The Bank Balance Sheet Effect on Loan Pricing and the Bank Size
Evidence from Main Bank-SME Relationships in Japan

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Abstract

We found that smaller banks distressed by non-performing loans charge small and medium enterprises a substantial premium in loan pricing. There is, however, no consistent result to imply that larger banks charge a similar premium. These findings suggest that frictions are present between firms and their smaller lenders. The premium charged by a smaller bank, however, does not increase in the strength of the bank's relationship with a borrower. Our further findings that smaller banks take advantage of less competitive lending environments by charging more rather imply that smaller banks behave as a local dominant in their home markets.

Keywords: Bank effects, relationship lending, main bank, non-price terms, sample selection, instrumental variable

JEL classification: C31, D82, G21, G28

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1. Introduction

Whether a lender's poor financial health tightens terms of loans to small and medium enterprises (SMEs) should draw attention of both academics and policymakers alike as the world underwent the unprecedented financial turmoil. There is a sizable empirical literature that discusses the effect of poor bank health on the quantity of loans supplied. The literature on the US episode of bank capital losses during the 1990-1991 period (Beranake and Lown, 1991; Berger and Udell, 1994; Peek and Rosengren, 1995) and the subsequent literature on the comparable Japanese episode during the 1997-1998 period (Woo, 2003; Watanabe, 2007) have reached the consensus that under the modern regulatory framework based on the risk based capital requirements, in response to severe capital losses, banks cut back on loan supply in order to restore their capital adequacy. This is a phenomenon known as a credit crunch.

Even in absence of regulatory distortions, frictions in credit markets alone enable a bank to tighten credit when the bank's balance sheet health deteriorates. As Holmstrom and Tirole (1997) illustrate, when information about a borrower's credit quality is asymmetric between a bank that monitors the borrower and individual investors that do not, the bank that incur losses on its capital raises the lending rates in the absence of a borrower's credit quality deterioration. Hubbard et al. (2002) go on to argue, "(b)ank-specific increases in the cost of funds would not be passed on to loan customers in the absence of informational or competitive frictions; borrowers could simply switch banks." They further discuss that "an idiosyncratic increase in the bank's cost of funds (say, from a decrease in capital or balance sheet liquidity) could increase the cost of funds to borrowers." Finding that, in the United States, the lending rate is indeed negatively associated with various measures for the bank balance sheet's health and liquidity, Hubbard et al. (2002) collectively call the effects of bank balance sheet based variables on the bank lending rate "bank effects."

The question that remains to be unanswered is what frictions lead to "bank effects." One possible explanation is that banks practice relationship lending and earn "information monopoly rents." The financial statements of SMEs, which are often unaudited, are generally less informative about borrowers' credit quality than those of larger firms. To mitigate the asymmetric information between a bank and a firm, the bank gathers information about the firm through establishing a close bank-firm relationship. When making a decision about underwriting a loan, a bank's preexisting relationship with a loan applicant may give the bank the informational advantage over new entrants. A bank's monitoring, which involves frequent contacts to its borrower, reveals more about the borrower's credit quality than the loan review process alone. Or, a bank learns a firm's cash flow management from changes in the settlement accounts that the firm opened at the bank. Then, as theoretically discussed in the literature, a lender's monopoly of certain relationship specific information about the firm creates an opportunity for the lender to exploit (capture) the firm (Greenbaum et al., 1989; Sharpe; 1990; Rajan, 1992).

Some authors (Stein, 2002; Cole et al., 2004; Berger et al., 2005; Berger and Udell, 2006) argue that small banks with a simpler organizational structure and more flexible decision making processes have a comparative advantage in relationship lending than large and complex banks. In light of this literature, one way to test the relationship lending hypothesis is to examine whether "bank effects" differ in magnitude between large banks and small banks.

To explore the lenders' pricing of loans to SMEs requires comprehensive information, both quantitative and qualitative, about those involved in the lending contract, a lender bank and a borrower firm, about non-price loan contract terms as well as about a lender-borrower relationship. We construct the matched data set of firms and their main banks using the data of the Survey of the Financial Environment (SFE) conducted in Japan, a large economy where SMEs are almost entirely bank dependent.

It is generally perceived that in Japan banks and SMEs are in close relationships.

This is in part because of the well recognized “main bank” system. As Hoshi and Kashyap (2001) argue, financial liberalization in the 1980s enabled large *keiretsu* firms to weaken their ties with their main banks in favor of unintermediated finances such as corporate bonds and commercial papers. Thus, the main bank system was only kept afloat in small business finances where asymmetric information is arguably more serious. Yet, the roles that main banks play in SME finances are not well studied.

Our principal methodological contributions to the extant literature are three. First, by splitting the sample firms into those that borrow from large banks and those that borrow from small banks, we explore the relationship between bank size and a bank’s rent appropriation.

Second, by using valid instrumental variables based on a firm’s balance sheet, we control for the endogeneity due to loan security by collateral. When estimating banks’ behavior of pricing loans to small firms, even though many variables that represent a borrower’s risk characteristics are included as control variables, there could remain an unobserved borrower risk component. A bank likely requests a borrower with high credit risk to secure a loan by physical collateral. Thus, loan security, if included as an independent variable for the regression equation for the lending rate, its coefficient would likely be positive. That is, loan security is correlated with an unobserved component of a borrower’s credit risk, which likely biases the OLS regression estimates. A secured loan to a borrower is less risky to a lender than an unsecured loan to the same borrower. When estimating a lender’s pricing behavior, we should capture the negative effect of loan security on the lending rate. As a key instrumental variable, we employ the ratio of a firm’s real estate holdings to total assets for physical collateral because real estates are the assets most commonly used as collateral in Japan.

Third, we control for another important source of endogeneity that stems from missing borrowing terms. If the sample of firms whose borrowing rate is missing is systematically different from that of firms whose borrowing rate is observed, without utilizing the information about the former sample, the coefficient estimates would unlikely to be bias free. We model the probit model for the probability that a borrowing rate is observed. The probit model's independent variables include an indicator for a firm's short-term loan demand.

Our findings, which, to the best of our knowledge, are new, are four. First, smaller local banks whose non-performing loans are large relative to their total loans charge substantial premiums associated with their unhealthy balance sheet on loans to SMEs. An increase in a small bank's non-performing loans as a percent of total loans by one standard deviation leads to an average increase in the bank's lending rate by 17 basis points. Second, there is no robust result to indicate that similar premiums are charged by larger banks. Third, premiums earned by smaller banks with poor balance sheets do not rise as their relationship with a borrower gets stronger. Fourth, smaller local banks charge higher lending rates in less competitive environments, whereas larger banks do not.

These findings suggest that rents appropriated by smaller banks do not necessarily originate from banks' informational advantage earned through stronger relationships with their borrowers. Our results rather highlight the picture of uncompetitive local credit markets in Japan where local giants, which are "small" relative to nationally operating banks that compete in metropolitan areas, deter deep penetration of other banks including larger nationally operating banks.

The remainder of the paper is arranged as follows. In section 2, theories are discussed and hypotheses are developed. In section 3, data and methodological issues are set out. In section 4, results are reported and interpreted. Section 5 concludes the paper.

2. Theoretical Backgrounds and Hypotheses Developments

The effect of a bank's financial strength on its loan pricing

Hubbard et al. (2002) discuss that without competitive or informational frictions in credit markets banks could not pass the bank specific (increases in) costs such as poor balance sheet health or an illiquid balance sheet on to their borrowers. If a bank offers a higher rate on a loan to a firm in order to compensate for its weak or fragile (less liquid) balance sheet, in a competitive credit market, the firm would be able to find other lenders who do not charge such premiums. Thus, in the equilibrium, no lender would be able to reflect its balance sheet problems on its contractual lending rates.[1] That is, the positive (negative) effects of a bank's weaker (stronger) balance sheet such as poorer (greater) capital adequacy and lower (higher) liquidity on the bank's lending rate, referred to as "bank effects" by Hubbard et al. (2002) are the evidence of the presence of frictions in credit markets.

More rigorously, according to the theoretical model developed by Holmstrom and Tirole (1997), when information about a borrower is not symmetric between a bank that monitors a borrower's project and individual investors who are incapable of monitoring her project, a decrease in a bank's capital adequacy leads to an increase in the bank's lending rates.[2] In light of these theoretical discussions, Hubbard et al. (2002) find that unhealthier banks whose capital adequacy is poorer and non-performing loans are larger relative to total assets charge higher lending rates ceteris paribus. This leads to the following hypothesis.

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[1] One may argue that even absence of pricing of a bank's balance sheet does not contradict the presence of the information monopoly rents. If, for example, banks charge the same premium on top of the competitive lending rate regardless of their balance sheet, the effect of balance sheet on the lending rates are not observed.

[2] As for the balance sheet liquidity, according to Kashyap et al. (2002), a bank is characterized as an institution to provide liquidity not only to demand depositors but also to borrowers in the form of loan commitments. Liquid assets serve for both commitment take down and deposit draw down. Since a bank is able to utilize the information it gathers when setting up commitments for term-lending, a bank's term-lending is constrained to its balance sheet liquidity.

H1. A bank's weaker (stronger) balance sheet such as poorer (greater) capital adequacy and lower (higher) liquidity has a positive effect on the bank's lending rate when a borrower's inherent credit quality and loan security are adequately controlled.

The costs and the benefits of the relationship lending

Boot (2000) defines the relationship lending (banking) as "the provision of financial services by a financial intermediary that i. invests in obtaining customer-specific information, often proprietary in nature; and ii. evaluates the profitability of these investments through multiple interactions with the same customer over time and/or across products." The stronger relationship reduces asymmetric information about a borrower firm's credit risk that exists between the firm and its lender. Thus, as the relationship lending possibly allows a firm, particularly an opaque small firm, access to a loan at terms more favorable than those that would be offered by competing lenders whose information about the firm is limited.

Earlier theoretical studies that regard a long lending relationship as a type of an implicit long-term contract show that, unlike a transaction based lender (an arm's length lender) who does not intend to roll over a loan, a relationship lender is able to exert control over a borrower by threatening to call (not to roll over) a loan if the borrower fails on her investment project and fails to meet the contractual dues, which induces the borrower to exert more effort on her project and the ex-post higher probability of a project's success (Stiglitz and Weiss, 1983; Bolton and Sharfstein, 1990; Boot and Thakor, 1994). That is, the relationship lending works as a disciplinary device to reduce a borrower's moral hazard and thus her credit risk, which likely leads to the reduced lending rate. This leads to the following hypothesis.

H2. The effect of the length of the relationship on the lending rate is negative.

However, a relationship lender's proprietary information about a firm's credit risk gives her opportunities to earn information monopoly rents. There are several theoretical studies to discuss this subject. Greenbaum et al. (1989) claim that a relationship lender's lending rate exceeds her cost of funds when she is better informed about her borrowers than her competitors and borrowers incur costs of searching new lenders. Sharpe (1990) argues that a relationship lender is able to capture the information monopoly rents which give her competitive advantages to offer lower rates to attract new borrowers. Rajan (1992) also suggests the information monopoly rents.[3] This leads to the following hypothesis.

H.3. "Bank effects" increase as stronger relationships enable banks to be more informed about their borrowers.

A large empirical literature about costs and benefits of relationship lending document mixed findings. Some find that the relationship length is negatively associated with the cost of borrowing (Berger and Udell, 1995; Berger et al., 2002; Brick and Palia, 2007), whereas others find the positive association between the two variables (Elsas and Krahnen, 1998; Machauer and Weber, 1998; Degryse and Van Cayseele, 2000; Lehmann and Neuberger, 2001; Degryse and Ongena, 2005).[4] Costs or benefits of longer relationship are also examined in terms of credit availability and collateral requirements, but their results are varied and inconclusive.[5] Other measures for the relationship strength used in the literature include the variables that measure the scope of the relationship such as the dummy variables to indicate that a firm receives

[3] For the extensive review of the theoretical literature on the relationship lending, see Boot (2000) and Ongena and Smith (2000).

[4] Studies including Petersen and Rajan (1994), Elsas and Kranen (1998), Harhoff and Korting (1998), Machauer and Weber (1998) Lehmann and Neuberger (2001) and Lehmann et al. (2004) do not find a significant influence of the relationship length on loan rates.

[5] For the extensive review of the relevant empirical literature, see Degryse and Ongena (2008).

non borrowing financial services such as deposit accounts and the financial management services (Cole et al., 2004) and a dummy variable to indicate whether a firm's lender is its main bank (Elsas and Krahanen, 1998; Machauer and Weber, 1998; Degryse and Van Cayseele, 2000; Lehmann and Neuberger, 2001; Degryse and Ongena, 2005).[6] [7] Yet, the results do not converge.

One of possible causes of the mixed results is that employed measures for the relationship strength do not capture a lender's increased access to the information about its borrower's credit quality (a lender's access to proprietary information about its borrower). Cole (1998), for instance, casts a doubt about the relationship length as a measure for the relationship strength by showing that an increase in the relationship length from the second year of the relationship does not improve credit availability.

Bank organizational structure and the relationship lending

The literature discusses that smaller banks with a simpler organizational structure, which allows more decentralized decision making processes (the smaller organizational distance between a bank's loan officer and its final decision maker), enable their loan officers to make frequent casual contacts with the managers of small firms so that they become specialized in customized relationship lending, whereas larger banks with a centralized and hierarchical organizational structure (the larger organizational distance

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[6] For the review of the studies that examine the scope of financial services provided by a lender, see Degryse and Ongena (2008). The literature largely agrees that incidence of a main bank has a positive influence on collateral pledged by a borrower but has no influence on the loan rate. Main banks may receive more collateral than non-main banks because main banks' borrowers are locked in, but also because main banks are the first lenders to their borrowers to seize collateral assets or can better evaluate these assets than outside banks (Machauer and Weber, 1998; Debryse and Van Cayseele, 2000; Lehmann and Neuberger, 2001; Menkhoff et al., 2006). The functions of the main bank system are beyond the scope of our paper. See Hoshi et al. (1991) and Weinstein and Yafeh (1998) in the context of large Japanese firms' relationships with their main bank. Furthur measures of relationship strength are the number of lenders (Petersen and Rajan, 1994; Harhoff and Koting; 1998; Machauer and Weber, 1998; Menkhoff et al., 2006) and mutual trust (Harhoff and Koting, 1998; Lehman and Neuberger, 2001).

[7] Most of Japanese banks we interviewed mentioned that, regarding SME lending, the information collected from the firms to which they lend as a main bank and that collected from the firms to which they lend as a non-main bank are qualitatively the same.

between a bank's loan officer and its final decision maker) prefer transaction lending solely based on verifiable hard information (Stein, 2002; Cole, et al., 2004; Berger et al., 2005; Berger and Udell, 2006). In other words, large banks make pricing decisions based on the information obtainable by their competitors so that they are unlikely to capture the rents, whereas small banks collect proprietary information and can extract the rents. This leads to the following hypotheses.

H4. The bank effects are observed not in lending rates on loans underwritten by large banks but in those on loans underwritten by small banks.

H3'. The positive association between the relationship strength and "bank effects" mentioned in H3 is observed only when banks are small.

3. Data and Methodology

3.1. Data

The survey used in this study, the Survey of the Financial Environment (SFE) has been conducted annually by the Small and Medium Enterprise Agency (SME Agency) since 2001. The survey was distributed to 15,000 firms randomly drawn from the database named "Financial Information Database" maintained by the Tokyo Shoko Research Corporation (TSR), a private credit research firm, which contains more than 1.2 million firms.[8] The SFE asked firms various questions concerning their relationship with their main bank, which are comparable to questions asked of small firms in the United States by the Survey of Small Business Finances (SSBF). We match each surveyed firm with its main bank from the answers given to the 2002 survey

[8] TSR is a Japanese affiliate of Dunn & Bradstreet that scores Japanese firms based on their internally developed model of a firm's probability of default.

of the SFE, which asked respondent firms to name their main bank.

The 2002 survey of the SFE, which asked all the relevant questions, asked respondent firms to provide answers to questionnaires as of October 31, 2002. The financial data of surveyed firms are compiled by the TSR as well. The data on the firms' main banks are compiled from "Financial Statements of All Banks" published by the Japanese Bankers' Association (JBA), "Financial Statements of All *Shinkin* Banks" and "Financial Statements of All Credit Cooperatives" published by Kinyu Tosho Consulting Ltd.[9]

When linking the SFE survey data with data on main banks, the selected date on which the data on the main banks are recorded is March 31, 2002, the most recent closing date of the fiscal year for Japanese financial institutions as of the survey date. Likewise, the data on each surveyed firm are linked to the TSR financial statement data on the firm at the most recent closing date of the survey year.[10] In addition, credit scores of sample firms rated by TSR were collected in 2002 and qualitative attributes of a firm such as a firm's geographical location, the demographic characteristics of a firm's representative, who is most likely a firm's president or CEO, and a firm's shareholder composition were collected by TSR in 2001 (TSR firm qualitative dataset).

The number of firms surveyed in the 2002 survey of the SFE was 8446. We first drop the firms that do not have their main bank since, in the SFE, regarding a firm's lenders, the information is collected only about a firm's main bank (the sample size is reduced to 7625 firms). We then drop the firms that had switched their main banks in 2002. Because the financial data of banks of sample firms are reported as of March 31, 2002, the most recent fiscal year end before the survey date, the firms that switched their main banks in 2002 are dropped to ensure that the financial data of each firm's

[9] JBA non-member banks, which are unconventional banks such as internet banks, are excluded.

[10] Unlike financial institutions, closing dates are scattered throughout the calendar year. Some firms' most recent financial statements available to us are more than one year (12 months) old as of the survey date so that regarding these firms the newer annual statements should exist. Please also see footnote 12 on the relevant issues.

main bank is exactly those of the bank the firm identifies as its main bank (reduced to 7568 firms). Furthermore, if a firm's main bank is either Resona Trust bank, which does not own the banking account but the trust account only, a government financial institution, an agricultural cooperative, Norinchukin Bank, which is a central institution of an agricultural, a forestry or a fishery cooperative, or a labor bank is dropped (reduced to 7332 firms). When matching the sample of 7332 firms with the sample of 7656 firms in the 2001 TSR firm qualitative dataset, about half of the firms drop from the dataset so that only 3679 firms remain. We admit that this sample size reduction is not desirable, though, without the firm qualitative data, we need to pay the price of losing such an important variable as a firm's geographical location, which is not only important as it is but is necessary in measuring the local credit market competitiveness. Dropping firms that are not small and medium enterprises (SMEs) defined by the Small and Medium Enterprise Basic Law reduces the sample size to 3273.[11] From this sample, dropping firms for which values for the variables we use in the regressions are missing, 2480 firms constitute our base sample.

3.2. Empirical Modeling

Modeling a bank's loan pricing

We examine a lender's bank effects on a bank's loan pricing. To this end, it suffices to model the regression of the lending rate that a lender bank charges on the bank effects after controlling for the credit quality. The first source of the credit risk is of course a borrower's inherent credit characteristics. The risk of the credit contract, however, can be effectively controlled by loan security. When a loan is collateralized, in theory, the credit risk should be reduced. Therefore, a bank's loan pricing is modeled as follows.

[11] For the definition of an SME, see Appendix A.

$$r_i = \alpha_0 + BE_i\alpha_1 + (RELAT_i \times BE_i)\alpha_2 + BC_i\alpha_3 + \alpha_4 LNLENGTH_i + RELAT_i\alpha_5 + FIRM_i\beta + \gamma COLLATERAL_i + \varepsilon_i \quad (1)$$

r_i is a firm i's borrowing rate from its main bank. The loan rate surveyed in the SFE is the highest rate on a loan with a maturity less than one year borrowed from a firm's main bank so that there is only a single observed loan rate for each firm.[12] To be clear, a firm's main bank is firm specific but the same bank can be shared by multiple sample firms as their main bank. BE_i is a vector of variables that measure firm i's main bank's financial health and/or its performance. $RELAT_i$ is a measure for the strength of firm i's relationship with its main bank. The interaction term $RELAT_i \times BE_i$ is included in order to test on H3. The coefficient vector of BE_i, $\alpha_1 + RELAT_i \times \alpha_2$ represents "bank effects." In light of H1, some coefficients in this vector are expected to be, on average, negative.[13] In light of H3, the sign of α_2 is expected to be negative. BC_i is a vector of the other bank specific controls. $LNLENGTH_i$ is the logarithm of firm i's relationship with its main bank. In light of H2, α_4 is expected to be negative. $FIRM_i$ is a vector of the variables that are meant to measure firm i's risk and demographic characteristics. $COLLATERAL_i$ is a dummy variable that indicates that

[12] This footnote is related to footnote 10. Since firms report neither the date of contract for a loan whose rate they report, which is the rate on a short-term loan with maturity less than one year (12 months) nor the exact maturity of the loan, we are unable to tell exactly which of available statements are the most recent to a lending bank when pricing the loan. For example, if for some firm the surveyed loan rate is 364 days old as of the survey date (October 2002), then the loan was made in October 2001. If this firm's annual financial statements are recorded every January, the most recent statements available to the lending institution when making the loan were recorded in January 2001. If, on the other hand, the loan's maturity is less than one month and was made in October 2001, and the firm's annual statements are recorded every September, the most recent statements available to the lender when making the loan were recorded in September 2002. Thus, in order to keep the sample size large, the firms whose most recent statements prior to the survey date are recorded from January 2001 to September 2002 are kept in the sample. As robustness tests, we examined the following two samples; the sample of firms whose most recent financial statements were reported from September 2001 to September 2002 (one year period prior to the survey date) and the sample of firms whose statements were reported from April 2001 to March 2002 (the fiscal year 2001 for governments and financial institutions). The results of subsequent analyses remain unchanged.

[13] The interpretation of the coefficient of the ratio of non-performing loans to total loans (BNPLLOAN in Table 1) is opposite to those of other bank health variables. In light of H1, the sign of this variable is positive.

firm i currently pledges physical collateral to its main bank.[14] The facility size is not included since the facility size is not surveyed in the SFE. There are papers which argue that the facility size does not affect the loan rate.[15]

The variables included in BE are the risk based capital adequacy ratio (BBIS), the ratio of non-performing loans to total loans (BNPLLOAN), the ratio of liquid assets to total assets (BLIQUID) and the ratio of net income to total assets (BROA). Regarding BNPLLOAN, non-performing loans are defined as the sum of loans to failed enterprises, loans whose interest payments have been suspended, loans whose interest payments have been suspended for 3 months or more and loans with concessions. Regarding BLIQUID, liquid assets are defined as a sum of cash and due from banks, call loans and investment securities.[16] Regarding the choice of variables included in BE, there are some differences from Hubbard et al. (2002). First, BBIS replaces the book based capital to total assets ratio because Japanese banks are subject to risk based capital requirements but not to the leverage ratio requirement. Second, BNPLLOAN replaces non-performing loans to total assets ratio because the latter is decomposed into BNPLLOAN and total loans to total assets ratio, a bank's choice variable that represents the bank portfolio risk. BNPLLOAN alone is a more accurate measure for bank health. Third, loan loss provision to total assets ratio is not included because this variable and BNPLLOAN are very highly correlated and inclusion of the two destabilizes the regression results due to multicollinearity.

The variables included in BC are three bank type dummies that indicate a firm's

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[14] The SFE does not ask a respondent firm about collateralization of a specific loan corresponding to the surveyed rate, the highest short rate agreed between the firm and its main bank because to do so likely misleads the firm. In Japan, it is a common practice that the assets that are pledged as collateral are designated as "root" collateral (*netanpo*) that are deemed to cover not only the present loan contract but also incoming future contracts. Thus, pledged collateral usually does not correspond to a specific loan contract one for one. In addition, should there be a default, what matters to a lending bank is not the recovery of each individual loan but the recovery of all the loans that the firm owes to the bank. Thus, even though the highest borrowing rate surveyed in the SFE may not be the rate on a collateralized loan, collateral may have an effect to reduce a loan risk.

[15] For the empirical evidence, see Hubbard et al (2002) for example.

[16] This is the bank balance sheet's liquidity measure used in Kashyap et al. (2002). Kashyap and Stein (2000) use the sum of cash and due from banks and securities as the liquidity measure.

main bank's bank type, REGIONAL for a regional bank, REGIONAL2 for a regional 2 bank and COOPERATIVE for a *shinkin* bank or a credit cooperative and the Herfindal Hirschman index for the number of branches in the prefecture that a firm's main bank is headquartered in (HHI).[17] Bank type dummies are meant to control for systematic institutional differences among lenders and bank size.[18] HHI is meant to measure a firm's main bank's competitive environment. We are unable to determine a measure for RELAT a priori since to do so involves not only theoretical concerns but also data specific empirical issues, which will be together addressed in Section 4.

The variables included in FIRM are the variables that measure a firm's solvency and liquidity such as a firm's credit score rated by TSR (SCORE), the ratio of capital to total assets (CAPITAL), the logarithm of total assets (LNTASSET) and the current ratio (the ratio of current assets to current liabilities, CURRENT). As additional control variables, we include the variables that capture a firm's demographics such as the logarithm of firm age (LNFAGE), the dummy variable to indicate that a firm's representative (president/CEO) is the firm's top shareholder (OWNER), the logarithm of a firm's representative's age (LNAGE) and a dummy variable to indicate that a firm's representative's educational attainment is four year college degree or more advanced

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17 For city, trust and long-term credit banks, the number of branches as of 2002 was obtained from *Nihon Kinyu Meikan* 2003 published from *Nihon Kinyu Tsushinsha*. For *shinkin* banks and credit cooperatives, they are assumed to have all of their branches within a prefecture that their headquarters are located in as by law they are required to operate in an area within a prefecture that their headquarters are located in.

18 "Major" banks including city and trust banks constitute the base group. Regional banks operate primarily within their home prefecture. Regional 2 banks are former mutual banks that operate primarily within an area smaller than a prefecture. *Shinkin* banks are small credit associations. Although the three types except for *shinkin* banks and credit cooperatives have no legal differences under the current Banking Act, in practice, they have been regulated separately. *Shinkin* banks and credit cooperatives are separately regulated under the *Shinkin* Act and the Credit Cooperative Act, respectively. *Shinkin* banks and credit cooperatives are grouped together because less than 10 firms have a credit cooperative as their main bank. It is generally true that "major" banks are the largest, regional banks are the second largest, regional 2 banks are the second to the smallest and cooperatives are the smallest. There are some exceptions. Hokuyo Bank, a regional 2 bank, is larger than most regional banks because it acquired most assets of a failed city bank, Hokkaido Takushoku Bank. Some *shinkin* banks are larger than regional 2 banks. Kano et al (2011) also employ bank type dummies to represent bank size.

(EDUC), as well as region and industry dummies.[19] OWNER likely serves as another risk measure since an owner managed firm may have greater risk appetite than a dispersedly owned firm.

Loan security

Equation (1) is meant to capture a bank's pricing behavior. Accordingly, COLLATERAL represents collateral's effect to reduce loan risk. Hence, from a loan pricing perspective, the expected sign of the coefficient of COLLATERAL is negative. Yet, the correlation between COLLATERAL and the short lending rate is found to be indeterminate in the literature.[20] This is because it is a common practice that a bank approves a loan application of a high risk firm conditional on loan security by physical collateral. In other words, an indicator for loan collateralization alone serves as a proxy for a firm's credit risk. As described above in our regressions, a borrower's credit risk is controlled as much as possible. There remains, however, a possibility that the unobserved risk factor in the error term ε_i is correlated with COLLATERAL. The trouble is that endogenous independent variables not only bias the estimated coefficients of themselves but also likely bias the estimated coefficients of other variables. In our context, without resolving endogeneity of COLLATERAL the estimates of the coefficients for the variables of our primary interests would be biased.

In order to obtain bias free coefficient estimates, we employ instrumental variables for COLLATERAL.[21] The employed instrumental variables are the ratio of real estates

[19] The regions considered are Hokkaido, Tohoku, Kanto excluding Tokyo, Tokyo, Chubu, Kansai, Chugoku, Shikoku and Kyushu. The industries considered are manufacturing, construction, communications and telecommunications, wholesale, retail, real estate, services and dining and "other."

[20] Berger and Udell (1990) and Machauer and Weber (1998) find the positive correlation between the lending rate and collateralization of a loan. Degryse and Van Cayseele (2000), Cressy and Toivanen (2001) and Pozzolo (2004) find the negative correlation.

[21] Steijvers and Voordeckers (2009) survey recent discussions of studies addressing endogeneity of collateral. Brick and Palia (2007) examine the similar simultaneous equation model of collateral and fees. In the United States, lines of credit, which charge a fee when set up, are widely contracted for short-term loans. In Japan, charging fees had been unlawful. It was only after the reform of the relevant law in March 1999 that charging fees became lawful only in the cases of lines

to total assets (REALRATIO) and a dummy variable to indicate that a firm's representative owns residential home (HOME) interacted with the average price of residential lands in a prefecture that a firm is located in (LANDPRICE).[22] The land price is interacted with the indicator of home ownership but is not interacted with REALRATIO because the numerator of REALRATIO is based on the sum of values of a firm's properties evaluated at some price albeit likely being a historical price and multiplying a current average land price to REALRATIO would lead to the value of each property multiplied by another different price. In this spirit, HOME is a dummy variable that is not valued in monetary term so that interacting this variable with local land price is valid. In Japan, real estates dominate collateralizable assets. Movable assets such as account receivables and inventories are barely used as collateral. Thus, the firms that hold larger real estates relative to their size are more likely to offer to pledge physical collateral to their main bank. Farinha and Santos (2002) share our spirit and use the ratio of tangible assets to total debts as a proxy for a firm's ability to pledge collateral when running regressions for the number of lender banks.[23] Likewise, firms, particularly small firms often pledge their owner's personal real estates to their main bank. If a firm's representative is a home owner, the firm has additional collateralizable assets along with properties that belong to the firm.

In Japan, presence of public credit guarantees in SME lending is large. In our base sample, 53% of firms obtain public credit guarantees on loans from their main bank. As Ono and Uesugi (2009) do for their analysis of private loan security, we

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of credit. For this reason, fees are not the important non-price terms of loan contract in Japan.

[22] Land prices by prefecture in 2002 are compiled from the Public Notice of Land Prices released by the Ministry of Land, Infrastructure, Transport and Tourism.

[23] Regarding the simultaneous equation system estimated by Brick and Palia (2007), the only significantly estimated coefficient is that of a dummy variable that is set to unity if either the principal owner or the firm has ever defaulted. This variable, however, is a proxy for a firm's credit risk and should be included as an independent variable. Bharath et al. (2011) use loan amount relative to total debt as an instrument for collateralizaton. They, however, use this variable as an instrument to identify a bank's collateral requirement rather than a firm's tendency to pledge collateral. Thus in our context of identifying a bank's loan pricing behavior, the variables used in the literature are not valid.

decide to drop firms whose loans are partially or entirely publicly guaranteed. Sample profiles are vastly different between the firms with publicly guaranteed loans borrowed from their main bank and those without. As demonstrated in Table A2, the firms with publicly guaranteed loans are, relative to those without, which are described in Table 1, small firms with a weak balance sheet (a low capital to total assets ratio and a low current ratio) and a low credit score that are frequently required to collateralize loans and are charged a high borrowing rate by their main bank. The anecdotal evidence based on our interviews of Japanese banks shows that the pricing of publicly guaranteed loans is highly distorted. When facing a high risk applicant, a bank requests the applicant to obtain a guarantee up to the guarantee limit available to her and then price an unguaranteed exposure. A bank can request a riskier firm to secure a greater proportion (amount) of loans to that firm with public guarantees at the cost of a higher amount of fees that the firm pays to a local Credit Guarantee Corporation, a government insured semi public guarantor, so that the bank is able to collect more from its existing loans when the firm defaults.[24] On the other hand, the greater the extent that loans borrowed by the firm is covered, the less risky a loan to that firm should be. One would need some valid instrumental variables to control for the endogeneity stemming from the CGC guarantees' coverage. Few variables, however, adequately capture a firm's incentives to obtain public guarantees.[25] For a reference, the major regressions run on the sample of the firms without publicly guaranteed loans, which will be soon discussed in section 4, are run on the sample of the firms with publicly guaranteed loans and their results are briefly discussed in Appendix B.

Sample selection

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[24] For details about the institutional backgrounds of the public guarantee system in Japan, see Uesugui et al. (2010).

[25] Uesugi et al. (2010) find that the ratio of long-term loans to total loans borrowed by a firm is positively related to the likelihood that a firm obtains public credit guarantees. This is because public guarantees are primarily aimed at but not limited to promoting long-term loans.

The short-term borrowing rate, our dependent variable is missing for 261 firms, roughly 21 percent of 1216 sample firms. Is it valid to run the regressions on the sample of only firms whose borrowing rate is observable? If 261 firms are randomly drawn from the base sample, the regression estimates would be bias free. Otherwise, there would be sample selection biases in coefficient estimates. There are primarily three possibilities for the missing short-term borrowing rate for a firm. First, the firm simply missed to report its borrowing rate though it actually borrowed from its main bank. Second, the firm had no short-term borrowing demand from its main bank at the time of survey. The firm either had no short-term borrowing demand or it successfully borrowed sufficient short-term loans from banks other than its main bank. Third, the firm had its short-term loan applications rejected.

At least the sample of firms whose borrowing rate is missing for the second or the third possibility is not the sample randomly drawn from the base sample. The third possibility is discussed in the context of availability of credit in relation to the relationship lending separately from terms of credit (Angelini et. al, 1998; Lehmann and Neuberger, 2001). When a loan applicant turns out to be risky, a bank either turns down her application, or offers her a high lending rate, which she may not necessarily accept. Thus in this case, as in the case of loan security, the probability that a firm's borrowing rate is missing and its borrowing rate are certainly not independent. Therefore, we model the sample selection mechanism in the following manner.

$$\Pr(y_i = 1) = f\left(BE_i, RELAT_i \times BE_i, BC_i, LNLENGTH_i, RELAT_i, FIRM_i, COLLATERAL_i, IV_i^y\right) \tag{2}$$

Where y_i is a dummy variable to take a value of one if firm i's borrowing rate on a short-term loan from its main bank is observed. IV_i^y is an exogenous instrumental variable for the selection probability. The employed instrumental variable is a dummy variable to indicate that a firm made applications of loans for the short-term use in nature from its main bank during one year period until the date of survey (SHORTAPPLY). SHORTAPPLY is meant to capture a firm's short-term borrowing demand from its main bank.[26] In practice, the inverse Mill's ratio is added to a set of independent variables for equation (1). We do not employ instrumental variables that capture the likelihood that a firm is turned down a loan because this likelihood reflects the firm's credit risk and thus endogenous.

4. Results

4.1. Summary Statistics

Table 1 displays the definitions of the variables employed in the empirical anlyses and Table 2 presents the descriptive statistics of the variables used in the regressions. First, the short-term borrowing rate is 1.651 percent on average. Second, our sample firms are relatively large SMEs. The medians of total assets, sales and employment are 1,784 million yen, 2,167 million yen and 47 so that their size is larger than that of firms surveyed in the SSBF.[27] The average firm age is 46 years old. The lending relationship is on average 32 years long, which is considerably longer than the average relationship length found for small firms in the United States (11 years in Berger and Udell, 1995; 8 years in Cole, 1998) but is comparable to that found for the medium sized German firms (25 years for annual turnover of about 30 million USD to 43 million

[26] SHORTAPPLY takes a value of 1 if a firm made loan applications for current working funds, seasonal funds, working funds for increased production, bridge funds, working funds for decreased production, funds to cover loan repayments and or funds to cover deficits.

[27] Since the SME basic law designates a firm as an SME if the firm's employment is not large or its equity is not large, firms that are very large either by the employment standard or by the equity standard are included in the sample. For instance, one may wonder whether a firm with 4606 employees, the largest employment by a sample firm, distorts the results. As a robustness check, we dropped firms that hire more than 300 employees and examined the results. The results did not change substantially (results are not reported).

USD, Elsas and Krahnen, 1998). As for loan security, 63 percent of sample firms pledge physical collateral to their main bank.

As for the distribution of main banks of our sample firms, 1215 firms in the base sample named 173 financial institutions as their main bank. They comprise of 10 "major" banks including 7 city banks and 3 trust banks (of 7 city banks, 8 trust banks and 2 long-term credit banks, and 38 percent of sample firms named major banks as their main bank), 63 regional banks (of 64 regional banks, 45%), 32 regional 2 banks (of 56 regional 2 banks, 9%), 68 *shinkin* banks and credit cooperatives (of 572 *shinkin* banks and credit cooperatives, 8%).[28]

4.2. Results

<u>Regressions without an interaction term of a relationship strength measure and a bank effect variable</u>

Table 3 shows the regression results for banks' loan pricing. The inverse Mills ratio obtained from the probit regression for equation (2) is included. Interaction terms $RELAT_i \times BE_i$ are dropped to examine what variable in the vector BE_i is relevant to loan pricing. If by any chance coefficients of some variables are statistically significant, one of them is interacted with a relationship strength measure one by one. We are reluctant to interact many variables with the same variable measuring the relationship strength to avoid serious multicollinearity.

Columns 1 and 2, 3 and 4 and 5 and 6 present the results for the full base sample, for the sample of firms whose main bank is small (the small bank borrower sample) and for the sample of firms whose main bank is large (the large bank borrower sample).

[28] Mizuho Financial Group was formed as a three way mergers among Daiichi Kangyo Bank, Fuji Bank, both of which were city banks, and Industrial Bank of Japan, a long-term credit bank, in April 2002. Mizuho FG owns two city banks, Mizuho Bank and Mizuho Corporate Bank. Thus, a firm that named either Mizuho Bank or Mizuho Corporate Bank had one of the three banks as its main bank as of March 2002. Since we are unable to identify which of the three merging banks was the firm's main bank as of March 2002, we constructed hypothetical Mizuho Financial Group by adding numbers for the three merging banks for each financial statement item.

Large banks are sample firms' main banks whose total assets are greater than the sample median. To be clear, the sample based on which the median is obtained is the sample of 1215 firms rather than the sample of banks so that the sample firms are evenly split between firms whose main bank is large and those whose main bank is small. 19 large banks are identified in this way.[29]

Since the coefficients of the inverse Mill's ratio are statistically significant at the 10 percent level for the full sample when the standard error is unadjusted for the first stage probit regression (unadjusted standard errors are not reported), the standard error is corrected for the first stage for all the samples following the methodology explained in Wooldridge (2002).[30] Regarding the full sample and the large bank borrower sample, small p values for the J statistics suggest that orthogonality conditions between our instrumental variables and an error term in the loan pricing equation are less likely to hold. In addition, for these samples, large p values for the C statistic, which is described in pages 232 and 233 of Hayashi (2000), suggest that the null of exogenous COLLATERAL is not rejected and the fact that a t statistic for endogeneity of COLLATERAL developed by Hausman (1978) is also small, which does not reject the null of exogenous COLLATERAL, either. Nevertheless, the OLS coefficient estimates, which are omitted for brevity, and the 2SLS estimates are qualitatively similar each other so that the 2SLS results are presented.[31]

For the full sample, among the coefficients of bank effect variables, statistically significant coefficients are a positive coefficient of BNPLLOAN and a negative

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[29] The median of total assets of 699 sample banks is 160,132 million yen. Only thirteen firms' main banks are banks whose total assets are less than 160,132 million yen.

[30] According to Wooldridge (2002), when the coefficient of the inverse Mill's ratio obtained from the first stage is significant, the statistical inference based on the unadjusted second stage standard errors is incorrect. The detailed methodology is explained in Appendix C.

[31] The test developed by Hausman (1978) is explained in page 119 of Wooldridge (2002). Essentially, a large t statistic implies that the 2SLS estimates are statistically different from the OLS estimates rather than that a variable COLLATERAL is exogenous. The positive and significant coefficients of COLLATERAL for the full sample and the large bank borrower sample are counterintuitive as bankers we interviewed themselves admit that, based on their internal loan pricing manual, they at least do not charge a positive spread on a secured loan to any given firm relative to the rate on an unsecured loan made to the same firm.

coefficient of BLIQUID. The effect of BNPLLOAN is positive and significant for the small bank borrower sample whereas none of coefficients of bank effect variables is significant for the large bank borrower sample. The effect of BNPLLOAN on small banks' loan pricing is not only statistically significant but also economically significant in the very low interest rate environment.[32] An increase in BNPLLOAN by one standard deviation leads to an increase in the lending rate by 17 basis points.[33] As for BROA, there is a possible reverse causality. As discussed earlier, for some firms, the borrowing rate could have been surveyed before its lender's financial statements had been reported. Thus, a bank that charged higher rates is likely more profitable than the bank that did not. When BROA is dropped from the regression, the results are unchanged (columns 2, 4 and 6). These findings support both H1 and H4. Frictions are present in lending markets for SMEs, particularly when lenders are small.[34]

The coefficients of bank type dummies that indicate a non-major bank tend to be positive and statistically significant for the full sample, whereas none of coefficients for bank type dummies is significant for large and small bank borrower samples. The coefficient of HHI is positive and significant for the full sample. Looking at the results for sub samples, as it turns out, the coefficient of HHI is positive and significant only for the small bank borrower sample. The coefficient of LNLENGTH is statistically insignificant, thus rejecting H2. Therefore, our finding contradicts the hypothesis that

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[32] As a reference, the average of the short borrowing rate (SHORTRATE) over the small bank borrower sample is 1.797.

[33] The standard deviation of BNPLLOAN for the small bank borrower sample is 0.032 (not reported), whereas that for the full sample is 0.031 (reported in Table 2). Regardless of which sample is used to calculate the standard deviation, the resulting number to measure the BNPLLOAN's effect on the lending rate does not change much.

[34] There is an alternative view that the positive coefficient of BNPLLOAN captures a borrower's risk. Hard financially pressed small banks lend to hard pressed (riskier) customers to earn sufficient interest rate so as to relieve their capital constraint. Admittedly, our variables to control a firm's risk may be inadequate. This view, however, is implausible because our sample firms have had long relationships with their main banks (on average 32 years). Should this view be true, small banks would switch borrowers frequently depending on their financial health. Yet, they have not done so. When a subsample of firms with their main bank relationship no less than 33 years is used, the coefficient of BNPLLOAN remains almost the same for small bank borrowers (results are not reported). This finding about long-lived relationships reinforces the positive coefficient of BNPLLOAN as a bank side effect.

a longer contract is used by a bank to discipline borrowers.

As for firm characteristics variables, the coefficients of SCORE are negative and statistically significant for all the three samples, indicating that a firm's external credit score is an important determinant of the lending rate.[35] Regarding the variables based on financial statements, the only statistically significant coefficients are negative coefficients of LNTASSSET, particularly for the large bank borrower sample. Apparently firm size is a more important factor for large banks than for small banks. The absence of significant coefficients of financial ratios does not mean that banks disregard solvency or liquidity measures based on financial statements, because SCORE, a summary variable based primarily on financial statements, is an important variable for loan pricing regardless of bank size. The positive and significant coefficient of OWNER found only for the small bank borrower sample suggests that small banks have an ability to infer an owner managed firm's risk appetite, whereas large banks do (need) not.

The coefficient of COLLATERAL is statistically insignificant for all samples but is negative for the small bank borrower sample and very small but positive for the large bank borrower sample. These results imply that, when a firm pledges physical collateral to its small main bank, the bank not only prices loan security itself but also assesses spill over of physical collateral's security on overall claims to the firm, for the firm's highest borrowing rate from its main bank, the rate surveyed in the SFE, among rates on possibly multiple loan contracts from the same bank, is presumably frequently unsecured. The inverse Mill's ratio is negative but is statistically insignificant for all the samples. The issues involving the endogeneity of collateral as well as the influences of sample selection on the empirical results will be discussed further in the next subsection.

[35] In our interviews, most banks agree that they refer to a firm's credit scores rated by TSR and Teikoku Databank when reviewing a loan application from the firm.

What measure for the relationship strength?

The remaining issue for running regressions of equation (1) is to choose a variable to measure the strength of a firm's relationship with its main bank. In the SFE, three candidate variables are available; the relationship length between a firm and its main bank (LENGTH), the scope of the relationship as measured by the number of non-loan services provided by a firm's main bank (SCOPE) and the distance between a firm and its main bank's branch that a bank's loan officer in charge of the firm belongs to (DISTANCE).[36]

The validity of the relationship length, which is by far the most often used measure for the relationship strength, is not warranted. According to Cole (1998), using the data of the SSBF, the preexisting borrowing relationship with its lender per se improves a small firm's chance of having its new loan application approved, but no evidence is found to indicate that a further extension in the relationship length from the second year drives a bank's approval decision in the borrower's favor. Even Berger and Udell (1995) who claim the negative coefficient of the relationship length for loan rate using the SSBF discuss that "no additional information is revealed after 30 years." Remember, in our dataset, the relationship is on average 32 years long. After such a long relationship, the further acquisition of information useful in loan pricing by extending a relationship one more year is unlikely.

The problem with SCOPE is that, as in the case of loan security, the number of non-loan products is an endogenous variable. When pricing a loan, a bank takes into account revenues earned from non-loan products. If such revenues are high, a bank

[36] In the SFE, a respondent firm is asked to choose one of the following 8 alternatives for the distance between the firm and its main bank's branch that manages the firm's loans, no greater than 500 meters, greater than 500 meters but no greater than 1 kilometer, greater than 1 kilometer but no greater than 10 kilometers, greater than 10 kilometers but no greater than 30 kilometers, greater than 30 kilometers but no greater than 50 kilometers and greater than 50 kilometers. To each alternative, we assigned 0.25 kilometer, 0.75 kilometer, 5.5 kilometers, 20 kilometers, 40 kilometers and 100 kilometers.

may offer a firm a reduction in the lending rate even though non-loan products are not explicitly tied to the loan contract.

As for DISTANCE, a bank's branching decisions do not depend on the location of any given small firm, so that, from the bank's loan pricing point of view, it is undoubtedly exogenous. A bank whose branch is located near its borrower is able to frequently visit and monitor the borrower. Therefore, the soft information about the borrower easily transmits to the bank when the loan officer reports at the branch upon return. Dygryse and Ongena (2005) find that a firm's closeness to its lender increases the lending rate. Petersen and Rajan (2002), on the other hand, discuss that the trend of historically increasing distance between a bank and its borrower is the evidence that the hard information becomes more useful for assessing the firm's credit quality and gradually substitutes the soft information. For these reasons, we employ DISTANCE as a measure for the relationship strength.[37]

Regressions with an interaction term

The primary objective to study equation (1) is to examine whether the bank effect on loan pricing originates from the relationship strength. As the presence of the bank effect is not confirmed for the firms whose main bank is large, we focus on the firms whose main bank is small. As Table 4 documents, when the interaction term between BNPLLOAN and LNDISTANCE is included, the coefficient of this interaction term is not statistically significant. The coefficient of BNPLLOAN itself is positive and statistically significant albeit slightly lower than the one obtained when the interaction term is excluded because its effect is now partly absorbed in the insignificant coefficient

[37] As it happens, variance inflation factors for the interaction term of the relationship strength measure and BNPLLOAN and for the relationship strength measure itself, when LENGTH or SCOPE is tested as the relationship strength measure in running regressions for equation (1) , were both very large (far greater than 10), implying that the multicollinearity posits a serious challenge (results are not reported). One manifestation of the problem is very large estimated standard errors, which is one of typical symptoms of the multicollinearity (results are not reported).

of the interaction term. The other estimated coefficients are qualitatively similar to those reported in Table 3. H3 is not supported. The coefficient of LNDISTANCE is not significant. It does not seem that the bank effect increases (decreases) with the proximity (distance) between a firm and its lender.[38]

4.3. The Effects of Endogeneity

Table 5 demonstrates comparisons of the results of regressions for small bank borrowers estimated using instrumental variables to control for endogeneity and those not using them. More specifically, columns 1 and 2 present the OLS regression results. Columns 3 and 4 present the results of the 2SLS regressions without the inverse Mills ratio obtained from the probit regression for equation (2). Columns 5 and 6 show the results of the baseline regressions from Table 1. To be clear, the comparison of columns 1 and 2 and columns 3 and 4 tells us to what extent endogeneous pledged collateral affects the estimated coefficients. Similarly, differences in the coefficient estimates reported in columns 3 and 4 from those reported in columns 5 and 6 are the influences of sample selection.

Collateral

The most remarkable difference between the results in columns 1 and 2 and those in columns 3 and 4 is that the coefficient of COLLATERAL is positive and significant when COLLATERAL is not instrumented (columns 1 and 2) and the same coefficient is negative and insignificant when it is instrumented (columns 3 and 4). This implies that our instrumental variables, particularly REALRATIO, effectively capture a firm specific factor, which is exogenous to a bank’s loan pricing decision, to increase the likelihood

[38] To say that H3 is rejected may be overstatement. This is because our measure for the relationship strength, DISTANCE, which is more preferred to other available measures statistically as well as conceptually, may likely fail to measure the increased information through the strengthened relationship.

that a firm pledges collateral to its main bank.[39] [40] Thus, when COLLATERAL is not instrumented, the endogenous effect that a bank requests a risky firm to collateralize loans dominates the weak risk reducing effect of loan security, which is identified only when COLLATERAL is instrumented. This is methodologically novel because it is our instrumental variables that lead to a plausible negative coefficient.[41] The formal tests such as the C statistics and the t statistic prefer 2SLS estimates to OLS estimates at the 10 percent significance level, supporting endogeneity of COLLATERAL. The effect of COLLATERAL on the loan rate is weak most likely because collateral pledged by a firm to its main bank does not necessarily cover the loan whose rate is surveyed in the SFE. Regarding coefficients of variables other than COLLATERAL itself, the coefficients of two important variables, BNPLLOAN and OWNER are substantially underestimated when COLLATERAL is not instrumented. In particular, the 2SLS estimate of the spread for a firm whose largest shareholder is its representative is 43 basis points when its OLS estimate is merely 31 basis points.

Sample selection

Earlier, we mentioned that the significant coefficient of the inverse Mill's ratio based on the standard 2SLS formula without standard error corrections is the evidence that the sample of firms with an observed borrowing rate from their main bank is not randomly drawn. In theory, the endogenously selected sample generally leads to biased coefficient estimates. Comparing columns 3 and 4 and columns 5 and 6, the

[39] The statistics based on the first stage results including the F statistic for excluded instrumental variables for the linear regression equation for COLLATERAL and the z statistic for SHORTAPPLY, an excluded instrumental variable for the probit model for the likelihood that a firm's borrowing rate on a short-term loan from its main bank is observed, are reported in each table.

[40] When as in Farinha and Santos (2002) the ratio of real estates to total debts (REALDEBT) is used as an instrumental variable instead of standardizing real estates by total assets, the results are essentially the same (results are not reported). We decide to present the results with REALRATIO because its correlation with COLLATERAL happens to be stronger than the correlation of REALDEBT with COLLATERAL.

[41] Taking advantage of the Italian data where a firm's multiple loans from different lenders are surveyed so that a firm specific effect would control for the time invariant firm specific risk, Pozzolo (2004) finds the negative and significant coefficient of collateral in the regression for loan rate.

coefficients of BNPLLOAN is smaller in the former than in the latter by about 6 percent. The sample selection likely is a cause for an underestimated bank effect. As for the validity of the first stage, the coefficient of SHORTAPPLY is statistically significant at the 1% significance level indicated by a z statistic, which implies that SHORTAPPLY, an indicator for a firm's short term borrowing demand, is a strong instrumental variable that is firm oriented and is independent of a bank's loan pricing.

4.4. The Credit Market Concentration and Loan Pricing

The sharp contrast between large banks and small banks in loan pricing is found not only in the coefficients of bank effect variables but in those of HHI, e.g., the strong positive effect of the concentrated lending market for small banks and the absence of such an effect for large banks. As Degryse and Ongena (2008) summarize in their Table 1, the literature largely agrees that the cost of borrowing is positively related to a higher HHI but is silent about the fact's heterogeneity across banks. Our findings suggest that small banks rather than large banks are monopolistic. Taking the finding with respect to HHI at face value, small banks are able to take advantage of the less competitive market, whereas large banks do not.

Table 6 shows the results of the regressions with the interaction term between BNPLLOAN and HHI as an additional independent variable for the small bank borrower sample. The regressions are run using the OLS (column 1), the 2SLS without sample selection consideration (column 2) and the 2SLS with sample selection consideration (column 3). In column 2, the coefficient of the interaction term is statistically significant at the 10 percent significance level, whereas neither the coefficient of BNPLLOAN nor that of HHI is significant at the 10 percent level.[42]

[42] Insignificant or weakly significant coefficients of the cross product between BNPLLOAN and HHI are in part due to increased standard errors resulting from multicollinearity among BNPL, HHI and their cross product. Variance inflation factors of BNPL, HHI and their cross product are 11.08, 13.88 and 20.45, respectively, for the regression whose results are reported in column 1, 12.22, 16.18 and 24.47, respectively, for the regression whose results are reported in column 2 and 11.01, 14.05

This fact suggests that frictions as proven by the positive coefficients of BNPLLOAN reported earlier could be more pronounced in concentrated lending markets. This reinforces our view that the frictions are not necessarily created through banks' relationship building. Rather, banks operating in concentrated markets are more easily able to take advantage of the frictions than those operating in competitive markets.

Our findings do not rule out the possibility that asymmetric information lies behind the frictions. According to Dell'Ariccia et al. (1999), while a locally large bank that has had lending relationships with a large number of local firms captures high quality borrowers and earn a positive profit, a local competitor who is unable to tell high quality new borrowers from low quality borrowers who were once rejected by the large bank is forced to earn zero profit, which then blocks other banks to enter the market as they would have to incur a loss as borrowers left to potential entrants include those who were rejected by both incumbents.

Remember small banks in our sample are defined in a relative term. The concentration in a small prefecture is attributable to a small number of "small" banks that are locally influential. As incumbents, such local banks are able to block other banks from penetrating deep into their home markets. Large banks in our sample, on the other hand, generally operate in more competitive markets: city and trust banks are based in metropolitan areas such as Tokyo and Osaka and large regional and regional 2 banks are based in populous industrial prefectures.

4.5. Alternative Definitions of Large and Small Banks

We defined large banks and small banks by splitting the sample firms by half based on their main bank's total assets. Arguably, this way of sub sampling is heavily dependent on the sample distribution. Alternatively we can define large and small banks based on the bank type as done in Kano et al. (2011). Specifically, one can

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and 20.39, respectively, for the regression whose results are reported in column 3.

designate "major" banks, which include city and trust banks in our sample as large banks and all the others as small. Not only historically are Japanese banks divided into "major" banks and others, but also this division is not merely nominal since the Financial Services Agency, the current Japanese regulator, draws the line between the two. For example, in October 2002, which happens to be the date of survey used in our study, the FSA instituted a tough initiative against "major" banks, the Program for Financial Revival, which requested banks to halve non-performing loans as a percent of total loans by March 2005. Regional, regional 2 and cooperative banks were all exempted from the Program.

Table 7 shows the results based on the abovementioned alternative sub sampling. The results found in Tables 3 and 4 are largely robust. One exception is that the coefficient and the associated standard error of BBIS jump up sharply for the large bank borrower sample when BROA is included as an independent variable. This anomaly, however, is likely a statistical artifact. For this sample, BBIS and BROA are very highly correlated. The correlation coefficient between the two variables is 0.88 (not reported), which results in an astonishingly high variance inflation factors (VIF) for the two variables.[43] The high correlation could be a side effect of a substantially reduced number of large banks based on the alternative definition. There are only 10 "major" banks in our sample.[44] A caveat is that the reduced number of large banks leads not only to a higher correlation between BBIS and BROA by chance but also leads to less sample variation in each bank effect variable, which may obscure the results statistically. When BROA is excluded, as anticipated, the results for the large bank borrower sample are qualitatively the same as the results reported in Table 3, although the coefficient of BBIS is weakly significant.[45] Another point worth mentioning is that the loan pricing

[43] The variance inflation factors for BBIS and BROA are above 20.
[44] Trust banks are specialized on non-bank trust services. Thus, generally few firms choose a trust bank as their main bank.
[45] The J statistic is now reasonably small so that the null hypothesis that orthogonality conditions between employed instrumental variables and the error term in the loan pricing equation do not hold

of the largest banks in Japan is less sensitive to SCORE, the credit risk measure assessed by TSR. One interpretation of this result is that internal ratings of the largest banks, on which their pricing is based, are less correlated with the TSR score than the smaller banks' ratings are.

4.6. Are Different Borrower Types between Large and Small Banks Affect the Results?

One may argue that the regression results may be biased due to a selection problem, that is, large banks choose to lend to relatively large firms and small banks choose to lend to relatively small firms. As found in Berger et al. (2005) and Uchida et al. (2008), in our sample, the firms that borrow from large banks are smaller than those that borrow from small banks. The median of total assets of large bank borrowers (2.8 billion yen) are more than twice as large as that of small bank borrowers (1.2 billion yen). Likewise, the median of the number of employees for the former (67 persons) is almost twice as large as that of the latter (36 persons). Thus, the concern about the selection problem is legitimate. In order to test on this possibility, we run the regressions for the sample of relatively small firms which employ less than 100 persons that borrow from large banks, which are defined as in Tables 2 through 6. As shown in Table 8, the sample of such firms and that of small bank borrower firms are comparable in terms of size as measured by total assets, sales and the number of employees. Financially, the two samples are similar, too. As shown in Table 9, the regression results for the sample of "small" large bank borrowers are qualitatively similar to the results for the entire sample of large bank borrowers. Our main finding that the coefficient of BNPL is insignificant remains the same.

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are rejected at the 5 percent significance level whereas the F statistic for excluded instruments is reasonably high, so that the results for the large bank borrower sample reported in Table 7 may be more reliable than the results reported in Table 3.

5. Conclusion

We found that relatively "small" banks including regional banks, regional 2 banks, *shinkin* banks and credit cooperatives charge a premium due to their poor balance sheet health as measured by a higher ratio of non-performing loans to total loans when pricing a loan to a small and medium enterprise. Large banks, however, do not charge such a premium. These findings suggest that frictions are present between firms and their small lenders but not between firms and their large lenders. The premium charged by a small bank, however, does not increase in the strength of the bank's relationship with a borrower as measured by the bank-firm distance. Thus, the standard relationship lending hypothesis, which advocates that a stronger relationship leads to a lender's larger rent, is not supported. Our findings that small banks take advantage of less competitive lending environments by charging more whereas large banks do not rather imply that small banks behave as a local dominant in their home markets. The rise of small banks as a local dominant may involve asymmetric information. As Dell'Ariccia et al. (1999) discuss, banks that are well informed about their local clients may be able to deter other less informed lenders from penetrating deep into their markets.

Our empirical findings have profound policy implications. It is relatively small local banks rather than large banks that capture firms by taking advantage of less competitive lending markets. From the financial stability point of view, poor health of small banks may be of little concern to policymakers. Reduction in non performing loans held by small banks, however, would benefit their borrowers by lowering the borrowing rates. Thus, ensuring small banks' financial health is crucial on stabilizing credit availability among bank dependent small and medium enterprises.

Appendix A. The Definition of a Small and Medium Enterprise in Japan

A small and medium enterprise is defined in the Small and Medium Enterprise Basic Law. Table A1 shows the definition of an SME in Japan.

Appendix B. The Results for the Sample of Publicly Guaranteed Firms

Table A2 shows the summary statistics of the variables that are used in our regressions as well as the variable that measures the share of loans borrowed from a firm's main bank covered by CGC public guarantees (GCOVER) for the sample of firms that borrow publicly guaranteed loans from their main bank.[46]

Table A3 shows the results for the sample of the firms that borrow publicly guaranteed loans from their main bank. In order to control for the potential risk reducing effect of the greater coverage of CGC loan guarantees, GCOVER is included as an additional independent variable.[47] The only results for the regressions with BROA as an independent variable are reported. Major differences from the results reported in Table 3 worth mentioning are threefold. First, as for the bank effect variables, the coefficient of BNPLLOAN is significant for the small bank borrower sample only. The significant coefficient, however, is about one half of the coefficient reported in Table 3. Second, the coefficient of BLIQUID is negative and significant not only for the full sample but also for the large bank borrower sample. Third, the coefficient of HHI for the small bank borrower sample, that is strongly statistically significant in Table 3, is not significant. These findings imply that the frictions are less

[46] A firm is asked to choose from 4 alternatives. "more than 0% but no less than 40%", "more than 40% but no less than 60%", "more than 60% but no less than 100%" and "100%". For these alternatives, GCOVER takes a value of 0.2, 0.5, 0.8 and 1 in the ascending order.

[47] The coefficient of GCOVER is positive and significant for the full and the large bank borrower samples. As described in footnote 25, based on Uesugi et al. (2010), the ratio of long-term loans to total loans borrowed by a firm (LONGRATIO) is a candidate variable as an instrument for GCOVER. Using this variable as an instrument, however, leads to extremely high variance influence factors for this variable and LNTASSET, which suggests unstable estimation results (results are not reported). Thus, we do not use LONGRATIO as an instrumental variable.

pronounced between publicly guaranteed firms and their small lenders.

Appendix C. The Methodology to Compute the Standard Errors for the Coefficients Estimated Using the Sample Selection 2SLS Model

In this appendix, we present the formula to compute the standard errors for the coefficients in the regression equation for the short-term lending rate, (1), estimated using the two stage least square (2SLS) when endogenous sample selection is considered. The following derivation follows chapters 6 and 17 of Wooldridge (2002). As explained in section 3, in the first stage, an endogenous independent variable is linearly regressed on instrumental variables. In addition, the sample selection is assumed to follow the probit model. Let y_2 be a binary variable that takes a value of one if a dependent variable y is observed and zero otherwise. The sample selection is modeled by the following equation.

$$\Pr\left(y_{2i} = 1 \middle| w_i\right) = \Phi\left(w_i \delta\right) \qquad \text{(A1)}$$

where w_i is a 1 by Q vector of independent variables for firm *i*, δ is a Q by 1 vector of parameters and Φ is a standard normal cumulative distribution function.

The inverse Mill's ratio is defined by the following equation.

$$\lambda_i = \lambda\left(w_i \delta\right) = \frac{\phi\left(w_i \delta\right)}{\Phi\left(w_i \delta\right)}$$

Thus, the regression equation augmented by the inverse Mill's ratio is,

$$y_i = x_{1i}\beta_1 + \gamma\lambda\left(w_i \delta\right) + u_i \qquad \text{(A2)}$$

x_{1i} is a 1 by K-1 vector of independent variables, β_1 is a K-1 by 1 vector of parameters and γ is a scalar parameter. Let $x_i = \left(x_{1i}, \lambda_i\right)$. Then equation (A2) is expressed as,

$$y_i = x\beta + u_i \qquad \text{(A2)'}$$

where $\beta = (\beta_1', \gamma)'$.

An estimate of λ_i, $\hat{\lambda}_i$ is obtained as $\hat{\lambda}_i = \lambda(w_i \hat{\delta})$ with a maximum likelihood estimate of probit parameters δ, $\hat{\delta}$. The 2SLS estimate of β, $\hat{\beta}$ is obtained by applying the 2SLS formula to equation (A2)' with λ_i replaced by $\hat{\lambda}_i$. Let $\hat{z}_i = (z_{1i}, \hat{\lambda}_i)$ be 1 by L vector of instrumental variables, where z_{1i} is a 1 by L-1 vector of exogenous variables. Since $\hat{\lambda}_i$ is constructed based on the probit model with exogenous independent variables, $\hat{\lambda}_i$ is also exogenous and can be used as an additional instrumental variable. $\hat{\beta}$ is given by,

$$\hat{\beta} = \left[\left(\sum_{i=1}^{N} \hat{x}_i' \hat{z}_i\right)\left(\sum_{i=1}^{N} \hat{z}_i' \hat{z}_i\right)^{-1}\left(\sum_{i=1}^{N} \hat{z}_i' \hat{x}_i\right)\right]^{-1}\left(\sum_{i=1}^{N} \hat{x}_i' \hat{z}_i\right)\left(\sum_{i=1}^{N} \hat{z}_i' \hat{z}_i\right)^{-1}\left(\sum_{i=1}^{N} \hat{z}_i' y_i\right) \qquad \text{(A3)}$$

where $\hat{x}_i = (x_{1i}, \hat{\lambda}_i)$ and N is the number of observations.

Write $y_i = \hat{x}_i \beta + (x_i - \hat{x}_i) + u_i$. Plugging this into (A3) and multiplying by $\sqrt{N}$ gives,

$$\sqrt{N}\left(\hat{\beta} - \beta\right) = \left(\hat{C}' \hat{D}^{-1} \hat{C}\right)^{-1} \hat{C}' \hat{D}^{-1} \left\{ N^{-\frac{1}{2}} \sum_{i=1}^{N} \hat{z}_i' \left[(x_i - \hat{x}_i)\beta + u_i\right] \right\}$$

where $\hat{C} = \dfrac{1}{N}\sum_{i=1}^{N} \hat{z}_i' \hat{x}_i$ and $\hat{D} = \dfrac{1}{N}\sum_{i=1}^{N} \hat{z}_i' \hat{z}_i$.

Following Wooldridge (2002), we obtain,

$$\sqrt{N}\left(\hat{\beta} - \beta\right) = \left(C' D^{-1} D\right)^{-1} C' D^{-1} \left\{ N^{-\frac{1}{2}} \sum_{i=1}^{N} \left[z_i' u_i - G r_i(\delta)\right] \right\} + o_p(1)$$

where $G = E\left[(\beta \otimes z_i)' \nabla_\delta x_i\right]$, $\nabla_\delta x_i$ is a K by Q Jacovian of $x_i = \left(x_{1i}, \lambda(w_i \hat{\delta})\right)$, $C = E[z'x]$ and $D = E[z' z]$.

By the central limit theorem, we have,

$$\sqrt{N}\left(\hat{\beta}-\beta\right)\overset{a}{\sim} N\left[0,\left(C^{'}D^{-1}C\right)^{-1}C^{'}D^{-1}MD^{-1}\left(C^{'}D^{-1}C\right)^{-1}\right] \qquad \text{(A4)}$$

where $M = Var\left[z_i^{'}u_i - Gr_i(\delta)\right]$ and $r_i(\delta)$ is obtained immediately below.

The first order condition for the maximum likelihood estimation of a probit model (A1) is given by,

$$\sum_{i=1}^{N} s\left(w_i,\hat{\delta}\right)=0 \qquad \text{(A5)}$$

where $s\left(w_i,\delta\right)=\dfrac{\phi\left(w_i\delta\right)\left[y_{2i}-\Phi\left(w_i\delta\right)\right]}{\Phi\left(w_i\delta\right)\left[1-\Phi\left(w_i\delta\right)\right]}$

A mean value expansion of (A5) and some algebra gives,

$$\sqrt{N}\left(\hat{\delta}-\delta\right)=N^{-\frac{1}{2}}\left[-\sum_{i=1}^{N}A_0^{-1}s_i\left(w_i,\delta\right)\right]+o_p(1)$$

where $A_0 \equiv E\left[\dfrac{\partial s\left(w_i,\delta\right)}{\partial\delta}\right]$.

The abovementioned $r_i(\delta)$ is defined as,

$$r_i(\delta)\equiv -A_0^{-1}s_i\left(w_i,\delta\right)=-E\left[\frac{\phi\left(w_i\delta\right)^2 w_i^{'}w_i}{\Phi\left(w_i\delta\right)\left[1-\Phi\left(w_i\delta\right)\right]}\right]\left[\frac{\phi\left(w_i\delta\right)\left[y_{2i}-\Phi\left(w_i\delta\right)\right]}{\Phi\left(w_i\delta\right)\left[1-\Phi\left(w_i\delta\right)\right]}\right]$$

As a result, the asymptotic variance of $\beta,\hat{\beta}$ is,

$$A\operatorname{var}\left(\hat{\beta}\right)=\frac{1}{N}\left(\hat{C}^{'}\hat{D}^{-1}\hat{C}\right)^{-1}\hat{C}^{'}\hat{D}^{-1}\hat{M}\hat{D}^{-1}\hat{C}\left(\hat{C}^{'}\hat{D}^{-1}\hat{C}\right)^{-1} \qquad \text{(A6)}$$

where

$$\hat{M}=\sum_{i=1}^{N}\left(\hat{z}_i^{'}\hat{u}_i-\hat{G}r_i\left(\hat{\delta}\right)\right)\left(\hat{z}_i^{'}\hat{u}_i-\hat{G}r_i\left(\hat{\delta}\right)\right)^{'}$$

$$r_i\left(\hat{\delta}\right)\equiv -\hat{A}_0^{-1}s_i\left(w_i,\hat{\delta}\right)=-\left[\frac{1}{N}\sum_{i=1}^{N}\left\{\frac{\phi\left(w_i\hat{\delta}\right)^2 w_i^{'}w_i}{\Phi\left(w_i\hat{\delta}\right)\left[1-\Phi\left(w_i\hat{\delta}\right)\right]}\right\}\right]^{-1}\left[\frac{\phi\left(w_i\hat{\delta}\right)\left[y_{2i}-\Phi\left(w_i\hat{\delta}\right)\right]}{\Phi\left(w_i\hat{\delta}\right)\left[1-\Phi\left(w_i\hat{\delta}\right)\right]}\right]$$

$$\hat{G}=\frac{1}{N}\sum_{i=1}^{N}\left(\hat{\beta}\otimes\tilde{z}_i\right)^{'}\nabla_{\delta}\hat{x}_i$$

What remains to be derived is the formula for $\nabla_{\delta}\hat{x}_i$.

The Q by K vector $\nabla_{\delta}\hat{x}_i$ is given by,

$$\nabla_\delta \hat{x}_i = \begin{bmatrix} O \\ \cdots\cdots\cdots\cdots \\ \dfrac{\partial\lambda\left(w_i\hat{\delta}\right)}{\partial\delta} w \end{bmatrix}$$

where O is a K-1 by Q matrix of zeros and $\dfrac{\partial\lambda\left(w_i\hat{\delta}\right)}{\partial\delta} = -\dfrac{w_i\,\delta\Phi\left(w_i\hat{\delta}\right)\phi\left(w_i\hat{\delta}\right)+\phi\left(w_i\hat{\delta}\right)^2}{\Phi\left(w_i\hat{\delta}\right)^2}$ is a Q by 1 vector. The standard errors of $\hat{\beta}$ are square roots of diagonal elements of equation (A6).

Notice that the expression for $\hat{M}$ reveals that when $\Phi\left(w_i\hat{\delta}\right)=1$ or $\Phi\left(w_i\hat{\delta}\right)=0$, the standard errors are unobtainable.[48]

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[48] In practice, even though mathematically neither $\Phi\left(w_i\hat{\delta}\right)=1$ nor $\Phi\left(w_i\hat{\delta}\right)=0$ holds true for some i, when one or both of the difference between $\Phi\left(w_i\hat{\delta}\right)$ and 0 or 1 is recognized to be zero in a software package, the resulting standard errors are unobtainable. In our computation, the regressions are run using STATA. When $\Phi\left(w_i\hat{\delta}\right)$ is obtained in a text file, the value is recorded to the seventh decimal place. That is, any number close to 0 and 1 to the eighth decimal place is recognized as 0 and 1, respectively. When there are a few observations with $\Phi\left(w_i\hat{\delta}\right)$ recognized as 0 or 1, these observations are dropped. When there are more, 0 and 1 are replaced with 0.0000001 and 0.9999999, respectively.

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Table 1. Definitions of Variables

Variables	Description
Dependent variable	
SHORTRATE	The highest rate on a loan with a maturity less than one year borrowed from a firm's main bank
Non-price terms	
COLLATERAL	A dummy variable that is set to unity if a firm pledges physical collateral to its main bank
Bank effect variables (BE)	
BBIS	The risk based capital adequacy ratio
BNPLLOAN	The ratio of non-performing loans to total loans
BLIQUID	The ratio of liquid assets to total assets
BROA	The return as measured by net income on total assets
BTASSET (LNBTASSET)	Total assets (its logarithm)
Bank controls (BC)	
MAJOR	A dummy variable that is set to unity if a firm's main bank is either a city bank, a trust bank or a long-term credit bank
REGIONAL	A dummy variable that is set to unity if a firm's main bank is a regional bank
REGIONAL2	A dummy variable that is set to unity if a firm's main bank is a regional 2 bank
COOPERATIVE	A dummy variable that is set to unity if a firm's main bank is either a *shinkin* bank or a credit cooperative
HHI	The Herfindal Hirschman index for the number of branches in the prefecture that a firm's main bank is headquartered in
Relationship variables (RELAT)	
LENGTH (LNLENGTH)	The length of the main bank relationship (its logarithm)
DISTANCE (LNDISTANCE)	The distance between a firm and its main bank's branch that a bank's loan officer in charge of the firm belongs to (its logarithm)
Firm specific variables (FIRM)	
CAPITAL	The ratio of capital to total assets
TASSET (LNTASSET)	Total assets (its logarithm)
CURRENT	The ratio of current assets to current liabilities
AGE (LNAGE)	Age of a firm's representative (its logarithm)
EDUC	A dummy variable that is set to unity if the educational attainment of a firm's representative is college or more advanced
FAGE (LNFAGE)	Firm age (its logarithm)
OWNER	A dummy variable that is set to unity if a firm's representative is the firm's top shareholder
SCORE	A credit score rated by Tokyo Shoko Research Corporation (a higher number means a lower credit risk)
Instrumental variables for COLLATEAL	
REALRATIO	The ratio of real estates to total assets
HOME	A dummy variable that is set to unity if a firm's representative owns residential home
LANDPRICE	The average price of residential lands in a prefecture that a firm is located in
Instrumental variables for the first stage probit model	
SHORTAPPLY	A dummy variable that is set to unity if a firm made applications of loans for the short-term use in nature from its main bank during one year period until the date of survey.

Table 2. Descriptive Statistics of Variables Used in Regressions

Variable	N	mean	median	standard error	min	max
SHORTRATE	954	1.651	1.625	0.862	0.000	9.999
BBIS	1215	0.102	0.104	0.017	0.052	0.183
BNPLLOAN	1215	0.086	0.086	0.031	0.026	0.222
BLIQUID	1215	0.296	0.283	0.063	0.140	0.629
BROA	1215	-0.004	-0.0003	0.007	-0.033	0.005
BTASSET (million yen)	1215	35,824,270	5,713,381	47,758,786	44,011	140,985,953
MAJOR	1215	0.379				
REGIONAL	1215	0.449				
REGIONAL2	1215	0.091				
COOPERATIVE	1215	0.081				
HHI	1215	965.0	884.9	602.5	305.2	2760.1
LENGTH	1215	32.4	32.0	15.9	0	99
DISTANCE	1113	7.5	5.5	15.0	0.25	100
TASSET (thousand yen)	1215	4,059,097	1,783,822	7,085,555	8,767	70,132,892
Sales (thousand yen)	1215	3,953,251	2,167,342	5,340,237	15408	56,049,947
The number of employees	1215	85.9	47	165.4	0	4606
SCORE	1215	60.0	60	6.6	34	82
CAPITAL	1215	0.361	0.351	0.302	-4.528	0.960
CURRENT	1215	1.904	1.368	2.395	0.034	54.049
OWNER	1215	0.383				
EDUC	1215	0.673				
AGE	1215	59.7	60	9.1	28	87
FAGE	1215	45.5	42	23.3	0	247
REALRATIO	1215	0.228	0.197	0.189	0	0.947
HOME	1215	0.923				
LANDPRICE (yen per square meter)	1215	119,238	75,300	90,317	34,400	308,900
COLLATERAL	1215	0.626				
Industry dummies						
Manufacturing	1215	0.361				
Construction	1215	0.202				
Communications & transportations	1215	0.040				
Wholesale	1215	0.157				
Retail	1215	0.053				
Real estate	1215	0.028				
Services and dining	1215	0.091				
Other	1215	0.068				
SHORTAPPLY	1215	0.505				

Note
Variable definitions are described in Table 1. The fact that the frequency that SHORTAPPLY takes a value of 1 is far less than the frequency that a short rate is observed is not particularly contradictory because banks often lend a short-term loan to a firm for its long-term use so as to discipline the firm to repay. Upon a firm's repayment on due, the bank decides to roll a loan over. Industry dummies whose descriptions are omitted in Table 1 are included to show the sample firms' industry distribution. Industry dummies are included in the regressions whose results are displayed in Tables 3 through 7, Table 9 and Table A3.

Table 3. The Results of Regressions without the Interaction Term between the Relationship Measure and the Bank Effect Variable

	Full sample		Large bank borrower sample		Small bank borrower sample	
BBIS	0.95	3.17	-0.64	5.75	1.06	1.33
	(2.91)	(2.46)	(6.87)	(3.85)	(4.52)	(4.26)
BNPLLOAN	2.82 **	2.68 **	0.75	0.14	5.20 **	5.07 **
	(1.18)	(1.13)	(2.00)	(1.74)	(2.05)	(2.08)
BLIQUID	-1.59 **	-1.42 **	-1.14	-0.73	-0.92	-0.94
	(0.74)	(0.72)	(1.33)	(1.15)	(0.94)	(0.94)
BROA	9.95		12.14		3.67	
	(5.81)		(9.98)		(10.84)	
REGIONAL	0.166 *	0.227 ***	0.069	0.126	0.005	-0.004
	(0.090)	(0.078)	(0.13)	(0.110)	(0.194)	(0.194)
REGIONAL2	0.419 *	0.520 **	0.219	0.414	0.402	0.397
	(0.218)	(0.220)	(0.323)	(0.300)	(0.297)	(0.293)
COOPERATIVE	0.318 *	0.347 *				
	(0.169)	(0.165)				
HHI	0.00018 **	0.00017 **	0.00005	0.00005	0.00026 **	0.00026 **
	(0.00007)	(0.00007)	(0.00013)	(0.00013)	(0.00011)	(0.00011)
LNLENGTH	0.02	0.02	0.01	0.01	-0.02	-0.02
	(0.07)	(0.07)	(0.08)	(0.08)	(0.13)	(0.14)
SCORE	-0.0310 ***	-0.0307 ***	-0.0302 ***	-0.0299 ***	-0.0293 ***	-0.0290 ***
	(0.0084)	(0.0082)	(0.0112)	(0.0108)	(0.0086)	(0.0086)
CAPITAL	-0.19	-0.19	0.01	-0.00	-0.39	-0.39
	(0.23)	(0.22)	(0.20)	(0.19)	(0.33)	(0.33)
LNTASSET	-0.090 ***	-0.092 ***	-0.121 *	-0.121 **	-0.072 *	-0.073 *
	(0.030)	(0.029)	(0.064)	(0.059)	(0.043)	(0.043)
CURRENT	0.023	0.022	-0.043	-0.038	0.030	0.030
	(0.036)	(0.035)	(0.062)	(0.055)	(0.051)	(0.051)
OWNER	0.275 ***	0.272 ***	0.145	0.144	0.426 ***	0.425 ***
	(0.088)	(0.087)	(0.145)	(0.136)	(0.145)	(0.145)
COLLATERAL	-0.143	-0.141	0.041	0.034	-0.465	-0.463
	(0.310)	(0.307)	(0.485)	(0.439)	(0.557)	(0.560)
Inverse Mill's ratio	-0.22	-0.23	-0.13	-0.16	-0.30	-0.30
	(0.19)	(0.18)	(0.23)	(0.21)	(0.24)	(0.24)
N (second stage)	954	954	468	468	486	486
N (first stage)	1215	1215	603	603	611	611
J statistic	5.830	7.123	4.931	5.265	1.284	1.480
	(0.0158)	(0.0076)	(0.0264)	(0.0218)	(0.2571)	(0.2238)
F statistic for excluded instruments for COLLATARAL	24.16	24.236	13.015	13.099	9.462	9.444
z statistic for SHORTAPPLY for the first stage probit	11.45	11.47	8.21	8.24	8.20	8.22
t statistic for endogeneity of COLLATERAL	1.62	1.62	0.46	0.48	1.78	1.78
C statistic	1.912	1.777	0.009	0.006	2.961	2.816
	(0.1668)	(0.1825)	(0.9258)	(0.9366)	(0.0853)	(0.0933)

Note
A dependent variable is SHORTRATE. Variable definitions are described in Table 1. ***, ** and * show that the coefficient is statistically significant at the 1 percent level, the 5 percent level and the 10 percent level, respectively. The Huber-White heteroskedasticity robust standard error is in parenthesis below the corresponding estimated coefficient. In the first stage of the estimation, the likelihood that a firm's borrowing rate on a short-term loan from its main bank is observed is estimated using the probit model with SHORTAPPLY as an additional independent variable. In the second stage for a firm's short-term borrowing rate from its main bank, the inverse Mill's ratio obtained from the first stage is added as an independent variable. The second stage is estimated by 2SLS using REALRATIO and HOME interacted with LANDPRICE as additional instrumental variables. In addition to the variables presented in the table, LNFAGE, LNAGE and EDUC as well as regional and industry dummies are included as controls. The large bank borrower sample is the sample of firms with a main bank whose total assets are greater than the sample median. The small bank borrower sample is the remainder. In computing standard errors, adjustments are made regarding the first stage probit regression. The methodology to compute standard errors are detailed in Appendix C. When there is a probability of the observable short rate predicted in the first stage is zero or one for any observation, the standard error is unable to compute. Such observations are dropped. Since dropped observations for the full sample are not necessarily the total of dropped observations for subsamples, the number of observations for the full sample does not necessarily equal the sum of numbers of subsamples. The C statistic is developed by Hausman (1978) and is described in pages 232 and 233 of Hayashi (2000). The numbers below the J statistic and below the C statistic are corresponding p values. The t statistic for endoegeneity of COLLATERAL is computed in the following two steps. First, COLLATERAL is regressed on all the exogenous variables including instrumental variables using OLS. The predicted residual from the COLLATERAL regression is added as an independent variable to a set of independent variables in the OLS regression for SHORTRATE. The t statistic is that of the coefficient of the predicted residual.

Table 4. The Results of Regressions with the Interaction Term between the Relationship Measure and the Bank Effect Variable

BBIS	-0.74 (3.48)	-0.67 (3.33)
BNPLLOAN	4.64 ** (2.10)	4.60 ** (2.01)
BLIQUID	-0.65 (1.04)	-0.66 (1.05)
BROA	0.93 (10.42)	
REGIONAL	-0.028 (0.196)	-0.029 (0.195)
REGIONAL2	0.410 (0.340)	0.408 (0.335)
BBNPLLOAN × LNDISTANCE	-0.09 (1.30)	-0.07 (1.28)
HHI	0.00024 ** (0.00010)	0.00024 ** (0.00010)
LNLENGTH	-0.04 (0.13)	-0.04 (0.13)
LNDISTANCE	-0.002 (0.073)	-0.002 (0.073)
SCORE	-0.0320 *** (0.0074)	-0.0319 *** (0.0074)
CAPITAL	-0.15 (0.12)	-0.15 (0.12)
LNTASSET	-0.075 ** (0.037)	-0.075 ** (0.037)
CURRENT	0.02 (0.03)	0.02 (0.03)
OWNER	0.361 *** (0.137)	0.362 ** (0.137)
COLLATERAL	-0.609 (0.528)	-0.611 (0.530)
Inverse Mill's ratio	-0.33 (0.26)	-0.33 (0.26)
N (second stage)	469	469
N (first stage)	566	566
J statistic	2.391 (0.1220)	2.359 (0.1246)
F statistic for excluded instruments for COLLATARAL	8.032	8.023
z statistic for SHORTAPPLY for the first stage probit	7.43	7.44
t statistic for endogeneity of COLLATERAL	1.92	1.92
C statistic	2.918 (0.0876)	2.877 (0.0899)

Note

A dependent variable is SHORTRATE. Variable definitions are described in Table 1. ***, ** and * show that the coefficient is statistically significant at the 1 percent level, the 5 percent level and the 10 percent level, respectively. The Huber-White heteroskedasticity robust standard error is in parenthesis below the corresponding estimated coefficient. In the first stage of the estimation, the likelihood that a firm's borrowing rate on a short-term loan from its main bank is observed is estimated using the probit model with SHORTAPPLY as an additional independent variable. In the second stage for a firm's short-term borrowing rate from its main bank, the inverse Mill's ratio obtained from the first stage is added as an independent variable. The second stage is estimated by 2SLS using REALRATIO and HOME interacted with LANDPRICE as additional instrumental variables. In addition to the variables presented on the table, LNFAGE, LNAGE and EDUC as well as regional and industry dummies are included as controls. The sample consists of firms with a main bank whose total assets are no greater than the sample median. In computing standard errors, adjustments are made regarding the first stage probit regression. The methodology to compute standard errors are detailed in Appendix C. The C statistic is developed by Hausman (1978) and is described in pages 232 and 233 of Hayashi (2000). The numbers below the J statistic and below the C statistic are corresponding p values. The t statistic for endoegeneity of COLLATERAL is computed in the following two steps. First, COLLATERAL is regressed on all the exogenous variables including instrumental variables using OLS. The predicted residual from the COLLATERAL regression is added as an independent variable to a set of independent variables in the OLS regression for SHORTRATE. The t statistic is that of the coefficient of the predicted residual.

Table 5. The Results of Regressions without Endogeneity Considerations

	OLS		2SLS without sample selection		2SLS with sample selection	
BBIS	1.27	1.54	0.57	0.90	1.06	1.33
	(2.62)	(2.56)	(2.88)	(2.79)	(4.52)	(4.26)
BNPLLOAN	4.41 **	4.27 ***	4.89 ***	4.73 ***	5.20 **	5.07 **
	(1.55)	(1.48)	(1.67)	(1.59)	(2.05)	(2.08)
BLIQUID	-1.12	-1.14	-1.06	-1.09	-0.92	-0.94
	(0.76)	(0.77)	(0.79)	(0.80)	(0.94)	(0.94)
BROA	3.83		4.54		3.67	
	(8.95)		(8.70)		(10.84)	
REGIONAL	0.141	0.139	0.006	0.004	0.005	0.004
	(0.144)	(0.142)	(0.147)	(0.146)	(0.194)	(0.194)
REGIONAL2	0.425	0.419	0.380	0.373	0.402	0.397
	(0.273)	(0.268)	(0.263)	(0.258)	(0.297)	(0.293)
HHI	0.00025 ***	0.00025 **	0.00026 ***	0.00027 **	0.00026 **	0.00026 **
	(0.00008)	(0.0007)	(0.00008)	(0.00008)	(0.00011)	(0.00011)
LNLENGTH	-0.07	-0.06	-0.01	-0.01	-0.02	-0.02
	(0.10)	(0.10)	(0.11)	(0.11)	(0.13)	(0.14)
SCORE	-0.0275 ***	-0.0272 ***	-0.0291 ***	-0.0287 ***	-0.0293 ***	-0.0290 ***
	(0.0064)	(0.0065)	(0.0069)	(0.0069)	(0.0086)	(0.0086)
CAPITAL	-0.47 **	-0.47 **	-0.49 **	-0.49 **	-0.39	-0.39
	(0.22)	(0.22)	(0.24)	(0.24)	(0.33)	(0.33)
LNTASSET	-0.079 **	-0.080 **	-0.071 **	-0.073 **	-0.072 *	-0.073 *
	(0.032)	(0.031)	(0.034)	(0.034)	(0.042)	(0.043)
CURRENT	0.027	0.026	0.018	0.018	0.030	0.030
	(0.019)	(0.019)	(0.0018)	(0.019)	(0.051)	(0.051)
OWNER	0.301 ***	0.300 ***	0.415 ***	0.413 ***	0.426 ***	0.425 ***
	(0.088)	(0.087)	(0.126)	(0.126)	(0.145)	(0.145)
COLLATERAL	0.340 ***	0.340 ***	-0.389	-0.382	-0.465	-0.463
	(0.071)	(0.071)	(0.461)	(0.461)	(0.557)	(0.560)
Inverse Mill's ratio					-0.30	-0.30
					(0.24)	(0.24)
N (second stage)	486	486	486	486	486	486
N (first stage)					611	611
J statistic			1.392	1.673	1.284	1.480
			(0.2381)	(0.1959)	(0.2571)	(0.2238)
F statistic for excluded instruments for COLLATARAL			10.484	10.499	9.462	9.444
z statistic for SHORTAPPLY for the first stage probit					8.20	8.22
t statistic for endogeneity of COLLATERAL			1.64	1.62	1.78	1.78
C statistic			2.496	2.349	2.961	2.816
			(0.1142)	(0.1253)	(0.0853)	(0.0933)
R-squared	0.2848	0.2846				

Note
A dependent variable is SHORTRATE. Variable definitions are described in Table 1. ***, ** and * show that the coefficient is statistically significant at the 1 percent level, the 5 percent level and the 10 percent level, respectively. The Huber-White heterosedasticity robust standard error is in parenthesis below the corresponding estimated coefficient. Columns 1 and 2 show the OLS results. Columns 3 and 4 report the results for the 2SLS regression with REALRATIO and HOME interacted with LANDPRICE as additional instrumental variables. Columns 5 and 6 are the same as columns 5 and 6 of Table 3. Regarding columns 5 and 6, in the first stage of the estimation, the likelihood that a firm's borrowing rate on a short-term loan from its main bank is observed is estimated using the probit model with SHORTAPPLY as an additional independent variable. In the second stage for a firm's short-term borrowing rate from its main bank, the inverse Mill's ratio obtained from the first stage is added as an independent variable. The second stage is estimated by 2SLS using REALRATIO and HOME interacted with LANDPRICE as additional instrumental variables. In all the three columns, in addition to the variables presented on the table, LNFAGE, LNAGE and EDUC as well as regional and industry dummies are included as controls. The sample consists of firms with a main bank whose total assets are no greater than the sample median. In computing standard errors for columns 5 and 6, adjustments are made regarding the first stage probit regression. The methodology to compute standard errors are detailed in Appendix C. When there is a probability of the observable short rate predicted in the first stage is zero or one for any observation, the standard error is unable to compute. Such observations are dropped. The C statistic is developed by Hausman (1978) and is described in pages 232 and 233 of Hayashi (2000). The numbers below the J statistic and below the C statistic are corresponding p values. The t statistic for endoegeneity of COLLATERAL is computed in the following two steps. First, COLLATERAL is regressed on all the exogenous variables including instrumental variables using OLS. The predicted residual from the COLLATERAL regression is added as an independent variable to a set of independent variables in the OLS regression for SHORTRATE. The t statistic is that of the coefficient of the predicted residual.

Table 6. The Results of Regressions with a Cross Product of BNPLLOAN and HHI

	OLS		2SLS without sample selection		2SLS with sample selection	
BBIS	0.64		-0.77		-0.24	
	(2.68)		(3.00)		(4.89)	
BNPLLOAN	1.72		-0.81		-0.14	
	(3.28)		(3.54)		(4.76)	
BLIQUID	-0.98		-0.77		-0.66	
	(0.75)		(0.80)		(1.00)	
BROA	3.08		2.97		2.28	
	(8.95)		(8.74)		(11.20)	
REGIONAL	0.135	*	-0.007		-0.007	
	(0.145)		(0.150)		(0.207)	
REGIONAL2	0.418		0.365		0.387	
	(0.275)		(0.265)		(0.305)	
HHI	0.00007		-0.00011		-0.00009	
	(0.00019)		(0.0002)		(0.00029)	
BNPLLOAN×HHI	0.0020		0.0043	*	0.0040	
	(0.0020)		(0.0023)		(0.0033)	
LNLENGTH	-0.06		0.00		-0.01	
	(0.10)		(0.11)		(0.14)	
SCORE	-0.0272	***	-0.0285	***	-0.0287	***
	(0.0064)		(0.0068)		(0.0089)	
CAPITAL	-0.46		-0.47	*	-0.38	**
	(0.22)		(0.24)		(0.35)	
LNTASSET	-0.080	**	-0.073	**	-0.074	**
	(0.032)		(0.034)		(0.044)	
CURRENT	0.025		0.015		0.026	
	(0.019)		(0.018)		(0.056)	
OWNER	0.302	***	0.419	***	0.429	***
	(0.087)		(0.127)		(0.149)	
COLLATERAL	0.332	***	-0.411		-0.479	
	(0.071)		(0.466)		(0.583)	
Inverse Mill's ratio						
N (second stage)	486		486		486	
N (first stage)					611	
J statistic			1.153		1.094	
			(0.2829)		(0.2955)	
F statistic for excluded instruments for COLLATARAL			10.4467		9.478	
z statistic for SHORTAPPLY for the first stage probit					8.18	
t statistic for endogeneity of COLLATERAL			1.65		1.78	
C statistic			2.612		3.047	
			(0.1060)		(0.0809)	
R squared	0.2857					

Note
A dependent variable is SHORTRATE. Variable definitions are described in Table 1. ***, ** and * show that the coefficient is statistically significant at the 1 percent level, the 5 percent level and the 10 percent level, respectively. The Huber-White standard error is in parenthesis below the corresponding estimated coefficient. Column 1 shows the OLS results. Column 2 reports the results for the 2SLS regression with REALRATIO and HOME interacted with LANDPRICE as additional instrumental variables. Regarding the regression whose results are reported in column 3, in the first stage, the likelihood that a firm's borrowing rate on a short-term loan from its main bank is observed is estimated using the probit model with SHORTAPPLY as an additional independent variable. In the second stage for a firm's short-term borrowing rate from its main bank, the inverse Mill's ratio obtained from the first stage is added as an independent variable. The second stage is estimated by 2SLS using REALRATIO and HOME interacted with LANDPRICE as additional instrumental variables. In all the three columns, in addition to the variables presented on the table, LNFAGE, LNAGE and EDUC as well as regional and industry dummies are included as controls. In computing standard errors, adjustments are made regarding the first stage probit regression. The sample consists of firms with a main bank whose total assets are no greater than the sample median. The methodology to compute standard errors are detailed in Appendix C. When there is a probability of the observable short rate predicted in the first stage is zero or one for any observation, the standard error is unable to compute. Such observations are dropped. The C statistic is developed by Hausman (1978) and is described in pages 232 and 233 of Hayashi (2000). The numbers below the J statistic and below the C statistic are corresponding p values. The t statistic for endoegeneity of COLLATERAL is computed in the following two steps. First, COLLATERAL is regressed on all the exogenous variables including instrumental variables using OLS. The predicted residual from the COLLATERAL regression is added as an independent variable to a set of independent variables in the OLS regression for SHORTRATE. The t statistic is that of the coefficient of the predicted residual.

Table 7. The Results of Regressions Based on Alternative Definitions of Large and Small Banks.

	Large bank borrower sample		Small bank borrower sample			
BBIS	23.97 **	7.15 *	1.30	3.10	1.22	2.77
	(11.56)	(4.17)	(5.38)	(4.69)	(3.30)	(3/04)
BNPLLOAN	-2.12	-0.03	5.14 ***	4.89 ***	5.01 ***	4.74 ***
	(2.01)	(2.01)	(1.93)	(1.85)	(1.87)	(1.78)
BLIQUID	1.62	-0.71	-1.25	-1.10	-1.33	-1.20
	(1.83)	(1.44)	(1.04)	(1.02)	(0.94)	(0.91)
BROA	-25.26		12.44		10.64	
	(16.83)		(8.95)		(7.71)	
REGIONAL			-0.070	-0.046	-0.119	-0.095
			(0.180)	(0.178)	(0.192)	(0.188)
REGIONAL2			0.183	0.234	0.159	0.202
			(0.227)	(0.233)	(0.229)	(0.231)
BBNPLLOAN × LNDISTANCE					-0.206	0.01
					(1.268)	(1.24)
HHI	-0.00005	-0.00005	0.00022 **	0.00022 **	0.00023 ***	0.00022 ***
	(0.00012)	(0.00015)	(0.00009)	(0.00009)	(0.00008)	(0.00008)
LNLENGTH	-0.03	-0.03	0.03	0.02	0.02	0.01
	(0.07)	(0.09)	(0.09)	(0.09)	(0.13)	(0.13)
LNDISTANCE					0.00	-0.01
					(0.07)	(0.07)
SCORE	-0.0209 ***	-0.0212 **	-0.0323 ***	-0.0315 ***	-0.0302 ***	-0.0294 ***
	(0.0074)	(0.0084)	(0.0091)	(0.0089)	(0.0063)	(0.0063)
CAPITAL	-0.03	-0.03	-0.41	-0.41	-0.25 *	-0.25 *
	(0.14)	(0.13)	(0.28)	(0.28)	(0.14)	(0.14)
LNTASSET	-0.096 **	-0.093	-0.091 ***	-0.094 ***	-0.079 **	-0.081 ***
	(0.041)	(0.057)	(0.035)	(0.034)	(0.032)	(0.030)
CURRENT	-0.075	-0.075	0.037	0.036	0.029	0.028
	(0.047)	(0.068)	(0.034)	(0.034)	(0.024)	(0.024)
OWNER	0.032	0.025	0.385 ***	0.377 ***	0.304 ***	0.295 ***
	(0.095)	(0.120)	(0.124)	(0.121)	(0.106)	(0.104)
COLLATERAL	0.314	0.313	-0.451	-0.397	-0.499	-0.437
	(0.340)	(0.386)	(0.423)	(0.410)	(0.387)	(0.381)
Inverse Mill's ratio	0.02	0.02	-0.28	-0.29	-0.32	-0.31
	(0.150000000)	(0.23)	(0.24)	(0.24)	(0.22)	(0.22)
N (second stage)	354	354	600	600	577	577
N (first stage)	461	461	754	754	696	696
J statistic	2.891	2.967	1.758	3.197	2.767	4.191
	(0.0891)	(0.0850)	(0.1849)	(0.0738)	(0.0962)	(0.0406)
F statistic for excluded instruments for COLLATARAL	9.115	9.131	14.306	14.324	12.517	12.635
z statistic for SHORTAPPLY for the first stage probit	7.40	7.36	9.22	9.23	8.36	8.37
t statistic for endogeneity of COLLATERAL	-0.30	-0.30	2.17	2.03	2.24	2.08
C statistic	0.400	0.403	3.793	2.836	3.667	2.807
	(0.5271)	(0.5256)	(0.0515)	(0.0922)	(0.0555)	(0.0938)

Note

A dependent variable is SHORTRATE. Variable definitions are described in Table 1. ***, ** and * show that the coefficient is statistically significant at the 1 percent level, the 5 percent level and the 10 percent level, respectively. The Huber-White heteroskedasticity robust standard error is in parenthesis below the corresponding estimated coefficient. In the first stage, the likelihood that a firm's borrowing rate on a short-term loan from its main bank is observed is estimated using the probit model with SHORTAPPLY as an additional independent variable. In the second stage for a firm's short-term borrowing rate from its main bank, the inverse Mill's ratio obtained from the first stage is added as an independent variable. The second stage is estimated by 2SLS using REALRATIO and HOME interacted with LANDPRICE as additional instrumental variables. In addition to the variables presented on the table, LNFAGE, LNAGE and EDUC as well as regional and industry dummies are included as controls. The large bank borrower sample is the sample of firms whose main bank is either a city bank, a trust bank or a long-term credit bank. The small bank borrower sample is the sample of firms whose main bank is either a regional bank, a regional 2 bank, a *shinkin* bank, or a credit cooperative. In computing standard errors, adjustments are made regarding the first stage probit regression. The methodology to compute standard errors are detailed in Appendix C. When there is a probability of the observable short rate predicted in the first stage is zero or one, the standard error is unable to compute. Such observations are dropped. The C statistic is developed by Hausman (1978) and is described in pages 232 and 233 of Hayashi (2000). The numbers below the J statistic and below the C statistic are corresponding p values. The t statistic for endoegeneity of COLLATERAL is computed in the following two steps. First, COLLATERAL is regressed on all the exogenous variables including instrumental variables using OLS. The predicted residual from the COLLATERAL regression is added as an independent variable to a set of independent variables in the OLS regression for SHORTRATE. The t statistic is that of the coefficient of the predicted residual.

Table 8. Descriptive Statistics of Selected Variables for the Sample of Firms that Borrow from Small Banks and the Sample of Small Firms that Borrow from Large Banks

Variable	Variable	N	mean	median	standard error	min	max
Small bank borrower sample	SHORTRATE	486	1.800	1.750	0.782	0.000	9.999
	HHI	611	1284.1	1322.4	579.5	305.2	2760.1
	LENGTH	611	33.2	33	16.2	0	99
	DISTANCE	611	6.1	5.5	11.3	0.25	100
	TASSET	611	3,404,468	1,161,639	7,259,396	8,767	70,132,892
	SALES	611	2,788,009	1,427,251	3,393,867	15,408	40,058,812
	The number of employees	611	63.7	36	80.7	0	950
	SCORE	611	60.4	61	6.8	34	79
	CAPITAL	611	0.382	0.372	0.258	-1.115	0.960
	CURRENT	611	1.995	1.443	2.154	0.158	28.119
	OWNER	611	0.427				
	EDUC	611	0.566				
	AGE	611	59.4	59	9.7	28	87
	FAGE	611	44.1	41	22.0	4	148
	HOME	611	0.935				
	REALRATIO	611	0.236	0.205	0.189	0	0.914
	COLLATERAL	611	0.638				
"Small" large bank borrower sample	SHORTRATE	316	1.566	1.500	0.782	0.000	9.999
	HHI	429	674.2	553.9	414.7	305.2	2203.6
	LENGTH	429	30.0	30	16.2	0	90
	DISTANCE	429	8.4	5.5	17.2	0.25	100
	TASSET	429	3,463,294	1,597,411	7,424,407	11,011	67,498,8325
	SALES	429	3,308,806	1,902,122	4,572,159	33,183	37,824,044
	The number of employees	429	41.5	36	27.6	0	99
	SCORE	429	59.0	58	6.0	40	82
	CAPITAL	429	0.365	0.344	0.254	-0.583	0.949
	CURRENT	429	1.871	1.365	1.794	0.060	20.840
	OWNER	429	0.371				
	EDUC	429	0.741				
	AGE	429	60.0	60	9.3	29	87
	FAGE	429	44.0	41	26.3	4	247
	HOME	429	0.925				
	REALRATIO	429	0.210	0.172	0.176	0	0.947
	COLLATERAL	429	0.543				

Note
The small bank borrower sample is the sample of firms with a main bank whose total assets are no less than the sample median, whereas "small" large bank borrower sample is the sample of firms that employ less than 100 persons with a large bank whose total assets are greater than the sample median as their main bank.

Table 9. The Regression Results for the Sample of Small Firms that Borrow from Large Banks

	"Small" large bank borrower sample		Large bank borrower sample	
BBIS	-1.11		-0.64	
	(8.64)		(3.85)	
BNPLLOAN	1.70		0.75	
	(1.35)		(1.74)	
BLIQUID	-1.70		-1.14	
	(1.22)		(1.15)	
BROA	18.24		12.14	
	(13.77)			
REGIONAL	0.112		0.069	
	(0.107)		(0.110)	
REGIONAL2	0.214		0.219	
	(0.323)		(0.300)	
HHI	0.00007		0.00005	
	(0.00066)		(0.00013)	
LNLENGTH	-0.07		0.01	
	(0.06)		(0.08)	
SCORE	-0.0298	***	-0.0302	***
	(0.0162)		(0.0108)	
CAPITAL	-0.49		0.01	
	(0.37)		(0.19)	
LNTASSET	-0.186	***	-0.121	*
	(0.056)		(0.059)	
CURRENT	0.022		-0.043	
	(0.049)		(0.055)	
OWNER	0.207		0.145	
	(0.158)		(0.136)	
COLLATERAL	0.228		0.041	
	(0.429)		(0.439)	
Inverse Mill's ratio	-0.21		-0.13	
	(0.16)		(0.21)	
N (second stage)	316		468	
N (first stage)	429		603	
J statistic	1.086		5.265	
	(0.2973)		(0.0218)	
F statistic for excluded instruments for COLLATARAL	8.426		13.099	
z statistic for SHORTAPPLY for the first stage probit	6.82		8.24	
t statistic for endogeneity of COLLATERAL	-0.11		0.48	
C statistic	0.158		0.006	
	(0.6907)		(0.9366)	

Note

A dependent variable is SHORTRATE. Variable definitions are described in Table 1. ***, ** and * show that the coefficient is statistically significant at the 1 percent level, the 5 percent level and the 10 percent level, respectively. The Huber-White heteroskedasticity robust standard error is in parenthesis below the corresponding estimated coefficient. In the first stage of the estimation, the likelihood that a firm's borrowing rate on a short-term loan from its main bank is observed is estimated using the probit model with SHORTAPPLY as an additional independent variable. In the second stage for a firm's short-term borrowing rate from its main bank, the inverse Mill's ratio obtained from the first stage is added as an independent variable. The second stage is estimated by 2SLS using REALRATIO and HOME interacted with LANDPRICE as additional instrumental variables. In addition to the variables presented in the table, LNFAGE, LNAGE and EDUC as well as regional and industry dummies are included as controls. The large bank borrower sample is the sample of firms with a main bank whose total assets are greater than the sample median. The "small" large bank borrower sample is the sample of firms contained in the large bank borrower sample that employ less than 100 persons. When there is a probability of the observable short rate predicted in the first stage is zero or one for any observation, the standard error is unable to compute. Such observations are dropped. In computing standard errors, adjustments are made regarding the first stage probit regression. The methodology to compute standard errors are detailed in Appendix C. The C statistic is developed by Hausman (1978) and is described in pages 232 and 233 of Hayashi (2000). The numbers below the J statistic and below the C statistic are corresponding p values. The t statistic for endoegeneity of COLLATERAL is computed in the following two steps. First, COLLATERAL is regressed on all the exogenous variables including instrumental variables using OLS. The predicted residual from the COLLATERAL regression is added as an independent variable to a set of independent variables in the OLS regression for SHORTRATE. The t statistic is that of the coefficient of the predicted residual.

Table A1. The Definition of a Small and Medium Enterprise in Japan

Industry	Equity is no more than	or	The number of employees is no more than
Manufacturing, construction and transportation	300 million yen		300
Wholesale	100 million yen		100
Retail	50 million yen		50
Service	500 million yen		100
Mining	300 million yen		300
Manufacturers of rubber products	300 million yen		900
Lodging	50 million yen		200
Software and information processing service	300 million yen		300

Source: The Small and Medium Enterprise Agency, the Ministry of Economy, Trade and Industries.

Table A2. Descriptive Statistics of Selected Variables for the Sample of Publicly Guaranteed Firms

Variable	N	mean	median	standard error	min	max
SHORTRATE	1184	2.450	2.250	1.079	0.000	9.999
BBIS	1265	0.099	0.100	0.020	0.045	0.215
BNPLLOAN	1265	0.087	0.086	0.035	0.026	0.361
BLIQUID	1265	0.300	0.283	0.072	0.140	0.709
BROA	1265	-0.003	0.0000	0.007	-0.030	0.005
BTASSET	1265	23,993,297	3,892,532	4,154,900	33,543	140,985,953
MAJOR	1265	0.248				
REGIONAL	1265	0.474				
REGIONAL2	1265	0.123				
COOPERATIVE	1265	0.156				
HHI	1265	985.2	948.9	562.2	305.2	2760.1
LENGTH	1265	30.1	30	14.8	1	86
DISTANCE	1232	5.2	5.5	7.7	0.25	100
TASSET	1265	1,719,580	931,268	2,858,792	34,146	58,649,915
SALES	1265	1,938,808	1,103,049	3,049,075	42,964	53,272,688
The number of employees	1265	53.8	32	88.8	0	2363
SCORE	1265	54.5	54	5.9	25	76
CAPITAL	1265	0.192	0.177	0.211	-1.685	0.887
CURRENT	1265	1.492	1.253	1.167	0.078	20.585
OWNER	1265	0.614				
EDUC	1265	0.512				
AGE	1265	58.0	58	9.3	29	91
FAGE	1265	44.8	40	26.3	4	377
HOME	1265	0.930				
REALRATIO	1265	0.250	0.230	0.176	0	0.939
COLLATERAL	1265	0.911				
GCOVER	1265	0.329				

Note
GCOVER is the variable that measures the coverage of government guarantees on all the loans borrowed by a firm. The firm is asked to choose from 4 alternatives, “more than 0% but no less than 40%”, “more than 40% but no less than 60%”, “more than 60% but no less than 100%” and “100%”. For these alternatives, GCOVER takes a value of 0.2, 0.5, 0.8 and 1 in the ascending order. Definitions of other variables are described in Table 1.

Table A3. The Regression Results for the Sample of Publicly Guaranteed Firms

	Full sample	Large bank borrower sample	Small bank borrower sample
BBIS	-2.30	7.29	-1.41
	(2.58)	(7.15)	(2.82)
BNPLLOAN	-0.00	-2.80	2.67 **
	(0.93)	(1.77)	(1.28)
BLIQUID	-1.89 ***	-2.74 **	-1.39
	(0.62)	(1.34)	(0.91)
BROA	7.74	-5.88	13.11
	(4.98	(12.73)	(11.61)
REGIONAL	0.247 **	0.32	-0.26
	(0.115)	(0.20)	(0.17)
REGIONAL2	0.057	0.11	-0.45 **
	(0.133)	(0.67)	(0.20)
COOPERATIVE	0.698 ***		
	(0.163)		
HHI	0.000013	0.00006	0.00002
	(0.00008)	(0.00014)	(0.00013)
LNLENGTH	-0.02	0.02	-0.13
	(0.06)	(0.07)	(0.12)
SCORE	-0.0431 ***	-0.0349 ***	-0.0449 ***
	(0.0057)	(0.0091)	(0.0082)
CAPITAL	-0.54 ***	-0.77 ***	-0.39
	(0.20)	(0.24)	(0.28)
LNTASSET	-0.075	-0.053	-0.172 **
	(0.054)	(0.080)	(0.075)
CURRENT	-0.071 **	-0.032	-0.074 **
	(0.027)	(0.049)	(0.033)
OWNER	-0.011	0.111	-0.175
	(0.071)	(0.097)	(0.121)
COLLATERAL	-0.056	-0.391	1.470
	(0.762)	(0.884)	(1.474)
GCOVER	0.46 **	0.54 *	0.44
	(0.19)	(0.29)	(0.27)
Inverse Mill's ratio	-0.51	-0.86 *	-0.21
	(0.35)	(0.44)	(0.46
N (second stage)	1184	591	594
N (first stage)	1265	629	637
J statistic	1.572	0.045	0.681
	(0.2100)	(0.8325)	(0.4093)
F statistic for excluded instruments for COLLATARAL	10.492	7.553	2.935
z statistic for SHORTAPPLY for the first stage probit	5.92	3.55	5.09
t statistic for endogeneity of COLLATERAL	0.54	0.86	-0.82
C statistic	0.144	0.789	0.474
	(0.7039)	(0.3745)	(0.4913)

Note

A dependent variable is SHORTRATE. Variable definitions are described in Table 1 and note of Table A2. ***, ** and * show that the coefficient is statistically significant at the 1 percent level, the 5 percent level and the 10 percent level, respectively. The Huber-White heteroskedasticity robust standard error is in parenthesis below the corresponding estimated coefficient. In the first stage, the likelihood that a firm's borrowing rate on a short-term loan from its main bank is observed is estimated using the probit model with SHORTAPPLY as an additional independent variable. In the second stage for a firm's short-term borrowing rate from its main bank, the inverse Mill's ratio obtained from the first stage is added as an independent variable. The second stage is estimated by 2SLS using REALRATIO and HOME interacted with LANDPRICE as additional instrumental variables. GCOVER is not treated as an endogenous variable because we do not find appropriate exogenous instrumental variables. In addition to the variables presented on the table, LNFAGE, LNAGE and EDUC as well as regional and industry dummies are included as controls. The large bank borrower sample is the sample of firms with a main bank whose total assets are greater than the sample median. The small bank borrower sample is the remainder. In computing standard errors, adjustments are made regarding the first stage probit regression. The methodology to compute standard errors are detailed in Appendix C. When there is a probability of the observable short rate predicted in the first stage is zero or one for any observation, the standard error is unable to compute. Such observations are dropped. Since dropped observations for the full sample are not necessarily the total of dropped observations for subsamples, the number of observations for the full sample does not necessarily equal the sum of numbers of subsamples. The C statistic is developed by Hausman (1978) and is described in pages 232 and 233 of Hayashi (2000). The numbers below the J statistic and below the C statistic are corresponding p values. The t statistic for endoegeneity of COLLATERAL is computed in the following two steps. First, COLLATERAL is regressed on all the exogenous variables including instrumental variables using OLS. The predicted residual from the COLLATERAL regression is added as an independent variable to a set of independent variables in the OLS regression for SHORTRATE. The t statistic is that of the coefficient of the predicted residual.