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Do Banks Produce Private Information?

Bank Screening and Ex-Post Small Firm Performance☆

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Abstract

This paper examines whether commercial banks screen loan applications based on private information on firms' future profitability, and consequently how banks' ex-ante private information and screening decisions affect firms' ex-post profitability. Using a dataset of banks' loan application screenings and the ex-post firm performance for SMEs, we obtained strong evidences suggesting that banks' ex-ante private information was related to firms' ex-post performance. We found this relationship to be especially strong for small, mature firms, which supports the relationship-lending hypothesis.

Key Words: Private information, relationship lending, information monopoly, and loan screening.

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Bank Screening and Ex-Post Firm Performance

1. Introduction

Modern banking theory posits that banks have private information on borrowers' creditworthiness and financial conditions, and that they utilize it in screening and monitoring borrowers (e.g., Diamond, 1984; Rajan, 1992). However, few studies obtain direct evidence on the presence of banks' private information. We try to fill in the void between the theory and evidence.

Specifically, we investigate banks' private information using a survey of Japanese small firms on whether firms' loan applications were accepted or rejected. This survey is similar to the National Survey of Small Business Finance (NSSBF) for U.S. firms. Combining the survey data with the firms' financial statement data, we analyze the ex-post firm performance of loan applicants.

Banks decide whether to make loans or not according to their judgment on the applicants' creditworthiness. Their judgment is based on borrowing firms' financial statements and other public information, and possibly on the private information that the banks have accumulated through their transactions with the borrowing firms. Though outsiders, including researchers, cannot directly observe banks' private information, we can estimate its usefulness and accurateness by observing the ex-post performance of borrowing firms after bank screenings.

One may simply think that if the ex-post performance of rejected firms turns out to be worse than that of accepted firms after controlling various financial variables, one can conclude that the bank's private information was useful in predicting the firm performance. However, we should make a distinction between two different

channels that potentially work between banks' loan screening and borrowing firms' ex-post performance.

First, a bank screens borrowing firms using its private information to forecast the borrowers' profitability and default probability. For example, the bank may have the information on the market value of the firm's real estate and other collateralized assets, credit guarantees and other off-balance-sheet liabilities, and the creditworthiness of the firm's clients. The bank rejects the application for loans from a firm whose profitability and default probability are forecast to worsen. If the bank's forecast is correct, the rejected firm will perform worse than the accepted firm after controlling for the firm characteristics contained in public information. We call the banks' ability to forecast the borrowers' future profitability the *information production effect.*

Second, rejected firms may find it difficult to obtain other sources of funds, face a liquidity shortage, miss out on profitable opportunities and see its profits deteriorate. We call this financial constraint effect faced by rejected borrowers the *information monopoly effect*. This effect works if other banks do not have enough information on the creditworthiness of the rejected firm to lend to it. Though other banks can access public information, it may take considerable time and effort for them to process it before deciding whether to make a loan to the firm. Actually, small- and medium-sized enterprises (SMEs) rarely disclose audited and reliable financial statements. Consequently, the rejected firm may experience a liquidity shortage.

We present an empirical approach from which we can distinguish between the information production effect and the information monopoly effect, and we apply it to a unique dataset of Japanese SMEs. Specifically, we compare the ex-post

performance between rejected firms and accepted firms to investigate the two effects of banks' private information.

We also investigate whether the above two bank information effects are different among various types of firms. In particular, we examine how firm age and size affect the accumulation of private information on the part of banks. Literature on relationship lending (e.g., Boot, 2000) emphasize that banks accumulate private information through a long-run relationship with their client firms. In this case, banks are likely to accumulate the private information of mature firms rather than young firms. In addition, bank information monopoly theory (e.g., Rajan, 1992) stresses that banks have an incentive to accumulate information on informationally opaque firms, because those firms find it difficult to raise funds in the public financial markets. In this case small firms, which tend to be informational opaque, are more likely to be monitored by banks than large firms.

Some preceding studies examine the ex-post firm stock price or operating performance after bank failures. If banks monopolistically own private information on borrowing firms, borrowing firms will face difficulty in raising external finance and see their performance deteriorate. Most of the existing evidences support this idea (Slovin et al.,1993; Bae et al., 2002; Yamori and Murakami,1999), though some studies found only small or negligible effects (Ongena et al., 2003; Brewer et al., 2003; Hori, 2005). These studies focus on the information monopoly effect.

To reveal the signal effect of bank private information, the response of stock prices to the announcement of new bank loans has been investigated. James (1987) and Lummer and MacConell (1989) find that following the announcement of new bank financing, the stock prices of the firms rise, suggesting that bank loans serve as favorable signals of the firms' performance. However, they do not compare the

performance between those that can borrow from banks and those that cannot. In a different context, Puri (1996) investigates the signal effect of bond underwriting by banks. Focusing on the U.S. bond market before the implementation of the Glass-Steagall Act, she found that banks' underwriting raised the bond prices as compared with security companies' underwriting. This finding also suggests that private information owned by banks serves as a positive signal.[1] While she detects the banks' information production effect in the securities underwriting business, we directly investigate the roles of bank private information in the bank loan business.

To our best knowledge, this is the first study that provides large-sample evidence on bank information production and the ex-post firm performance for small and medium-sized firms. Many testable implications are most relevant to time series data when relating bank decisions to post-decision firm performance. This paper contributes to the literature on relationship lending (Petersen and Rajan, 1994; Angelini et al., 1998; Cole, 1998; Harhoff and Körting, 1998; Boot, 2000). Existing studies on relationship lending examine the effects of bank-firm relationships on the availability and price of credit, obtaining positive results in most cases. These studies judge the accumulation of private information on the part of banks by the availability and price of credit using cross sectional data. However, a positive correlation between the close bank-firm relationship and the availability of credit does not necessarily imply that banks produce private information thorough relationships. Peek and Rosengren (2005), for example, document a perverse incentive of Japanese

[1] Puri (1996) analyzes only the information production effect and implicitly assumes no information monopoly effect, which seems reasonable for firms that issue public bonds. However, for SMEs we cannot *a priori* neglect the possibility of the information monopoly effect.

banks to extend loans to almost insolvent borrowers, especially to closely related borrowers. On the other hand, we use a panel data set to judge the accumulation of private information by investigating the ex-post performance of borrowers. Thus we can test the hypotheses that banks produce private information and that they utilize it to screen creditworthy borrowers. We also investigate whether information effects are stronger on young or small firms than on mature or large firms to test the hypothesis that banks produce private information through long-term relationships with informational-opaque firms.

The rest of the paper is composed as follows. In Section 2, we present an empirical method that enables us to detect the information production effect and the information monopoly effect of bank private information. In Section 3, we describe our dataset. In Section 4, we present our empirical results. Section 5 concludes.

2. Hypotheses

In this section, we present a simple model of the relationship between bank screening and firm profitability. Based on this model, we conduct an empirical analysis to test whether a bank produces private information on the borrowing firm in the next section.

A firm applies for a loan from a bank. The firm's next-period profit depends on whether or not the bank accepts the loan application, as well as the firm's current profit and other characteristics of the firm. If the bank rejects the loan application, the firm may find it difficult to obtain financing from other financial institutions, fall into liquidity shortage, and miss out on profitable opportunities. We call this channel of bank private information on firm profitability the *information monopoly effect*. We specify the firm profit as

(1) $$F_{it+1} = \beta_0 F_{it} - \beta_1 B_{it}^f - \beta_2 REJECT_{it} + v_{it+1},$$

where t denotes the year when firm i applies a loan. The dependent variable F_{it+1} denotes firm i's profit in year $t+1$. Among the dependent variables, $REJECT_{it}$ is a dummy variable that takes the value of one if the bank rejects the loan application in year t and zero otherwise. If the information monopoly effect works, the coefficient on *REJECT* turns out to be negative (β_2 is positive). F_{it} denotes firm i's profit as of year t. If the firm's profits are positively correlated over time, β_0 is positive. B_{it}^f denotes a vector of firm characteristics that is in the public information set, such as leverage and size. v_{it+1} is a random shock that affects the firm's next-period profit but is not included in the public information set.

The bank receives an imperfect signal, u_{it}, of the firm's random shock v_{it+1}. We assume u_{it} and v_{it+1} to be drawn from the joint normal distribution with each mean zero, each variance σ_u^2 and σ_v^2, respectively, and the correlation coefficient $\rho \geq 0$. ρ represents the accuracy of the bank's private information on the firm's next-period profit. If ρ is positive, we say that the *information production effect* of bank private information works. The bank decides whether to accept the loan application or not based on the signal u_{it}. Specifically, the bank that receives the signal u_{it} accepts the loan application if the firm's expected profit, conditional on the bank granting the loan, exceeds some threshold value, $\overline{F}_{it+1}$.

(2a) $REJECT_{it} = 0$ *if* $E[F_{it+1} | REJECT_{it} = 0, u_{it}] = \beta_0 F_{it} - \beta_1 B_{it}^f + E[v_{it+1} | u_{it}] > \overline{F}_{it+1}$,

(2b) $REJECT_{it} = 1$ *otherwise*.

From the assumption of the joint normal distribution for u_{it} and v_{it+1},

(3) $$E[v_{it+1} | u_{it}] = \rho \frac{\sigma_v}{\sigma_u} u_{it}.$$

The threshold value is assumed to depend on the bank's capitalization and the

bank-firm relationship.

$$(4)\quad \overline{F}_{it+1} = -\gamma_0 B_{it}^m - \gamma_1 X_{it} + \gamma_2 COL_{it} + \varepsilon_{it},$$

where B_{it}^m is a vector of the bank's capitalization variables, X_{it} is a vector of the bank-firm relationship variables, and COL_{it} is a dummy variable that takes unity if the firm pledges collateral to the bank and zero otherwise. We briefly discuss the rationale for these variables.

If a less-capitalized bank tends to apply a more stringent standard to accept the loan application (creditl crunch), the coefficient on a variable in B_{it}^m will be negative (γ_0 is positive). Some theoretical and empirical studies support the credit crunch hypothesis positing that a deterioration of bank capital results in a decrease in the supply of loans. The asymmetric information between banks and investors makes issuing new equity costly (Myers and Majluf, 1984; Stein, 1998; Diamond and Rajan, 2000). As a result, poorly-capitalized banks have to curtail their loans either because of their own incentive problems or because of capital adequacy requirements. Holmstrom and Tirole (1997) develop an incentive model of financial intermediation and find that when bank capital decreases, capital-poor firms are the first to get squeezed. Thakor (1996) shows that capital requirements linked solely to credit risk tighten equilibrium credit rationing. Many empirical studies focus on the 1990-91 recession in New England and obtain evidence supporting the credit crunch hypothesis (Bernanke and Lown, 1991; Peek and Rosengren, 1995; Hancock and Wilcox, 1998, among others). There are also some empirical studies suggesting the credit crunch by Japanese banks during the 1990s, though the exact period of credit crunch detected varies (Ito and Sasaki (2002) for the early 1990s, Woo (2003) for the 1997 crisis period, and Montgomery (2005) throughout the 1990s).

There are several reasons why the bank-firm relationship affects the threshold

value, $\overline{F}_{it+1}$. The firm establishes a business relationship with a bank in order to increase the likelihood that it will have access to bank loans in tough times (Petersen and Rajan, 1994). Jiangli et al. (2008) obtained evidences supporting this idea for Korean and Thai firms during the Asian financial crisis. In Japan, the bank affiliated with the firm may want to rescue the firm even in an almost insolvent state by lending on favorable conditions (Peek and Rosengren, 2005). In addition, if the bank can gain profits besides loans from a wide-range of transactions with the firm, it may apply a looser standard to accept the loan application. For any case, the coefficient on a variable in X_{it} is expected to be negative (γ_1 to be positive). ε_{it} is a random shock to the threshold value set by the bank that is drawn from a normal distribution with mean zero, variance σ_{ε}^2, and no correlation with v_{it+1} or u_{it}.

There are two competing theories concerning the role of collateral in SME financing. Bester (1985) posits that a low risk firm pledges collateral to distinguish itself from a high risk firm, while Boot et al., (1991) insists that a bank demands a high risk firm to pledge collateral to curb the firm's moral hazard. In the former case, a bank is more likely to lend to a firm that offers collateral, because the bank considers such a firm to be less risky. On the other hand, in the latter case a bank is less likely to lend to a firm that offers collateral because the bank considers such a firm to be more risky. There are also competing theories concerning the role of collateral in bank monitoring. Rajan and Winton (1995) argue that collateral can increase a lender's incentive to monitor under certain conditions. In their model, when banks demand collateral it signals that a firm is in bad shape. On the other hand, Manove et al., (2001) posit that strong creditor protection may result in an inefficiently low level of project screening by banks, suggesting that a low quality firm is less likely to post collateral and more likely to be rejected. Though empirical evidence for the role of collateral in the U.S. SME financing is mixed (Berger and Udel, 1990, 1995;

Pozzolo, 2004; Krahnen, 2000), Ono and Uesugi (2009) found a positive correlation between the borrower's risk and collateral. Based on their evidence, we may presume that those firms that offer collateral are more likely to be rejected. If this is the case, γ_2 is expected to be positive.

Substituting (3) and (4) into (2a) and (2b), we can summarize the bank decision as

$$(5)\quad REJECT_{it}^{*} = -\beta_0 F_{it} + \beta_1 B_{it}^{f} - \gamma_0 B_{it}^{m} - \gamma_1 X_{it} + \gamma_2 COL_{it} + \tilde{u}_{it},$$

$$(6)\quad REJECT_{it} = \begin{cases} 1 & if \quad REJECT_{it}^{*} \geq 0 \\ 0 & if \quad REJECT_{it}^{*} < 0 \end{cases},$$

where $\tilde{u}_{it} \equiv \varepsilon_{it} - \rho \frac{\sigma_v}{\sigma_u} u_{it}$ is a random shock drawn from the normal distribution with mean zero, variance $\sigma_{\tilde{u}}^2 \equiv \sigma_\varepsilon^2 + \rho^2 \sigma_v^2$, and

$$(7)\quad \tilde{\rho} \equiv corr(\tilde{u}_{it}, v_{it+s}) = -\frac{\rho^2 \sigma_v}{\sqrt{\sigma_\varepsilon^2 + \rho^2 \sigma_v^2}}$$

Equation (7) shows that $\tilde{\rho}$ is monotonically decreasing in ρ and takes the value of zero if ρ is zero. $\tilde{\rho} \approx -\rho$ if σ_ε^2 is sufficiently small.

Now we can summarize two testable hypotheses concerning the effects of the bank's private information on the firm's profit.

Hypothesis 1: ***Information production effect.***

If the bank decides whether to accept the loan application or not based on the private signal that is informative to the borrower's future profit, $\tilde{\rho} < 0$.

Hypothesis 2: ***Information monopoly effect.***

If the bank's rejection of the firm's loan application causes the firm's future profits to deteriorate due to the bank's information monopoly, the coefficient on *REJECT* in Equation (1) is negative ($\beta_2 > 0$).

To further clarify the above two effects, we derive the difference between the expected profits of the firm whose loan application is accepted and the firm whose loan application is rejected. Defining

$$(8)\quad \phi_{it} = \phi[(-\beta_0 F_{it} + \beta_1 B_{it}^f - \gamma_0 B_{it}^m - \gamma_1 X_{it} + \gamma_2 COL_{it})/\sigma_{\tilde{u}}], \text{ and}$$

$$(9)\quad \Phi_{it} = \Phi[(-\beta_0 F_{it} + \beta_1 B_{it}^f - \gamma_0 B_{it}^m - \gamma_1 X_{it} + \gamma_2 COL_{it})/\sigma_{\tilde{u}}],$$

where ϕ and Φ denote the marginal and cumulative density functions of the standard normal distribution, we get

$$(10)\quad E[F_{it+1} \mid REJECT_{it} = 1] = \beta_0 F_{it} - \beta_1 B_{it}^f - \beta_2 + \tilde{\rho}\sigma_v \frac{\phi_{it}}{\Phi_{it}}, \text{ and}$$

$$(11)\quad E[F_{it+1} \mid REJECT_{it} = 0] = \beta_0 F_{it} - \beta_1 B_{it}^f + \tilde{\rho}\sigma_v \left[\frac{-\phi_{it}}{1-\Phi_{it}}\right].$$

From Equations (10) and (11), we obtain

$$(12)\quad E[F_{it+1} \mid REJECT_{it} = 1] - E[F_{i,t+1} \mid REJECT_{it} = 0] = -\beta_2 + \tilde{\rho}\sigma_v \frac{\phi_{it}}{\Phi_{it}[1-\Phi_{it}]}.$$

(see Green, 2008, for example). Equation (12) shows that the difference between the expected profit of the rejected and accepted firms depends on the information monopoly effect, $-\beta_2$, and the information production effect, $\tilde{\rho}\sigma_v \frac{\phi_{it}}{\Phi_{it}[1-\Phi_{it}]}$.

3. Empirical Methodology and Data

3.1 Methodology

Because the bank's decision and the firm's future profitability depends on each other, as we have shown in Section 2, we perform the simultaneous estimation of Equations (1) and (5) using the maximum likelihood estimator.[2] Hypothesis 1 (the *information production effect*) can be tested by determining whether or not the correlation coefficient of the error terms of the two equations is negative. Hypothesis 2 (*the information monopoly effect*) can be tested by checking whether or not the coefficient of *REJECT* in Equation (1) is negative.

3.2 Data

Data Source

We use the *Corporate Finance Survey* published by the Small and Medium Enterprise Agency in December, 2001. This *Survey* is similar to the NSSBF1993 (the National Survey of Small Business Finance) for similar size U.S firms. The sample firms are randomly drawn from the firms contained in the TSR (Tokyo Shoko Research) database belonging to all industries except agriculture, fishery and forestry, financial services, and public services. Large firms are included in the sample so that they account for 10 percent of the total in each industry. The inquiries cover the three-year period from January 1999 to December 2001.

The *Survey* contains information on whether the firms' applications for loans had been rejected by their main banks in the preceding three years. The *Survey* also includes information on the number of years the firms have been in business, the numbers of employees, the numbers of years over which they have been transacting with their main bank, the year when they changed their main banks, the number of financial institutions that provide the firm with banking services, and their industries as of the end of October

[2] This is a so-called treatment effect model.

2001. In addition, the *Survey* contains information on whether the firms' business conditions were good, unchanged, or bad for each of the last three years.

We obtain information about the firms' financial statements and their main banks from the TSR database. The firms' main banks are identified as the first financial institutions listed in the TSR database.[3] The *Survey* data is linked to the main banks' financial statements available in the Nikkei Needs database.

In the National Survey of Small Business Finance, all other data are available for only one year, with the exception of sales figures (Peterson and Rajan, 1997). One advantage of our survey that is different from the NSSBF is that subsequent firm performance is available. This enables us to investigate the implications of the information hypotheses as they pertain to the changes of the firm profitability from the pre-screening level to the post-screening one.

Sample Selection

We use the data as of years 2000 and 2001 for the years of bank screening (year t in Equations (1) and (5)) and examine the ex-post performance of firms in years 2001 and 2002. From detailed information for year 2001 that included the number of years firms had been transacting with their main banks, the number of financial institutions that firms were

[3] The Corporate Finance Survey does not contain information on the firms' main banks. The first financial institution listed in the TSR database has been determined by TSR researchers to be the most important one, based on the information they obtain from the firm managers. As such, it should coincide with the one firm managers also regard as the most important. However, if a firm changes its main bank during the inquiry period, the "most important bank" may be different. It is because of this reason we exclude those firms that changed main banks during the inquiry period (Jan. 1999 - Dec. 2001).

transacting with, and the share of loans that were extended by their main banks, we were able to infer those same pieces of information for year 2000.

The sample consists of the firms that satisfy the following four conditions. First, they are classified as small or medium-sized enterprises according to the Small and Medium-Sized Firm Fundamental Law.[4] Second, their main financial institutions are major banks, long-term credit banks, trust banks, first-tier regional banks, second-tier regional banks or credit banks (*shinkin*) whose financial statements are available. Third, we exclude those firms whose loan applications were rejected consecutively for two years or more. Thus we can accurately identify the effects of a firm's loan rejection in one year on its profit in the following year. Finally, to identify the firms' main banks correctly, we restrict our sample firms to those who did not change their main banks during 1999-2001. The number of remaining firms that satisfy these conditions is 3,173. Loan rejections account for a 3.4% share of the 4,687 firm-year samples.

Variables

We first describe the variables in the loan rejection equation (5), and then those in the

[4] The Small and Medium-Sized Firm Fundamental Law defines SMEs, in principle, as those firms whose equity is ¥300 million yen or less, or who have 300 employees or less. However, the maximum capital amounts are set to ¥100 million for wholesale industries and ¥50 million yen for retail and service industries, and the maximum number of employees is set to 100 for wholesale and service industries and 50 for retail industries.

[6] We add the logarithm of the number of years a firm has been in business as an explanatory variable of Equation (5), finding that it takes an insignificant coefficient and that it is highly correlated with the number of years a firm has been transacting with its main bank.

firm profit equation (1).

As a measure of firm profit, F_{it}, we use *EBTDA* (Earnings before interest, taxes, depreciation and amortization) as a proportion of total assets. *EBTDA* represents the firm's cash flow and is therefore an appropriate measure of firm profitability. On the other hand and in spite of being widely used in other studies of Japanese firms, ROA (after-tax return on assets) is problematic for our purpose because a firm whose loan application is rejected may reduce investment and hence capital stock and depreciation, which has an increasing effect on ROA. It is expected that a bank is more likely to deny the loan applications from less profitable firms.

As firm characteristic variables, B_{it}^{f}, we use the debt-to-asset ratio (*DEBT*), business condition dummy (*BUSINESS*), sales-to-asset ratio (*SALES*), and logarithm of the number of employers (*SIZE*).[6] *BUSINESS* takes the value of one if the firm responded "good" or "unchanged" to the question of business conditions, and the value of zero if it responded "bad." A high *DEBT* means a high default risk and hence is likely to result in a high probability of rejection, implying that it takes a positive sign in the loan rejection equation (5). On the other hand, high *SALES* and *BUSINESS* are expected to take negative coefficients in the loan rejection equation (5).

However, until the middle of the 1990s, the Japanese government denied the existence of nonperforming loans, and its complicity enabled banks to pursue forbearance-lending policies. If banks liquidate impaired firms, the difference between the face value of loans and the value of the foreclosed assets become losses on their own balance sheets. Likewise, debt forgiveness results in losses from nonperforming loans. Indeed, Hoshi and Kashyap (2004) and Caballero, Hoshi and Kashyap (2008) show how the dysfunctional Japanese banking system misallocates funds by keeping many insolvent firms in business. Similarly, Peek and Rosengren (2005) examine the misallocation of credit in Japan associated with

the perverse incentives of banks to provide additional credit to the weakest firms. It is possible that a bank accepts the loan applications from less profitable or unhealthier industrial firms but denies the loan applications from more profitable or healthier industrial firms.

Appropriate measures for bank capitalization, B_{it}^{m}, are difficult to find because the accounting capital and the risk-adjusted regulatory capital ratio under the Basel standard (the so-called BIS capital ratio) are often prone to discretion and not coincident with the economic value of capital (e.g., Shrieves and Dahl, 2003). Given no one perfect measure, we use three alternative variables. One is the difference between the BIS ratio and the minimum requirement level (8 percent for internationally active banks and 4 percent for domestic banks) (e.g., Peek and Rosengren, 2005). We call it *CAPITAL MARGIN*. Another is the share of non-performing loans, i.e., risk-management loans,[7] in total assets (*NPL*), which is supposed to be negatively correlated with the economic value of capital. The last one is the growth rate of deposits outstanding (*DEPOSIT*). If a large amount of deposits are drawn from a poorly capitalized bank, the bank may face a liquidity shortage and be forced to reduce loans by applying strict standards in screening loan applications. In the loan rejection equation (5), *CAPITAL MARGIN* and *DEPOSIT* are supposed to take negative coefficients, while *NPL* is supposed to take a positive coefficient. In the case of *DEPOSIT*, however, it may take a positive coefficient if depositors draw deposits from banks with loose screening standards because they consider such banks to be risky. In addition, if a poorly-capitalized bank tried to collect a large amount of deposits by raising deposit interest rates in order to invest in risky loans (Hellman, Murdock and Stiglitz, 2000; Gan 2004), then DEPOSIT would take a positive coefficient. We suppose that this is not

[7] Risk-management loans are defined as the sum of loans to borrowers in legal bankruptcy, past due loans three months or more in arrears, and restructured loans.

plausible during the sample period when the regulators strengthened the enforcement of the capital adequacy requirements and the deposit interest rates at most banks were very close to zero.

For the firm-bank relationship measure, X_{it}, we use the number of years the firm has been transacting with its main bank (*RELATIONSHIP YEARS*) and the number of financial institutions that the firm transacts with. These measures are widely used in the literature on relationship lending, especially for SME finance (Petersen and Rajan, 1994; Angelini et al., 1998, Cole, 1998; Harhoff and Körting, 1998, among others). The firms that have been transacting with their main banks for a long time and those that transact with a small number of financial institutions are supposed to have a strong relationship with their main banks. Considering that the effect of the number of financial institutions on the main bank's decision on loan screening is supposed to be nonlinear (Hosono et al., 2004), we use a dummy variable that takes the value of one if the number of the transacting banks is three or more, and the value of zero otherwise (*BANKS>2*). The threshold value of three is chosen based on the median of the number of the transacting banks.

In the loan rejection equation (5), *RELATIONSHIP YEARS* and *BANKS>2* are supposed to take negative and positive coefficients, respectively.

Finally, the dummy (*COLATTERAL*), the dummy(GUARANTEE) takes the value of one if the firm provides its main bank with collateral, guarantee and the value of zero otherwise respectively. In the firm profit equation (1), the profit, F_{it}, is *EBITDA*, as in the loan rejection equation (5). If *EBITDA* is serially correlated, its coefficient is positive. As firm characteristics variables, we use *BUSINESS*, *SIZE*, and the logarithm of the firm age (*AGE*). *BUSINESS* is supposed to take a positive coefficient, while *AGE* is supposed to take a negative coefficient if a young firm is likely to grow rapidly.[8]

[8] We add the debt-to-asset ratio and sales-to-asset ratio to the explanatory variables of

Descriptive Sample Statistics

Table 1 presents the descriptive sample statistics of all the samples and sub-samples for accepted firms and rejected ones. One feature of Japanese firm-bank relationships is that most firms, even SMEs, transact with multiple banks. The mean and median numbers of banks that firms transact with are 3.38 and 3 respectively. More than half of our sample firms transact with theree or more banks. There is a large variation in the average number of bank relations across countries. Detragiache, Garella and Guiso (2000) report that single banking is prevalent in the U.S. [9] On the other hand, Ongena and Smith (2000) and Jiangli, Unal and Yom (2008) find that single banking is relatively uncommon in Europe and crisis-hit Asian countries, respectively.[10]

The proportion of the firms that pledge collateral to tis main bank is 84.5 percent,

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Equation (1), finding that neither of them has a significant coefficient and that no other variables change the significance levels of the coefficients. We also add nine regional dummies and 4 industry dummies to Equations (1) and (5), finding that few of them are significant.

[9] Detragiache, Garella and Guiso (2000) report that the proportion of single banking is 44.5 percent of the U.S. SMEs based on the 1988-89 NSSBF.

[10] Ongena and Smith (2000, Table 1) report that the average number of bank relations varies from 2.3 for Norway to 15.2 for Italy, with the cross-country average of 5.6. Jiangli, Unal and Yom (2008) find that the average (median) numbers of bank relations are 1.93 (1) for Indonesia, 5.96 (4) for Korea, 3.06 (2) for the Philippines, and 2.29 (2) for Thailand.

which is much higher than those reported for the U.S and some European countries[11]. Also 78% of the firms provide their main banks guarantees.

Comparing the accepted and rejected firms, we see that rejected firms exhibit a high *DEBT*, a low *EBITDA*, low *SALES*, bad *BUSINESS*, a young *AGE*, short *RELATIONSHIP YEARS*, a small *SIZE*, a high likelihood of *COLLATERAL*, and a high likelihood of *GUARANTEE*. Rejected firms' next-period *EBITDA* is lower than accepted firms.

4. Estimation Results

4.1 Results for all sample firms

Table 2 presents the estimation results for all sample firms. We first look at the loan rejection equation (5). *EBITDA* has a negative and significant coefficient, as is expected. Among the firm characteristics variables, *BUSINESS* and *SIZE* have negative and significant coefficients, while *DEBT* has a positive and significant coefficient. As for the bank capitalization variables, neither *CAPITAL MARGIN* nor *NPL* is significant, suggesting no evidence of a capital crunch. *DEPOSIT* has a positive and significant coefficient, suggesting that depositors withdraw deposits from a bank that adopts a loose standard for loan screening. Looking at the firm-bank relationship variables, *RELATIONSHIP YEARS* has a negative and significant coefficient, and *BANKS>2* has a positive and significant coefficient, as expected. Finally, *COLLATERAL* takes a positive

[11] Using the 1988-89 NSSBF, Berger and Udell (1995) find that 53 percent of the U.S. small businesses pledge collateral to banks. Jimenez, Salas and Saurina (2006) examine loans to Spanish firms and find that the proportion of loans with collateral is 30.5 percent in short-term loans and 50.8 percent for long-term loans. Harhoff and Korting find that for German firms, this figure is 62 percent.

and significant coefficient, suggesting that a bank tends to demand collateral from a risky borrower and tends to reject such a firm's loan application. It is consistent with Gan (2006, 2007) that firms invest less if the value of landholding drops more. This suggests that after the burst of asset price bubble in the early 1990s, the banks are less likely to lend to firms that have pledged collateral. *GUARANTEE* takes a positive but insignificant coefficient.

Our finding that banks deny loan applications from less profitable and more indebted firms appears to be inconsistent with Hoshi and Kashyap (2004), Peek and Rosengren (2005), and Caballero, Hoshi and Kashyap (2008), who find the misallocation of credit in Japan associated with the perverse incentives of banks to provide additional credit to the weakest firms in the late 1990s. Some factors may account for the difference. First, banks had only to extend credit to cover interest payments in order to underreport non-performing loans. They did not necessarily extend new loans to impaired borrowers. Second, while the perverse incentive of banks is found for loans towards listed firms, our sample firms are small- and medium-sized firms. It seems natural that banks tended to evergreen the firms to which they had a large exposure. Finally, while the perverse incentive of banks was detected for the 1990s, our sample period for the bank screening covers 2000 and 2001. The Japanese supervisors became more and more stringent to window-dressing and other practices to conceal non-performing loans after the regulatory reform in 1998[12].Gan (2006, 2007) finds that Japanese firms rapidly reduced investments

[12] In 1998, Financial Supervisory Agency was established as an independent organization in charge of financial supervision, for which Ministry of Finance had been responsible until then. The Financial Reconstruction Act and the Rapid Recapitalization Act were passed also in 1998, which enabled the government to inject public money to banks and to nationalize failing banks. Based on these Acts, two major banks were nationalized and public funds were injected to other major banks. See Sakuragawa and Watanabe (2009) for

in the late 1990s due to severe credit constraints. In particular, special inspections towards major banks conducted from March 2000 to September 2001 prevented banks to underreport or evergreen non-performing loans.

Turning to the firm profit equation (1), *EBITDA* and *BUSINESS* take positive and significant coefficients, as expected. *SIZE* takes positive and significant coefficients, suggesting that larger firms are more likely to increase profits. *AGE* takes a negative and significant coefficient, suggesting that the profits of matured firms are more likely to drop.

Looking at the two-bank private information effects, we see that the information monopoly effect is not significant, while the information production effect is significant, as can be seen in the loan rejection dummy in Equation (1) and the correlation coefficient of the residuals from Equations (1) and (5), respectively. In Japan, most SMEs transact with multiple financial institutions, which may result in our findings against the information monopoly effect.[13]

4.2 Firm Size, Age and Relationship-Lending

Bank private information effects may depend on firm age and size. Firm age may matter because relationship lending theory posits that banks acquire and accumulate private information through long-run relationships with client firms. Banks may not yet have enough information for young firms. If this is the case, the information production effect is negligible for young firms. Firm size may also matter because more and more medium-sized firms are beginning to access market-based financing sources, including

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details.

[13] Our findings against the information monopoly effect are also consistent with Hosono et al., (2004), suggesting that multiple financial institutions share borrowers' information through transactions.

privately placed bonds and syndicated loans, for which multiple financial institutions and investors share information on the firms. For medium-sized firms, public information is so abundant that banks have little incentive to accumulate private information on them. Considering such heterogeneity among SMEs, we divide the sample firms into three categories: young firms, small and mature firms, and medium-size mature firms. We regard firms that have been in business for thirteen years or more, which is the fifth percentile, as mature firms and the other firms as young firms. We consider those firms with at least 87 employees, which is the seventy-fifth percentile, as medium-sized firms and the others as small firms.

Tables 3A, 3B and 3C describe the sample statistics for each sub-sample of firms. The proportion of loan rejections was 4.4%, the highest, for young firms, 3.9% for small and mature firms, and 1.7%, the lowest, for medium-sized mature firms. In each group, rejected firms display a high *DEBT*, a low *EBITDA*, low *SALES*, short *RELATIONSHIP YEARS*, small *SIZE*, a high likelihood of *COLLATEAL* and a high likelihood of *GUARANTEE*. While the *AGE* of rejected firms is less than that of accepted medium-sized mature firms, no such tendency can be observed for young firms or small and mature firms. Tables 4A, 4B and 4C present the estimation results for each subgroup. Table 4A shows the results for young firms. In the loan rejection equation (5), there is no variable that takes a significant coefficient if all the explanatory variables are included (in columns 1 to 3). Taking into consideration the possibility that young firms' financial statements are often opaque and unreliable, we omit the financial statement variables and re-estimate the model, finding that *BUSINESS* and *SIZE* take negative and significant coefficients in the results for all sample firms. In the firm profit equation (1), *EBITDA* and *BUSINESS* take positive and significant coefficients, while *SIZE* is not significant. *AGE* takes positive and significant coefficients, unlike the all-sample results, implying that the relationship

between firm age and profit is non-linear. Looking at the correlation coefficient of the residuals, we observe no information production effect. This result is consistent with the relationship-bank theory, which posits that banks accumulate private information through their long-running relationships with firms (e.g., Boot, 2000). As for the information monopoly effect, the coefficient for *REJECT* is negative but not significant, which may be the result of a relatively small sample size.

Table 4B shows the results for medium-sized mature firms. In the loan rejection equation (5), *EBITDA*, *SIZE* and *RELATIONSHIP YEARS* take negative and significant coefficients and *DEBT* takes a positive and significant coefficient, like the results for all sample firms. Unlike the results for the entire sample, however, *BANKS>2* takes a negative but insignificant coefficient. In the firm profit equation (1), *EBITDA* and *BUSINESS* take positive and significant coefficients. Importantly, we observe no information monopoly effect or information production effect, consistent with the casual observation that medium-sized mature firms can access various financing sources in the markets.

Finally, Table 4C shows the results for small mature firms. The overall results are similar to those for all sample firms. In the loan rejection equation (5), *EBITDA*, *BUSINESS*, *SALES*, *SIZE, RELATIONSHIP YEARS* and *BANKS>2* take negative and significant coefficients while *DEBT*, *COLLATERAL*, and *DEPOSIT* take positive and significant coefficients. In the firm profit equation (1), *EBITDA* and *BUSINESS* take positive and significant coefficients, and AGE takes a negative and significant coefficient. The information production effect is significant, as it is for the full sample results. On the other hand, the coefficient on *REJECT* in Equation (1) is positive and significant at the 10% level, which is not consistent with the information monopoly effect.

We can summarize the sub-sample results with the explanation that the full-sample results for the bank information production effect are brought about mainly by small, mature firms.

4.3 Comparisons with the existing literature

Some previous studies examine the information monopoly effect by investigating the effects of bank failures on client firms. Slovin et al. (1993) found that the stock prices of client firms moved down when the Continental Illinois Bank was on the verge of failure, and then moved up when Federal Deposit Insurance Corporation began to rescue the Bank. Bae et al. (2002) show that adverse shocks to Korean banks during the 1997-98 period had a negative effect on the values of their client firms and that this adverse effect on firm value is a decreasing function of the financial health of both the banks and their client firms.

On the other hand, Ongena et al., (2003) used the near-collapse of the Norwegian banking system during 1988-1991 to investigate the impact of bank distress announcements on the stock prices of firms maintaining a relationship with a distressed bank. They found that firms faced only small and temporary changes, on average, in stock price and that firms with access to unused liquid bank funds and firms that issued equity just prior to the crisis experienced relatively high abnormal returns.

For the failures of Japanese banks, there are mixed results. Yamori and Murakami (1999) found that the failure of Hokkaido Takushoku Bank in 1997 had a negative impact on the stock returns of client firms. Hori (2005) also picked up the failure of Hokkaido Takushoku Bank and extended sample firms to include unlisted client firms. He found that no significant difference existed between client firms and non-client firms after the bank failure, though he also showed that those client firms that had low-grades before the failure

and those that were not transferred to Hokuyo Bank when it acquired the business of Hokkaido Takushoku Bank, saw their profits deteriorate. Brewer et al., (2003) examined the failures of Hokkaido Takushoku Bank, Long-Term Credit Bank of Japan, and Nippon Credit Bank during 1997-1998, and found that the declines in the stock returns of the client firms on the dates of the disclosure of failures were not significantly different from those of non-client firms.

Given the various events and different time periods or countries, it is difficult to directly compare these preceding studies. However, the evidence for the information monopoly effect in Japan seems to be weaker than it is in the U.S. This may be due to the fact that most Japanese firms transact with many banks. Our evidence against the information monopoly effect also supports this view.

Some other studies, though few, are concerned with the information production effect. James (1987) and Lummer and MacConell (1989) find that following the announcement of new bank financing, the stock prices of the firms rise. Puri (1996) found that banks' underwriting raised the bond prices as compared with security companies' underwriting in the U.S. bond market before the implementation of the Glass-Steagall Act. Though they do not directly compare the ex-post performance of rejected firms and accepted firms, all of their findings are consistent with the bank information effect, which we have detected in this paper.

Evidence found in the relationship lending literature is also related to this paper. Petersen and Rajan (1994) analyzed data collected in a survey of U.S. small firms (the National Survey of Small Business Finance (NSSBF) collected by the U.S. Small Business Administration) and found that the effects of relationship are larger on the availability of credit than on the price of credit. In particular, they found that firm age and the length of the longest relationship had positive impacts on the availability of credit while the

BANKS>2 firms borrowed from had a negative impact. The positive firm age effect found in their study is consistent with our results. Berkowitz and White (2002) also used data from the 1993 NSSBF and found that the years of the bank relationship were negatively correlated with the credit constraint under which firms were discouraged or denied. They also found that the owner's age was negatively correlated with credit constraint in the case of non-corporate firms, and that the firm size (measured by employment) was negatively correlated with it in the case of corporate firms.[14]

Angelini et al. (1998) used a sample of small Italian firms. They found that with banks other than cooperative banks, lending rates tend to increase with the length of the relationship for all customers, whereas with local cooperative banks this is the case for non-member customers only. Their result, which is in line with bank capture or informational monopoly theories (Sharpe, 1990; Rajan, 1992), may be surprising given that small Italian firms tend to deal with multiple banks (Detragiache et al., 2000). Harhoff and Körting (1998) analyzed data in a survey of small- and medium-sized German firms and found that relationship variables have a bearing on loan collateralization and availability.

Finally, we point out that our estimation results on the role of collateral in bank screening are consistent with Ono and Uesugi (2009), who found a positive correlation between the borrowers' risk and the presence of collateral. On the other hand, empirical evidence for U.S. SMEs is mixed. Berger and Udel, (1990, 1995) and Pozzolo (2004) found a positive correlation between borrowers' risk and the presence of collateral, while Krahnen (2000) found no significant correlation between them.

[14] Berkowitz and White (2002) find that high homestead exemptions tend to lead to credit constraint under which firms are either discouraged or denied. For the effects of bankruptcy laws on small firm finance and entrepreneurial activity, see Gropp et al. (1996) and Fan and White (2003), respectively.

5. Conclusion

Observing the bank screening of loan applications and the ex-post firm performance, we investigated the accuracy of bank private information. Specifically, we examined whether banks screen loan applications based on private information on firms' future profitability (the *information production effect*), and whether rejected firms cannot be refinanced and consequently experience reduced profits (the *information monopoly effect*). Using a dataset for Japanese SMEs, we obtained strong evidence supportive of the information production effect, while we found no evidence to support the information monopoly effect. We also found that this result is mainly driven by relatively small and mature SMEs, for which a strong information production effect can be observed.

Our results are consistent with the relationship-lending theory positing that banks acquire and accumulate private information through long-run relationships with borrowing firms, especially with small, mature firms, who face difficulty obtaining financing from markets (Petersen and Rajan, 1994; Berkowitz and White, 2002; Harhoff and Körting, 1998) . Our results also suggest that the information monopoly problems raised by Rajan (1992) and Sharpe (1990) may not be very serious for Japanese SMEs, most of which transact with multiple financial institutions.

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Table 1. Descriptive Sample Statistics

variable	no. of obs.	mean	median	sd
		A. All firms		
Loan Screening				
REJECT	6695	0.034	0.000	0.181
Firm Characteristics				
EBITDA	6695	5.179	4.327	7.571
EBITDA(t+1)	6695	4.954	4.159	6.830
SALES	6695	1.469	1.269	1.111
DEBT	6695	0.763	0.792	0.227
NO. OF WORKERS	6695	71.173	41.000	89.510
AGE	6695	42.407	39.000	22.183
BUSINESS	6695	0.685	1.000	0.464
BUSINESS(t+1)	6695	0.583	1.000	0.493
Bank Characteristics				
DEPOSIT	6695	1.681	1.691	3.006
NPL	6695	4.023	3.646	1.911
CAPITAL MARGIN	6695	4.745	4.290	2.102
Firm-Bank Relationships				
RELATIONSHIP YEARS	6695	31.810	30.000	15.030
NO. OF BANKS	6695	3.384	3.000	2.563
BANKS>2	6695	0.576	1.000	0.494
COLLATERAL	6695	0.845	1.000	0.362
GUARANTEE	6695	0.781	1.000	0.414
		B. Accepted firms		
Firm Characteristics				
EBITDA	6469	5.304	4.417	7.533
EBITDA(t+1)	6469	5.064	4.227	6.745
SALES	6469	1.475	1.275	1.119
DEBT	6469	0.758	0.788	0.226
NO. OF WORKERS	6469	72.199	42.000	90.515
AGE	6469	42.500	39.000	22.209
BUSINESS	6469	0.693	1.000	0.461
BUSINESS(t+1)	6469	0.593	1.000	0.491
Bank Characteristics				
DEPOSIT	6469	1.669	1.650	3.009
NPL	6469	4.020	3.646	1.916
CAPITAL MARGIN	6469	4.746	4.290	2.097
Firm-Bank Relationships				
RELATIONSHIP YEARS	6469	31.935	30.000	15.035
NO. OF BANKS	6469	3.396043	3.000	2.586
BANKS>2	6469	0.576	1.000	0.494
COLLATERAL	6469	0.842	1.000	0.365
GUARANTEE	6469	0.777	1.000	0.416
		C. Rejected firms		
Firm Characteristics				
EBITDA	226	1.616	2.566	7.801
EBITDA(t+1)	226	1.785	2.681	8.322
SALES	226	1.309	1.074	0.839
DEBT	226	0.896	0.897	0.217
NO. OF WORKERS	226	41.819	27.500	44.162
AGE	226	39.739	35.000	21.313
BUSINESS	226	0.482	0.000	0.501
BUSINESS(t+1)	226	0.296	0.000	0.458
Bank Characteristics				
DEPOSIT	226	2.043	1.934	2.880
NPL	226	4.113	3.682	1.748
CAPITAL MARGIN	226	4.715	4.170	2.252
Firm-Bank Relationships				
RELATIONSHIP YEARS	226	28.226	29.000	14.462
NO. OF BANKS	226	3.168	3.000	1.873
BANKS>2	226	0.580	1.000	0.495
COLLATERAL	226	0.929	1.000	0.257
GUARANTEE	226	0.876	1.000	0.330

Table 2. Estimation Results for All Firms

***, ** and * represent the significance levels at 1%, 5% and 10%, respectively. athrho is the inverse hyperbolic tangent of ρ: athrho=0.5*ln((1+ρ)/(1-ρ)), where ρ is the correlation coefficient of the residuals of Eq. (1) and (5) 3. lnsigma is ln(σ), where σ is the standard error of the residual of Eq. (1). 4. LR-test is the X-square statistics of the null hypothesis that ρ is zero.

	1	2	3	4
	EBITDA(t+1): Eq. (1)			
EBITDA	0.333***	0.333***	0.333***	0.333***
	(32.985)	(32.966)	(32.965)	(32.975)
BUSINESS (t+1)	2.403***	2.402***	2.403***	2.403***
	(15.806)	(15.800)	(15.800)	(15.802)
SIZE	0.221***	0.220***	0.220***	0.220***
	(2.640)	(2.625)	(2.626)	(2.633)
AGE	-0.650***	-0.650***	-0.650***	-0.650***
	(4.615)	(4.618)	(4.617)	(4.616)
REJECT	0.03	-0.05	-0.052	-0.019
	(0.044)	(0.074)	(0.076)	(0.028)
Constant	3.886***	3.896***	3.896***	3.892***
	(6.689)	(6.706)	(6.705)	(6.699)
	REJECT: Eq. (5)			
Firm Characteristics				
DEBT	0.621***	0.627***	0.623***	0.646***
	(5.072)	(5.098)	(5.076)	(5.357)
EBITDA	-0.020***	-0.020***	-0.020***	-0.020***
	(4.180)	(4.059)	(4.073)	(4.079)
BUSINESS	-0.315***	-0.315***	-0.314***	-0.318***
	(4.895)	(4.892)	(4.881)	(4.947)
SALES	-0.114***	-0.116***	-0.114***	-0.116***
	(2.842)	(2.873)	(2.844)	(2.928)
SIZE	-0.171***	-0.171***	-0.170***	-0.168***
	(4.978)	(4.946)	(4.928)	(5.125)
Bank Characteristics				
DEPOSIT	0.026***			0.026***
	(2.639)			(2.616)
NPL		(0.010)		
		(0.621)		
CAPITAL MARGIN			(0.007)	
			(0.459)	
Firm-Bank Relationships				
RELATIONSHIP YEAR	-0.169***	-0.166***	-0.164***	-0.169***
	(3.329)	(3.276)	(3.234)	(3.340)
BANKS>2	0.079	0.082	0.079	
	(1.186)	(1.226)	(1.177)	
COLLATERAL	0.394***	0.385***	0.383***	0.429***
	(3.295)	(3.229)	(3.211)	(3.696)
GUARANTEE	0.126	0.119	0.12	
	(1.357)	(1.281)	(1.294)	
Constant	-1.296***	-1.209***	-1.224***	-1.205***
	(4.961)	(4.478)	(4.556)	(4.754)
athrho	-0.102**	-0.096**	-0.096**	-0.098**
	(2.467)	(2.289)	(2.283)	(2.373)
lnsigma	1.798***	1.798***	1.798***	1.798***
	(207.244)	(207.318)	(207.319)	(207.296)
No. of Observations	6695	6695	6695	6695
Log Likelihood	-22424.3	-22427.4	-22427.5	-22426
Wald	1859.46	1859.622	1859.689	1859.503
Prob	0	0	0	0
LR-test	4.61	4.049	4.023	4.304
Prob>chi2	0.032	0.044	0.045	0.038

Table 3A. Descriptive Sample Statistics for Young Firms (Age<=13)

variable	no. of obs.	mean	median	sd
		A. All young firms		
Loan Screening				
REJECT	388	0.044	0.000	0.205
Firm Characteristics				
EBITDA	388	6.784	4.975	18.665
EBITDA(t+1)	388	6.301	4.648	9.961
SALES	388	2.144	1.892	1.442
DEBT	388	0.883	0.873	0.370
NO. OF WORKERS	388	37.693	22.000	50.187
AGE	388	9.464	10.000	2.908
BUSINESS	388	0.753	1.000	0.432
BUSINESS(t+1)	388	0.673	1.000	0.470
Bank Characteristics				
DEPOSIT	388	1.651	1.636	2.927
NPL	388	4.016	3.628	2.118
CAPITAL MARGIN	388	4.605	4.160	2.164
Firm-Bank Relationships				
RELATIONSHIP YEARS	388	10.369	10.000	6.181
NO. OF BANKS	388	3.003	2.000	2.349
BANKS>2	388	0.472	0.000	0.500
COLLATERAL	388	0.629	1.000	0.484
GUARANTEE	388	0.729	1.000	0.445
		B. Accepted young firms		
Firm Characteristics				
EBITDA	371	6.997	5.110	18.949
EBITDA(t+1)	371	6.555	4.955	9.811
SALES	371	2.145	1.873	1.455
DEBT	371	0.882	0.873	0.377
NO. OF WORKERS	371	38.491	23.000	50.967
AGE	371	9.461	10.000	2.908
BUSINESS	371	0.763	1.000	0.426
BUSINESS(t+1)	371	0.687	1.000	0.464
Bank Characteristics				
DEPOSIT	371	1.643	1.636	2.967
NPL	371	4.027	3.628	2.147
CAPITAL MARGIN	371	4.569	4.120	2.111
Firm-Bank Relationships				
RELATIONSHIP YEARS	371	10.404	10.000	6.256
NO. OF BANKS	371	3.019	2.000	2.382
BANKS>2	371	0.472	0.000	0.500
COLLATERAL	371	0.623	1.000	0.485
GUARANTEE	371	0.722	1.000	0.448
		C. Rejected young firms		
Firm Characteristics				
EBITDA	17	2.122	2.759	9.948
EBITDA(t+1)	17	0.759	3.127	11.827
SALES	17	2.118	2.277	1.141
DEBT	17	0.911	0.894	0.122
NO. OF WORKERS	17	20.294	10.000	22.707
AGE	17	9.529	11.000	3.002
BUSINESS	17	0.529	1.000	0.514
BUSINESS(t+1)	17	0.353	0.000	0.493
Bank Characteristics				
DEPOSIT	17	1.824	1.861	1.894
NPL	17	3.778	3.593	1.384
CAPITAL MARGIN	17	5.378	4.260	3.094
Firm-Bank Relationships				
RELATIONSHIP YEARS	17	9.588	10.000	4.273
NO. OF BANKS	17	2.647	2.000	1.455
BANKS>2	17	0.471	0.000	0.514
COLLATERAL	17	0.765	1.000	0.437
GUARANTEE	17	0.882	1.000	0.332

Table 3B. Descriptive Sample Statistics for Middle-sized Matured Firms (Age>13 and No. of Workers>87)

variable	no. of obs.	mean	median	sd
	A. All middle-sized matured firms			
Loan Screening				
REJECT	1620	0.017	0.000	0.128
Firm Characteristics				
EBITDA	1620	5.776	5.038	6.361
EBITDA(t+1)	1620	5.316	4.837	6.672
SALES	1620	1.246	1.114	0.664
DEBT	1620	0.731	0.763	0.198
NO. OF WORKERS	1620	182.729	151.000	121.224
AGE	1620	51.539	48.500	23.255
BUSINESS	1620	0.706	1.000	0.456
BUSINESS(t+1)	1620	0.618	1.000	0.486
Bank Characteristics				
DEPOSIT	1620	1.817	1.744	3.288
NPL	1620	3.680	3.458	1.513
CAPITAL MARGIN	1620	4.405	4.110	1.666
Firm-Bank Relationships				
RELATIONSHIP YEARS	1620	36.836	36.000	15.637
NO. OF BANKS	1620	4.495	4.000	2.831
BANKS>2	1620	0.766	1.000	0.423
COLLATERAL	1620	0.865	1.000	0.342
GUARANTEE	1620	0.651	1.000	0.477
	B. Accepted middle-sized matured firms			
Firm Characteristics				
EBITDA	1593	5.833	5.082	6.358
EBITDA(t+1)	1593	5.411	4.860	6.602
SALES	1593	1.249	1.118	0.660
DEBT	1593	0.729	0.762	0.198
NO. OF WORKERS	1593	183.505	151.000	121.898
AGE	1593	51.699	49.000	23.331
BUSINESS	1593	0.709	1.000	0.454
BUSINESS(t+1)	1593	0.621	1.000	0.485
Bank Characteristics				
DEPOSIT	1593	1.807	1.744	3.266
NPL	1593	3.674	3.458	1.512
CAPITAL MARGIN	1593	4.407	4.110	1.664
Firm-Bank Relationships				
RELATIONSHIP YEARS	1593	36.996	36.000	15.632
No. OF BANKS	1593	4.500	4.000	2.838
BANKS>2	1593	0.767	1.000	0.423
COLLATERAL	1593	0.864	1.000	0.343
GUARANTEE	1593	0.650	1.000	0.477
	C. Rejected middle-sized matured firms			
Firm Characteristics				
EBITDA	27	2.405	2.420	5.714
EBITDA(t+1)	27	-0.309	0.436	8.347
SALES	27	1.059	0.788	0.829
DEBT	27	0.829	0.890	0.165
NO. OF WORKERS	27	136.926	126.000	54.880
AGE	27	42.111	47.000	15.858
BUSINESS	27	0.519	1.000	0.509
BUSINESS(t+1)	27	0.407	0.000	0.501
Bank Characteristics				
DEPOSIT	27	2.444	1.482	4.419
NPL	27	4.009	3.688	1.618
CAPITAL MARGIN	27	4.248	3.600	1.772
Firm-Bank Relationships				
RELATIONSHIP YEARS	27	27.370	29.000	12.977
No. OF BANKS	27	4.222	4.000	2.375
BANKS>2	27	0.704	1.000	0.465
COLLATERAL	27	0.926	1.000	0.267
GUARANTEE	27	0.667	1.000	0.480

Table 3C. Descripteive Sample Statistics for Small Matured Firms (Age>13 and No. of Workers<=87)

variable	no. of obs.	mean	median	sd
	A. All small matured firms			
Loan Screening				
REJECT	4687	0.039	0.000	0.193
Firm Characteristics				
EBITDA	4687	4.840	4.052	6.219
EBITDA(t+1)	4687	4.717	3.899	6.542
SALES	4687	1.490	1.305	1.177
DEBT	4687	0.764	0.795	0.218
NO. OF WORKERS	4687	35.387	31.000	22.001
AGE	4687	41.978	39.000	19.913
BUSINESS	4687	0.673	1.000	0.469
BUSINESS(t+1)	4687	0.564	1.000	0.496
Bank Characteristics				
DEPOSIT	4687	1.637	1.650	2.908
NPL	4687	4.142	3.688	1.999
CAPITAL MARGIN	4687	4.874	4.460	2.215
Firm-Bank Relationships				
RELATIONSHIP YEARS	4687	31.847	30.000	13.721
NO. OF BANKS	4687	3.031	3.000	2.366
BANKS>2	4687	0.517	1.000	0.500
COLLATERAL	4687	0.856	1.000	0.351
GUARANTEE	4687	0.830	1.000	0.376
	B. Accepted small matured firms			
Firm Characteristics				
EBITDA	4505	4.977	4.126	6.105
EBITDA(t+1)	4505	4.819	3.967	6.461
SALES	4505	1.499	1.314	1.189
DEBT	4505	0.758	0.789	0.215
NO. OF WORKERS	4505	35.616	31.000	22.044
AGE	4505	41.968	39.000	19.877
BUSINESS	4505	0.681	1.000	0.466
BUSINESS(t+1)	4505	0.575	1.000	0.494
Bank Characteristics				
DEPOSIT	4505	1.622	1.636	2.916
NPL	4505	4.141	3.688	2.007
CAPITAL MARGIN	4505	4.881	4.460	2.215
Firm-Bank Relationships				
RELATIONSHIP YEARS	4505	31.918	30.000	13.703
NO. OF BANKS	4505	3.030	3.000	2.386
BANKS>2	4505	0.517	1.000	0.500
COLLATERAL	4505	0.852	1.000	0.355
GUARANTEE	4505	0.827	1.000	0.378
	C. Rejected small matured firms			
Firm Characteristics				
EBITDA	182	1.452	2.552	7.878
EBITDA(t+1)	182	2.192	2.705	7.924
SALES	182	1.270	1.069	0.767
DEBT	182	0.905	0.898	0.230
NO. OF WORKERS	182	29.720	25.000	20.153
AGE	182	42.209	36.000	20.858
BUSINESS	182	0.473	0.000	0.501
BUSINESS(t+1)	182	0.275	0.000	0.448
Bank Characteristics				
DEPOSIT	182	2.004	2.061	2.676
NPL	182	4.160	3.682	1.800
CAPITAL MARGIN	182	4.722	4.225	2.221
Firm-Bank Relationships				
RELATIONSHIP YEARS	182	30.093	29.000	14.069
NO. OF BANKS	182	3.060	3.000	1.778
BANKS>2	182	0.571	1.000	0.496
COLLATERAL	182	0.945	1.000	0.229
GUARANTEE	182	0.907	1.000	0.292

Table 4A. Estimation Results for Young Firms (Age<=13)

***, ** and * represent the significance levels at 1%, 5% and 10%, respectively. athrho is the inverse hyperbolic tangent of ρ: athrho=0.5*ln((1+ρ)/(1-ρ)), where ρ is the correlation coefficient of the residuals of Eq. (1) and (5) 3. lnsigma is ln(σ), where σ is the standard error of the residual of Eq. (1). 4. LR-test is the X-square statistics of the null hypothesis that ρ is zero.

	1	2	3	4
	EBITDA(t+1): Eq. (1)			
EBITDA	0.108***	0.107***	0.107***	0.110***
	(4.260)	(4.254)	(4.247)	(4.372)
BUSINESS (t+1)	5.498***	5.496***	5.476***	5.679***
	(5.500)	(5.504)	(5.479)	(5.745)
SIZE	0.422	0.418	0.412	
	(0.869)	(0.861)	(0.851)	
AGE	3.151***	3.147***	3.151***	3.266***
	(2.643)	(2.640)	(2.643)	(2.756)
REJECT	-7.98	-8.198*	-8.528*	-5.25
	(1.641)	(1.741)	(1.904)	(1.103)
Constant	-5.235	-5.195	-5.18	-4.146
	(1.594)	(1.581)	(1.579)	(1.420)
	REJECT: Eq. (5)			
Firm Characteristics				
DEBT	-0.236	-0.24	-0.277	
	(0.507)	(0.516)	(0.572)	
EBITDA	-0.016	-0.016	-0.018	
	(1.288)	(1.269)	(1.462)	
BUSINESS	-0.375	-0.371	-0.339	-0.478**
	(1.510)	(1.499)	(1.350)	(2.014)
SALES	-0.001	0.004	0.001	
	(0.005)	(0.045)	(0.013)	
SIZE	-0.205	-0.217	-0.198	-0.222*
	(1.469)	(1.530)	(1.420)	(1.759)
Bank Characteristics				
DEPOSIT	0.022			
	(0.458)			
NPL		(0.041)		
		(0.612)		
CAPITAL MARGIN			0.067	
			(1.421)	
Firm-Bank Relationships				
RELATIONSHIP YEAR	-0.076	-0.067	-0.101	
	(0.291)	(0.258)	(0.388)	
BANKS>2	0.094	0.095	0.156	
	(0.358)	(0.365)	(0.597)	
COLLATERAL	0.222	0.23	0.199	
	(0.769)	(0.796)	(0.687)	
GUARANTEE	0.334	0.346	0.393	
	(0.957)	(0.983)	(1.076)	
Constant	-0.905	-0.718	-1.211	-0.741*
	(1.107)	(0.837)	(1.410)	(1.857)
athrho	0.244	0.257	0.278	0.082
	(0.987)	(1.075)	(1.222)	(0.362)
lnsigma	2.177***	2.178***	2.179***	2.174***
	(57.870)	(57.801)	(57.747)	(60.220)
No. of Observations	388	388	388	388
Log Likelihood	-1457.33	-1457.23	-1456.47	-1459.95
Wald	110.851	111.226	111.986	105.823
Prob	0	0	0	0
LR-test	0.366	0.44	0.599	0.107
Prob>chi2	0.545	0.507	0.439	0.744

Table 4B. Estimation Results for Medium-size Matured Firms (Age>13 & No. of Worker>87)

***, ** and * represent the significance levels at 1%, 5% and 10%, respectively. athrho is the inverse hyperbolic tangent of ρ: athrho=0.5*ln((1+ρ)/(1-ρ)), where ρ is the correlation coefficient of the residuals of Eq. (1) and (5) 3. lnsigma is ln(σ), where σ is the standard error of the residual of Eq. (1). 4. LR-test is the X-square statistics of the null hypothesis that ρ is zero.

	1	2	3	4
	EBITDA(t+1): Eq. (1)			
EBITDA	0.462***	0.462***	0.462***	0.464***
	(20.105)	(20.088)	(20.094)	(20.353)
BUSINESS (t+1)	2.295***	2.294***	2.294***	2.312***
	(7.793)	(7.791)	(7.791)	(7.902)
SIZE	0.042	0.04	0.04	
	(0.134)	(0.128)	(0.128)	
AGE	-0.183	-0.183	-0.184	
	(0.525)	(0.525)	(0.527)	
REJECT	-3.108*	-3.204*	-3.230*	-2.951*
	(1.652)	(1.665)	(1.707)	(1.649)
Constant	2.218	2.231	2.234	1.745***
	(1.055)	(1.060)	(1.062)	(3.494)
	REJECT: Eq. (5)			
Firm Characteristics				
DEBT	1.025**	0.999**	1.030**	0.870*
	(2.124)	(2.057)	(2.135)	(1.892)
EBITDA	-0.034**	-0.035**	-0.033**	-0.038**
	(2.075)	(2.082)	(2.011)	(2.371)
BUSINESS	-0.296*	-0.273	-0.294	-0.276
	(1.645)	(1.505)	(1.631)	(1.558)
SALES	-0.146	-0.15	-0.149	
	(1.052)	(1.082)	(1.070)	
SIZE	-0.541**	-0.538**	-0.568**	-0.594**
	(2.201)	(2.185)	(2.280)	(2.476)
Bank Characteristics				
DEPOSIT	0.025			
	(1.072)			
NPL		0.042		
		(0.834)		
CAPITAL MARGIN			(0.046)	
			(0.879)	
Firm-Bank Relationships				
RELATIONSHIP YEARS	-0.338***	-0.340***	-0.338***	-0.338***
	(2.705)	(2.697)	(2.710)	(2.755)
BANKS>2	-0.19	-0.166	-0.197	
	(0.985)	(0.862)	(1.020)	
COLLATERAL	0.176	0.164	0.184	
	(0.576)	(0.539)	(0.599)	
GUARANTEE	-0.04	-0.067	-0.041	
	(0.205)	(0.348)	(0.211)	
Constant	1.361	1.263	1.739	1.613
	(0.988)	(0.907)	(1.225)	(1.217)
athrho	-0.047	-0.039	-0.037	-0.056
	(0.400)	(0.326)	(0.318)	(0.521)
lnsigma	1.734***	1.734***	1.734***	1.734***
	(98.646)	(98.658)	(98.663)	(98.636)
No. of Observations	1620	1620	1620	1620
Log Likelihood	-5227.48	-5227.7	-5227.64	-5229.42
Wald	618.192	617.908	618.177	617.717
Prob	0	0	0	0
LR-test	0.128	0.088	0.085	0.211
Prob>chi2	0.721	0.767	0.771	0.646

Table 4C. Estimation Results for Small Matured Firms (Age>13 and No. of Workers<=87)

***, ** and * represent the significance levels at 1%, 5% and 10%, respectively. athrho is the inverse hyperbolic tangent of ρ: athrho=0.5*ln((1+ρ)/(1-ρ)), where ρ is the correlation coefficient of the residuals of Eq. (1) and (5) 3. lnsigma is ln(σ), where σ is the standard error of the residual of Eq. (1). 4. LR-test is the X-square statistics of the null hypothesis that ρ is zero.

	1	2	3	4
EBITDA(t+1): Eq. (1)				
EBITDA	0.451***	0.451***	0.451***	0.451***
	(32.482)	(32.464)	(32.464)	(32.479)
BUSINESS (t+1)	2.138***	2.138***	2.138***	2.138***
	(12.685)	(12.682)	(12.682)	(12.684)
SIZE	0.280**	0.279**	0.279**	0.280**
	(2.271)	(2.263)	(2.264)	(2.270)
AGE	-1.007***	-1.007***	-1.007***	-1.007***
	(5.173)	(5.174)	(5.173)	(5.173)
REJECT	1.091*	1.022	1.027	1.077*
	(1.743)	(1.624)	(1.630)	(1.719)
Constant	4.347***	4.355***	4.352***	4.347***
	(5.430)	(5.440)	(5.436)	(5.430)
REJECT: Eq. (5)				
Firm Characteristics				
DEBT	0.895***	0.904***	0.897***	0.907***
	(5.653)	(5.695)	(5.663)	(5.769)
EBITDA	-0.026***	-0.025***	-0.025***	-0.026***
	(4.245)	(4.104)	(4.120)	(4.212)
BUSINESS	-0.302***	-0.302***	-0.301***	-0.306***
	(4.106)	(4.114)	(4.100)	(4.171)
SALES	-0.114**	-0.117**	-0.114**	-0.108**
	(2.409)	(2.454)	(2.403)	(2.309)
SIZE	-0.154**	-0.151**	-0.147**	-0.154**
	(2.430)	(2.388)	(2.305)	(2.429)
Bank Characteristics				
DEPOSIT	0.028**			0.028**
	(2.434)			(2.417)
NPL		(0.016)		
		(0.845)		
CAPITAL MARGIN			(0.012)	
			(0.707)	
Firm-Bank Relationships				
RELATIONSHIP YEAR	0.12	0.121	0.115	0.124*
	(1.608)	(1.628)	(1.542)	(1.664)
BANKS>2	-0.127**	-0.128**	-0.126**	-0.132***
	(2.564)	(2.572)	(2.540)	(2.686)
COLLATERAL	0.399***	0.385***	0.379**	0.450***
	(2.683)	(2.597)	(2.561)	(3.120)
GUARANTEE	0.168	0.163	0.167	
	(1.418)	(1.384)	(1.418)	
Constant	-1.764***	-1.647***	-1.669***	-1.665***
	(5.232)	(4.756)	(4.863)	(5.078)
athrho	-0.122***	-0.116***	-0.116***	-0.121***
	(3.127)	(2.947)	(2.954)	(3.092)
lnsigma	1.731***	1.731***	1.731***	1.731***
	(166.750)	(166.807)	(166.802)	(166.763)
No. of Observations	4687	4687	4687	4687
Log Likelihood	-15448.2	-15450.6	-15450.7	-15449.2
Wald	1615.939	1615.98	1616.037	1615.942
Prob	0	0	0	0
LR-test	7.796	7.015	7.023	7.636
Prob>chi2	0.005	0.008	0.008	0.006