The Role of Collateral and Personal Guarantees in Relationship Lending:

Evidence from Japan's SME Loan Market[*]

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Abstract

This paper investigates the determinants of the use of collateral and personal guarantees in Japan's SME loan market. We find that firms' riskiness does not have a significant effect on the likelihood that collateral is used. We find, however, that main banks whose claims are collateralized monitor borrowers more intensively, and that borrowers who have a long-term relationship with their main banks are more likely to pledge collateral. These findings are consistent with the theory that the use of collateral is effective in raising the bank's seniority and enhances its screening and monitoring. This incentive effect for the bank becomes tenuous for personal guarantees.

1 Introduction

A key issue of interest in the recent literature on financial intermediation has been the role of relationship lending. Relationship lending is particularly common in the case of small business lending, because small businesses typically rely on bank loans for a substantial part of their financing needs but also tend to be informationally opaque. An important issue in this context is the use of collateral, which is a common feature of loan contracts between small firms and banks around the world, and a number of theoretical and empirical studies have examined why it is so widespread and how it relates to the incentives for borrowers and lenders and the borrower-lender relationship. For instance, it has been argued that in the presence of information asymmetries between creditors and borrowers, collateral may mitigate the problem of adverse selection (Bester, 1985; 1987) and/or the problem of moral hazard (Bester, 1994; Boot, Thakor, and Udell, 1991). Collateral also affects the incentives of creditors, who will use it either as a substitute for (Manove, Padilla, and Pagano, 2001) or complement to (Rajan and Winton, 1995; Boot 2000; Longhofer and Santos, 2000) screening and monitoring efforts. Another aspect of collateral that studies have concentrated on is that its presence may depend on the length and intimacy of the relationship between creditors and borrowers (Boot, 2000; Boot and Thakor, 1994; Sharpe, 1990). Existing empirical research has yet to reach decisive conclusions about the nature of these relationships.

This paper seeks to contribute to the existing literature on collateral using a unique firm-level data set of the small and medium sized enterprise (SME) loan market in Japan. Explicitly differentiating physical collateral (such as real estate) and personal guarantees by business representatives, we investigate how the use of collateral and personal guarantees affects the incentives of borrowers, lenders, and the relationship between them. More specifically, we examine the following three issues. First, we examine whether riskier borrowers are more likely to be required to provide collateral or personal guarantees. Second, we investigate how collateral and

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personal guarantees affect banks' monitoring of borrowers. Third, we examine the correlation between the use of collateral and personal guarantees on the one hand and the closeness of borrower-lender relationships on the other.

The data set we employ is based mainly on the "Survey of the Financial Environment" (SFE) conducted by the Small and Medium Enterprise Agency of Japan in October 2002. In order to focus on firms that mostly depend on bank loans for their financing, we limit the sample to firms satisfying the legal definition of an SME in Japan. We then combine the SFE data for each SME with information on their main bank obtained from the bank's financial statements in order to control for lender characteristics as well. Furthermore, to control for the effect of government credit guarantees on collateral and personal guarantees, in the main analysis of this paper we exclude from the sample all firms that enjoyed any form of government credit guarantee.[1] As a result of this screening process, we end up with a sample of 1,702 firms.

Our main findings can be summarized as follows. We find that firms' riskiness does not have a significant effect on the likelihood that collateral is used. Thus, we cannot find firm evidence that the use of collateral mitigates moral hazard. We find, however, that banks whose claims are collateralized monitor borrowers more intensively, and that borrowers who have a long-term relationship with their main bank are more likely to pledge collateral. These findings suggest that collateral is complementary to relationship lending. In contrast, the complementarity between relationship lending and personal guarantees is weaker.

As far as we know, this is the first empirical study that systematically examines the role of collateral and personal guarantees in Japan's SME loan market. The two main contributions of the paper are as follows. First, given that Japan is generally considered to have a relationship-based

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[1] How we control for the effect of government credit guarantees is explained in detail later. To check the robustness of our main analysis, in Section 4.3 we also include firms some of whose loans are covered by government credit guarantees (firms all of whose loans are fully covered are still excluded). The sample size in this case is 3,945 firms.

financial system in which the relationship-lender, the main bank, plays a central role in corporate financing (Rajan and Zingales, 2003), the study helps to improve our understanding of the role of collateral in relationship lending and complements existing studies that focus on the United States and Europe. Second, and more importantly, by distinguishing collateral and personal guarantees, the study detects an important role of collateral in relationship lending that has not been remarked on much before. As we argue below, although a typical SME in Japan has a long-term relationship with its main bank, it actually engages in transactions with several banks, which is not common in other countries. A possible corollary of this is that because of the informational free-rider problem it creates, this practice may reduce the main bank's incentive to screen and monitor borrowers. Since collateral defines the order of seniority among creditors, using collateral may mitigate the free-rider problem and enhance the main bank's screening and monitoring. This incentive effect for the main bank becomes tenuous for personal guarantees, because personal guarantees do not define the seniority among creditors. Thus, our work provides empirical evidence on how collateral affects relationship lenders' incentives, and complements previous studies that focus on the problem of borrower incentives (moral hazard and adverse selection).

The remainder of the paper is organized as follows. Section 2 develops our empirical hypotheses which are based on previous theoretical models and empirical research. Section 3 describes the data and variables that are used in the paper, and explains our empirical model. Section 4 presents the results of our empirical analysis, and Section 5 concludes.

2 Empirical hypotheses

2.1 Borrower riskiness

Much of the empirical literature in this field examines theoretical predictions of asymmetric information models on the relationship between risk and collateral. If the bank cannot discern

borrowers' riskiness (hidden information), then collateral may serve as a screening device to distinguish between borrowers and to mitigate the adverse selection problem (Bester, 1985). This follows from the observation that a lower-risk borrower has a greater incentive to pledge collateral than a risky borrower, because of his lower probability of failure and loss of collateral. Hence, the lower-risk borrower will choose the contract with collateral.

On the other hand, if the lender can observe the ex-ante risk, but there are information asymmetries with regard to actions taken by the borrower after the loan is extended, collateral potentially provides an incentive to mitigate moral hazard. Thus, opposite to models focusing on hidden information, those concentrating on hidden action suggest that it is observably riskier borrowers that will pledge collateral, because collateral induces more effort by the borrower (Boot, Thakor, and Udell, 1991), or reduces the incentives of strategic default (Bester, 1994).

Because our data base only contains measures of firms' observed riskiness (namely, credit scores), we couch our first empirical hypothesis as follows:

Hypothesis 1 (H1): The use of collateral is higher among observably higher-risk (low credit score) borrowers if the lender requires collateral in order to mitigate the extent of moral hazard. Alternatively, if borrowers pledge collateral as a signal of their unobserved high credit quality, then there is negative or no relationship between the use of collateral and the credit score.

Consistent with the theory of moral hazard, most existing empirical studies, including Berger and Udell (1990; 1995), have found a positive relationship between collateral and borrowers' ex-ante risk. Jiménez, Salas and Saurina (2006) directly test the adverse selection and moral hazard hypotheses by separating ex-ante and ex-post measures of borrower riskiness, namely defaults prior to and after the loan origination. Their results suggest that although observed riskiness increases the

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likelihood that collateral is used, there is also a negative association between collateral and default after the loan has been granted, which is consistent with the adverse selection argument.

It should be noted that theories of collateral as a solution to moral hazard and/or adverse selection problems assume collateral is external to the firm.[2] Unfortunately, our measure of the incidence of collateral does not distinguish between firm (inside) collateral and personal (outside) collateral. Hence, throughout our analysis, we will assume that collateral is mostly inside, but allow for the fact that there may also be some outside collateral. As for personal guarantees, they clearly represent outside collateral.

2.2   Screening and monitoring by the lender

Recent research on collateral also discusses how collateral affects lenders' incentives with regard to information production, that is, the screening of borrowers' quality and the monitoring of their performance. These theories of the effect of collateral on lenders' incentives apply to both inside and outside collateral. Manove, Padilla, and Pagano (2001), for instance, argue that, from banks' point of view, collateral can be considered as a substitute for the evaluation of the actual risk of a borrower. Thus, banks that are highly protected by collateral may perform less screening of the projects they finance than is socially optimal.

However, several theoretical studies argue that collateral may complement lenders' screening and monitoring activities. In the presence of other claimants, lenders' incentive to monitor borrowers is reduced due to the informational free-rider problem. In order to enhance lenders' incentive to monitor, loan contracts must be structured in a way that makes lenders' payoff sensitive

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[2] Possible different roles between outside and inside collateral are empirically explored by Brick and Palia (2007) and Pozzolo (2004). Brick and Palia (2007) find that riskier borrowers are more likely to pledge inside (firm) collateral, but that there is no statistically significant relationship between outside (personal) collateral and borrower risk. In contrast, Pozzolo (2004) finds that physical collateral, which can be either inside or outside, is not associated with borrowers' observed risk, but that personal guarantees (outside collateral) are positively associated with risk.

to borrowers' financial health. Rajan and Winton (1995) argue that collateral may serve as a contractual device to increase lenders' monitoring incentive, because collateral is likely to be effective only if its value can be monitored. Moreover, the use of collateral as an incentive will be more extensive when the value of such collateral (as in the case of accounts receivable and inventories, for example) depreciates rapidly if business conditions deteriorate, than when the value of collateral is relatively stable (as in the case of, e.g., real estate).[3] Longhofer and Santos (2000) argue that collateral serves as an incentive for information production by the principal lender in the presence of several creditors, because taking collateral is effective in making its loan senior to other creditors' claims. Thus, the bank that provides collateralized loan is able to reap the benefits of screening and monitoring activities. Note that this argument does not straightforwardly apply to personal guarantees, because, in general, personal guarantees do not define seniority among several creditors.[4]

As we have a proxy variable for the intensity of monitoring by the principal lender, our second hypothesis for the empirical analysis is as follows:

Hypothesis 2 (H2): The use of collateral decreases with the intensity of monitoring by the principal lender if collateral reduces lenders' incentive to exert effort in loan management. Alternatively, if collateral serves as an incentive device to induce monitoring efforts by the principal lender in the presence of other claimants, then we expect a positive relationship between the use of collateral and monitoring intensity.

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[3] Another related benefit of using inventories and accounts receivable as collateral is that they may reveal valuable information about the business (Boot, 2000). This provides further illustration why there are likely to be complementarities between collateral and lenders' monitoring effort.

[4] In contrast, in cases where several creditors take a specific asset as collateral at the same time, it is usually defined who will take the first lien, who will take the second, and so forth.

To our knowledge, there are only two existing studies that empirically assess whether the use of collateral and personal guarantees substitute for or complement screening and monitoring by the lender. Examining Spanish loan data, Jiménez, Salas and Saurina (2006) found that banks with a lower level of expertise (smaller banks and savings banks) in small business lending use collateral more intensively. This is consistent with the theory that collateral is used as a substitute for the evaluation of credit risk. On the other hand, Voordeckers and Steijvers (2006), using Belgian loan data, found that the screening effort by the lender, as approximated by the number of days needed by a bank to judge the credit request, does not significantly affect the probability of collateral being pledged.

The present study complements these works investigating the relationship between collateral and screening by focusing on the relationship between collateral and monitoring using Japanese firm data. Our proxy variable for monitoring intensity is the frequency of document submissions to the main bank.

2.3 Relationship between the borrower and the lender

The existing literature on relationship lending provides conflicting predictions on how the strength of the relationship between borrower and lender affects the likelihood of collateral being pledged. By establishing a solid relationship with the borrower, the lender learns about the hidden attributes and actions of the borrower, thus reducing information asymmetries. Hence, the terms of loan contracts may become more favorable to the borrower if the firm has transactions with a specific relationship lender over a long period of time and thus establishes trust, resulting in a lower likelihood of collateral being pledged (Boot and Thakor, 1994). However, a solid relationship may become detrimental to the borrower if the bank exerts its information monopoly by charging higher interest rates or requiring more collateral (Sharpe, 1990). If such a hold-up problem is indeed

common, then there is likely to be a positive correlation between the strength of a relationship and the use of collateral. It should be noted that these theories assume that the collateral is outside collateral.

In addition, collateral can also be used as an incentive device in mitigating the soft-budget constraint problem in relationship lending (Boot, 2000). For example, consider the case where a borrower in difficulty asks the bank for more credit and reduced interest obligations in order to avoid default. Although a transaction-based lender would not lend to such a borrower, a relationship lender that has already made loans might accept the borrower's request in the hope of recovering a previous loan. However, once the borrower realizes he can renegotiate the loan contract relatively easily, he has an incentive to misbehave ex ante (the soft budget problem). In such cases, collateral will increase the ex-post bargaining power of the lender and hence reduce the extent of the soft-budget constraint problem, because collateral makes the value of the lender's claim less sensitive to the borrower's total net worth. These theoretical considerations apply to inside collateral as well as outside collateral and lead to the following hypothesis:

Hypothesis 3 (H3): Borrowers that establish a solid relationship with their principal lender are *less* likely to use collateral if the relationship reduces information asymmetries and enhances mutual trust between the borrower and the lender. Alternatively, borrowers with a strong relationship with their principal lender are *more* likely to use collateral if the effects of the hold-up problem or the mitigation of the soft-budget constraint problem dominate.

There are a vast number of empirical studies that have investigated how the relationship between a borrower and a lender may affect loan contract terms such as interest rates and collateral requirements in small business lending. The variables used to proxy the relationship vary in the

literature and include, for example, the duration of the lender-borrower relationship, the number of financial products the borrower has purchased from the lender (to gauge the scope of the relationship), and the number of banks with which the borrower has transactions. Research examining this issue from an empirical perspective, just like the theoretical literature, arrives at mixed results that depend on the proxy variable employed.

Berger and Udell (1995), Brick and Palia (2007), Harhoff and Körting (1998), and Jiménez, Salas and Saurina (2006) find a negative relationship between the duration of bank-firm relationships and the probability that collateral will be pledged. Similarly, Harhoff and Körting (1998), assuming that a high concentration of borrowing from one bank represents a strong lender-borrower relationship, find that the incidence of collateralization of credit lines increases as the number of financial institutions the firm is borrowing from rises. In contrast to these studies, Degryse and Van Cayseele (2000) obtain a positive relationship between the scope of lender-borrower relations and the collateral requirement. And Elsas and Krahnen (2000), using survey data from German banks, find that "house banks" have a higher probability of holding loans backed by collateral and personal guarantees than other banks. As proxies for the lender-borrower relationship, we employ the duration, as well as the scope, of the main bank-borrower relationship, the number of banks with which the borrower has transactions, and a dummy variable that indicates whether the borrower has proprietary transactions with its main bank.

3 Data, variables, and empirical model

3.1 Data

For the empirical analysis, we employ data from the "Survey of the Financial Environment" (SFE) conducted by the Small and Medium Enterprise Agency of Japan in October 2002. The SFE survey is based on a sample drawn from the "Financial Information Database" of Tokyo Shoko

Research (TSR), a commercial credit research firm, containing information on more than 1.2 million firms. The SFE questionnaire was sent out to a total of 15,000 companies, mainly SMEs, of which 8,466 responded. Because the Financial Information Database contains the balance sheet and income statements of firms, we have a firm-level data set that includes not only responses to the SFE questionnaire but also the financial statements of the surveyed firms. In order to focus on firms that mostly depend on bank loans for their financing, we limit the sample to those firms satisfying the legal definition of SMEs in Japan, that is, firms with 300 or fewer employees or with registered capital outstanding of 300 million yen or less. We then match our firm-level data with the financial variables of firms' main banks. These main bank variables come from several sources: the financial statements of banks provided by the Japanese Bankers Association and the Shinkin Bank Association and, for data of banks' SME lending, the October 2002 issue of "Shinyo Hoken Geppo (Credit Insurance Monthly)" published by the Japan Finance Corporation for Small and Medium Enterprise (JASME); in addition, we use banks' annual reports in order to supplement the data that are missing in the other sources. Due to the lack of financial statements data for credit cooperatives, government sponsored financial institutions, and non-banks, we dropped those firms from the sample whose main bank is one of these financial institutions.

For our analysis, the effects of government credit guarantees on collateral and personal guarantees need to be controlled for. Until October 2007, the government-sponsored Credit Guarantee Corporations in principle covered 100 percent of the guaranteed loan amount.[5] Thus, the use of credit guarantees significantly reduces banks' incentives to require collateral or personal guarantees. To circumvent this problem, we exclude from the sample all SMEs that enjoyed any form of government credit guarantees. As a result, we have 1,702 firms for the main statistical

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[5] From October 2007, the ratio of credit covered by the credit guarantee corporation was reduced to 80 percent of the guaranteed loan amount.

analysis. The overwhelming majority of sample firms are non-listed firms.[6]

The advantages of our data set are threefold. First, the SFE asks whether the borrowing firm has pledged collateral and/or personal guarantees to the "main bank (relationship lender)." To be precise, the SFE defines collateral as physical assets or securities that the creditor can sell in the event that the borrower defaults. In many cases, the assets pledged as collateral are in the form of real estate. On the other hand, a personal guarantee refers to a contractual obligation of the business representative or other third parties, such as the relatives of the representative or other directors of the borrowing firm, to repay loans in the event of a default. Second, in addition to collateral and personal guarantees, the SFE asks a variety of detailed questions regarding the financial transactions between a borrower and its main bank such as the number of years that the borrower and its main bank have been conducting transactions, the list of financial services that the borrower has purchased from the main bank, and the frequency of document submissions by the borrower to the main bank. These variables enable us to closely investigate how collateral/personal guarantees are related to the monitoring activities of the main bank and to the closeness of the borrower-lender relationship. Third, by matching the SFE data with SMEs' and banks' financial statements data, we are able to control for borrowing firm and main bank characteristics in examining the determinants of collateral/personal guarantees. In addition, the Financial Information Database published by TSR also contains the credit score of sample firms that, as well as financial statement variables, takes non-financial statement items such as the firm's reputation into account, and we use the credit score as a proxy for firms' riskiness.

Although our data set contains the most detailed data available on financing in Japan, several caveats need to be mentioned. First, even though all the firms in the sample correspond to the legal definition of SMEs, their average size is larger than that of the total population of SMEs in Japan.

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[6] Only 58 of the 1,702 companies in our sample are listed.

There are about 1.5 million company SMEs and 2.8 million proprietorship SMEs in Japan.[7] Our

analysis is limited to companies and does not include proprietorships due to the lack of financial

statement data for proprietorships. Even among companies, only relatively sizeable ones have the

resources to regularly produce financial statements and report them to the TSR. We will discuss this

issue further below. The second caveat is that questions in the SFE are about transactions between a

firm and its main bank, but not about individual loan contracts. Therefore, if a firm has multiple

loan contracts with its main bank with different contract terms on the provision of collateral and

personal guarantees, the use rates of collateral and personal guarantees are upward biased. The third

caveat is that, as is the case in most surveys, the SFE only deals with surviving firms, although it

does include firms that have previously defaulted. And fourth, the SFE does not distinguish inside

and outside collateral.

To circumvent the possible biases caused by the relatively large size of our sample firms, we

implement two robustness checks in the next section. First, we divide the sample into two

subsamples based on the number of employees. Second, we include firms using government credit

guarantees for some but not all of their loans. Although the Credit Guarantee Corporations secure

100 percent of the guaranteed loan amount, this does not necessarily mean that the main bank bears

no credit risk with respect to that firm, since the bank may have extended loans without credit

guarantees to the same firm as well. Because the SFE asks firms using credit guarantees whether

loans outstanding from the main bank are fully covered by the credit guarantee program, we can

identify borrowing firms that *partially* use credit guarantees for loans from its main bank. Therefore,

as long as the main bank bears some credit risk with regard to such firms, it continues to face

incentives to screen and monitor borrowers and to build long-term relationships. Incorporating these

firms increases our sample size and reduces the average size of sample firms: the sample size grows

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[7] The figures are from the "Establishment and Enterprise Census in Japan 2004" published by the Ministry of Internal Affairs and Communications.

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from 1,702 firms to 3,945 firms, while the average and the median numbers of employees are 108.3 and 61.5 for firms *none* of whose loans are covered by the credit guarantees and 75.7 and 40.0 for firms *some but not all* of whose loans are covered by the credit guarantees.

3.2   Variables

A list of the variables used in our empirical analysis and their definitions is provided in Table 1, while Table 2 presents summary statistics of these variables for the sample of firms without any credit guarantees. The summary statistics for the sample including firms that enjoy credit guarantees for some (but not all) of their loans are provided in the Appendix.

[Insert Tables 1 and 2]

The dependent variables, *COLL* and *GUAR*, are dummy variables that take a value of 1 if the borrower pledges collateral/personal guarantees to its main bank. The use ratios of collateral and personal guarantees are 71.7 percent and 66.7 percent, respectively. The key explanatory variables for our empirical analysis are organized to correspond to our hypotheses: a variable relating to the riskiness of the borrower, a variable relating to monitoring by the lender, and variables on the relationship between the borrower and the lender.

To examine Hypothesis 1, borrowers' riskiness is proxied by the credit score (*SCORE*) provided by the TSR. Financial institutions view the TSR's credit score as a common metric of credit risk for SMEs in Japan. In addition, the credit score is likely to be negatively correlated with the default rate.[8] The score ranges from 0 to 100 points, with a higher credit score implying a lower

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[8] The TSR does not disclose the ex-post default rate by credit score, but several studies using the credit scores provided by Teikoku Data Bank (TDB), another major credit research firm in Japan, report that the TDB credit score is negatively correlated with the ex-post default rate. See, for instance, Mori et al. (2002). The

credit risk. The score consists of four components: (i) management ability (such as the business experience of the manager) and outstanding assets that can be collateralized (20 points); (ii) the growth potential of sales and profits (25 points); (iii) stability factors such as firm age, the amount of capital outstanding, and the payment and credit history of the firm (45 points); and (iv) reputation and disclosure (10 points). The score is subjective in the sense that each TSR researcher grades the firms for which he is responsible, and researchers are asked to assign a score of 50 points to the "average" firm with which they are working. Table 2 shows that the mean of *SCORE* is 59.1, suggesting that our sample is skewed toward relatively "good" firms. We expect a negative sign for *SCORE* if the moral hazard hypothesis applies.

Monitoring by the lender is proxied by the variable *DOC_FREQ*, which is used to examine Hypothesis 2. The SFE asks respondent firms how often they submit relevant documents such as financial statements and cash flow forecast tables to their main bank so that banks can assess borrowers' credit risk, and we use this information as a proxy for the intensity of monitoring by the main bank. The index variable *DOC_FREQ* shows the frequency of such submissions, with 1 indicating the highest frequency and 4 the lowest frequency.[9] The mean of *DOC_FREQ* is 3.0. We expect a positive sign for *DOC_FREQ* if collateral leads main banks to reduce their monitoring efforts. Alternatively, if collateral serves as an incentive device to induce efforts by the main bank, then the sign for *DOC_FREQ* should be negative.

Finally, to investigate Hypothesis 3, we use the following lender-borrower relationship variables; *DURATION* (in logarithm), which represents the duration of the main bank-borrower

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TDB credit score is constructed in a similar way as the TSR credit score.

[9] We investigated the frequency of document submission (*DOC_FREQ*) by type of bank to examine whether particular types of banks monitor borrowers more intensively, as posited in Jiménez, Salas and Saurina (2006). However, we do not find any relationship between the type of bank and monitoring intensity. This lends support to our empirical strategy of not positing a priori which type of lenders have a relative advantage in evaluating and managing the credit risks involved in small business lending. Several lender characteristics will be taken into account below.

relationship: *SCOPE*, which indicates the number of financial products the borrower has purchased from its main bank (the scope of the relationship); and *BANKS*, which stands for the number of banks with which the borrower has transactions. We also construct a dummy variable, *ONE_BANK*, which takes a value of 1 if the borrower has proprietary transactions with its main bank. Similar to the definition of a "house bank" in Elsas and Krahnen's (2000) study on Germany, the definition of a main bank in the SFE is somewhat subjective as each respondent firm is asked to choose its main bank based on its own perceptions. As for *SCOPE*, the SFE asks firms to list all products, other than loans, which they have purchased from their main bank.[10] We then tabulate the number of products that each firm has purchased. The means of the variables are 32.6 years for *DURATION*, 4.2 products for *SCOPE*, and 4.1 banks for *BANKS*. In comparison with other countries, the duration of bank-borrower relationships in Japan is extremely long, and the number of banks with which SMEs have transactions is fairly large.[11] We would expect a negative sign for *DURATION* and *SCOPE*, and a positive sign for *BANKS* if a closer relationship between a borrower and a lender reduces the use of collateral, and vice versa otherwise.

Other than the key variables above, we include variables to control for loan contract terms, borrower characteristics, and lender characteristics. Loan contract terms are *GUAR* in the collateral equation (and *COLL* in the personal guarantees equation) and *RATE*. We use the dependent variable of one equation (say, *GUAR*) as an explanatory variable in the other equation (the collateral equation in this case). The variable *RATE* indicates the short-term interest rate on a firm's loan from its main bank as of the end of October 2002, in percentage points. If the borrower has several

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[10] See Table 1 for the precise construction of this variable.
[11] The average number of years for borrower-lender relationships in previous studies are 11.4 (Berger and Udell, 1995) and 8.5 (Brick and Palia, 2007) for the United States; 12.8 for Germany (Harhoff and Körting, 1998), 7.9 for Belgium (Degryse and Cayseele, 1999) and 3.2 for Spain (Jiménez, Salas and Saurina, 2006). The average number of banks with which small businesses have transactions is 1.2 in the United States (Brick and Palia, 2007), 1.8 in Germany (Harhoff and Körting, 1998), and 4.0 in Spain (Jiménez, Salas and Saurina, 2006).

short-term loans with its main bank, then the loan with the highest interest rate is reported. The mean of *RATE* is 1.667 percent – quite a low level, which is due to the stagnation of the Japanese economy and ultra-loose monetary policy at that time. These contract terms are potentially endogenous, and we discuss how we deal with the problem of endogenous regressors below.

We also control for borrower and main bank characteristics with which the use of collateral and personal guarantees may be associated. There are four variables to represent borrower characteristics. The variable *LOGSALES* is the logarithm of annual gross sales of the firm and stands for the size of the firm.[12] The variable *CASH_RATIO* (cash holdings/gross sales) represents the liquidity position of the firm. The variable *MATURITY* is the ratio of short-term to long-term loans of the firm. Because long-term loans such as for equipment and real estate are more likely to be secured by these assets, we expect a negative correlation between *MATURITY* and the use of collateral.[13] We also control for the industry the firm belongs to by constructing nine industry dummy variables.

We use three variables for lender (main bank) characteristics: *SME_LOANS*, *BANK_SHARE*, and *NPL*. *SME_LOANS* is the ratio of SMEs loans to total loans and is intended to capture the main bank's degree of specializing in SME lending. *BANK_SHARE* is the share of a bank's assets to total banking sector assets and represents the size of the main bank. Finally, *NPL* is the ratio of nonperforming loans to total loans.

3.3 Empirical model

To examine Hypotheses 1, 2, and 3, we estimate the following equation:

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[12] As alternatives, we also use the logarithm of assets and the logarithm of the number of employees as proxies for firm size. The results obtained are essentially the same as when we use *LOGSALES*.
[13] Ideally, we would like to control the weighted average maturity of the firm's loans from its main bank. However, as noted above, because the questions in the SFE are not about individual loan contracts, we do not have such data.

$$\Pr(Y_{ij} = 1) = f(SCORE_j, DOC\_FREQ_{ij}, RELATION_{ij},$$
$$FIRM_j, LENDER_i, TERMS_{ij}, INSTRUMENTS_j)$$

where Y_{ij} is either $COLL_{ij}$ or $GUAR_{ij}$. $SCORE_j$ is the TSR credit score of firm j. DOC_FREQ_{ij} is the frequency of document submissions by firm j to its main bank i. $RELATION_{ij}$ is a vector of variables indicating the bank-firm relationship, and $FIRM_j$ and $LENDER_i$ are vectors of variables indicating firm and lender characteristics. We also control for the contracting terms ($TERMS_{ij}$) such as the interest rate, $RATE_{ij}$, and whether the borrower also pledges a guarantee or collateral to its main bank. These variables are potentially endogenous, and we formally examine the exogeneity of these contract terms variables below. In those cases where at least one of the variables turns out to be endogenous, we use instrumental variables. The instrumental variables for interest rates are measures of market power and the age of the borrowing firm ($FIRMAGE_j$). We use the Herfindahl Index for SME loans in the prefecture of the firm, denoted as HHI_j, as our market power measure. Since we cannot obtain figures for each city bank's SME loans outstanding in each prefecture, HHI_j is computed based on the share of SME loans outstanding for banks other than city banks, that is, smaller banks including regional banks, second-tier regional banks, *Shinkin* banks, and *Shinkumi* banks (credit cooperatives). To compensate for this deficiency of our Herfindahl Indices, we also include the aggregated share of city banks in SME loans in the prefecture of the firm ($CITY\_SHARE_j$). These market power variables are taken from the "Regional Finance Map 2002" published in the *Kinyu Journal*. Two instrumental variables for personal guarantees are employed, $OWNER\_REP_j$ and $OWNER\_FAMILY_j$. $OWNER\_REP_j$ is a binary variable that takes unity if the surname of the representative of the firm matches that of one of the major shareholders, while $OWNER\_FAMILY_j$ counts the number of major shareholders whose surname is identical to that of the representative. These variables are useful in approximating the risk of commingling of business assets and the personal assets of the owner, which makes the use of personal guarantees more likely.

The instrumental variable for collateral is the ratio of real estate holdings to total assets ($LAND\_RATIO_j$). Because real estate is the asset most frequently used as collateral in lending to SMEs in Japan,[14] we believe $LAND\_RATIO_j$ is an appropriate instrumental variable for collateral. The validity of these instruments will be formally tested in our analysis below.

We begin with the probit estimations for collateral and personal guarantees, assuming that the contract terms are exogenous explanatory variables. For example, regarding the probit estimation for collateral, the interest rates $RATE_{ij}$ and the binary variable for personal guarantees $GUAR_{ij}$ are assumed to be exogenous. We then implement tests for exogeneity of $RATE_{ij}$ and $GUAR_{ij}$ (in the case of the collateral equation) applying the methodology of Rivers and Vuong (1988) and Wooldridge (2002, p. 474). The procedure is as follows: (i) We run the OLS regression for possibly endogenous variables, $RATE_{ij}$ and $GUAR_{ij}$, on all other independent variables (including instrumental variables) and obtain the reduced form residuals. (ii) We then run the probit regression for $COLL_{ij}$ on all exogenous variables (including possibly endogenous variables and their instrumental variables) and the residuals obtained in the first step. If the t-statistics on these residuals show they are insignificant, then we fail to reject the null that the contract terms are exogenous and thus adopt the probit estimations that treat the contract term variables as exogenous. If one (or both) of the contract term variables turns out to be endogenous, we then check the validity of the instrumental variables by regressing the instrumented variable on the instrumental variables. Finally, we employ Wooldridge's (2002, pp. 477-478) maximum likelihood estimation (MLE) procedure with the endogenous variable. The idea is to obtain the parameters of the model and their standard errors by maximizing the likelihood function of the following equation:

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[14] The 2001 SFE provides the composition of collateral by type of assets pledged (multiple answers allowed). Among those respondent firms that pledged collateral to their main bank, 95.9 percent answered that they pledged real estate. Other collateralized assets, in their order of importance following real estate, are deposits (22.8 percent), equity securities (9.2 percent), and commercial bills (6.9 percent).

$$f(Y_{ij}, TERMS_{ij} \mid \mathbf{z}) = f(Y_{ij} \mid TERMS_{ij}, \mathbf{z}) f(TERMS_{ij} \mid \mathbf{z})$$

where $\mathbf{z}$ is a vector of instrumental variables.

4 Empirical results

4.1 Collateral

Table 3 reports the benchmark probit estimation in which contract terms are treated as exogenous variables for the sample of firms without government credit guarantees. Note that the coefficients on both contract terms variables, *GUAR* and *RATE*, are positive and highly significant, indicating that borrowers who pledge personal guarantees and incur higher short-term interest rates are more likely to have collateralized loans. Regarding our empirical hypotheses, the estimation results in Table 3 show that a firm's riskiness does not have any significant effect on the use of collateral, that a more frequent submission of relevant documents is associated with a greater use of collateral, and that the longer the duration and the wider the scope of the relationship, the more likely it is that the borrower pledges collateral.

[Insert Table 3]

The lower part of Table 3 reports the exogeneity tests for *GUAR* and *RATE*. The z-statistics of the residual terms obtained from the first-step estimation for *GUAR* and *RATE* indicate that we can reject the null hypothesis that *GUAR* is exogenous, but that we cannot reject the null that *RATE* is exogenous. Thus, we proceed to the MLE estimation in which only *GUAR* is treated as endogenous. To begin with, Table 4 assesses the explanatory power of our instrumental variables for personal guarantees. In cases where the instrumental variables alone or both the instruments and other exogenous variables are incorporated as regressors, we reject the null that coefficients on

OWNER_REP and *OWNER_FAMILY* are jointly zero. Thus, we can use these instrumental variables with some confidence.

[Insert Table 4]

Table 5 reports the MLE estimation for the collateral equation in which *GUAR* is treated as endogenous. In terms of our empirical hypotheses, the results are qualitatively the same as the benchmark estimation in Table 3 where *GUAR* is treated as an exogenous variable. The coefficient on *SCORE* is again insignificant, and thus the moral hazard hypothesis is not supported.[15] This may be because our collateral variable does not differentiate inside and outside collateral. The coefficient on *DOC_FREQ* is negative and significant, and thus provides support for the hypothesis that collateral serves as an incentive for monitoring efforts by the main bank. Finally, the coefficients on *LOGDURATION* and *SCOPE* are both positive and significant, which is consistent with the hypothesis that a stronger borrower-lender relationship contributes to the use of collateral, presumably because of the hold-up problem or because collateral is used to mitigate the soft-budget constraint problem.

[Insert Table 5]

Taken together, our empirical results suggest that, in Japan, collateral is complementary to relationship lending. As noted above, unlike in some of the other developed countries, SMEs in Japan tend to have transactions with a fairly large number of banks. Under such circumstances, a

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[15] If the borrower uses collateral as a signaling device of his unobservable high credit quality, then there may be no relationship between collateral usage and *SCORE*. Our data reveals, however, that the interest rate at which firms borrow is higher for those pledging collateral than those that do not – a result that is in contradiction with the signaling hypothesis.

main bank's incentive to screen and monitor borrowers and establish relationships may be reduced due to the informational free-rider problem. Collateral works as an incentive for main banks to invest in relationship building, because in Japan it is usually the case that the main bank takes a first lien on collateral so that its claims are senior to those of other lenders.

Turning to the other control variables, the coefficients on *LOGSALES* and *LAND_RATIO* are positive and significant, indicating that larger firms and firms where real estate makes up a larger share of their assets are more likely to pledge collateral. The negative coefficient on *MATURITY* implies that the larger a firm's ratio of short-term to long-term loans, the less likely it is that it will pledge collateral to its main bank. Finally, the negative coefficient on *SME_LOANS* implies that banks whose loan portfolios are more concentrated on SME lending are less likely to require collateral.

4.2   Personal guarantees

Table 6 reports the benchmark probit estimation for personal guarantees and the exogeneity tests for *COLL* and *RATE*. Unlike in the collateral equation, we cannot reject the null hypotheses that *COLL* and *RATE* are exogenous. Hence, we proceed with our benchmark estimation. Similar to the results of the collateral equation, we find that the coefficients on both contract terms variables, *COLL* and *RATE*, are positive and highly significant. That is, the use of personal guarantees is positively associated with collateral usage and higher interest rates. Regarding our three empirical hypotheses, we find no statistically significant relationships: none of the coefficients on *SCORE*, *DOC_FREQ*, *LOGDURATION*, *SCOPE*, *BANKS*, and *ONE_BANK* is significant. However, we do find that *OWNER_REP* has a statistically significant positive impact, and that *LOGSALES* has a significant negative impact on the use of personal guarantees. Taken together, these results suggest that the main bank requires personal guarantees from smaller firms whose business is strongly

controlled by the business representative. Because there is more of a commingling risk for smaller and more owner-oriented firms, our empirical results can be interpreted as indicating that the main objective of Japanese banks in asking for personal guarantees in lending to SMEs is to limit the extent of the risk of the commingling of representatives' personal wealth and business assets. With respect to main bank characteristics, we find a significant positive coefficient for *SME_LOANS* and a significant negative coefficient for *NPL*, indicating that banks with a larger SME loans ratio or a smaller non-performing loans ratio are more likely to ask for personal guarantees from their borrowers.

[Insert Table 6]

Most importantly, we do not find a complementary relationship between personal guarantees on the one hand and monitoring efforts and borrower-lender relationship variables on the other. Thus, the incentive effect for the lender becomes tenuous in the case of personal guarantees, and a likely explanation for this finding is that, unlike collateral, personal guarantees do not define the seniority among creditors.

4.3   Robustness

As explained in Section 3, in the baseline analysis we used a sample that excluded firms that relied on the government-sponsored credit guarantee program. As a result, our sample consists of relatively large SMEs, and the estimation may be influenced by the size of the firms we chose. To verify that our main conclusions above are not distorted by the size of sample firms, we perform two exercises. Firstly, we split our sample and see whether we can obtain similar results. We split our sample along the median number of employees, which is 62, and estimate an instrumental variable probit regression for the collateral equation and a simple probit regression for the personal

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guarantees equation (Tables 7(a) and 7(b)). Both in the collateral equation and in the personal guarantees equation, we obtain qualitatively the same results as in the previous sections for smaller firms with 62 or fewer employees.[16]

[Insert Tables 7(a) and 7(b)]

Secondly, we rerun our regressions using the sample containing firms that relied on credit guarantees for some (but not all) of their loans and that includes smaller SMEs. In order to control for the use of credit guarantees, we add the dummy variable *GOVGUAR* that takes a value of 1 if the firm used credit guarantees for loans from its main bank. The results are reported in Tables 8(a) and 8(b). A number of things are worth noting. First, the coefficient on *SCORE* in the collateral equation is still insignificant, and the sign and significance of the coefficients on *DOC_FREQ*, *LOGDURATION*, and *SCOPE* are the same as in the analysis in the previous section. These findings confirm our conclusion that collateral is complementary to relationship lending. Second, in the personal guarantees equation, the coefficient on *DOC_FREQ* is significantly negative, which also suggests that the use of personal guarantees is positively associated with the intensity of monitoring by the main bank. Regarding the relationship variables in the personal guarantees equation, we obtain a significant positive coefficient for *SCOPE*, which indicates a complementary relationship between the closeness of lender-borrower ties and personal guarantees. Note, however, that we obtain significant negative coefficients for both *BANKS* and *ONE_BANK*, implying a non-linear relationship between the number of banks with which a firms conducts transactions and the probability of pledging personal guarantees. Having transactions with a smaller number of

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[16] In the personal guarantees equation, the coefficient on *LOGSALES* is no longer significant, but that on *OWNER_REP* is still significantly positive, so our conclusion that main banks ask for personal guarantees in order to limit the extent of risk of commingling of owners' personal wealth and business assets still seems to hold.

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banks increases the probability of pledging personal guarantees. In contrast, a main bank with no rival lender to extend a loan to a borrower has a smaller incentive to require personal guarantees since it has the priority to receive repayments.[17]

[Insert Tables 8(a) and 8(b)]

5 Concluding Remarks

This paper investigated the role of collateral and personal guarantees using a unique data set of Japan's SME loan market. We found that firms' riskiness does not have a significant effect on the likelihood that collateral is used. We found, however, that main banks whose claims are collateralized monitor borrowers more intensively, and that borrowers who have a long-term relationship with their main banks are more likely to pledge collateral. Our empirical evidence thus suggests that collateral is complementary to relationship lending. In contrast, personal guarantees only weakly complement relationship lending.

As far as we know, this is the first empirical study to systematically examine the role of collateral and personal guarantees in SME lending in Japan and as such complements previous studies on collateral that focus on the United States and Europe. More importantly, by distinguishing between collateral and personal guarantees, we were able to detect an important role of collateral in relationship lending that has not been much remarked on before. SMEs in Japan, unlike in other developed countries, tend to have transactions with a fairly large number of banks. Under such circumstances, the incentives for main banks to screen and monitor borrowers and establish solid relationships may be reduced due to the informational free-rider problem. Because it

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[17] Our empirical results indicate that this argument does not apply for collateral, presumably because the main bank faces the threat that another bank provides a collateralized loan in which the rival takes the first lien. In contrast, because personal guarantees do not define the seniority among creditors, it is sufficient for the main bank to ask the borrower to pledge personal guarantees after the rival bank makes a loan.

defines the order of seniority among creditors, collateral provides an incentive for main banks to invest in relationship building and thus results in greater monitoring efforts. This incentive effect for the lender becomes tenuous for personal guarantees, because these do not define seniority among creditors. Our work thus provides empirical evidence on how collateral affects relationship lenders' incentives, and complements previous studies on collateral that focus on incentive problems on the part of borrowers (moral hazard and adverse selection).

A few caveats with regard to our analysis need to be borne in mind. First, the SFE sample is skewed toward large SMEs, which may bias our empirical results. We tried to circumvent this problem by splitting the sample and by using sample firms whose loans are partially guaranteed by the credit guarantee program, but it may still be the case that our results only apply to fairly sizable, well-established SMEs. Second, although we find evidence that the use of collateral is positively associated with the strength of borrower-lender relationships, we do not exactly know whether this is due to the hold-up problem or lenders' incentive to mitigate the soft-budget constraint problem in relationship lending. In order to evaluate the efficiency of the use of collateral in small business lending, it is important to further investigate the motivation of banks in requiring collateral and personal guarantees. It is also necessary to evaluate whether the enhanced bargaining power of the lender, be it due to hold-up of the borrower or mitigation of the soft budget constraint, increases the availability of credit for small businesses. These issues should be addressed in future studies.

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Table 1.   Definitions of Variables

Variable	Definition
Dependent variables	
COLL	1 if the borrower pledges collateral to its main bank, 0 otherwise.
GUAR	1 if the borrower pledges a personal guarantee to its main bank, 0 otherwise.
Riskiness of borrower	
SCORE	TSR Credit Score (0-100).
Monitoring by lender	
DOC_FREQ	Index variable indicating the frequency of document submissions to the borrower's main bank: 1: once every 1-2 months, 2: quarterly, 3: semi-annually, 4: annually.
Relationship between borrower and lender	
LOGDURATION	Log of the duration of the main bank-borrower relationship in years.
SCOPE	Number of financial products the borrower has purchased from its main bank. Firms surveyed in the SFE are asked to tick all applicable items from the following list: (i) current account, (ii) term deposit, (iii) draft payment collection, (iv) settlement of notes payable, (v) foreign exchange transactions, (vi) bond underwriting, (vii) capital increase underwriting, (viii) bank's capital increase underwritten by the borrower, (ix) receipt of seconded or former bank employees, (x) business with bank affiliates, (xi) participation in meetings with customers/suppliers organized by bank, (xii) use of services (e.g. financial consultations) provided by bank, (xiii) introduction of customers. We exclude items (viii) and (ix), which appear irrelevant for our measure of the lender-borrower relationship.
BANKS	Number of banks the borrower has transactions with.
ONE_BANK	1 if the borrower has a single bank it conducts transactions with.
Terms of loan contracts	
RATE	Short-term interest rate charged by the main bank. If the borrower has several short-term loans with its main bank, the loan with the highest rate is reported.
GOVGUAR	1 if the borrower uses government sponsored credit guarantees for the loans provided by its main bank, 0 otherwise.
Borrower characteristics	
LOGSALES	Log of gross annual sales.
CASH_RATIO	Ratio of cash holdings to total sales.
MATURITY	Ratio of short-term to long-term loans, where short-term loans are defined as loans with a maturity of less than one year.
IND1-IND9	Borrower dummy variable classified by industry: 1: construction, 2: manufacturing, 3: IT and transportation, 4: wholesale, 5: retail, 6: real estate, 7: restaurants, 8: services, 9: other.
Lender characteristics	
SME_LOANS	Ratio of SME loans to total loans.
BANK_SHARE	Share of a bank's assets to total banking sector assets.
NPL	Ratio of non-performing loans to total loans. Non-performing loans consist of loans to borrowers in legal bankruptcy, past due loans in arrears by 3 months or more, and restructured loans.
Instrumental variables	
FIRMAGE	Age of the borrowing firm.
HHI	Herfindahl Index for SME loans in the prefecture of the firm. The Herfindahl Index is computed based on the share of SME loans of regional banks, second-tier regional banks, *shinkin* banks, and *shinkumi* banks.
CITY_SHARE	City banks' share of SME loans in the prefecture of the firm.
OWNER_REP	1 if the last name of the representative matches the surname of one of the major shareholders.
OWNER_FAMILY	Number of major shareholders whose surname is identical to that of the representative.
LAND_RATIO	Ratio of real estate holdings to total assets.

Table 2. Summary Statistics

	N	Mean	Median	Standard deviation	Min.	Max.
Dependent variables						
COLL	1702	0.717	1	0.450	0	1
GUAR	1702	0.667	1	0.471	0	1
Riskiness of borrower						
SCORE	1702	59.147	59	6.551	32	78
Monitoring by lender						
DOC_FREQ	1702	3.032	3	1.080	1	4
Relationship between borrower and lender						
LOGDURATION	1702	3.301	3.497	0.722	0	4.595
SCOPE	1702	4.208	4	1.767	0	9
BANKS	1702	4.117	4	2.834	0	30
ONE_BANK	1702	0.111	0	0.314	0	1
Terms of loan contracts						
RATE	1702	1.668	1.625	0.697	0	6
Borrower characteristics						
LOGSALES	1702	14.753	14.852	1.288	9.930	18.310
CASH_RATIO	1702	0.168	0.103	0.293	0	7.475
MATURITY	1702	0.585	0.606	0.323	0	1
IND1(Construction)	1702	0.290	0	0.454	0	1
IND2(Manufacturing)	1702	0.148	0	0.355	0	1
IND3(IT and Transportation)	1702	0.039	0	0.195	0	1
IND4(Wholesale)	1702	0.179	0	0.384	0	1
IND5(Retail)	1702	0.115	0	0.319	0	1
IND6(Realestate)	1702	0.038	0	0.192	0	1
IND7(Restaurants)	1702	0.004	0	0.059	0	1
IND8(Services)	1702	0.108	0	0.310	0	1
IND9(Other)	1702	0.079	0	0.269	0	1
Lender characteristics						
SME_LOANS	1702	0.485	0.464	0.113	0.228	0.806
BANK_SHARE	1702	0.034	0.006	0.043	0.000	0.109
NPL	1702	0.085	0.086	0.029	0.026	0.221
Instrumental variables						
FIRMAGE	1702	47.154	43	27.943	1	434
HHI	1702	2304.538	2237.182	1396.269	402.239	6135.069
CITY_SHARE	1702	0.248	0.104	0.235	0.011	0.597
OWNER_REP	1702	0.578	1	0.494	0	1
OWNER_FAMILY	1702	1.374	1	1.381	0	8
LAND_RATIO	1702	0.135	0.106	0.128	0	0.842

Table 3. Probit Estimation for *COLL* and Exogeneity Test for *GUAR* and *RATE*

Probit regression
Dependent variable: *COLL*

	Coeff.	z	p-value
GUAR	0.68	8.18	0.000
SCORE	0.00	-0.31	0.753
DOC_FREQ	-0.13	-3.30	0.001
LOGDURATION	0.43	8.06	0.000
SCOPE	0.09	3.65	0.000
BANKS	0.01	0.72	0.470
ONE_BANK	-0.01	-0.05	0.957
RATE	0.32	4.82	0.000
LOGSALES	0.08	2.01	0.044
CASH_RATIO	0.26	1.45	0.146
MATURITY	-0.61	-4.98	0.000
IND1	0.40	2.68	0.007
IND2	0.13	0.81	0.420
IND3	0.29	1.23	0.220
IND4	0.15	0.92	0.357
IND5	0.40	2.22	0.026
IND6	0.89	3.24	0.001
IND7	-0.18	-0.32	0.746
IND8	-0.11	-0.68	0.498
SME_LOANS	-0.60	-1.33	0.183
BANK_SHARE	-2.01	-1.69	0.091
NPL	0.76	0.58	0.565
LAND_RATIO	3.70	9.96	0.000
Constant	-2.87	-3.82	0.000
Obs.	1702		
Log likelihood	-749.96		
LR chi squared (23)	526.82		
Prob > chi squared	0		
Pseud R squared	0.2599		

Exogeneity Test for *GUAR* and *RATE*

	Coeff.	z	p-value
resid_GUAR	-1.71	-5.90	0.000
resid_RATE	0.05	0.06	0.955

Table 4. Validity of Instruments for *GUAR*

	Coeff.	z	p-value	Coeff.	z	p-value
Probit regression						
Dependent variable: *GUAR*						
SCORE				0.00	0.00	0.998
DOC_FREQ				-0.10	-2.85	0.004
LOGDURATION				0.12	2.40	0.016
SCOPE				0.04	1.89	0.059
BANKS				-0.01	-0.99	0.321
ONE_BANK				-0.17	-1.31	0.191
LOGSALES				-0.23	-5.88	0.000
CASH_RATIO				-0.01	-0.07	0.945
MATURITY				-0.43	-3.65	0.000
IND1				0.12	0.85	0.394
IND2				0.13	0.80	0.422
IND3				0.25	1.22	0.222
IND4				0.45	2.95	0.003
IND5				0.51	3.04	0.002
IND6				-0.07	-0.32	0.752
IND7				-0.13	-0.22	0.826
IND8				0.04	0.27	0.786
SME_LOANS				1.08	2.52	0.012
BANK_SHARE				-2.30	-2.10	0.036
NPL				-2.47	-2.00	0.045
OWNER_REP	0.86	9.11	0.000	0.77	7.65	0.000
OWNER_FAMILY	0.15	4.06	0.000	0.08	2.08	0.037
Constant	-0.20	-4.12	0.000	2.93	4.70	0.000
Obs.	1702			1702		
Log likelihood	-924.01			-841.291		
LR chi squared (23)	318.21			483.65		
Prob > chi squared	0			0		
Pseud R squared	0.1469			0.2233		
Chi squared value that instruments are jointly zero				151.00		
p-value				0.0000		

**Table 5. Simultaneous System Probit Estimation
for *COLL***

Instrumental variable probit regression
Dependent variable: *COLL*; Instrumented variable: *GUAR*
Instrumental variables: *OWNER_REP, OWNER_FAMILY*

	Coeff.	z	p-value
GUAR	1.50	9.73	0.000
SCORE	-0.01	-0.78	0.435
DOC_FREQ	-0.10	-2.59	0.010
LOGDURATION	0.37	6.82	0.000
SCOPE	0.06	2.62	0.009
BANKS	0.01	0.91	0.365
ONE_BANK	0.05	0.44	0.662
RATE	0.28	4.47	0.000
LOGSALES	0.17	4.02	0.000
CASH_RATIO	0.22	1.35	0.177
MATURITY	-0.42	-3.43	0.001
IND1	0.27	1.82	0.068
IND2	-0.01	-0.04	0.971
IND3	0.19	0.83	0.407
IND4	-0.08	-0.49	0.625
IND5	0.17	0.94	0.345
IND6	0.81	3.05	0.002
IND7	-0.11	-0.21	0.835
IND8	-0.12	-0.75	0.452
SME_LOANS	-0.87	-2.00	0.046
BANK_SHARE	-1.31	-1.14	0.254
NPL	1.53	1.20	0.231
LAND_RATIO	3.32	9.23	0.000
Constant	-4.16	-5.62	0.000
Obs.	1702		
Log likelihood	-1581.02		
Wald chi squared (45)	1048.82		
Prob>chi squared	0.0000		

Table 6. Probit Estimation for *GUAR* and Exogeneity Test for *COLL* and *RATE*

Probit regression

Dependent variable: *GUAR*

	Coeff.	z	p-value
COLL	0.56	6.63	0.000
SCORE	0.01	1.00	0.316
DOC_FREQ	-0.06	-1.49	0.135
LOGDURATION	0.04	0.83	0.407
SCOPE	0.03	1.48	0.140
BANKS	-0.02	-1.25	0.210
ONE_BANK	-0.19	-1.48	0.139
RATE	0.17	2.79	0.005
LOGSALES	-0.22	-5.51	0.000
CASH_RATIO	-0.03	-0.21	0.837
MATURITY	-0.25	-2.11	0.035
IND1	0.05	0.36	0.721
IND2	0.08	0.48	0.630
IND3	0.14	0.67	0.506
IND4	0.42	2.70	0.007
IND5	0.41	2.40	0.016
IND6	-0.25	-1.15	0.249
IND7	-0.03	-0.05	0.963
IND8	0.02	0.11	0.909
SME_LOANS	1.11	2.56	0.011
BANK_SHARE	-1.83	-1.64	0.100
NPL	-2.91	-2.32	0.020
OWNER_REP	0.69	6.77	0.000
OWNER_FAMILY	0.06	1.61	0.108
Constant	2.03	2.84	0.004
Obs.	1702		
Log likelihood	-813.189		
LR chi squared(23)	539.85		
Prob > chi squared	0		
Pseud R squared	0.2492		

Exogeneity Test for *COLL* and *RATE*

	Coeff.	z	p-value
resid_COLL	-0.16	-0.44	0.661
resid_RATE	-0.21	-0.26	0.798

Table 7(a). Simultaneous System Probit Estimation for *COLL* by Firm Size

Instrumental variable probit regression
Dependent variable: *COLL*; Instrumented variable: *GUAR*;
Instrumental variables: *OWNER_REP, OWNER_FAMILY*

	Small firms with *EMP*<=62			Large firms with *EMP*>62		
	Coeff.	z	p-value	Coeff.	z	p-value
GUAR	1.62	7.06	0.000	1.36	5.80	0.000
SCORE	0.00	-0.41	0.680	-0.01	-0.90	0.366
DOC_FREQ	-0.13	-2.31	0.021	-0.11	-1.80	0.072
LOGDURATION	0.34	4.91	0.000	0.37	4.12	0.000
SCOPE	0.07	1.98	0.047	0.07	1.99	0.046
BANKS	0.02	0.73	0.468	0.01	0.45	0.650
ONE_BANK	0.01	0.03	0.973	0.13	0.57	0.567
RATE	0.29	3.66	0.000	0.30	2.70	0.007
LOGSALES	0.01	0.09	0.931	0.17	2.00	0.045
CASH_RATIO	0.12	0.57	0.570	0.31	1.32	0.188
MATURITY	-0.39	-2.57	0.010	-0.59	-2.58	0.010
IND1	0.10	0.46	0.643	0.24	1.12	0.263
IND2	-0.01	-0.06	0.949	-0.07	-0.26	0.797
IND3	-0.07	-0.17	0.862	0.10	0.32	0.746
IND4	0.10	0.46	0.643	-0.24	-0.96	0.338
IND5	0.20	0.82	0.411	0.08	0.29	0.770
IND6	0.81	2.63	0.009	6.80	0.00	1.000
IND7	-5.49	0.00	1.000	-0.41	-0.69	0.490
IND8	-0.02	-0.10	0.920	-0.29	-1.16	0.248
SME_LOANS	0.01	0.03	0.980	-1.74	-2.47	0.014
BANK_SHARE	0.50	0.29	0.771	-3.32	-2.05	0.040
NPL	-1.20	-0.67	0.502	3.45	1.76	0.078
LAND_RATIO	3.33	7.09	0.000	3.31	5.45	0.000
Constant	-2.31	-2.17	0.030	-3.25	-2.21	0.027
Obs.	858			844		
Log likelihood	-782.766			-743.72		
Wald chi squared	499.92			537.7		
Prob>chi squared	0			0		

Note: *EMP* stands for the number of employees.

Table 7(b). Probit Estimation for *GUAR* by Firm Size

Probit regression
Dependent variable: *GUAR*

	Small firms with *EMP*<=62			Large firms with *EMP*>62		
	Coeff.	z	p-value	Coeff.	z	p-value
COLL	0.72	6.19	0.000	0.43	3.27	0.001
SCORE	0.01	1.14	0.255	0.01	0.68	0.498
DOC_FREQ	-0.01	-0.14	0.891	-0.07	-1.43	0.154
LOGDURATION	0.07	0.98	0.327	0.08	0.88	0.380
SCOPE	-0.02	-0.70	0.483	0.08	2.60	0.009
BANKS	-0.03	-1.41	0.158	0.00	0.20	0.840
ONE_BANK	-0.16	-1.00	0.318	-0.25	-1.13	0.258
RATE	0.05	0.63	0.531	0.37	3.53	0.000
LOGSALES	-0.10	-1.57	0.117	-0.37	-4.69	0.000
CASH_RATIO	0.05	0.26	0.797	-0.21	-0.76	0.449
MATURITY	0.06	0.36	0.717	-0.78	-4.06	0.000
IND1	-0.02	-0.10	0.918	0.09	0.46	0.644
IND2	-0.10	-0.45	0.652	0.40	1.60	0.111
IND3	0.44	1.13	0.260	0.08	0.28	0.783
IND4	0.19	0.83	0.408	0.63	2.63	0.009
IND5	0.14	0.55	0.581	0.73	2.86	0.004
IND6	-0.24	-0.91	0.364	-0.91	-1.62	0.105
IND7				0.55	0.86	0.392
IND8	-0.17	-0.72	0.471	0.15	0.62	0.537
SME_LOANS	0.22	0.35	0.725	2.25	3.43	0.001
BANK_SHARE	-2.65	-1.49	0.136	-1.38	-0.91	0.361
NPL	0.50	0.26	0.794	-4.75	-2.65	0.008
OWNER_REP	0.97	6.04	0.000	0.44	3.13	0.002
OWNER_FAMIL	-0.01	-0.20	0.841	0.13	2.23	0.026
Constant	0.31	0.29	0.771	3.63	2.67	0.008
Obs.	857			844		
Log likelihood	-365.231			-409.537		
LR chi square(2?)	228.4			328.95		
Prob > chi squar	0			0		
Pseud R squared	0.2382			0.2865		

Note: *EMP* stands for the number of employees.

Table 8(a). Simultaneous System Probit Estimation for *COLL* for Sample Including Firms With Government Guarantees for Part of Their Loans

Instrumental variable probit regression
Dependent variable: *COLL* ; Instrumented variable: *GUAR* ;
Instrumental variables: *OWNER_REP* , *OWNER_FAMILY*

	Coeff.	z	p-value
GUAR	1.35	9.28	0.000
SCORE	-0.01	-1.55	0.121
DOC_FREQ	-0.14	-5.02	0.000
LOGDURATION	0.38	10.07	0.000
SCOPE	0.07	3.69	0.000
BANKS	0.00	0.06	0.954
ONE_BANK	-0.01	-0.09	0.928
RATE	0.17	4.26	0.000
GOVGUAR	0.30	4.02	0.000
LOGSALES	0.15	4.69	0.000
CASH_RATIO	0.45	2.94	0.003
MATURITY	-0.40	-4.20	0.000
IND1	0.34	2.87	0.004
IND2	0.08	0.66	0.511
IND3	0.05	0.30	0.766
IND4	0.01	0.10	0.920
IND5	0.19	1.35	0.176
IND6	1.00	4.15	0.000
IND7	-0.39	-1.16	0.248
IND8	-0.18	-1.41	0.159
SME_LOANS	-0.58	-1.81	0.070
BANK_SHARE	-1.56	-1.73	0.083
NPL	0.50	0.53	0.599
LAND_RATIO	3.27	12.32	0.000
Constant	-3.46	-6.11	0.000
Obs.	3934		
Log likelihood	-2525.28		
Wald chi squared (47)	1834.42		
Prob>chi squared	0.0000		

Table 8(b). Probit Estimation for *GUAR* for Sample Including Firms With Government Guarantees for Part of Their Loans

Probit regression
Dependent variable: *GUAR*

	Coeff.	z	p-value
COLL	0.55	7.69	0.000
SCORE	0.01	1.62	0.105
DOC_FREQ	-0.07	-2.46	0.014
LOGDURATION	0.03	0.64	0.524
SCOPE	0.05	2.56	0.010
BANKS	-0.03	-2.27	0.023
ONE_BANK	-0.20	-1.91	0.056
RATE	0.13	2.91	0.004
GOVGUAR	0.77	10.53	0.000
LOGSALES	-0.17	-5.22	0.000
CASH_RATIO	-0.04	-0.29	0.774
MATURITY	-0.29	-2.94	0.003
IND1	0.04	0.30	0.762
IND2	0.08	0.60	0.548
IND3	0.19	1.05	0.294
IND4	0.38	2.90	0.004
IND5	0.49	3.28	0.001
IND6	-0.03	-0.14	0.888
IND7	0.24	0.55	0.580
IND8	0.02	0.16	0.876
SME_LOANS	1.33	3.90	0.000
BANK_SHARE	-1.04	-1.15	0.252
NPL	-2.65	-2.62	0.009
OWNER_REP	0.53	6.54	0.000
OWNER_FAMILY	0.07	2.35	0.019
Constant	1.24	2.13	0.033
Obs.	3934		
Log likelihood	-1184.68		
LR chi squared(25)	1189.56		
Prob > chi squared	0		
Pseud R squared	0.3342		