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Do Banks Have 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 Japanese 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-banking, information monopoly, and loan screening.

JEL Classification Codes: G21, G32.

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Do Banks Have Private Information?

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 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 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 loan 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 banking (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 informationally opaque, are more likely to be monitored by banks than large firms. To our best knowledge, this paper is the first that investigates the presence of banks' private information by looking at the ex-post firm performance after bank screening.

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. Slovin et al. (1993) supported this idea by examining the stock prices of the client firms of failing Illinois Bank. Bae et al. (2002) also shows that adverse shocks to banks in South Korea have a negative effect on the value of their client firms. On the other hand, Ongena et al. (2003) found only small and temporary impacts of the near-collapse of the Norwegian banking system during 1988-1991 on the stock prices of the client firms. For the client firms of failed Japanese banks, existing results are mixed: Yamori and Murakami (1999) found evidence supportive of the information monopoly hypothesis while Brewer et al. (2003) and Hori (2005) found evidence against it. 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.[4] 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.

This paper also contributes to the literature on relationship banking (Petersen and Rajan, 1994; Angelini et al., 1998; Cole, 1998; Harhoff and Korting, 1998; Boot, 2000). Existing studies on relationship banking examine the effects of bank-firm relationships on the availability and price of credit, obtaining positive results in most cases. While these studies judge the accumulation of private information on the part of banks by the availability and price of credit, we investigate the ex-post firm performance to see whether the above two information effects are different between young and mature firms, and between

[4] 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.

small and large 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 has 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 financial difficulty, 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

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

where the dependent variable F_{it+1} denotes firm i's profit in year $t+1$. Among the dependent variables, D_{it} is a dummy variable that takes the value of one if the bank rejects the loan application in year t and zero otherwise (*REJECT*). 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) $D_{it} = 0$ *if* $E[F_{it+1} | D_{it} = 0, u_{it}] = \beta_0 F_{it} - \beta_1 B_{it}^f + E[v_{it+1} | u_{it}] > \overline{F}_{it+1}$,

(2b) $D_{it} = 1$ *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) $\overline{F}_{it+1} = -\gamma_0 B_{it}^m - \gamma_1 X_{it} + \varepsilon_{it}$,

where B_{it}^m is a vector of the bank's capitalization variables, and X_{it} is a vector of the bank-firm relationship variables. If a less-capitalized bank tends to apply a more stringent standard to accept the loan application (capital crunch), the coefficient on a variable in B_{it}^m will be negative (γ_0 is positive).

There are several reasons why the bank-firm relationship affects the threshold value, $\overline{F}_{it+1}$. 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}.

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

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

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

where $\tilde{u}_{it} \equiv \varepsilon_{it} - \rho \dfrac{\sigma_v}{\sigma_u} u_{it}$ 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 with 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

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

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

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

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

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

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

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

(see Green, 2008, for example). Equation (12) shows that the difference between the expected profit of the rejected and the accepted firm 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.[5] Hypothesis 1 (the *information production effect*) can be tested by determining whether or not the correlation coefficients 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 service their banking needs, and their industries as of the end of October 2001. In addition, the Survey contains information on whether the firms' business conditions are good, unchanged, or bad for each of the last three years.

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

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.[6] 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 the availability of subsequent firm performance. This enables us to investigate the implications of the information hypotheses as they pertain to the time series.

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 transacting with, and the share of loans that were issued 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.[7] Second, their main financial institutions are

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[6] 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).

[7] 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

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.[8]

Variables

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

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

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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.

[8] While our data source is the same as that of Hosono et al., (2003), our sample size is smaller than their 3,576 because we restrict our sample firms to those whose financial variables, including EBITDA, that we have made available by matching the Survey data to the TSR database.

the number of employers (*SIZE*).[9] *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 with "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 (1). On the other hand, high *SALES* and *BUSINESS* are expected to take negative coefficients in the loan rejection equation (5).

Appropriate measures for bank capitalization, B_{it}^{m}, are difficult to find because accounting capital including the risk-adjusted regulatory capital ratio under the Basel standard (the so-called BIS 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% for internationally active banks and 4% 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,[10] 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.

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[9] 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 it is highly correlated with the number of years a firm has been transacting with its main bank.

[10] 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.

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-banking, 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 financial institutions is four or more, and the value of zero otherwise (*NUMBER OF INSTITUTIONS*). In the loan rejection equation (5), *RELATIONSHIP YEARS* and *NUMBER OF INSTITUSIONS* are supposed to take negative and positive coefficients, respectively.

Finally, we add the collateral dummy to the explanatory variables of the loan rejection equation (5). This dummy (*COLLATERAL*) takes the value of one if the firm provides its main bank with collateral and the value of zero otherwise. 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. Based on their evidence, we may presume that those firms that offer collateral are more likely to be rejected.

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.[11]

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. About one-sixth of our sample firms transact with four or more banks.

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*, and a high likelihood of *COLLATERAL*. 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.

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

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* are 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 *NUMBER OF INSTITUTIONS* has a positive and significant coefficient, as expected. Finally, *COLLATERAL* takes a positive 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.

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

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.[12]

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-banking theory posits that banks acquire and accumulate private information through long running relationships with client firms. Banks may

[12] 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.

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 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*, and a high likelihood of *COLLATEAL*. 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, *NUMBER OF INSTITUTIONS* takes a negative and significant coefficient, possibly suggesting that many banks compete to transact with good medium-sized, mature firms. 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* and *RELATIONSHIP YEARS* take negative and significant coefficients while *DEBT*, *NUMBER OF INSTITUTIONS*, *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-banking 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 number of institutions 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.[13]

[13] 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.

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 Elsas and Krahnen (2000) found no significant correlation between them.

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-bank 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 INSTITUTIONS(>=4)	6695	0.174	0.000	0.379
Other Controls				
COLLATERAL	6695	0.845	1.000	0.362
		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 INSTITUTIONS(>=4)	6469	0.173	0.000	0.378
Other Controls				
COLLATERAL	6469	0.842	1.000	0.365
		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 INSTITUTIONS(>=4)	226	0.208	0.000	0.407
Other Controls				
COLLATERAL	226	0.929	1.000	0.257

Table 2. Estimation results for all the sample firms

	1	2	3
	EBITDA (t+1): Eq. (1)		
EBITDA	0.333***	0.333***	0.333***
	(32.99)	(32.97)	(32.97)
BUSINESS (t+1)	2.403***	2.403***	2.403***
	(15.81)	(15.80)	(15.80)
SIZE	0.221***	0.220***	0.220***
	(2.64)	(2.63)	(2.63)
AGE	−0.650***	−0.650***	−0.650***
	(4.61)	(4.62)	(4.62)
REJECT	0.05	−0.03	−0.033
	(0.07)	(0.04)	(0.05)
Constant	3.884***	3.894***	3.893***
	(6.69)	(6.70)	(6.70)
	REJECT: Eq. (5)		
Firm Characteristics			
DEBT	0.647***	0.652***	0.648***
	(5.35)	(5.36)	(5.34)
EBITDA	−0.020***	−0.019***	−0.020***
	(4.17)	(4.05)	(4.05)
BUSINESS	−0.315***	−0.314***	−0.314***
	(4.89)	(4.89)	(4.89)
SALES	−0.115***	−0.117***	−0.115***
	(2.89)	(2.94)	(2.90)
SIZE	−0.168***	−0.167***	−0.167***
	(5.13)	(5.07)	(5.06)
Bank Characteristics			
DEPOSIT	0.027***		
	(2.66)		
NPL		−0.01	
		(0.62)	
CAPITAL MARGIN			−0.008
			(0.56)
Firm-Bank Relationships			
RELATIONSHIP YEARS	−0.174***	−0.170***	−0.168***
	(3.42)	(3.37)	(3.32)
NUMBER OF INSTITUTIONS	0.136*	0.130*	0.131*
	(1.73)	(1.66)	(1.67)
Other Controls			
COLLATERAL	0.427***	0.415***	0.414***
	(3.67)	(3.58)	(3.57)
Constant	−1.215***	−1.132***	−1.140***
	(4.78)	(4.30)	(4.35)
athrho	−0.104**	−0.097**	−0.097**
	(2.53)	(2.35)	(2.35)
lnsigma	1.798***	1.798***	1.798***
	(207.23)	(207.31)	(207.31)
No. of Observations	6695	6695	6695
Log Likelihood	−22424.54	−22427.71	−22427.75
Wald	1859.19	1859.36	1859.46
Prob	0	0	0
LR-test	4.86	4.29	4.25
Prob>chi2	0.03	0.04	0.04

Notes

1. ***, ** and * represent the significance levels at 1%, 5% and 10%, respectively.
2. 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 χ-square statistics of the null hypothesis that ρ is zero.

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 INSTITUTIONS(>=4)	388	0.103	0.000	0.304
Other Controls				
COLLATERAL	388	0.629	1.000	0.484
		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 INSTITUTIONS(>=4)	371	0.102	0.000	0.304
Other Controls				
COLLATERAL	371	0.623	1.000	0.485
		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 INSTITUTIONS(>=4)	17	0.118	0.000	0.332
Other Controls				
COLLATERAL	17	0.765	1.000	0.437

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 INSTITUTIONS(>=4)	1620	0.185	0.000	0.388
Other Controls				
COLLATERAL	1620	0.865	1.000	0.342
	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 INSTITUTIONS(>=4)	1593	0.186	0.000	0.390
Other Controls				
COLLATERAL	1593	0.864	1.000	0.343
	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 INSTITUTIONS(>=4)	27	0.074	0.000	0.267
Other Controls				
COLLATERAL	27	0.926	1.000	0.267

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 INSTITUTIONS(>=4)	4687	0.177	0.000	0.381
Other Controls				
COLLATERAL	4687	0.856	1.000	0.351
		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 INSTITUTIONS(>=4)	4505	0.174	0.000	0.379
Other Controls				
COLLATERAL	4505	0.852	1.000	0.355
		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 INSTITUTIONS(>=4)	182	0.236	0.000	0.426
Other Controls				
COLLATERAL	182	0.945	1.000	0.229

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

	1	2	3	4
	EBITDA (t+1): Eq. (1)			
EBITDA	0.108***	0.108***	0.108***	0.110***
	(4.29)	(4.29)	(4.29)	(4.370)
BUSINESS (t+1)	5.554***	5.555***	5.551***	5.679***
	(5.56)	(5.57)	(5.57)	(5.740)
SIZE	0.451	0.45	0.449	
	(0.93)	(0.92)	(0.93)	
AGE	3.135***	3.132***	3.131***	3.266***
	(2.63)	(2.63)	(2.63)	(2.760)
REJECT	-6.458	-6.549	-6.631	-5.25
	(1.09)	(1.11)	(1.21)	(1.100)
Constant	-5.416	-5.396	-5.405*	-4.146
	(1.640)	(1.640)	(1.650)	(1.420)
	REJECT: Eq. (5)			
Firm Characteristics				
DEBT	-0.148	-0.145	-0.164	
	(0.32)	(0.31)	(0.34)	
EBITDA	-0.014	-0.013	-0.015	
	(1.00)	(0.96)	(1.08)	
BUSINESS	-0.401	-0.4	-0.389	-0.478**
	(1.57)	(1.57)	(1.51)	(2.010)
SALES	-0.022	-0.02	-0.03	
	(0.24)	(0.21)	(0.33)	
SIZE	-0.202	-0.21	-0.185	-0.222*
	(1.51)	(1.55)	(1.39)	(1.760)
Bank Characteristics				
DEPOSIT	0.023			
	(0.48)			
NPL		-0.041		
		(0.59)		
CAPITAL MARGIN			0.058	
			(1.22)	
Firm-Bank Relationships				
RELATIONSHIP YEARS	-0.111	-0.102	-0.136	
	(0.41)	(0.38)	(0.51)	
NUMBER OF INSTITUTIONS	-0.011	-0.015	-0.071	
	(0.03)	(0.04)	(0.18)	
Other Controls				
COLLATERAL	0.305	0.315	0.293	
	(1.10)	(1.13)	(1.05)	
Constant	-0.612	-0.429	-0.811	-0.741*
	(0.79)	(0.52)	(1.02)	(1.860)
athrho	0.157	0.162	0.168	0.082
	(0.52)	(0.54)	(0.60)	(0.360)
lnsigma	2.174***	2.175***	2.175***	2.174***
	(58.72)	(58.65)	(58.80)	(60.220)
No. of Observations	**388**	**388**	**388**	388
Log Likelihood	-1457.95	-1457.88	-1457.36	-1459.95
Wald	108.75	108.78	109.01	105.82
Prob	0	0	0	0
LR-test	0.1	0.1	0.15	0.11
Prob>chi2	0.75	0.76	0.7	0.74

Notes

1. ***, ** and * represent the significance levels at 1%, 5% and 10%, respectively.
2. 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 χ^2-square statistics of the null hypothesis that ρ is zero.

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

	1	2	3
	EBITDA (t+1): Eq. (1)		
EBITDA	0.462***	0.462***	0.462***
	(20.08)	(20.06)	(20.07)
BUSINESS (t+1)	2.294***	2.294***	2.294***
	(7.79)	(7.79)	(7.79)
SIZE	0.041	0.039	0.039
	(0.13)	(0.12)	(0.12)
AGE	-0.184	-0.184	-0.185
	(0.53)	(0.53)	(0.53)
REJECT	-3.203	-3.292	-3.302
	(1.59)	(1.61)	(1.64)
Constant	2.232	2.244	2.245
	(1.06)	(1.06)	(1.07)
	REJECT: Eq. (5)		
Firm Characteristics			
DEBT	0.874*	0.851*	0.880*
	(1.85)	(1.79)	(1.86)
EBITDA	-0.035**	-0.036**	-0.034**
	(2.14)	(2.17)	(2.07)
BUSINESS	-0.292	-0.267	-0.292
	(1.63)	(1.48)	(1.62)
SALES	-0.117	-0.123	-0.119
	(0.84)	(0.89)	(0.86)
SIZE	-0.612**	-0.601**	-0.640**
	(2.45)	(2.41)	(2.53)
Bank Characteristics			
DEPOSIT	0.023		
	(0.99)		
NPL		0.044	
		(0.87)	
CAPITAL MARGIN			-0.042
			(0.80)
Firm-Bank Relationships			
RELATIONSHIP YEARS	-0.342	-0.351	-0.352
	(1.20)	(1.23)	(1.24)
NUMBER OF INSTITUTIONS	-0.323**	-0.324**	-0.322**
	(2.55)	(2.54)	(2.55)
Other Controls			
COLLATERAL	0.177	0.156	0.183
	(0.59)	(0.52)	(0.61)
Constant	1.624	1.486	1.981
	(1.16)	(1.05)	(1.37)
athrho	-0.04	-0.033	-0.032
	(0.30)	(0.25)	(0.25)
lnsigma	1.734***	1.734***	1.734***
	(98.65)	(98.67)	(98.67)
No. of Observations	1620	1620	1620
Log Likelihood	-5227.13	-5227.24	-5227.28
Wald	617.92	617.67	617.88
Prob	0	0	0
LR-test	0.08	0.05	0.05
Prob>chi2	0.78	0.82	0.82

Notes

1. ***, ** and * represent the significance levels at 1%, 5% and 10%, respectively.
2. 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 χ-square statistics of the null hypothesis that ρ is zero.

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

	1	2	3
		EBITDA (t+1): Eq. (1)	
EBITDA	0.451***	0.451***	0.451***
	(32.49)	(32.48)	(32.47)
BUSINESS (t+1)	2.139***	2.138***	2.138***
	(12.69)	(12.68)	(12.68)
SIZE	0.281**	0.279**	0.280**
	(2.28)	(2.27)	(2.27)
AGE	-1.006***	-1.007***	-1.006***
	(5.17)	(5.17)	(5.17)
REJECT	1.127*	1.057*	1.059*
	(1.81)	(1.69)	(1.69)
Constant	4.343***	4.351***	4.348***
	(5.43)	(5.44)	(5.43)
		REJECT: Eq. (5)	
Firm Characteristics			
DEBT	0.910***	0.919***	0.912***
	(5.81)	(5.85)	(5.82)
EBITDA	-0.026***	-0.025***	-0.025***
	(4.29)	(4.14)	(4.15)
BUSINESS	-0.300***	-0.300***	-0.300***
	(4.08)	(4.10)	(4.09)
SALES	-0.113**	-0.116**	-0.112**
	(2.39)	(2.45)	(2.38)
SIZE	-0.120**	-0.121**	-0.120**
	(2.49)	(2.49)	(2.48)
Bank Characteristics			
DEPOSIT	0.029**		
	(2.48)		
NPL		-0.015	
		(0.84)	
CAPITAL MARGIN			-0.014
			(0.82)
Firm-Bank Relationships			
RELATIONSHIP YEARS	-0.161**	-0.157**	-0.152**
	(2.53)	(2.49)	(2.39)
NUMBER OF INSTITUTIONS	0.199**	0.193**	0.194**
	(2.30)	(2.24)	(2.25)
Other Controls			
COLLATERAL	0.446***	0.428***	0.424***
	(3.08)	(2.97)	(2.95)
Constant	-1.650***	-1.533***	-1.546***
	(5.03)	(4.55)	(4.63)
athrho	-0.125***	-0.119***	-0.119***
	(3.24)	(3.06)	(3.06)
lnsigma	1.731***	1.731***	1.731***
	(166.72)	(166.78)	(166.78)
No. of Observations	4687	4687	4687
Log Likelihood	-15448.06	-15450.59	-15450.61
Wald	1615.82	1615.86	1615.94
Prob	0.00	0.00	0.00
LR-test	8.34	7.54	7.50
Prob>chi2	0.00	0.01	0.01

Notes

1. ***, ** and * represent the significance levels at 1%, 5% and 10%, respectively.
2. 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 χ-square statistics of the null hypothesis that ρ is zero.