previous studies. Indeed, our results are consistent with the idea that observationally riskier borrowers are more likely to pledge collateral. Finally, we observe the borrower's total wealth including assets pledged as collateral and unpledged assets. This allows us to investigate not only whether borrowers pledge collateral but also how much collateral they pledge relative to the size of the loan. Most importantly, however,

by observing the value of the unpledged assets our study is the first to differentiate between the bank's requirement to pledge collateral for risky borrowers and the borrowers' ability to pledge collateral.

The paper is structured as follows: Section 2 provides an overview of the relevant existing theory and empirical evidence on the determinants of collateral use. Section 3 provides background about the Vietnamese banking market. Section 4 presents our empirical model and derives our main hypotheses. Section 5 describes the data, variables, and method we use to test the main hypotheses. We present the results of our empirical analysis in Section 6, and Section 7 concludes.

2. Literature review

2.1. Theory

Collateral is a defining feature of a loan contract, together with the interest rate, maturity, size, and any possible covenants. Drawing from current theories, collateral helps banks to solve two main problems. First, collateral can limit bank's losses in the case of default by liquidating the collateral. Second, collateral can solve the problem of asymmetric information between banks and borrowers arising when borrowers own private information that is not available to banks. It is obvious how collateral works to solve the first problem. It is however more complex to understand how the later problem is solved by the use of collateral. Theories about collateral solving the asymmetric information problem can be divided into two main streams. First, collateral can be used as a signaling instrument providing banks with valuable information about the borrower's quality that would not be available otherwise. High-quality borrowers who have private information about their good creditworthiness know that the chance of default on the loan and the loss of their collateral are unlikely. Therefore, high-quality borrowers are more willing to pledge collateral in compensation of more favorable contract terms than low-quality borrowers. Hence, collateral helps reduce adverse selection by signaling (Stiglitz and Weiss, 1981; Bester, 1985; Chan and Kanatas, 1985; Besanko and Thako, 1987). In these papers a menu of contracts is offered to borrowers: one with high collateral and low interest rate and the other with low collateral and high interest rate. The borrowers can choose their preferred contract

themselves and by choosing high collateral, they signal their status as high-quality borrowers. Second, collateral helps solve the problem of moral hazard after the loan is granted (Booth, Thakor and Udell, 1991). Collateral provides an incentive to borrowers to exert optimal effort or to invest the loan in appropriate investments as their payoff in the case of default is lower with collateral than without collateral. The presence of collateral is therefore associated with lower ex post default. In general, theories that view collateral as a solution to the asymmetric information problem predict a negative relation between presence of collateral and the borrower's risk level, both ex ante and ex post.

However, collateral requires monitoring and increases legal cost that might be high enough to offset any advantage of collateral for a bank in terms of lower loss given default and reduced asymmetric information. More importantly and contradictory to the arguments of the asymmetric information theories, there is a common view among bankers that collateral is associated with riskier borrowers (Berger and Udell, 1990; Jimenez and Saurina, 2004; Inderst and Mueller, 2006). The rationale is that with their information obtained from ex ante screening, banks would be able to identify risky borrowers. Since collateral helps to reduce the loss in case of default, bank would require more collateral from borrowers with higher default risk. This is commonly called the observed-risk hypothesis.

2.2. Empirical evidence

Although a substantial amount of empirical work is devoted to banking issues, there are only a limited number of studies investigating the determinants of collateral in bank loans. Moreover, this scarce empirical literature has not settled whether collateral is associated with riskier or safer borrowers. On one hand, empirical studies explains the use of collateral as a consequence of adverse selection (Jimenez, Salas, and Saurina, 2006; Degryse and Van Cayseele, 2000), and/or moral hazard (Booth et al., 1991) and conclude that the presence of collateral is a signal of safe borrowers. On the other hand, the majority of studies find that collateral is associated with high risk borrowers and therefore support the observed-risk hypothesis (Berger and Udell, 1990; Jimenez and Saurina, 2004; Booth and Booth, 2006; Blazy and Weill, 2006).

Among studies supporting the adverse selection theory, the most recent one is from Jimenez, Salas, and Saurina (2006) who analyze a wide range of determinants of the presence of collateral including credit quality of borrowers; competition in the credit market; borrower-lender relationship; loan characteristics; and macroeconomic conditions. Their findings are consistent with collateral as a solution to adverse selection problems, i.e. their results provide direct evidence of a negative association between collateral and borrower's risk. They find that the possibility of using collateral to signal credit quality occurs mainly among young borrowers who have no previous record of financial or commercial activities. This is the group for which the asymmetric information effect is likely to be the strongest. Focusing on the associations between collateral, banking relationship and risk premium, Degryse and Van Cayseele (2000) find a negative link between the presence of collateral and the loan's interest rate (a proxy for risk premium) for a sample of 18,000 Belgian loans. This indicates that less risky borrowers pledge collateral to signal their credit quality.

The number of studies which find evidences supporting the observed-risk hypothesis, that is, a positive relation between the presence of collateral and the default risk, is substantial. In an early study Berger and Udell (1990) investigate the relationship between collateral and credit risk for a sample of one million loans from US banks. They test the hypothesis that adverse selection is the motive for collateralization by regressing the risk premium on a set of loan characteristics including a dummy variable considering whether the loan is secured or not. They find a positive and significant relationship between collateral and risk premium and conclude that the observed-risk hypothesis holds: Banks require more collateral from risky borrowers while at the same time charging them higher borrowing cost (higher risk premium).

Jimenez and Saurina (2004) investigate the wide range of determinants of the probability of default of bank loans by analyzing 3 million loans provided by Spanish banks. They use the probability of default as an ex-post credit risk measure. They test both hypothesizes of the asymmetric information theory: the presence of collateral helps limit adverse selection and reduce moral hazard. The ex post credit risk is regressed on a set of loan characteristics including information on collateral while controlling for other explanatory variables. They find a positive relation between the ex

post credit risk and the presence of collateral which is in accordance with the observed-risk hypothesis.

Booth and Booth (2006) use a two-step regression to examine the relation between the borrowing cost and the presence of collateral on a sample of 977 US loans in the period from 1987 to 1989. They first examine the factors determining the presence of collateral to see whether the presence of collateral is a function of ex ante default risk and various controlling variables. They next examine the borrowing cost of secured and unsecured loans controlling for the interdependence between the decision to pledge collateral and loan spreads. They find that firms pledge collateral to minimize direct borrowing cost. Furthermore, in accordance with the observed-risk hypothesis they find that a number of observable risk characteristics are related to the probability that a loan is secured. Thus, their results confirm that the presence of collateral is associated with high risk borrowers.

Blazy and Weill (2006) examine why banks require collateral, and whether their reasons vary among collateral types. Their study is among the very few that investigate simultaneously the role of collateral in reducing loss in case of the default and in solving the asymmetric information problem. Firstly, they run the regression of loan loss ratio on the presence of collateral with a set of possible explanatory variables. This loan loss ratio is defined as loan loss divided by loan amount. Loan loss is built using both actual recovered amounts and discounted expected amounts. They observe a negative coefficient which indicates that collateral helps reduce banks' losses given default. Secondly they estimate a simultaneous equations model incorporating the interdependencies between risk premium and the collateral value. Their findings however indicate that information asymmetries are not of prime importance in the bank's decision to secure a loan as they show a positive relation between collateral variables and risk premium. The reduction of the loan loss and the observed-risk hypothesis may thus explain the use of collateral.

Liberty and Mian (2009) examine the use of collateral in emerging economies. They explore how the level of financial development in a country affects the collateral cost of capital using a novel cross-country data set containing small and medium business loans issued by a multinational bank in 15 emerging economies. They find that riskier firms in

6

financially developed economies are able to access credit, pledging a lower amount of collateral and with greater flexibility in the type of assets they can offer as collateral. Their finding suggests a possible channel through which better financial and legal institutions expand credit to riskier firms.

This review on the empirical literature leads to three main contributions of our paper. First, none of empirical studies investigates the use of collateral in retail loans, they all use loans granted to limited liability corporations. So our paper can shed a new light on studying the determinants of collateral for retail loans where the borrower is fully liable with all her wealth. Second, empirical studies mainly focus on developed countries where the financial system and the legal framework help provide more transparent information on credit history of borrowers and the information asymmetric therefore has less effect. In contrast our study focuses on the Vietnamese banking market, where institutional structures are largely lacking and information asymmetries are much more severe. Third, most of the existing papers use a proxy for ex ante credit risk observed by the bank such as borrowing rate or ex post default rate. In contrast, we are able to directly observe the borrower's ex ante credit risk as we have access to the borrower's credit score calculated by the bank at the time of the loan application. This allows us to better test the observed risk hypothesis than in the previous studies.

3. The Vietnamese banking market

In 1987, Vietnam started its transformation to a market economy. Part of this process is the replacement of the monopoly of state-owned banks by a two-level banking system consisting of a national central bank on one level and state-owned as well as commercial banks on another level.[1] Projects to modernize the inter-bank market, to create an international accounting system, and to allow outside audits of major Vietnamese banks are ongoing. However, the banking system continues to suffer from lack of capital, inadequate provisions for possible loan losses, low profitability, inexperience in capital

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[1] In 2005, this second level of the Vietnamese banking system contained five state-owned commercial banks, one social policy bank, 31 foreign bank branches, 40 foreign credit institution representative offices, five joint-venture commercial banks, 36 domestic joint-stock commercial banks, seven finance companies, and the Central People's Credit Fund System with 23 branches and 888 local credit funds.

markets, and the slow pace of institutional reform. With respect to risk assessment and management, there are numerous difficulties including a lack of transparency in non-performing loan disclosure. In order to improve risk management in light of Basel II, Vietnam's central bank has been reviewing its risk management regulations. As part of a broader strategy - which also addresses the banks' business strategy, assets and liability management, and internal audit - all state-owned commercial banks and joint-stock commercial banks have been asked to develop a comprehensive credit manual which takes international practices in risk management into account.

In this double-level banking system, the national central bank is not engaged any more in trading activities, nor is it directly involved in the process of acquiring or locating capital in the banking and financial market. All of those functions are carried out by commercial banks and other financial companies. These banks also provide banking services to corporations and individuals for profit including traditional services like payment transactions, deposit taking, lending, issuing credit and debit cards and modern services like internet banking. This second level is dominated by the state owned commercial banks, which accounted for almost of 80% of commercial bank operation in Vietnam in 2005. However, despite the inadequacy of the legal framework and transitional problems, private commercial banks have made significant progress.

The data used in this study originates from one of the joint-stock commercial banks in Vietnam. Sharing the common situation of all commercial banks in Vietnam, about 60 to 70% of the bank's capital asset is employed for lending activities. Profit from these activities accounts for a major part of bank's total profit. Strategically the bank is focused on the retail sector, i.e. lending to consumers, entrepreneurs, and SMEs. During Vietnam's recent period of high economic growth and transformation to a market economy, there has been an increasing demand of capital in this retail sector. Lending volumes have grown substantially since 1990 and although state owned enterprises are still the dominant users of credit, their share in bank credit fell from 86% in 1991-92 to 58% in December 2005 due to growing loan demand from retail borrowers. Within the retail credit sector, joint stock commercial banks play an important role as they account for more than 50% of outstanding loan value.

Due to its strategic focus on retail lending, the bank from which our data originates has developed competencies in particular regarding the risk assessment of borrowers during the initial screening. As a first step in the process of credit approval at the bank, borrowers have to fill in a loan application form. There they are asked to fill in their personal information (age, address, occupation, marital status, relation with any other bank, etc) as well as information about the loan that they are applying for (amount, purpose, etc). More importantly, the borrowers are also asked to provide information about their assets that can be pledged as collateral though they might not necessarily be used as collateral in the end. Second, all information provided by the borrowers is certified by the bank regarding its correctness. Third, because a sophisticated credit scoring system is not yet in place at the bank, rules of thumb are used. These take the form of a list of criteria that the credit officers can refer to. Generally, if the loan amount is less than 100 million Vietnamese dong (VND, approximately 3.000 euro) and all the criteria are met at the minimum required level then the loan application will be approved without requiring collateral. If the loan amount is more than 100 million VND all criteria will be assessed at a more critical level and a collateral requirement becomes more likely. The criteria that the bank uses to assess their borrowers include the borrower's monthly income, her occupation, years with the current employer, the industry of occupation, etc. These criteria are combined into an *ex ante risk score*. For more detailed information about how this score is computed, please refer to Table A1 in the appendix.

Table 1 provides a snapshot of part of the bank's outstanding loan portfolio. Between 2006 and 2009, the bank has extended 39.052 loans of which the majority finance consumer spending (55%). Overall 45% of these loans are collateralized with consumer and commercial loans showing the highest fraction of collateralization. The bank is free to decide on the interest it charges its borrowers and Table 1 reveals that the bank charges on average a lower interest rate for collateralized loans (15.1%) than for uncollateralized ones (22.3%). This is true for each loan purpose.

[Insert Table 1 about here]

9

4. Empirical model and hypotheses

We model collateral as determined by borrower characteristics, loan characteristics, the bank-borrower relationship and regional governance characteristics:

$$collateral_{D,i} = \beta_0 + \sum_j \beta_{1,j} borrower_{ij} + \sum_j \beta_{2,j} loan_{ij} + \sum_j \beta_{3,j} bank-borrower-relationship_{ij}$$

$$+ \sum_j \beta_{4,j} regional-governance_{ij} + \sum_j \beta_{5,j} time-dummy_j + \varepsilon_i \tag{1}$$

where collateral$_{D,i}$ is a dummy that takes the value of one if loan i is collateralized, and zero otherwise. To investigate how different determinants affect the requirement of collateral, we use probit regression to estimate the probability of a loan being secured by collateral. The probability of a loan being secured is given by:

$$\Pr{ob}(collateral_D = 1) = \int_{-\infty}^{\infty} \Phi(\beta' X) \tag{2}$$

where Φ is the standard normal distribution function and X is a vector of explanatory variables as listed in equation (1). Borrower characteristics include the borrower's *ex ante risk score*, his *wealth*, *age* and *living comfort level*. Loan characteristics include the *duration* of the loan, a *large loan$_D$* dummy which indicates loans with a size larger than 100 million VND, and dummies indicating the loan purpose as commercial, real estate, consumer or other. The bank-borrower relationship is measured by the *years with the bank*, the scope of the relationship as indicated by the *number of bank products* that the customer is using, the *number of prior loans* that the borrower obtained from the bank, and a dummy indicating if the customer has a business relationship with another bank (*other bank$_D$*). Regional governance is characterized by the *fraction of entrepreneurs* in the provincial population, a *provincial legal index* and by the distance between the bank branch that makes the loan and the headquarter (*distance to headquarter*). As the bank requires borrowers to conduct business with their local branch, these governance proxies are measured for the province in which the branch and borrower are located. Finally, time dummies identify in which quarter of 2006 to 2009 the loan was signed. Details on these variables can be found in Table A2 in the appendix. Each of these variables will be motivated as we discuss our hypotheses below.

Hypothesis 1 (H1). Observed riskier borrowers are more likely to pledge collateral.

Boot et al. (1991) find that when lenders based on their information regarding the credit quality of borrowers can differentiate high from low risk borrowers, high risk borrowers obtain loans with collateral and low risk borrowers obtain loans without having to pledge collateral. We can directly observe the *ex ante risk score* of each borrower's credit quality as assessed by the bank. The higher the score, the lower the borrower's credit risk. A positive coefficient for this proxy indicates that the observed-risk-hypothesis holds.

Hypothesis 2 (H2). Given the same observed credit quality, wealthier borrowers are more likely to pledge collateral in order to benefit from a lower borrowing rate.

This hypothesis is based on the argument that the use of collateral helps reduce asymmetric information between borrowers and lenders and that banks are more willing to grant secured loan with lower interest rate (Bester, 1985; Chan and Kanatas, 1985; Besanko and Thakor, 1987a). Knowing that secured loans will be charged lower interest rate (see Table 1), borrowers who are able to pledge collateral have a strong incentive to do so. We proxy the ability to pledge collateral with the size of the borrower's *wealth*. In addition, we consider the borrower's *living comfort level* as an indicator of his wealth. Once the borrower fills in the loan application form, a credit officer will verify all the provided information and visit the borrower's place of residence. The credit officer will then rank the living comfort of the borrower from luxury to poor based on established criteria including the neighborhood and number of bed rooms. In additional analyses, we also consider the impact of the interest rate on the collateral decision more directly. For each loan type and month of loan signing, we calculate the average interest rate across all unsecured loans minus the average interest rate across all secured loans. We then match this interest difference to each of our loan observations by loan time and month of loans signing. If the borrower has pledgable assets (*wealth* > 0), we set our *interest benefit* proxy equal to the interest difference. If the borrower does not have pledgable assets, we set our *interest benefit* proxy to zero. Thus, our proxy reflects the *interest benefit* that the borrower can potentially earn by pledging her assets as collateral. If interest rates are driving the borrower's decision to pledge collateral then a higher *interest benefit* should increase the likelihood of collateral.

11

Hypothesis 3a (H3a). The likelihood of using collateral decrease with length of borrower-lender relationship if the benefits of relationship lending dominates, and increase with the length of the relationship if the cost of the "hold-up" problem associated with the relationship lending dominates (scale of the relation).

This hypothesis is based on studies about the effect of relationship lending on the likelihood of collateral (Boot, 2000; Berger and Udell, 2002, Jimenez et al, 2006). In addition, Boot et al. (1991) find that collateral can be a solution to problems of moral hazard and Boot and Thakor (1994) show that relationship lending can be viewed as a substitute for collateral in terms of reducing moral hazard as the repeated interaction between borrowers and lenders helps to build trust. In this case, *years with bank* should carry a negative coefficient. In contrast, a longer relationship can be associated with a higher likelihood of collateral use if longer-term relationships reflect more severe hold-up problems (Greenbaum et al, 1989; Sharpe, 1990; Rajan, 1992, Farinha and Santos, 2002). Is so, the coefficient of *years with bank* should be positive. Additionally we use the *number of prior loans* as a proxy for the strength of the bank-borrower relationship.

Hypothesis 3b (H3b). The likelihood of collateral use decreases with the number of different financial services that a borrower purchases from the bank.

We base this hypothesis on a number of studies that investigate the relationship between the scale and scope of the lending relationship and the use of collateral (Degryse and Cayseele, 2000; Petersen and Rajan, 1994; Chakraborty and Hu, 2000). While the scale of a lending relationship specifies the length of the relation between lenders and borrowers which we test with the above hypothesis, the scope of the lending relationship specifies number of different financial services that the borrowers uses. Lenders have access to private information when borrowers use non-loan financial services (such as checking accounts, saving accounts, or other financial services). This information can easily be quantified, transmitted, and combined with other available information to effectively assess different aspects of the borrower's profile. An increased scope should therefore reduce the need for collateral. We measure the scope with the *number of bank products* used by the borrower. This proxy ranges from 0 to 4 and we predict a negative coefficient.

Hypothesis 4 (H4). The likelihood of using collateral increases with the competition among borrowers for loans.

This hypothesis is on the argument that when there is competition among borrowers for loans, lenders have more bargaining power. Therefore to reduce their lost given default lenders would require more collateral. However, competition among borrowers for loans ultimately decreases the competition among lenders. Besanko and Thakor (1987) show that low competition among lenders increases the rents of lenders in all stages of the world. This suggests that the use of collateral is less likely with monopoly than competition. Following Malesky and Taussig (2008), we measure the *fraction of entrepreneurs* as the number of active legal entities per 1000 citizens in the borrower's province. Here we assume that the number of citizens per province proxies for the lending resources assigned to that particular province and that more legal entities per 1000 citizens imply more competition among borrowers for loans. This proxy should work as well for consumer loans as commercial loans can eat up the lending resource and leave only a small proportion to consumer loans. We predict a positive coefficient for this proxy.

In addition, we test another angle of the competition aspect, i.e. we consider whether or not the borrower has a relation with other banks. *Other bank$_D$* can also be seen as a proxy for the competitiveness among lenders that would reduce the use of collateral. However, when the borrowers have more borrowing sources, this lack of exclusivity may reduce the quality of private information gathered by the banks (Thakor, 1996; Chakraborty and Hu, 2000) which in turn would increase the use of collateral. The empirical result will tell us which of these two effects prevails in the data set.

Hypothesis 5 (H5). A better legal environment will reduce the use of collateral.

A better legal environment would give the lenders more power to pursue borrowers once they default and therefore reduce the incentive for borrowers to walk away from their loans (strategically default). The *provincial legal index* indicates whether the provincial legal framework appears to be transparent and supportive of enterprises. It is measured by five criteria: Whether the legal system provides mechanism for firms to appeal officials' corrupt behavior; whether the provincial government would uphold firm's contracts and

property rights in a business dispute (firm confidence in legal institutions); whether firms rely on legal institutions to resolve dispute; number of law suit cases (where claimant was not SOE or foreign company) per 100 active Firms. The better the legal framework according to these criteria is the higher the value of the variable is. This indicates a negative coefficient. In contrast, if the legal environment is poor, the lender might not have any incentive to use collateral as the chance of recovering the collateral in case of default is low. In this case, the provincial legal index should be positively related to collateral.

Hypothesis 6 (H6). The use of collateral increases over the crisis period when uncertainty increases.

It is commonly believed that uncertainty increases during a crisis. As we have been discussing, collateral helps to reduce the adverse selection and moral hazard which increase with uncertainty. Therefore over a crisis period banks would require more collateral to help them overcome the increase in adverse selection and moral hazard problems. We include quarterly dummy variables reflecting the loan signing date and we predict that the coefficients of quarterly dummy variables in 2008 and 2009 are positive while in the other years they are negative.

In assigning control variables we include *age* of borrowers, loan's *duration*, *distance* from the branch *to headquarter*, and *large loan* dummy which takes value of 1 if the loan amount is larger than 100 million VND and zero otherwise. The reason we are interested in the cut-off of 100 million VND is that it is used as a threshold by the bank to distinguish between small and large loans with different requirement for collateral.

5. Data

The data for our study were collected from one of the large commercial banks in Vietnam. The data set represents that part of the bank's loan portfolio that was granted from June 2006 until March 2009 by all 163 branches of the bank in Vietnam.

The data set consists of 51,161 loans given to borrowers with different purposes (commercial, real-estate, consumer, and other). Loans with commercial purpose refer to

loans granted to independent entrepreneurs (typically fully-liable single-person or family businesses). Loans with real-estate purpose refer to loans that are used to buy a house or a piece of land. Loans for consumer purpose are those used to pay for living expenses, including marriage expenses, education, etc. There are a number of loans with unknown purpose. They are mainly loans to employees of the bank itself or to employees of other companies with guarantee from their employers. For these loans, purposes are not recorded in the system and therefore unknown in our data set. As Table 1 has shown 55% of the loans are loans for consumer purpose; 13% are loans for commercial purpose; 10% are for real-estate purpose. The rest which is 22% are un-known purpose. Hence, our sample is dominated by consumer loans. Some borrowers take several loans at this bank, so our data set covers loans granted to 39,052 borrowers- implying that on average a borrower has 1.31 loans at the bank at that point in time. For borrowers with more than one loan, loans are aggregated to borrower level and the most recent loan is kept in the sample. Table 2 presents summary statistics for the explanatory variables of the model for all loans in Panel A and for collateralized versus uncollateralized loans in Panel B. The ex ante risk score reveals that the bank focuses on relatively safe borrowers: The average score is 40 out of a maximum of 50. Collateralized loans are associated with on average riskier borrowers with a score of 38.58 compared to 40.67 for uncollateralized loans. This would support the observed risk hypothesis. The average wealth of a borrower is 869 trillion VND but the differences between collateralized versus uncollateralized borrowers are substantial: 1,819 trillion VND versus 114 trillion VND. This supports the idea that borrowers provide collateral if they are able to – possibly in order to benefit from the lower interest rates documented in Table 1 for collateralized loans. The living comfort level proxy points into the same direction. Furthermore, collateralized loans have a longer duration, are more likely to be larger than 100 million VND, and are more likely made by a branch further away from the bank's headquarter. Regarding the bank-borrower relationship, collateralized borrowers have a longer relationship, more prior loans, but use fewer different bank products and are less likely to have another banking relationship. Table 3 shows the number of observations over time. The number of new loans increases until the end of 2007 and then starts to drop. Compared to the fourth quarter of 2007, the

number of new loans was 90% lower in the third quarter of 2008. By the first quarter of 2009, loan volumes had recovered to 41% of the IV2007-level.

[Insert Tables 2 and 3 about here]

6. Results

6.2. Empirical evidence regarding our main hypotheses

Panel A of Table 4 shows the probit model estimations for all loans, commercial loans, real-estate loans, consumer loans, and other loans. The coefficient of the *ex ante risk score* is negative and significant in the estimations for all loans, commercial loans, and consumer loans thereby confirming H1. Thus borrowers with lower credit quality as observed by the bank are more likely to pledge collateral. For real-estate and other loans the coefficient insignificant. One can argue that the bank relies more on their general assessment criteria to judge a consumer and commercial loan as there the use of funds involve more uncertainty than real estate loans. With real-estate loans, the information about the real-estate itself also provide a piece of additional information to the bank about the borrowers. Other loans include loans to employees of the bank itself or guaranteed by the borrowers' employer. With those loans, the bank can just make the decision independently from the general criteria as they have other sources of information to rely on. Thus our findings confirm the conclusion reached in previous studies (Berger and Udell, 1990, 1995; Jimenez and Saurina, 2004; Jimenez et al, 2006) that observed credit risk is the dominant factor in determining the use of collateral and that the higher risk observed by the bank the more collateral will be pledged. However the ex ante credit risk which reflects directly how the bank observes a borrower's credit profile that we use in this paper to distinguish among borrowers of different observed credit quality allow a better test of the hypothesis than do the proxy variables used in the previous studies.

Wealth has a positive and significant coefficient estimated for all loans except real estate loans. Thus the majority of the data confirms H2. Our finding confirms the conclusion of Booth and Booth (2006) that collateral pledging decisions are generally consistent with borrowing cost minimization. It has been an obstacle in studying collateral to distinguish between the willingness to pledge collateral and the ability to do so. However, using w*ealth* we directly measure the borrower's ability to pledge collateral and can thus test

16

the hypothesis more accurately. Given the same level of observed credit risk, meaning the same requirement from the bank's side to secure the loans, borrowers with ability to pledge in collateral will be more likely to do so to get the advantage on the lower borrowing rate for secured loans documented in Table 1. This finding is supported by the fact that the *living comfort level* behaves in the same way as *wealth* in the model. In contrast to *wealth*, however, the *living comfort level* is also significant for real estate loans.

The length of the lending relationship measured by *years with bank* has positive and significant coefficient estimated for all different loan groups (H3a). This finding confirms that the "hold-up" effect dominates the benefit of the lending relationship and provides a direct support for the conclusion made in previous studies (Greenbaum et al., 1989; Sharpe, 1990; Rajan, 1992, Farinha and Santos, 2002) that a longer duration of the lending relationship can be associated with higher likelihood of collateral use. To control for the fact that the borrowers with long lending relationships might be the "big" borrowers who tend to borrow loans with large amount and therefore being asked to secure their loan we test the impact of the interactive term between loan size and the relationship duration, *large loan$_D$ * years with bank*. This interactive term has negative and significant coefficient estimated for all loans and the different loan types except other loans. Thus the hold-up effect of the lending relationship is generally less when the loans are larger. The second proxy for the lending relationship, *number of prior loans*, also has positive and significant coefficient estimated for all different groups of loan. This again confirms the hold-up effect increasing the incidence of collateral use with the scale of the relationship.

The proxy for the scope of the lending relationship, *number of bank products*, has a negative and significant coefficient for all different types of loans. This confirms our hypothesis (H3b). This finding is consistent with the results found in the previous studies about the effect of scope of the lending relationship on collateral use (Degryse and Cayseele, 2000; Petersen and Rajan, 1994; Chakraborty and Hu, 2000). Thus, while scale of the lending relationship increases the likelihood of using collateral, the scope, e.g. the number of different services that the borrowers use from the same bank, actually reduces the incidence of using collateral. The information the bank acquires from the borrowers

17

through different kinds of services, for example different types of account such saving account, or debit account, helps the bank to monitor and assess different aspect of the borrowers. It reduces both adverse selection and moral hazard and therefore the bank requires less collateral.

The *fraction of entrepreneurs* which proxies for the competition for loans has a positive and significant coefficient. This confirms our hypothesis (H4). Thus when borrowers have to compete for loans, banks have more bargaining power and are thus able to require collateral more frequently in order to cover their loss given default. This finding also indirectly provides evidence supporting the conclusion reached by Besanko and Thakor (1987) that the likelihood of using collateral decreases with the concentration in the credit market.

Other bank$_D$ indicates if borrowers have a relationship with other banks and is used to test what impact of the existence of another potential lending source would have on the use of collateral. As we discussed in the hypothesis section this dummy can also be seen as a proxy for the competitiveness among lenders that would reduce the use of collateral. However this lack of exclusivity may reduce the quality of private information gathered by the banks (Thakor, 1996; Chakraborty and Hu, 2000) which in turn would increase the use of collateral. *Other bank$_D$* has a negative coefficient for all types of loans, it is however not significant for commercial or consumer loans. Thus we can tentatively conclude that the existence of an alternative lending source to a borrower gives the bank a thread of competition and that it reduces the likelihood of using collateral.

Hypothesis 5 (H5) is rejected as the coefficients the *provincial legal index* is significantly positive implying that a better legal environment increases the use of collateral. The insignificant coefficient for real-estate loans might indicate an interesting result. One can argue that a better legal environment actually reassures borrowers to pledge collateral. This should sound strange in a developed country but in a developing country such as Vietnam, the banking system is still quite concentrated and banks have substantial bargaining power over borrowers. Especially in case of default when the collateral is liquidized, banks have the power to decide how the collateral can be liquidized even at a disadvantage of the default borrowers. For example in liquidation, a collateralized asset is likely to be sold under value as banks do not have an incentive to exert any additional

18

effort to sell the asset at a price beyond the value of the loan. With a better legal environment at least the borrowers can be reassured that they can have some legal support to be able to negotiate or to be involved in the deal in case of collateral liquidation.

Our result confirms hypothesis 6 (H6) which predicts that the incidence of using collateral increases over the crisis periods. The last financial crisis started to show some impacts on the financial market in Vietnam at the beginning of 2008 and the empirical result shows that the coefficients of all quarterly dummy variables for 2008 and 2009 are positive and significant. With this result we can conclude that over crisis periods when uncertainty increases that makes adverse selection and moral hazard more severe bank would require more collateral as a solution for asymmetric information and reduce their lost in case of default. This is consistent with the result found by Jimenez et al. (2006). Note that significance pattern of the coefficients differs across the remaining loan types, i.e. commercial, consumer and real estate loans show significantly less collateralization before the crisis. Finally, borrowers of other loans always seem to hold more collateral.[2]

The remaining control variables indicate that the larger the loan amount and the longer the loan *duration*, the more likely it is that collateral will be used, especially when the loan amount exceeds 100 million VND. The coefficients of *age* of the borrowers are positive and significant for all loan groups. This aligns with findings by Jimenez et al (2009). It however differs from Berger and Udell (1995), who find a negative effect of borrower age in the likelihood of collateral use. *Distance to headquarter* is also controlled for but does not have any significant impact on collateralization.

[Insert Table 4 about here]

Panel B of Table 4 illustrates the change in the predicted probability of collateralization for a one-standard deviation change in each independent continuous variable or for a change from 0 to 1 for each independent dummy variable. The results are reported for the regression on 'all loans' in Panel A. Overall, the model predicts that 48.4% of loans are collateralized which is close to the sample frequency of 45%. The largest impact on

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[2] The other loan type shows results that are generally different from the remaining loan types. This is not surprising as these borrowers are either bank employees or have their loan guaranteed by an affiliated company. In the final version of this study we plan to explore this group and its special characteristics in more depth.

collateralization can be observed for the *number of bank products* (-72%) followed by *large loans$_D$* (+36%). The effect of the *ex ante risk score* is only moderate with -3.2%. This can however be explained with the relatively low variability of the score as reported in Panel A of Table 2 and the similarity of the average scores for collateralized and uncollateralized loans as reported in Panel B of Table 2. The effect of the crisis also becomes clear: In 2008 and 2009 the probability of collateralization increased between 11.1% and 33.0% compared to the third quarter of 2006. In conclusion, the estimated coefficients of our model reported in Panel A generally imply an economically substantial impact of the significant borrower characteristics, loan characteristics, bank-borrower relationships, and regional governance features on the use of collateral.

6.2. Additional analyses of the collateralization decision

We wish to provide more detailed results regarding the interest cost driven motivation of pledging collateral and regarding the value of the pledged assets.

First, the results in Table 5 provide additional support for the interest-rate driven motivation of borrowers to pledge collateral. When we introduce into our regressions the *interest benefit* that a borrower with collateralizable assets can gain, we find positive and significant coefficients. The coefficients of *wealth* remain significantly positive while the significance of the *living comfort level* effect is somewhat reduced. Overall this indicates that borrowers who have assets at their disposal are inclined to pledge them as collateral and this inclination rises as the associated interest rate benefit increases. In economic terms the effect is substantial. For all loans, an increase in *interest benefit* by one standard deviation around the mean is associated with an increase in the likelihood of collateral by 26.49% (from 33.65% to 60.14%).

[Insert Table 5 about here]

Second in Table 6, we explore the amount of collateral provided borrowers using the same set of explanatory variables as used in Table 4. We focus on our combined sample of all loan types. As we include collateralized and uncollateralized loans, we estimate tobit regressions which take the left censoring of our dependent variables at zero into account.

20

We measure the value of collateral in absolute as well as relative terms. We start with the ratio of collateral value to loan amount as our first proxy. In order to reduce the impact of outliers, i.e. loans with very high collateral to loan value ratio, we also use the natural log of this ratio and a collateral index based this ratio. Finally, we use the nominal value of the collateral itself. From Table 6, we conclude that the factors that determine whether or not collateral is provided also affect the amount of collateral. The sign and significance of the coefficients match those reported in Table 4. Exceptions are the dummies for large loans. Not surprisingly, we find that larger loans have collateral which has a high absolute value but low value relative to the size of the loan. The most interesting results in this table are the coefficients of the time dummies which clearly show that both the absolute as well as the relative value of the collateral increases as the crisis approaches. Compared to the third quarter of 2006, collateral values increase until the third quarter of 2008 before dropping again.

[Insert Table 6 about here]

7.   Conclusions

In this paper we present an empirical analysis of the determinants of collateralization of retail loans. We focus our analysis on six main hypotheses and test these using a unique data set at loan of loans originated by a large commercial bank in Vietnam between 2006 and 2009.

Previous empirical research shows that lenders require collateral for loans granted to borrowers with lower credit quality. The results in our paper are based on a direct measure of credit risk as observed by the bank and confirm that the observed credit quality of the borrower is an important determinant of the use of collateral. In addition, we find that wealthier borrowers who are able to pledge collateral do so to benefit from low borrowing rates. We also find that the hold-up effect dominates the benefit of relationship lending in terms of a higher likelihood of collateral in new loans. However, the scope rather than scale of the borrower-lender relationship actually improves the terms of the loan contract as the usage of collateral decrease. Finally, the likelihood of using collateral is higher in credit markets where borrowers have to compete more for

funds. Additionally, we find that over crisis periods when uncertainty increases and lending resources are limited, collateralization also increases.

Overall, our findings for Vietnam as a developing banking market are to in parts consistent with existing evidence from developed markets. Our analysis however also reveals new results regarding the willingness and ability of borrowers to pledge collateral which have not yet been documented for developed or developing banking markets. These findings offer ample opportunities for future research.

Appendix

[Insert Tables A1 and A2 here]

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Table 1: Characteristics of the bank's loan portfolio

	All loans	Commercial loans	Real-estate loans	Consumer loans	Other loans
number of loans signed 2006-2009	39,052	5,226	3,784	21,376	8,666
fraction of collateralized loans	45.0%	26.5%	16.8%	50.5%	6.2%
average value of collateral in collateralized loans					
collateral to loan value ratio	6.4	5.0	3.1	8.3	4.7
collateral value (bn VND)	1.3	1.3	2.0	1.0	0.9
average interest rate					
uncollateralized loans	22.3%	20.8%	21.2%	22.4%	22.4%
collateralized loans	15.1%	14.5%	14.6%	15.5%	15.7%

Table 2: Descriptive statistics

Panel A: All loans

Variable	Mean	Standard deviation	Minimum	Maximum	Obser-vations
Borrower characteristics					
Ex ante risk score	40.00	5.00	15.00	50.00	39,052
Wealth (bn VND)	0.87	2.34	0.00	134.00	39,052
Age (years)	38.00	10.00	20.00	87.00	39,052
Living comfort level	1.10	0.00	1.00	3.00	39,052
Interest benefit (0.01=1%)	0.03	0.05	-0.15	0.17	39,052
Loan characteristics					
Duration (years)	3.33	2.75	0.08	30.00	39,052
Large loan$_D$	0.36	0.00	0.00	1.00	39,052
Bank-borrower relationship					
Years with bank	1.52	2.04	0.00	8.00	39,052
Number of prior loans	0.95	4.58	0.00	423.00	39,052
Number of bank products	2.78	1.57	0.00	4.00	39,052
Other bank$_D$	0.12	0.00	0.00	1.00	39,052
Regional governance					
Provincial legal index	4.08	0.51	0.00	6.55	39,052
Distance to headquarter (km)	22.00	112.00	0.00	1,024.00	38,980
Fraction of entrepreneurs	3.67	0.67	0.36	4.39	38,977

Panel B: Collateraltized versus uncollateralized loans

Variable	Collateralized loans			Uncollateralized loans		
	Mean	Standard deviation	Obser-vations	Mean	Standard deviation	Obser-vations
Borrower characteristics						
Ex ante risk score	38.58	4.97	17,377	40.67	5.07	21,675
Wealth (tr VND)	1,810.00	3,160.00	17,377	114.00	761.00	21,675
Age (years)	43.11	9.96	17,377	34.77	8.55	21,675
Living comfort level	1.18	0.56	17,377	1.04	0.26	21,675
Interest benefit (0.01=1%)	0.06	0.05	17,377	0.00	0.01	21,675
Loan characteristics						
Duration (years)	4.10	3.75	17,377	2.70	1.27	21,675
Large loan$_D$	0.64	0.48	17,377	0.14	0.35	21,675
Bank-borrower relationship						
Years with bank	2.15	2.19	17,377	1.01	1.75	21,675
Number of prior loans	1.89	6.25	17,377	0.19	2.30	21,675
Number of bank products	1.29	1.20	17,377	3.97	0.33	21,675
Other bank$_D$	0.09	0.29	17,377	0.15	0.35	21,675
Regional governance						
Provincial legal index	4.10	0.45	17,377	4.07	0.56	21,675
Distance to headquarter (km)	13.74	89.33	17,344	29.31	126.64	21,636
Fraction of entrepreneurs	3.79	0.29	17,342	3.57	0.85	21,635

Table 3: Number of observation over time

Quarter	Number of loans	Fraction of sample
III2006	1,880	4.8
IV2006	2,013	5.2
I2007	2,017	5.2
II2007	2,293	5.9
III2007	5,126	13.1
IV2007	8,639	22.1
I2008	6,792	17.4
II2008	3,127	8.0
III2008	820	2.1
IV2008	2,769	7.1
I2009	3,576	9.2
Total	39,052	100.0

Table 4: The determinants of collateral

Panel A: Regression coefficients					
	All loans	Commercial loans	Real-estate loans	Consumer loans	Other loans
Intercept	-0.41	-3.45	1.36	-0.73	-2.97 **
	-0.58	-1.43	1.15	-0.55	-2.62
Borrower characteristics					
Ex ante risk score	-0.02 ***	-0.03 **	0.00	-0.02 ***	0.00
	-5.08	-2.31	-0.14	-4.62	-0.30
Wealth	0.17 ***	0.03 *	0.06	0.17 ***	1.21 ***
	4.41	1.92	1.13	3.91	11.95
Age	0.02 ***	0.04 ***	0.02 ***	0.03 ***	0.02 ***
	10.71	6.71	2.46	10.54	4.81
Living comfort level	0.22 ***	0.17 *	0.42 ***	0.21 *	0.24 **
	2.45	1.72	3.10	1.84	1.97
Loan characteristics					
Duration	0.01	0.10 ***	0.10 ***	0.08 ***	-0.06 ***
	1.20	2.53	5.69	3.93	-3.13
Large loan$_D$	0.94 ***	1.96 ***	2.32 ***	1.10 ***	0.66 ***
	8.10	8.16	5.76	10.51	4.98
Commercial loan$_D$	0.79 ***				
	9.92				
Real estate loan$_D$	0.69 ***				
	3.92				
Other loan$_D$	0.69 ***				
	3.12				
Bank-borrower relationship					
Years with bank	0.25 ***	0.41 ***	0.30 ***	0.28 ***	0.14 ***
	19.46	7.35	3.61	15.79	6.94
Years with bank * Large Loan$_D$	-0.12 ***	-0.28 ***	-0.18 **	-0.17 ***	-0.03
	-5.72	-4.90	-2.13	-7.98	-0.87
Number of prior loans	0.05 ***	0.22 ***	0.30 ***	0.03 *	0.07 **
	4.30	5.41	4.63	1.72	2.11
Number of bank products	-1.37 ***	-1.66 ***	-1.49 ***	-1.34 ***	-0.94 ***
	-23.63	-13.37	-14.18	-22.81	-8.27
Other bank$_D$	-0.36 ***	-0.24	-0.77 ***	-0.16	-0.42 ***
	-2.97	-1.28	-3.57	-1.04	-4.46
Regional governance					
Fraction of entrepreneurs	0.34 ***	1.06 ***	-0.21 *	0.39 **	0.28 ***
	4.31	2.92	-1.69	2.03	2.93
Provincial legal index	0.29 ***	0.66 **	0.26	0.34 **	0.32
	3.08	2.12	1.25	1.99	1.38
Distance to head-quarter	-0.00	0.00	-0.00 *	0.00	0.00
	-1.15	0.10	-1.79	-0.59	-0.38
Time dummies					
IV-2006	-0.45 **	-0.08	-0.69 ***	-0.74 **	-0.77
	-2.03	-0.34	-1.80	-2.29	-1.36
I-2007	-0.16	-0.10	-0.62	-0.43 *	0.52 **
	-0.88	-0.49	-1.25	-1.75	1.97
II-2007	-0.10	-0.71 ***	-0.83 ***	-0.20	0.53 *
	-0.85	-2.55	-2.46	-1.19	1.85
III-2007	-0.26 ***	-1.17 ***	-0.95 ***	-0.31 **	0.54 *
	-2.58	-5.11	-3.19	-2.39	1.88
IV-2007	-0.14	-0.48 *	-0.76 ***	-0.22 *	0.37
	-1.22	-1.76	-2.53	-1.89	1.09
I-2008	0.28 *	-0.06	-0.89 ***	0.12	1.33 ***
	1.85	-0.19	-2.70	0.71	4.63
II-2008	0.90 ***	-0.23	-0.50	0.53 ***	2.16 ***
	6.54	-0.72	-1.08	2.67	7.21
III-2008	0.77 ***	-0.20		-0.22	3.53 ***
	2.68	-0.40		-0.81	10.52
IV-2008	0.63 ***	0.09	-0.16	-0.12	2.54 ***
	2.99	0.40	-0.34	-0.52	7.80
I-2009	0.40 **	-1.02 ***	-0.96 *	-0.05	2.16 ***
	2.10	-3.52	-2.69	-0.24	7.39
log likelihood	-3,990.2	-225.8	-190.1	-2,044.4	-665.9
pseudo R^2	0.851	0.882	0.906	0.858	0.796
number of observations	38,977	5,221	3,760	21,320	8,662

Note: This panel shows the result of a probit regression estimation. The dependent variable is a dummy equal to one for a collateralized loans and zero otherwise. For each independent variable, the first row shows the estimated coefficient and the second row the z-statistic. Standard errors are heteroskedasticity robust and clustered by bank branch. ***, **, and * indicate statistical significance at the 1%, 5%, and 19% level, respectively. No real-estate loans are made in III-2008 and the dummy is therefore excluded.

Table 4: The determinants of collateral

Panel B: Economic relevance

	predicted probability of collateralization		
	from	to	change
Borrower characteristics			
Ex ante risk score	50.0%	46.8%	-3.2%
Wealth	40.4%	56.5%	16.0%
Age	44.0%	52.9%	8.9%
Living comfort level	46.5%	50.3%	3.7%
Loan characteristics			
Duration	47.6%	49.2%	1.6%
Large loan$_D$	35.3%	71.2%	36.0%
Commercial loan$_D$	44.2%	74.1%	29.9%
Real estate loan$_D$	45.8%	71.9%	26.1%
Other loan$_D$	42.3%	69.0%	26.7%
Bank-borrower relationship			
Years with bank	38.3%	58.7%	20.4%
Years with bank * Large Loan$_D$	52.4%	44.4%	-8.0%
Number of bank products	85.1%	13.1%	-72.0%
Number of prior loans	43.8%	53.1%	9.3%
other bank$_D$	50.1%	36.2%	-13.9%
Regional governance			
Fraction of entrepreneurs	43.9%	52.9%	9.1%
Provincial legal index	45.6%	51.2%	5.7%
Distance to head-quarter	49.7%	47.1%	-2.6%
Time dummies			
IV-2006	49.3%	32.1%	-17.3%
I-2007	48.7%	42.3%	-6.5%
II-2007	48.7%	44.5%	-4.1%
III-2007	49.8%	39.7%	-10.1%
IV-2007	49.7%	44.1%	-5.6%
I-2008	46.5%	57.6%	11.1%
II-2008	45.5%	78.6%	33.0%
III-2008	47.8%	76.1%	28.3%
IV-2008	46.7%	70.6%	23.9%
I-2009	47.0%	62.7%	15.7%
overall predicted probability of collateral		48.4%	
fraction of collateralized loans in sample		45.0%	

Note: This panel shows the effect of a change in a the independent variable from half a standard deviation below the mean to half a standard deviation above the mean on the predicted probability of collateral. If the independent variable is a dummy, a change from 0 to 1 is considered. All other independent variables are kept at their mean values. The results reported in this panel refer to the regression for 'all loans' in Panel A. The overall predicted probability of collateral is calculated when all independent variables are at their mean.

Table 5: The role of interest rates in the borrower's collateralization decision

	All loans	Commercial loans	Real-estate loans	Consumer loans	Other loans
Intercept	0.11	-4.16 *	0.46	0.96	-3.27 ***
	0.14	-1.87	0.24	0.79	-2.59
Borrower characteristics					
Ex ante risk score	-0.01 ***	-0.03 *	0.03 *	-0.01 **	-0.01
	-3.57	-1.85	1.81	-2.31	-0.74
Wealth	0.13 ***	0.03 **	0.01	0.11 ***	0.82 ***
	4.50	2.09	0.49	3.41	2.97
Age	0.02 ***	0.04 ***	0.02 *	0.02 ***	0.02 ***
	7.72	5.61	1.76	7.17	3.38
Living comfort level	0.19 **	0.13	0.24	0.17	0.23 *
	2.00	1.10	1.42	1.58	1.64
Interest rate benefit	14.71 ***	13.31 ***	31.31 ***	20.45 ***	13.70 ***
	19.60	7.77	11.13	13.13	10.86
Loan characteristics					
Duration	0.01	0.13 ***	0.05 ***	0.12 ***	-0.05 ***
	1.39	3.43	3.57	5.13	-3.12
Large loan$_D$	0.79 ***	1.97 ***	3.00 ***	0.95 ***	0.67 ***
	6.59	7.34	11.30	9.62	3.32
Commercial loan$_D$	1.36 ***				
	14.15				
Real estate loan$_D$	0.84 ***				
	5.20				
Other loan$_D$	1.02 ***				
	4.83				
Bank-borrower relationship					
Years with bank	0.26 ***	0.44 ***	0.31 ***	0.31 ***	0.13 ***
	16.70	7.42	5.31	14.81	6.22
Years with bank * Large Loan$_D$	-0.12 ***	-0.30 ***	-0.19 ***	-0.19 ***	-0.02
	-4.97	-4.77	-2.64	-8.94	-0.36
Number of prior loans	0.04 ***	0.22 ***	0.26 ***	0.02	0.05
	4.00	5.88	3.33	1.55	1.60
Number of bank products	-1.32 ***	-1.69 ***	-1.49 ***	-1.25 ***	-0.82 ***
	-21.83	-14.01	-14.47	-17.33	-8.21
Other bank$_D$	-0.25 **	-0.29	-0.78 ***	-0.03	-0.26 ***
	-2.14	-1.60	-2.48	-0.18	-2.49
Regional governance					
Fraction of entrepreneurs	0.28 ***	1.09 ***	-0.20	0.21	0.28 ***
	3.39	3.36	-0.83	1.17	2.50
Provincial legal index	0.14	0.80 ***	0.19	-0.07	0.32
	1.33	2.51	0.98	-0.45	1.26
Distance to head-quarter	0.00	0.00	0.00	0.00	0.00
	-0.57	-0.28	-0.68	0.93	-0.43
Time dummies					
log likelihood	-3,319.0	-195.7	-106.7	-1,556.2	-585.5
pseudo R^2	0.876	0.897	0.947	0.892	0.820
number of observations	38,977	5,221	3,760	21,320	8,662

Note: This table shows the result of a probit regression estimation. The dependent variable is a dummy equal to one for a collateralized loans and zero otherwise. For each independent variable, the first row shows the estimated coefficient and the second row the z-statistic. Standard errors are heteroskedasticity robust and clustered by bank branch. ***, **, and * indicate statistical significance at the 1%, 5%, and 19% level, respectively. No real-estate loans are made in III-2008 and the dummy is therefore excluded.

Table 6: The determinants of the collateral value

	collateral to loan value ratio	ln(collateral to loan value ratio)	collateral index	collateral value
Intercept	-21.40 ***	-1.62 ***	-1.91 ***	-2.48 ***
	-5.51	-3.78	-3.06	-6.82
Borrower characteristics				
Ex ante risk score	-0.03 **	0.00 **	-0.01 ***	0.00
	-2.16	-2.22	-2.88	0.01
Wealth	1.06 ***	0.10 ***	0.10 ***	0.62 ***
	7.05	7.76	7.97	14.10
Age	0.16 ***	0.02 ***	0.02 ***	0.01 ***
	11.51	11.44	10.63	4.12
Living comfort level	0.27	0.07 ***	0.15 ***	0.11 ***
	1.33	2.85	3.82	3.42
Loan characteristics				
Duration	-0.14 ***	-0.01 ***	-0.01	0.03 ***
	-4.13	-3.02	-0.86	6.03
Large loan$_D$	-2.07 ***	-0.09 **	0.26 ***	0.37 ***
	-6.29	-2.00	3.74	10.50
Commercial loan$_D$	-0.53 *	0.02	0.20 ***	0.14 ***
	-1.86	0.48	3.24	3.88
Real estate loan$_D$	-0.82 ***	-0.14 ***	-0.02	0.18 ***
	-3.01	-3.64	-0.37	3.41
Other loan$_D$	-0.74	-0.07	0.01	0.02
	-0.49	-0.37	0.02	0.10
Bank-borrower relationship				
Years with bank	1.19 ***	0.16 ***	0.27 ***	0.13 ***
	7.29	9.91	13.46	6.78
Years with bank * Large Loan$_D$	-0.03	0.00	-0.02 *	-0.02 *
	-0.48	-0.16	-1.63	-1.79
Number of prior loans	0.13 ***	0.02 ***	0.03 ***	0.00
	3.30	3.57	3.67	0.33
Number of bank products	-5.38 ***	-0.74 ***	-1.22 ***	-0.62 ***
	-19.13	-25.04	-27.79	-14.24
Other bank$_D$	-1.73 ***	-0.21 ***	-0.32 ***	-0.16 ***
	-4.07	-4.26	-3.81	-3.34
Regional governance				
Fraction of entrepreneurs	2.85 ***	0.33 ***	0.50 ***	0.19 ***
	4.99	5.16	5.44	2.76
Provincial legal index	2.85 ***	0.33 ***	0.53 ***	0.27 ***
	5.76	6.07	6.49	4.51
Distance to head-quarter	-0.01 ***	0.00 ***	0.00 ***	0.00 ***
	-3.42	-3.44	-3.12	-2.72
Time dummies				
IV-2006	-0.32	-0.04	-0.05	-0.03
	-0.67	-0.59	-0.45	-0.60
I-2007	0.44	0.05	0.05	0.10
	0.93	0.75	0.43	1.40
II-2007	0.93 *	0.10 *	0.15 *	0.26 ***
	1.91	1.91	1.65	3.70
III-2007	0.80 *	0.06	0.02	0.23 ***
	1.83	1.07	0.20	4.25
IV-2007	0.80 *	0.06	0.01	0.25 ***
	1.71	1.02	0.12	4.24
I-2008	2.00 ***	0.22 ***	0.27 ***	0.38 ***
	4.01	3.57	2.48	7.01
II-2008	3.63 ***	0.42 ***	0.61 ***	0.54 ***
	6.10	6.42	6.04	6.41
III-2008	5.07 ***	0.58 ***	0.92 ***	0.26 **
	3.62	3.40	3.05	2.24
IV-2008	3.66 ***	0.42 ***	0.60 ***	0.36 ***
	5.60	5.29	4.82	4.88
I-2009	2.87 ***	0.34 ***	0.48 ***	0.32 ***
	5.28	4.94	4.15	4.59
log likelihood	-67,300.0	-28,100.0	-35,500.0	-31,500.0
pseudo R^2	0.504	0.670	0.716	0.700
number of observations	38,977	38,977	38,977	38,977

Note: This table shows the result of a tobit regression estimation on a sample combining all loan types. For each independent variable, the first row shows the estimated coefficient and the second row the t-statistic. Standard errors are heteroskedasticity robust and clustered by bank branch. ***, **, and * indicate statistical significance at the 1%, 5%, and 19% level, respectively.

31

Table A1: Borrower characteristics included in the bank's ex ante credit score

Characteristic	Subdivision	Points
Years in current employment/business	Unemployed or 0 years	0
	Less than 2 years but more than 0 years	5
	More than 2 years	10
Industry where the loan will be invested in	Transportation, Tourism, Store/Office renting, Service sector	0
	Agriculture, Construction	5
	Other	10
Years of education	Less than 14 years or missing	0
	More than 14 and less than 16 years	5
	More than 16 years	10
Industry in which borrower is engaged	Unemployed	0
	Service sector	5
	Other	10
Monthly Income	No income	0
	Less than 7.000.000 VND (in Hanoi or HCM city) or less than 5.000.000 VND (in other provinces)	5
	More than 7.000.000 VND (in Hanoi or HCM city) or more than 5.000.000 VND (in other provinces)	10

Notes: To calculate the ex ante risk score, all points are added up. A higher score indicates lower risk.

Table A2: Variable sources and definitions

Category	Variable	Definition
Dependent variable	Collateral$_D$	Dummy equal to one for collateralized loans, zero otherwise.
	Collateral to loan value ratio	Value of collateral divided by the loan amount.
	ln(collateral to loan value ratio)	Logarithm of collateral to loan value ratio.
	Collateral index	Index based on collateral to loan value ratio (CLR): 0 if unsecured; index=1 if 0<CLR<1 ; index=2 if 1<= CLR <1.5; index=3 if 1.5< =CLR<5; and index=4 if CLR>=5.
	Collateral value	Value of collateral in billion VND, missing for non-collateralized loans.
Borrower characteristics	Ex ante risk score	Score assigned to borrower during initial screening process. Range from 0 to 50 with higher value indicating lower risk.
	Wealth	Total wealth of borrower in billion of VND. Wealth refers to assets and includes real estate, automobile, or machines.
	Age	Age of borrower in years.
	Living comfort level	Index measuring how comfortable the borrower's living environment is. This index ranges from 1 to 3 with higher value indicating higher comfort levels.
	Interest rate benefit	First, an interest rate difference is calculated as the average interest rate of all unsecured loans minus the average interest rate of all secured loans. This differences calculated separately for each loan type and each month of loan signing. Second, for each loan observation the relevant interest rate difference is identified based on loan type and month of loan signing. If the borrower has pledgable assets, the interest benefit is set equal to this interest rate difference. if the borrower does not have pledgable asset, the interest benefit is set equal to zero.
Loan characteristics	Duration	Loan maturity in years
	Large loan$_D$	Dummy equal to one for loans with size larger than 100 million VND.
	Commercial loan$_D$	Dummy equal to one for loan used by entrepreneur for business purposes, zero otherwise.
	Real estate loan$_D$	Dummy equal to one for loan used by entrepreneur or consumer to purchase real estate, zero otherwise.
	Consumer loan$_D$	Dummy equal to one for loan used by consumer to fund consumer spending including living expenses, school tuition, marriage cost, health care expenses, zero otherwise.
	Other loan$_D$	Dummy equal to one for loan used by other retail borrower, zero otherwise. This category includes loans to employees of the bank and its affiliates.
Bank-borrower relationship	Years with bank	Years since the first business contact / loan / account with the bank.
	Number of prior loans	Number of prior loans that the customer has had with the bank.
	Number of bank products	Number of different bank products that the customer uses with the bank. This includes saving accounts, debit account, prepaid card, and credit card.
	Other bank$_D$	dummy equal to one if the borrower indicated to the lender that she is holding accounts with another bank.
Regional governance	Fraction of entrepreneurs	Number of entrepreneurs per 1000 inhabitants, measured at provincial level. Source: General Statistical Office's Enterpreprise Census in 2005 - GSO (2005).
	Provincial legal index	Index measuring how transparent and supportive the provincial legal framework appears to be to the enterprises. Scale from 0 to 10 with higher values indicating better legal framework. Source: Provincial Competitiveness Index- PIC- Survey instrument and methodology can be obtained at http://www.pcivietnam.org.
	Distance to headquarter	Distance in km between branch and bank headquarters.

Note: Unless otherwise indicated, the sources for all variables are the bank's confidential records about the borrower.