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The Objective Function of Government-controlled Banks in a Financial Crisis

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Abstract

We present evidence that government-controlled banks significantly increased its lending to small and medium-sized enterprises (SMEs) whose main bank is a large bank operating internationally or nationwide in the 2007-2009 financial crisis. Further analyses show that both the weak relationship between them and the crowding-out due to the demand surge of large corporations that were temporarily shut out of the securities market contributed to this phenomenon. The mixed Cournot oligopoly model including a government-controlled bank, a profit-maximizing main bank providing a differentiated service, and other profit-maximizing banks providing a non-differentiated service shows that the above finding regarding a weak relationship is consistent with government-controlled banks maximizing welfare rather than their own profit.

Keywords: Government-controlled banks, Mixed oligopoly, Relationship banking, Small business financing
JEL classification: G21 H44

[1] This paper is a result of researches of the Study Group at the Small and Medium Enterprise (SME) Unit of the Japan Finance Corporation (JFC) and the Study Group on Dynamics of Corporate Finance and Corporate Behavior at the Research Institute of Economy, Trade, and Industry (RIETI) in Tokyo, Japan. I gratefully acknowledge the SME unit of JFC for allowing us to access the internal credit information for our research. I am also grateful for insightful comments by Masahisa Fujita, Kaoru Hosono, Daisuke Miyakawa, Masayuki Morikawa, Atsushi Nakajima, Keiichiro Oda, Hiroshi Ohashi, Yoshiaki Shikano, Hirofumi Uchida, Taisuke Uchino, Ken'ichi Ueda, Iichiro Uesugi, Wako Watanabe and other participants in the workshops at JFC, RIETI and Waseda University and those in a session at the 9th Regional Finance Conference at Kansai Gaidai University, Osaka, Japan. I am fully responsible for all possible remaining errors in this paper.

1 Introduction

The existing literature on government-controlled banks has presented mixed judgments on the banks' contribution to economic efficiency. The seminal empirical study by La Porta et al. (2002) shows international evidence for the under-performance of government-owned banks. Several subsequent studies show evidence that such inefficiency mainly comes from the political constraint or the political capture (e.g., Sapienza, 2004; Dinç, 2005).[1] On the other hand, recent studies show evidence for the bright side of government-controlled banks, such as mitigating the credit constraint against SMEs (Behr et al., 2013; Sekino and Watanabe, 2014), and the less procyclicality of their lending (Micco and Panizza, 2006; Coleman and Feler, 2015), especially in countries with good governance (Bertay et al., 2015). It is, however, still an open question whether the existence of government-controlled banks is welfare-improving.

This interesting and important question boils down to the question of which is the actual objective function of government-controlled banks among various alternatives, such as their own profits, the social welfare, or some other political interests. To figure out an empirical strategy to detect their objective function, first we applied a mixed Cournot oligopoly model (Fraja and Delbono, 1989; Ide and Hayashi, 1992; Matsumura, 1998) to the loan market for a firm. The standard mixed-oligopoly model assumes a public firm, which maximizes the social welfare, and multiple profit-maximizing private firms. We introduce an additional twist of the asymmetry among profit-maximizing private banks to take into account the relationship banking, which is widely accepted phenomenon in small business financing (see for the list of the existing studies, e.g., Degryse et al., 2009). Namely, we assume a credit market with a government-controlled bank, a main bank providing a differentiated service based on its information advantage, and another private bank without such an advantage.

We consider two cases; first, the case where the government-controlled bank maximizes the social welfare, which is defined by the sum of the profits of all banks and the surplus for the borrowing firm; second, the case where the government-controlled bank is a profit maximizer

[1] More recently, Pereira and Maia-Filho (2015) find a slower transmission of the monetary policy to the interest rates of government-controlled banks. Illueca et al. (2014) find excess risk-taking by local-government-controlled banks.

like a private non-main bank. We find that the welfare-maximizing government-controlled bank increases its lending more for firms with a weak relationship with its main bank, in the sense that the extent of differentiation of the main bank is lower and that the main-bank loan demand is more price-elastic, in response to the increased loan demand. This is because the government-controlled bank is less willing to interrupt a lending relationship between a firm and its main bank if it provides a differentiated service that is more valuable for the firm and contributes more to the social welfare. In contrast, a profit-maximizing government-controlled bank never adjusts its lending according to the strength of the main-bank relationship. This result suggests that we can detect whether a government-controlled bank is a profit maximizer or a welfare maximizer by examining whether it increases lending more to firms with a weaker main-bank relationship in response to a surge in loan demand.

The microdata provided by the Small and Medium Enterprise unit of the Japan Finance Corporation (JFC), one of the major government-controlled banks for SMEs, enables us to conduct this empirical test. The dataset contains information on the annual financial statements and other basic characteristics of each past and current borrower, and outstanding loan amounts from the SME unit of JFC and private banks up to the four largest lenders. The most desirable feature of the data is that it contains the identifier of these private banks so that we can match the bank information.

We focus on the dataset from 2007 to 2011 before and after the 2007-09 financial crisis severely affected the Japanese economy through the sharp reduction of exports to the USA and Europe in the accounting period ending in 2009. The benefits of using the Japanese dataset are threefold. First, the financial crisis was an exogenous shock to Japanese banking and industrial sectors. The banking sector was barely affected by the shock while the shock had a deep impact on the performance and financing behavior of the industrial sectors, especially the exporting sectors. This allows us to be free from the endogeneity problem of the lending behavior of banks. Second, we observed a clear surge in the demand for bank loans in the accounting period ending in 2009 (for typical Japanese firms, the end of the accounting year is in March). The survey for large banks conducted by the Bank of Japan clearly shows this (Figure 1). This is because of the temporary shutdown of the commercial paper and bond markets (Uchino, 2013)

and the precautionary motivations in response to the disastrous drop in corporate earnings in the exporting sector as shown in Section 3. This point ensures the theoretical assumption of the exogenous loan demand shift for our empirical hypothesis. Third, the dataset enables us to construct a three-way panel dataset by firm, year, and lender. Thus, we can obtain a clear estimation of the supply shift by banks after controlling for the unobservable time-varying firm characteristics, such as the magnitude of a demand shock and other credit characteristics by introducing the firm-by-year cross fixed effect.

From the regression using the three-way panel data to control for the firm-by-year cross fixed effect, the year fixed effect, and other control variables, we find that the government-controlled banks increased their lending to SMEs in 2009 and 2010. This increase is larger for firms whose main bank is a large bank, which operates nationwide and internationally. The difference is statistically and economically significant: 1.2 times larger than those whose main bank is a regional bank in 2009, and 1.3 times larger in 2010. As a result, the share of government-controlled banks for these firms became significantly higher than that for those whose main bank is a regional bank.

Further analyses show that this result is driven by both the weak relationship between large banks and SMEs, which has been recognized in the existing literature (e.g., Cole et al., 2004; Berger et al., 2005; Uchida et al., 2008; Nemoto et al., 2011; Ogura and Uchida, 2014), and the crowding out by the surge in loan demand for large banks from large corporations that were temporarily shut out of the securities market in the crisis. The former factor is consistent with the welfare-maximizing behavior in the above theoretical prediction. This finding offers support for the positive impact on the social welfare of the existence of the government-controlled bank. The latter factor is more consistent with the moral-hazard model by Holmstöm and Tirole (1997), where those with less internal capital are dropped out of the credit market first.

The remaining part of this paper is organized as follows. We describe the source of our dataset in Section 2. The financial condition and financing behavior of Japanese SMEs in the 2007-09 financial crisis are described in Section 3. A theoretical model to derive an empirical strategy to detect the objective function of the government-controlled bank is presented in Section 5. The hypothesis for the statistical test, the data description, the specification for the estimation,

and the result of the test are presented in Section 6. Section 7 presents the conclusion and the limitation of our analysis.

2 Data

The dataset for this study is the internal credit information of borrowers at the SME unit of JFC. JFC is a government-controlled lending institution that provides a subsidized policy loans for SMEs; micro corporations including start-up firms and farmers; and individuals. The SME unit is the business unit focusing on loans for SMEs. The total outstanding loan amount of this unit was about 5.2 trillion JPY in March 2009. The asset size is close to that of larger cooperative banks, which are called *shinkin* banks, and smaller regional banks.

Their internal credit information includes the annual financial statement information and other basic characteristics of each borrowing firm, such as the industrial classification, the year of establishment and the location of the JFC branch that transacts with the firm, and the internal credit rating. The most notable feature of the dataset is that it contains the outstanding loan amount provided by JFC and other private and government-owned institutions. The names of lenders can be identified for the largest four lenders to match the financial and other information of each lender. This information enables us to examine what types of firms became more dependent on government-bank lending in the crisis and evaluate the economic efficiency of government-bank lending.

We use the observations from calendar years 2007 to 2011, from right before the outbreak of the crisis to several years after. The dataset covers not only firms with a current positive amount of loan outstanding from JFC but also those without it for several years before starting a transaction or after closing a transaction with JFC.

The industrial composition of the borrowers at the SME unit of JFC tilted more toward the manufacturing sector than the population, which is measured by the 2009 Economic Census (Table 1). Table 3 shows the descriptive statistics of the variables to be used for the regressions later. The definition of each variable is listed in Table 2. The median of the main-bank share of loans and that of deposits are about 30%. The median of the share of government-controlled banks is about 28%, somewhat lower than that of the main bank. The number of lenders except

for JFC is 3 on average. The minimum is 1, i.e., each firm has a relationship with at least one bank other than JFC. This is because JFC does not provide checking, savings, and settlement services. The median of the asset size is 770 million JPY. The Credit Risk Database (CRD), which is closer to the population of the SMEs with the access to the loan market, indicates the median asset size is 85 million JPY in 2003 (Table 1.4 on p.21 in Shikano, 2008). Thus, our dataset focuses on larger firms among the SMEs. Among the various financial ratios of firms, a novel measure is the variable, *liquid.short*, which is defined by the absolute value of the negative part of the cash/deposit holding at the beginning of the current period after subtracting the change in the operating cash flow from the previous period. This variable captures the extent of the cash shortage due to the negative shock to the sales of each firm. We expect that the higher value of this variable indicates the strong demand for loans to cover a temporary cash shortage.

More than half of our sample firms choose regional banks[2] as their main bank (Table 4), which operate within a single or a couple of adjacent prefectures. Some 20% are cooperative banks and the remaining 25% are large banks, which operate nationwide or internationally.[3] Large banks have features clearly different from those of other types of banks. First, the main-bank shares of deposits and loans are significantly lower when the main bank is a large bank than otherwise (Panels (a) and (b), Figure 2). Second, firms switch their main banks more frequently when their main bank is a large bank than otherwise (Table 5). The probability that a firm switches main banks from the previous year is higher by at least 1% for larger banks. The difference was at a maximum in 2010, the later stage of the financial crisis. Third, the ratio of SME loans over total loans of large banks is significantly lower than that for other types of banks (Panel (c), Figure 2).[4] The difference is about 10-15%. The gap significantly widened in 2009, in the midst of the crisis, and has remained wider since then, as large banks decreased the SME ratio considerably, while regional banks slightly increased the SME ratio. In contrast to the decline of large banks in SME lending, the share of the government-controlled banks for firms whose main bank is a large bank kept increasing in 2008 (Panel (d), Figure 2). These figures and

[2]Regional banks include both the member banks of the Regional Banks Association of Japan and the Second Association of Regional Banks.

[3]Large banks include the so-called city banks and trust banks.

[4]Cooperative banks are allowed to lend to SMEs only by regulation.

table suggest that large banks maintain a weaker relationship with SMEs than regional banks even if they are recognized as a main bank by the firm or other lenders.

Table 6 shows the comparison of characteristics of those firms whose main bank is a large bank and others as of 2009, right after the outbreak of the financial crisis. The main-bank share of loans and deposits decreased significantly more for firms whose main bank is a large bank, and the loan share of government-controlled banks increased for the former firms while it decreased for the other firms. The former group of firms has assets twice as larger as the latter group. The credit rating in the JFC for those whose main bank is a large bank are significantly higher than other firms whereas the damage to the credit rating, sales, interest coverage ratio, and liquidity shortage from 2008 to 2009 (Δcredit rating, Δln(sales), Δint.cover., and Δliquid.short) are more severe for the former group of firms. This is because the share of the exporting sector, such as the manufacturing sector, is larger in the clientele of large banks than that of regional banks or cooperative banks (electronics, transport. equip., and other mfg. dummies). In short, those whose main bank is a large bank are larger and more credit-worthy, but they are affected more severely by the temporary shock due to the global financial crisis.

3 Corporate Finance of Japanese SMEs in the 2007-09 Financial Crisis

3.1 Loan demand increased sharply in 2009

The dataset shows that the 2007-09 financial crisis severely affected the Japanese SME loan market with a short lag through the plummeting export to the USA and Europe. Panel (a) of Figure 3 is the plot of the sector average of the ratio of EBITDA over total assets, which is calculated from the microdata provided by JFC and is normalized to 100 in 2007 for all sectors. Clearly, the earnings of Japanese SME exporters in the electronics, transportation equipment (including auto parts), and other manufacturing sectors dropped by more than 50% from 2008 to 2009. These exporters increased their cash holdings in response to this serious crisis, probably with a precautionary motivation (Panel (b) in Figure 3) despite the fact that the cash flow from their usual operation had dramatically contracted. The increased cash holdings were mainly financed by bank loans as is indicated by the sharp increase in the ratio of loans over assets in

the export sectors (Panel (c) in Figure 3).

3.2 Banks responded differently by type

The aggregate outstanding loans of every type of banks increased from 2008 to 2009 by 5.1% in major banks, 3.7% in regional banks, and 2.1% in Shinkin banks. However, the response of SME lending by each individual bank varies by its type. Figure 4 shows the average annual change in the percentage ratio of loans of each lender over firm assets. The government-controlled banks for SMEs including the SME unit and the Micro Corporation and Individual unit of JFC and the Shoko Chukin Bank, another government-controlled bank for SMEs, increased their lending sharply in 2009 and kept increasing it until 2011. Regional banks also increased their lending in 2009 but decreased it in 2010 by the same magnitude as the increase in the previous year. In contrast, large banks never increased their lending even in 2009, although the speed of reduction slowed in 2009. This stark contrast between regional banks and large banks is likely to come from the fact that the relationships of a large bank with SMEs are weaker than those of a regional bank as found in the extant empirical studies[5] and the tables and figures in the previous section. As a result of this difference in their responses, the share of government-controlled banks in firms whose main bank is a large bank kept increasing after 2009, whereas it was almost constant after 2009 for those whose main bank was a regional bank or a cooperative bank (Panel (d) in Figure 2).

4 Preliminary Regression Analysis: Share of the Main Bank and Government-Controlled Banks

To check whether the casual observation that the share of government-controlled banks increased for firms whose main bank is a large bank in 2009 is not driven by factors other than bank characteristics, such as characteristics of the clientele of each type of bank, we regress the government-controlled banks' share to bank-type dummies and various firm and main-bank characteristics. Firm characteristics include mainly those related to the creditworthiness of each firm. Main-bank characteristics mainly consist of the financial soundness or risk-taking capacity

[5] Nemoto et al. (2011) provides evidence for this point by showing that a premium resulting from relational lending is negligible for large banks while it is significant for smaller banks.

of each bank, such as capital ratio, ROA, or non-performing loan ratio. The details of the variable definition and the descriptive statistics are listed in Tables 2 and 3, respectively. We also run a regression of which the dependent variable is the main-bank loan share, or the ratio of total borrowing over total assets of each firm, to look at the change in the main-bank share and the change in total borrowing at the crisis.

The precise specification for this preliminary regression is

$$\begin{aligned} \ln(gov.\ bank\ for\ SMEs\ share_{it}) &= \beta_0 + \beta_1 \cdot MB\ large_{it} + \sum_{s=2008}^{2011} \beta_s \cdot MB\ large_{is} \cdot FY(s)_t \\ &\quad + \delta' X_{it} + \theta_t + \mu_i + \epsilon_{it}, \end{aligned} \tag{1}$$

where i is the index for each firm, $t = \{2007, \cdots, 2011\}$, and β's, γ's and a column vector δ are coefficients to be estimated. X_{it} is a column vector of control variables including the interaction term of the year dummies and sector dummies. θ_t is the year fixed effect. μ_i is the firm fixed effect. ϵ_{it} is the error term. $\ln(gov\ bank\ for\ SMEs\ share_{it})$ is a logit-transformed share of government-controlled banks for SMEs in the loan for firm i in year t (see Table 2 for details). $MB\ large_{it}$ is a dummy variable, which equals one if the main bank of firm i in year t is a large bank. $FY(s)_t$ is a dummy variable, which is equal to one if $t = s$ or zero otherwise.

The regression result is listed in Table 7. Column (1) is the list of estimated coefficients and the firm cluster robust standard errors when we regress the logit-transformed government-controlled bank share. The base category is the firms whose main bank is a regional bank or a cooperative bank. The estimated coefficient for year dummies $FY(2008) - FY(2011)$ is negative and significant. This indicates that the government-owned bank share for regional banks and cooperative banks kept decreasing after 2007. In contrast, the estimated coefficients of the interaction terms of $MB\ large$ and year dummies are positive and significant. These results show that the reduction of the share of government-controlled banks is slower when a main bank is a large bank. In other words, the dependence on government-controlled banks is larger for those whose main bank is a large bank.

Panel (a) in Figure 4 shows the estimated mean government-controlled bank share for firms whose main bank is a large bank (solid curve) and others (dotted curve). All numbers are normalized so that the government-controlled bank lending share in 2007 is set to 100. The

government-controlled bank share dropped by 10% from 2007 to 2010 when the main bank was a regional bank or a cooperative bank, while the reduction was less than 3% when the main bank was a large bank. Thus, the regression shows that the firms whose main bank was a large bank got more dependent on government-controlled banks in the crisis than others even after controlling for individual firm characteristics and main-bank characteristics.

Column (2) in Table 7 shows the result when we regress the logit-transformed main-bank share. The estimated coefficient of MB_large is deeply negative and significant. This point shows that the main-bank share is smaller when a main bank is a large bank given the same firm characteristics and the same financial soundness of the main bank. Thus, the relationship between large banks and SMEs is weaker than that between regional banks and SMEs. The estimated coefficients of *MB large*$\times$*FY(2008)* and *MB large*$\times$*FY(2009)* are negative and significant. This indicates that the share of large main banks kept decreasing in the financial crisis. Panel (b) in Figure 4 is the plot of the estimated annual mean main-bank share. The main-bank share increased in 2009 if the main bank was a regional bank or a cooperative bank, whereas it did not when it was a large bank.

Column (3) in Table 7 shows the result when we regress the ratio of total borrowing over total assets of each firm. The estimated coefficients of the interaction terms of MB_large and year dummies are negative and significant. This means that a firm borrowed less when its main bank was a large bank than otherwise despite having the same level of creditworthiness. Panel (c) in Figure 4 shows that the total loans of a firm decreased in 2008 when its main bank was a large bank and remained at a lower level than those whose main bank was a regional or a cooperative bank. These results suggest that a large bank decreased its lending to SMEs relative to regional banks, and in place of large banks, the government-controlled banks filled the need for funds.

The control variables also show interesting results. Main-bank characteristics in Columns (2) and (3) show that the main-bank share and total borrowing reduce when the main bank suffers from a higher non-performing loan ratio. However, the effect of the capital adequacy ratio of the main bank, which is adjusted by subtracting the minimum requirement for the credit risk, to the main-bank share is opposite: the main-bank share is decreasing in the capital ratio of a

main bank. This point indicates that a public capital injection to large banks was not a right prescription, in particular, for Japan in this financial crisis. As for the firm characteristics, firms with a higher credit rating have higher share of government-controlled banks, a lower share of main banks and lower borrowing. Perhaps this captures the reverse causality, i.e., those with less debt are rated higher. On the other hand, the improvement in credit rating increases the main-bank share and total borrowing while it reduces the dependence on government-controlled banks. Larger and older firms, which are presumably more credit-worthy, depend less on government-controlled banks. Those with more tangible assets that are pledgeable for collateral are more dependent on their main bank and have a higher dependence on borrowing.

5 Model for the Welfare Evaluation of Government-Controlled Banks

To evaluate the welfare effect of such lending behavior by government-controlled banks, we construct a model to elucidate the difference between a government-controlled bank that maximizes its own profit and another one that maximizes the social welfare consisting of the total borrower's profit and the total lender's profit. From this theoretical analysis, we derive a statistical hypothesis for detecting the objective function of government-controlled banks; either social welfare or their own economic profit.

5.1 Setup

We consider the case where a main bank, a non-main bank, and a government-controlled bank are potential lenders for a firm. We assume that the firm prefers loans from its main bank to those from others. This sort of the brand loyalty would be generated by the borrower's expectation that the main bank is willing to provide additional loans in a flexible manner when it is under temporary financial distress (Chemmanur and Fulghieri, 1994; Dinç, 2000) or the expectation for additional services, such as more effective advising and monitoring, based on proprietary information at the main bank generated from a long-term relationship (Boot and Thakor, 2000; Yafeh and Yosha, 2001). We assume that the loans from non-main banks and the government-controlled bank are homogeneous services. To formulate this assumption into

an analytical model, we assume the following loan demand function of a firm.

$$L_m = \alpha - \delta\beta R_m + \gamma R_o + \gamma R_g, \tag{2}$$

$$L_o = \alpha - \beta R_o + \gamma\delta R_m + \gamma R_g, \tag{3}$$

$$L_g = \alpha - \beta R_g + \gamma\delta R_m + \gamma R_o, \tag{4}$$

where the subscript m indicates the main bank, o indicates the non-main private bank, and g indicates the government-controlled bank. L is the amount of a loan. R is the gross interest rate of the loan. The other letters are exogenous parameters. We assume

$$\gamma/\beta < \delta < 1,\ \beta > 3\gamma > 0,\ \text{and}\ \alpha/(\beta - 2\gamma) > r,$$

where r is the funding cost, which is common to all types of banks, or an opportunity cost for lending to this firm. The first two inequalities assure that the self-price impact is stronger than the cross price impact from the other banks. The second and third inequalities assure the positive amount of the loan supply by the main bank in the equilibrium in the subsequent analysis. The parameter δ is the key to bring the brand loyalty for the main bank loan. This parameter indicates that the negative demand impact of an increased interest rate is smaller for a main bank than non-main banks.

We consider a mixed-oligopoly loan market, where a government-controlled bank, which may maximize the social welfare, and private banks, which engage in asymmetric Cournot competition, are operating (e.g., Fraja and Delbono, 1989; Ide and Hayashi, 1992; Matsumura, 1998). By solving the above simultaneous equations of demand functions with respect to each interest rate, we obtain the following inverse demand functions,

$$R_m = K\{a - bL_m - c(L_o + L_g)\}, \tag{5}$$

$$R_o = a - bL_o - c(L_m + L_g), \tag{6}$$

$$R_g = a - bL_g - c(L_m + L_o), \tag{7}$$

where $K \equiv 1/\delta$, $a \equiv \alpha/(\beta-2\gamma)$, $b \equiv (\beta-\gamma)/((\beta-2\gamma)(\beta+\gamma))$, and $c \equiv \gamma/((\beta-2\gamma)(\beta+\gamma))$. $K > 1$ by the previous assumption. K is an indicator of the strength of the main-bank relationship of

each firm in the sense that the higher K indicates the stronger loyalty to its main bank or lower price elasticity of demand for the main-bank loan.

5.2 Equilibrium

5.2.1 Welfare-maximizing government-controlled banks

First, we consider the Nash equilibrium in the case where the government-controlled bank sets its amount of lending to this firm so as to maximize the social welfare in the market for lending to this firm, i.e., the sum of the firm profit and the total profit of all lenders.

The profit maximization problem for the main bank is

$$\max_{L_m} \quad K(a - bL_m - c(L_o + L_g))L_m - rL_m. \tag{8}$$

That for the non-main private bank is

$$\max_{L_o} \quad (a - bL_o - c(L_m + L_g))L_o - rL_o. \tag{9}$$

The welfare maximization problem for the policy bank is

$$\begin{aligned}\max_{L_g} \quad & \int_0^{L_m} K(a - bl - c(L_o + L_g))dl + \int_0^{L_o} (a - bl - c(L_m + L_g))dl \\ & + \int_0^{L_g} a - bl - c(L_m + L_o)dl - r(L_m + L_o + L_g).\end{aligned} \tag{10}$$

The first term is the firm profit from the loan from a main bank, the second term is the firm profit from the loans from non-main banks, and the third term is that from the loans by the govenment-controlled bank, and the last term is the total funding cost for the banking sector for supplying the loans to the firm.

The F.O.C.s for each of these problem are

$$K(a - 2bL_m - c(L_o + L_g)) - r = 0, \tag{11}$$

$$a - 2bL_o - c(L_m + L_g) - r = 0, \tag{12}$$

$$-(1 + K)cL_m + a - bL_g - 2cL_o - r = 0. \tag{13}$$

The second-order condition for the maximization is satisfied since the differentiation of the left-hand side of each of these F.O.C.s is negative.

Solving this system of equations with respect to L_m, L_o, and L_g gives the equilibrium supply of loans by each type of banks.

The impact of the demand shock, which is expressed by the increase in a, on the supply by the government-controlled bank is

$$\frac{dL_g}{da} = \frac{2b - (K+2)c}{sb^2 + c\{b - (k+3)c\}}. \tag{14}$$

The effect of the strength of the main-bank relationship on this response is

$$\frac{d^2L_g}{dKda} = -\frac{c(b-c)(2b+c)}{[2b^2 + c\{b-(K+3)c\}]^2} < 0. \tag{15}$$

This is negative under the above parametric assumptions. It means that the government-controlled bank supplies larger amounts to a firm whose main-bank relationship is weak and supplies less to a firm whose main-bank relationship is strong in response to the increase in the loan demand of the firm. This is because the welfare-maximizing government bank takes into account the fact that a unit of loans from the main bank generates more benefits for the firm than does a unit of loans from the other banks including the government bank because of the additional benefit from the relationship banking by the main bank. This effect is captured by the first term in the LHS of the FOC for the government-controlled bank (13). As K gets larger and the loans from the main bank L_m get larger due to the demand increase, the marginal social welfare of a unit of loans by the government-controlled bank decreases. Thus, the government-controlled bank is less willing to provide a loan to those with higher K, i.e., those with a strong relationship with their main bank.

5.2.2 Profit-maximizing government-controlled bank

Now we consider the case where the government-controlled bank behaves in the same way as the non-main bank as a Cournot competitor. The government-controlled bank solves the same maximization problem as that of the non-main private bank in this case. The F.O.C. for the government-controlled bank is given by

$$a - 2bL_g - c(L_m + L_o) - r = 0. \tag{16}$$

Solving the system of equations of Eqs. (11), (12), and (16) gives the equilibrium loan supply of each type of banks. In this case, the effect of the positive loan demand shock, which is expressed

by the increase in a, on the loan supply of the government-controlled bank L'_g is

$$\frac{dL'_g}{da} = \frac{1}{2(b+c)}. \tag{17}$$

The effect of the intensity of the main-bank relationship on this response is

$$\frac{d^2L'_g}{dKda} = 0. \tag{18}$$

Namely, the government-controlled bank does not adjust its supply according to the intensity of the main-bank relationship of the borrowing firm.

The following proposition is a summary of the results in this section.

Proposition (Welfare Maximizing vs. Profit Maximizing)**.** *The increment of the amount of lending by a welfare-maximizing government-controlled bank is decreasing in the strength of the relationship between the borrower and its main bank. The increment of the amount of lending by a profit-maximizing government-controlled bank is independent of the strength of the relationship between the borrower and its main bank.*

This proposition suggests that we can identify whether the government bank is trying to maximize the social welfare by examining the negative correlation between the supply of government-controlled bank lending and the strength of the main-bank relationship of the borrower under the surge of loan demand like that in the Japanese loan market in 2009.

6 Hypothesis Test: Government-Controlled Bank Lending and Main-Bank Relationship in the Surge of Loan Demand

6.1 Hypothesis

To test the above proposition, we need a good proxy measure for the strength of the main-bank relationship. Many existing studies suggest that the information on whether the main bank is a large bank can work as a proxy for the weakness of a main-bank relationship. The theory suggests that a large bank with a more centralized lending decision mechanism is not competent in utilizing the soft information that is required for relationship banking (e.g., Stein, 2002), and several empirical studies show supportive evidence for this (e.g., Cole et al., 2004; Berger et al., 2005; Uchida et al., 2008; Nemoto et al., 2011; Ogura and Uchida, 2014). Typical large banks in

Japan are city banks and trust banks that operate nationwide and internationally. The weakness of the relationships of large banks with SMEs are also consistent with the significantly lower main-bank share when the main bank is a large bank in Figure 2 and the higher probability of a main-bank switch at large banks in Table 5. By relying on these observations and existing results, we test the following hypothesis after controlling for all possible factors.

Hypothesis. *Loan amounts from government-controlled banks increased more for firms whose main bank is a large bank in the financial crisis.*

It has been already mentioned in Section 3.1 that the surge in Japanese loan demand was observed in 2009 right after the outbreak of the financial crisis. Thus, if we find that the above hypothesis is not supported by our dataset, it means that Japanese policy banks are not maximizing the social welfare.

6.2 Identification strategy

We use the information on the amount of outstanding loans from each bank at the end of each accounting period of each firm. As noted in the data description, our dataset includes these items for the largest four lenders and the SME unit of JFC. If the number of lenders except the SME unit of JFC exceeds four, the outstanding loans of the fourth largest lender and other smaller lenders including the unknown lenders are summed up and classified as loans from miscellaneous "Other institutions". The composition of the types of lenders in each year is listed in Table 7. Regional banks including cooperative banks accounts for the largest part of the dataset, about 30%. The class "Other institutions", which is the mixture of the fourth largest and smaller lenders, also accounts for about the same portion of the observation as regional banks. Government banks for SMEs, including the SME unit and the Micro Corporation and Individual unit of JFC, and Shoko Chukin Bank account for the next largest part, about 25%. Large banks account for about 15%. The other government banks, including Development Bank of Japan, account for a very small part of our observation.

Table 8 shows the descriptive statistics of the outstanding loan of each lender, which is normalized by the total asset of each firm, $loan/asset$, and the difference of it from the previous year, $\Delta loan/asset$. The mean of $loan/asset$ is 15%, and the median is 6%. Those of $\Delta loan/asset$

are zero. Panel (a) in Figure 4 is the plot of the sample mean of $\Delta loan/asset$ by each class of lenders. Clearly, the loans by government banks for SMEs kept increasing from 2009 to 2011. The increase in the loans from government banks for SMEs increased more precipitously when the main bank of a firm was a large bank than otherwise.

We estimate the following linear fixed-effect model by using the three-way panel data.

$$\begin{aligned}\Delta loan/asset_{ijt} = \beta_0 + \beta_1 large\ bank_{jt} + \sum_{s=2008}^{2011} \beta_s large\ bank_{js} \times FY(s)_t \\ + \gamma_1 gov.\ bank\ for\ SME_{jt} + \sum_{s=2008}^{2011} \gamma_s gov.\ bank\ for\ SME_{js} \times FY(s)_t \\ + \lambda_1 gov.\ bank\ for\ SME_{jt} \times MB\ large_{it} \\ + \sum_{s=2008}^{2011} \lambda_s gov.\ bank\ for\ SME_{js} \times MB\ large_{it} \times FY(s)_t \\ + \theta_t + \rho_{it} + \epsilon_{ijt}, \end{aligned} \tag{19}$$

where i is the index of a firm, j is the index of a bank, and t $(= 2007, \cdots, 2011)$ is the year. β's, γ's, and λ's are the coefficients to be estimated. A column vector. θ_t is the year fixed effect for year t. ρ_{it} is the cross fixed effect of firm i and year t. ϵ_{ijt} is the error term. The definitions of the other variables are listed in Table 3.

The most important coefficients for our hypothesis test are λ_{2009} and λ_{2010}. If Japanese government-controlled banks behave as a welfare maximizer rather than a profit maximizer, these coefficients are positive and significant. A notable benefit of estimating the model with the three-way panel data is that we can introduce the firm-year cross fixed effect to control for the magnitude of a demand shock and other time-varying unobservable individual firm factors since we have multiple observations for each firm-year cell.

6.3 Results

The baseline results of the estimation are listed in Column (1), Table 10. The coefficients of $gov.\ bank\ for\ SME_{js} \times MB\ large_{it} \times FY(s)_t$ in 2009 and 2010, i.e., λ_{2009} and λ_{2010} are positive and significant at a 1% significance level. To see the economic significance of this effect, we plot the estimated average of $\Delta loan/asset$ by the class of financial institutions in Figure 6 based on the estimation of Column (1) in Table 10. The difference in $\Delta loan/asset$ between firms whose

main bank is a large bank and others is 0.19% in 2009 and 0.25% in 2010. Given the fact that the estimated mean of $\Delta loan/asset$ of the government banks for SMEs is 0.96% in 2009 and 0.78% in 2010 (Figure 6), the difference is very large, $0.19/0.96 \times 100 = 19.8\%$ in 2009 and 31.3% in 2010, i.e., the increment of the government-controlled banks lending for firms with a large main bank increased faster than those with a regional main bank by 1.2 times in 2009 and by 1.3 times in 2010.

The theoretical model suggests that the shift to a government-controlled bank becomes larger as the demand shock gets larger. To examine this prediction, we estimated the above model augmented with the interaction term of $gov.\ bank\ for\ SME_{js} \times MB\ large_{it} \times FY(s)_t \times ln(liquid.short)$. The higher liquid.short indicates the larger demand for loans to fill in the shortage of liquidity. The estimation result is listed in Column (2) in Table 10. The estimated coefficient of the additional interaction term is positive and significant from 2007 to 2010, i.e., the larger demand shock brings a larger shift of large-bank users to a government-controlled bank.

To see whether this shift is concentrated on those who kept borrowing from a government-controlled bank, i.e., whether the effect comes from the intensive margin or from the extensive margin, we estimate the baseline model with the sample that kept borrowing from 2007 to 2011 from a government-controlled bank for SMEs. The result is listed in Column (3) in Table 10. The estimated coefficients of $gov\ bank\ for\ SME_{js} \times MB\ large_{it} \times FY(s)_t$ in 2009 and 2010 barely differ from the baseline result in Column (1) in terms of magnitude and statistical significance. Thus, the shift to the government-controlled bank by large-bank users is observed equally in the intensive margin and the extensive margin.

6.4 Interpretation of the results

The above regression results show that the government-controlled banks for SMEs in Japan filled in the shortage of loan supply from large banks after the outbreak of the financial crisis. Given the fact that the relationships between large banks and SMEs are weak and that the loan demand was high in 2009, we are tempted to conclude that this result is consistent with the hypothesis that the government-controlled banks behaved as a welfare maximizer. However,

there remains rooms for a couple of alternative interpretations.

6.4.1 Did the low interest rate of a government-controlled bank attract a large-bank user?

One possible alternative interpretation is that the interest rate offered by a government-controlled bank was lower than that offered by large banks. However, this interpretation is not plausible because the average financing cost of large banks is significantly lower than regional banks (Figure 7) and the rate offered by a large bank is less likely to exceed the rate offered by a regional bank. Those dependent on cooperative banks and regional banks are the first to switch to government-controlled banks if the interest rate differential really matters.

6.4.2 Did large corporations crowd out SMEs from large banks?

Another alternative interpretation is that the shift of large-bank-dependent SMEs to a government-controlled bank was a result of the crowding out due to the loan demand surge of large corporations (see Figure 1) that were shut out of the commercial paper market in 2008 and 2009. This story is plausible and consistent with the prediction by Holmstöm and Tirole (1997) that those less capitalized firms are dropped out of the credit market first, as long as large banks encounter a capacity constraint.

To examine this possibility by clarifying what the dummy variable that indicates the main bank is a large bank represents, we replace the dummy with a more explicit measure of the bank-firm relationship and a measure of a possibility of the crowding-out by large corporations.

We use the main-bank share of deposits as of 2007, before the crisis, as the measure of the strength of a main-bank relationship. We use the deposit share instead of the loan share because the dataset provider recognizes the main bank by the deposit account information. For example, more than 10% of our observations report that the main-bank loan share is zero (see Table 3) while almost all firms report that they keep a positive balance of deposits at their main bank. This way to identify a main bank is consistent with the existing empirical studies that the balance of a checking account is the most potential information source for relational lenders (Mester et al., 2007; Norden and Weber, 2010).

As a measure for the possibility of the crowding out, we use the ratio of SME loans to total

loans of each bank as of 2007. We assume that a bank with a lower SME ratio has a business line that is oriented to large corporations and is more prone to the demand surge from large corporations.

Column (1) in Table 11 shows the result of the regression using the relationship measure in place of the large main-bank dummy. The interaction term $gov.\ bank\ for\ SMEs \times FY(s) \times MB\ deposit\ share$ is negative when s is 2009, 2010, and 2011 and is statistically significant when s is 2010 or 2011. This result indicates that the dependence on a government-controlled bank increased more for firms whose main-bank relationship is weaker. The result is consistent with the welfare maximization of the government-controlled bank in the theory.

Column (2) in Table 11 shows the result when we introduce the interaction terms of *MB SME ratio*, which is the ratio of SME loans over total loans of the main bank as of 2007. The estimated coefficient of the interaction terms of the MB SME ratio indicates that firms whose main bank is oriented more toward large corporations shifted to a government-controlled bank more than others did in 2010. The estimated coefficients of the interaction terms of the main-bank relationship, $MB\ deposit\ share$, do not change much from those in Column (1). The difference of the SME ratio between regional banks and large banks as of 2007 is about 11% (Panel (d), Figure 2). This difference increased the shift from a large main bank to a government-controlled bank by $11 \times 0.0058 = 0.0638$ in 2010. The average difference of the main-bank share of deposits between regional banks and large banks as of 2007 was about 4%. This difference increases the shift from a large main bank to a government-controlled bank by $4 \times 0.0095 = 0.037$ in 2010 and $4 \times 0.0046 = 0.0184$ in 2011. The result shows that both the relational factor as is predicted in the theoretical model and the crowding-out factor worked at a similar magnitude.

7 Conclusion

We have shown theoretically that government-controlled banks increase their lending more for those firms with a weak bank relationship in response to the loan demand surge if they are maximizing the social welfare by applying a mixed-oligopoly model. Our empirical analysis shows that government-controlled banks for SMEs indeed increased their lending more to SMEs whose

main bank was a large bank in 2009 and 2010, when a surge in demand for bank loans was observed. Given the fact that many extant studies have proven that large banks are not conducting relationship banking for SMEs, this result provides us with evidence for the possibility that government-controlled banks are maximizing the social welfare by filling in the shortage of the loan supply by large main banks. Given the finding by the extant literature such as Uesugi et al. (2014) that the lending by a government-controlled bank in Japan helped borrowers avoid a sharp drop in investment and employment, the result supports the usefulness of a government-controlled bank under a financial crisis. However, we also find that this is not the only mechanism for the increased dependence on government-controlled banks by firms whose main bank is a large bank. Our result indicates that the crowding out from large-corporation-oriented large banks due to the loan demand surge of large corporations was also at work at the same level of magnitude.

Of course, our analysis does not perfectly take into account all aspects of the potential costs of policy lending by government-controlled banks. The most notable cost is the one resulting from the fact that policy lending is highly likely to be subject to a certain political bias, which results in costly resource misallocation as shown in the extant literature. For example, financial aid for SMEs can be a very popular policy agenda for representative candidates to obtain support from the local chamber of commerce and industry, which are often influential in elections. It is also hard for candidates to criticize this aiding-the-weak type of policy, since such policies are likely to elicit people's sympathy. This situation easily leads to an excess in such policies and deters a healthy metabolism of the industry by hampering the dynamism of entry and exit. How we can estimate the optimal size of the government-controlled bank and how we can achieve the optimal size with avoiding political bias remain open and challenging questions.

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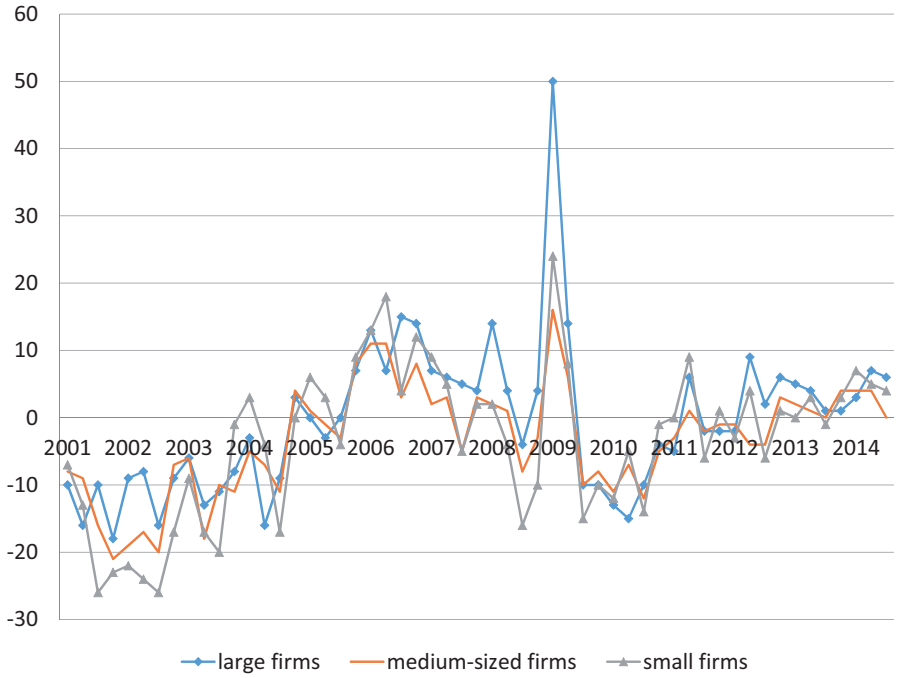
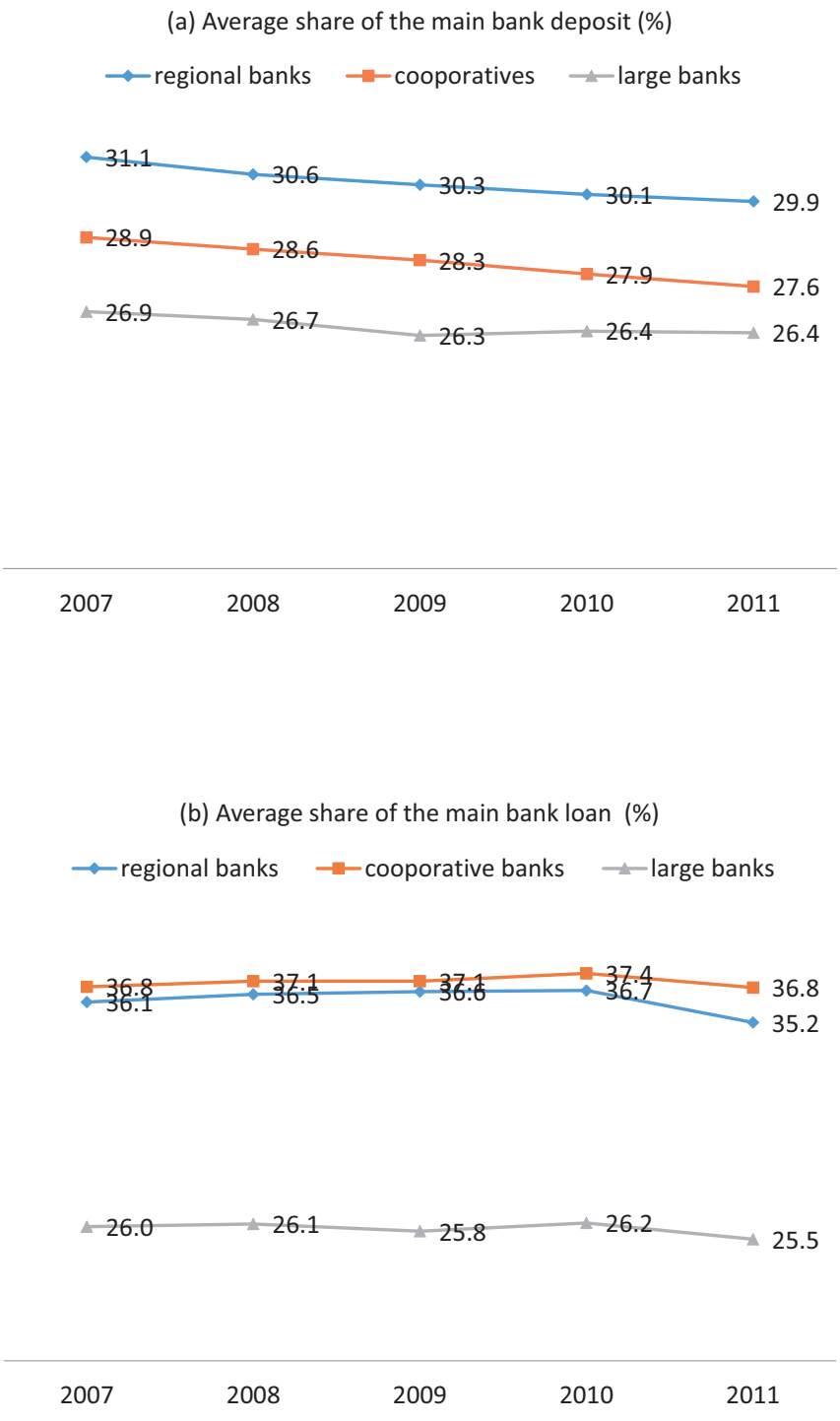
Figure 1: Fund Demand Diffusion Index in the Last 3 Months (%)

Definition: (ratio of "increase") + (ratio of "increase somewhat") /2
-(ratio of "decrease") - (ratio of "decrease somewhat"/2)



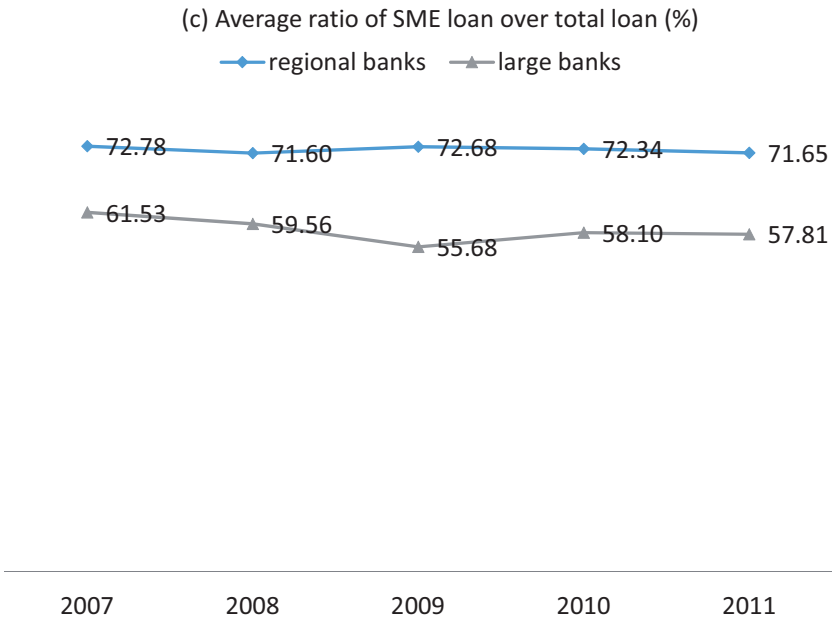
Source: *Senior Loan Officer Opinion Survey on Bank Lending Practices at Large Japanese Banks*, Bank of Japan.

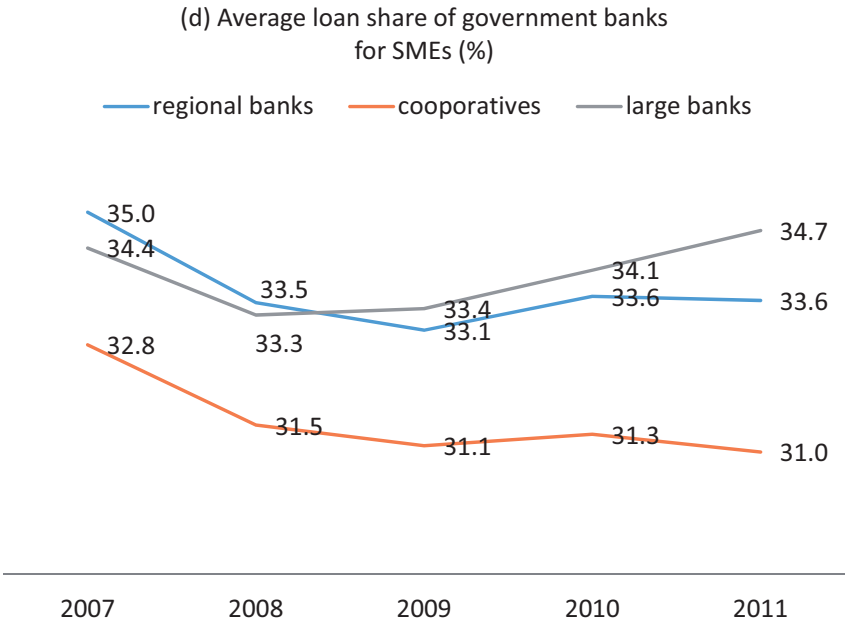
Figure 2: Share of Each Bank at Each Firm



Source: Author's calculation from the microdata of borrowers at the SME unit of JFC.

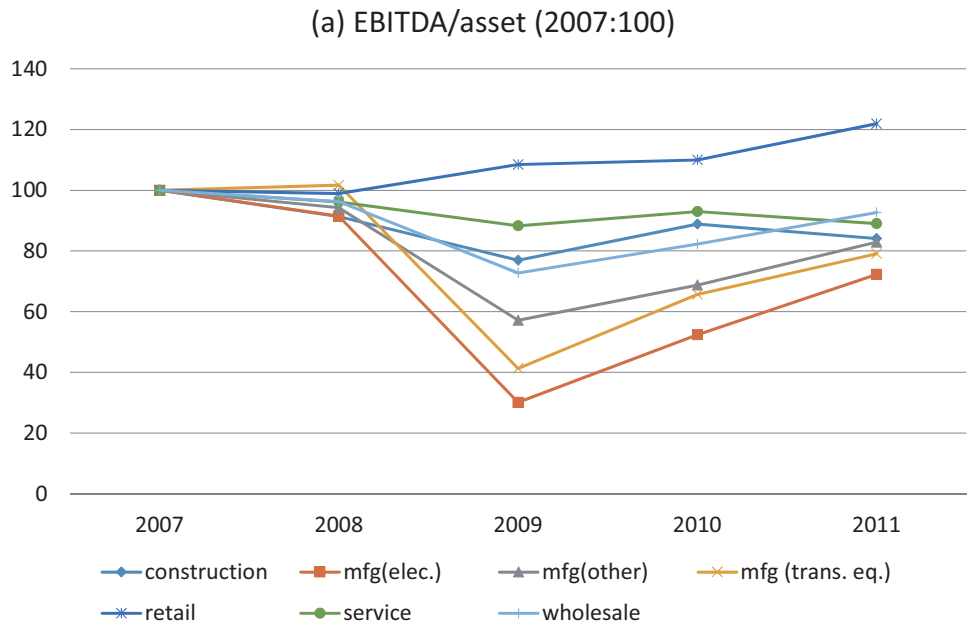
Figure 2: (cont.)





Source: Author's calculation from the microdata of borrowers at the SME unit of JFC in Panel (d) and that from the bank financial statements of NIKKEI NEEDS, augmented with the Japan Bankers Association online database for the bank financial statements for the unlisted banks in Panel (c).

Figure 3: Financial Conditions of SMEs



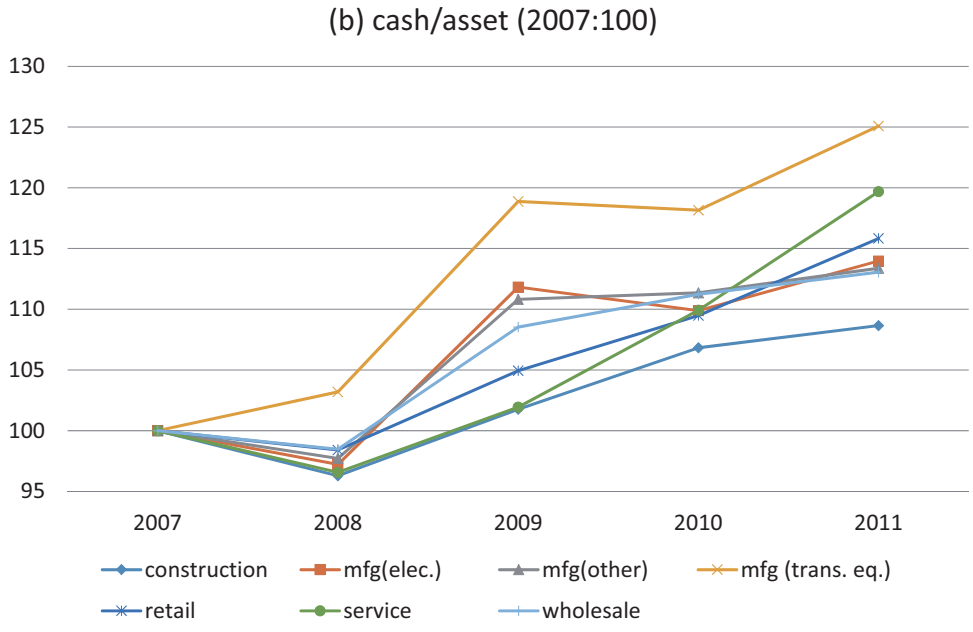
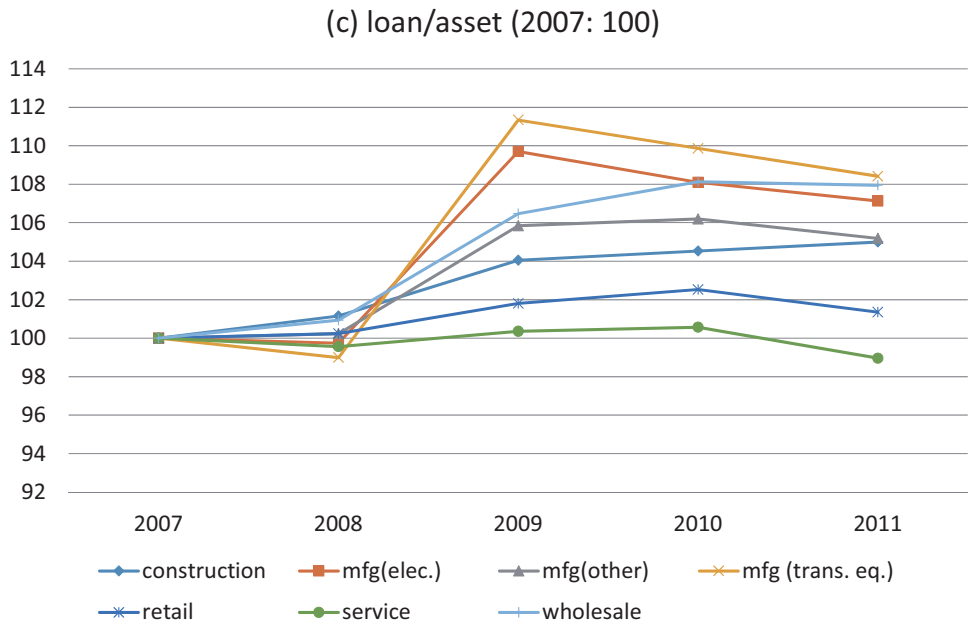
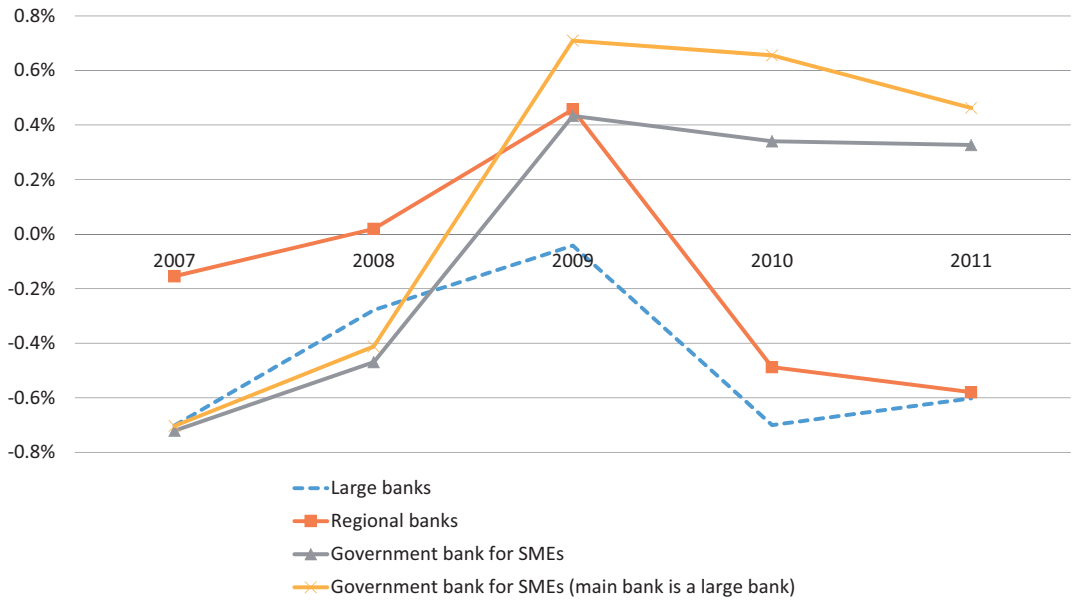


Figure 3: (cont.)



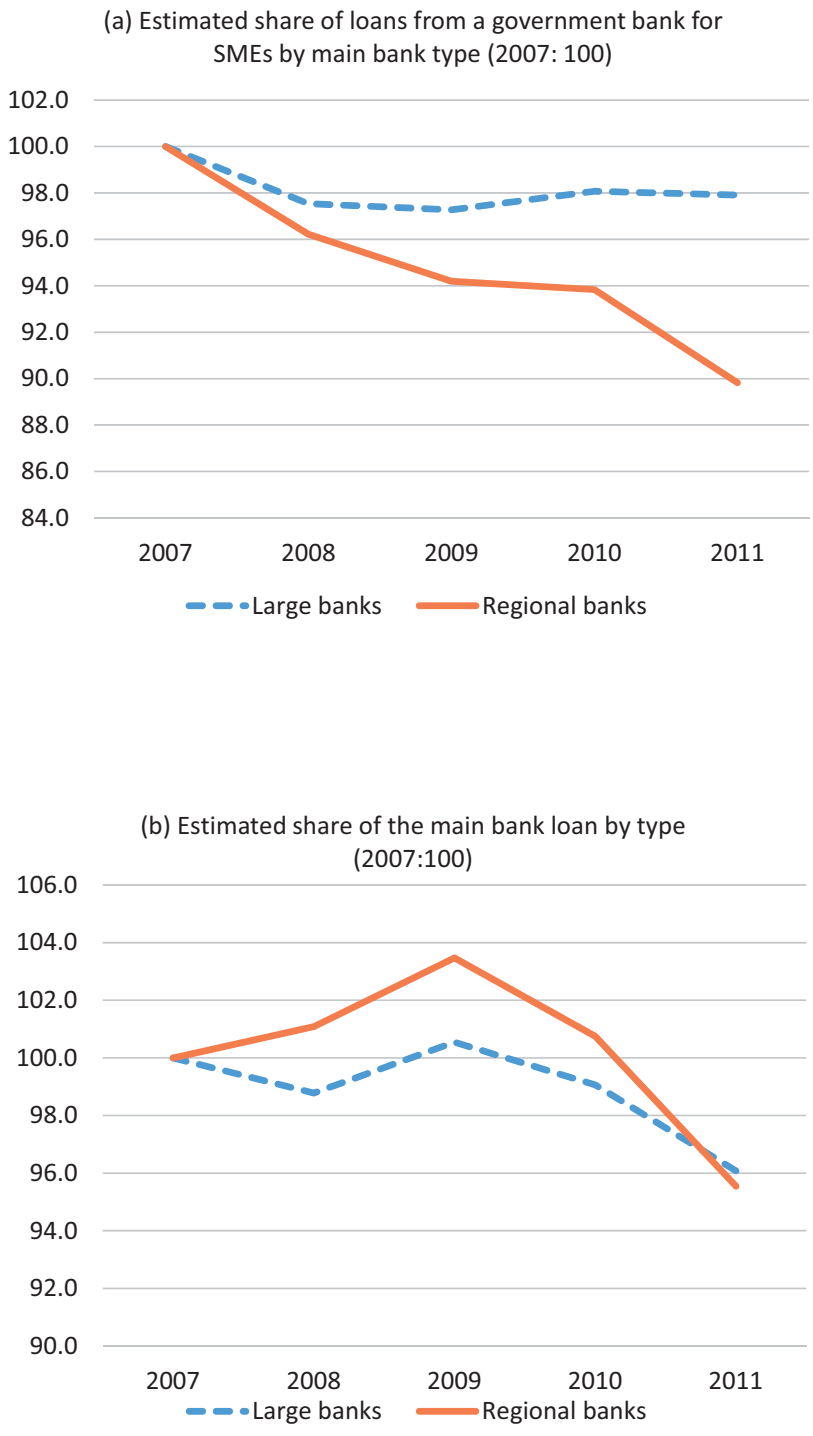
Source: Author's calculation from the microdata of borrowers at the SME unit of JFC.

Figure 4: Average Annual Change of Loan/Asset from a Lender to a Firm (%)



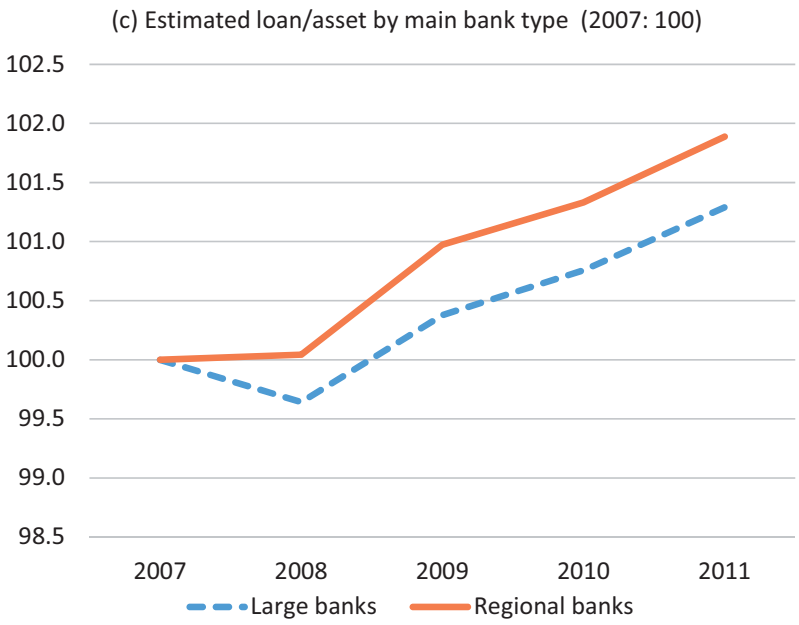
Source: Author's calculation from the microdata of borrowers at the SME unit of JFC.

Figure 5: Fitted Value of the Regression



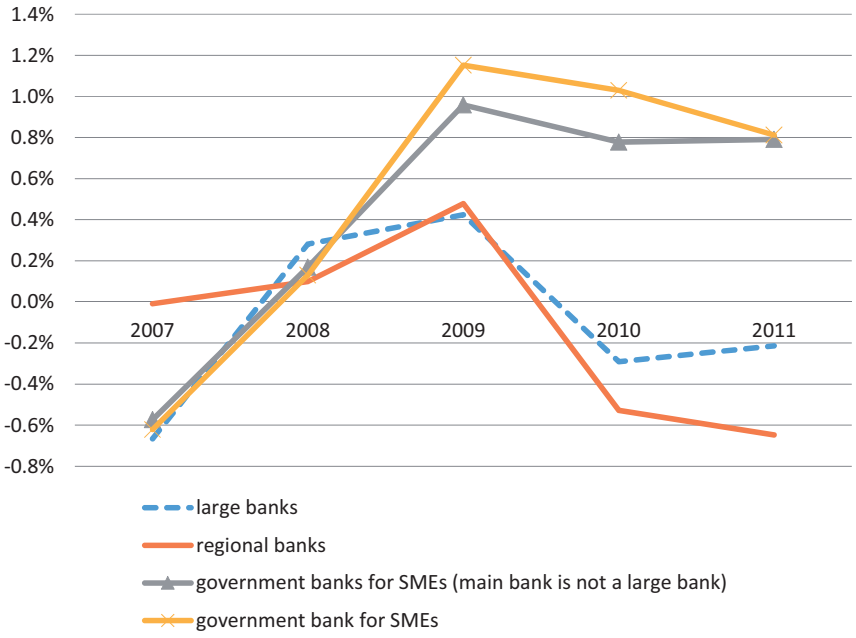
Source: Author's calculation from the result in Table 7.

Figure 5: (cont.)



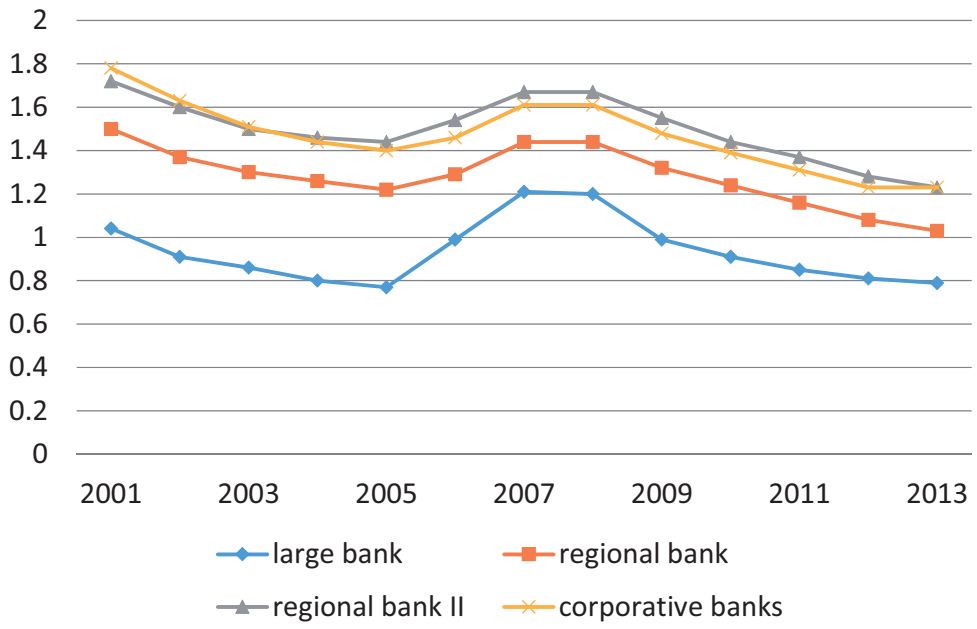
Source: Author's calculation from the result in Table 7.

Figure 6: Estimated Change in Average Loan/Asset (%)



Source: Author's calculation from the regression (1) in Table 10.

Figure 7: Average Funding Cost (%)



Source: Japanese Bankers Association and *Zenkoku Shinyo Kinko Gaikyo* (Shinkin Central Bank) for cooperative banks.

Table 1: Number of Sample SMEs by Year and Sector

	2007	2008	2009	2010	2011	total	(share)	Economic Census	
communication	307	310	330	450	517	1,914	1.3%	46,747	2.7%
construction	2,738	2,548	2,410	2,347	2,293	12,336	8.1%	331,079	18.9%
logistics	1,976	1,917	1,851	1,800	1,820	9,364	6.2%	56,444	3.2%
manufacturing (electronics)	907	908	850	870	868	4,403	2.9%	21,776	1.2%
manufacturing (trans. equip.)	548	539	526	552	553	2,718	1.8%	11,381	0.7%
manufacturing (other)	12,780	12,352	11,769	11,332	11,075	59,308	39.1%	241,873	13.8%
real estate	2,378	2,354	2,307	2,090	1,975	11,104	7.3%	182,060	10.4%
retail	2,534	2,429	2,311	2,229	2,192	11,695	7.7%	279,626	16.0%
service	2,876	2,915	2,874	2,966	3,005	14,636	9.7%	386,427	22.1%
wholesale	4,543	4,396	4,246	4,279	4,348	21,812	14.4%	189,621	10.8%
others	491	468	452	445	440	2,296	1.5%	2,583	0.1%
total	32,078	31,136	29,926	29,360	29,086	151,586	100.0%	1,749,617	100.0%

(Note) The top row indicates the year at the end of each accounting period. The Economic Census column is based on the number of companies (excluding sole proprietorships) in the 2009 Economic Census for Business Frame (Kiso Chosa), Statistics Bureau, Ministry of Internal Affairs and Communications, Japan. Three sectors in the manufacturing sector are calculated by the author based on this statistic. The other parts are from Panel (3), Table 1, on page 285 of the Statistical Appendix of the 2012 White Paper on Small and Medium Enterprises in Japan.

Table 2: Variable Definition

variable	definition
loan/asset	Loan from a bank to a firm divided by the total assets of the firm.
Δloan/asset	loan/asset(t) - loan/asset(t-1).
large bank	Dummy variable, which equals one if the lender is a large bank or zero otherwise. Large banks include city banks and trust banks.
gov. bank for SMEs	Dummy variable, which equals one if the lender is a government-owned bank for SMEs or zero otherwise. The government-owned banks for SMEs include the SME unit and the Micro Business and Individual unit in the Japan Finance Corporation, and the Shoko Chukin Bank.
gov. bank	Dummy variable, which equals one if the lender is a government-owned bank not for SMEs or zero otherwise.
other institutions	Dummy variable, which equals one if the lender is an institution classified into other miscellaneous institutions.
FY(2###)	Dummy variable to indicate the accounting year (FY) ending in 2###.
Gov. bank for SMEs share	Share of loans from government banks for SMEs at each firm at the end of the accounting year ending in FY. Government banks for SMEs include the SME unit and the Micro Business and Individual unit of Japan Finance Corporation, and the Shoko Chukin Bank.
MB loan share	The largest main-bank share of loans at the end of the accounting year ending in FY.
MB deposit share	The largest main-bank share of deposits at the end of the accounting year ending in FY.
ln(gov. bank for SMEs share)	Logit-transformed gov. bank for SMEs share, i.e., ln(gov. bank for SMEs share /(1 - gov. bank for SMEs share)). The share is replaced with 0.9999 if it is one, and with 0.0001 if it is zero.
ln(MB loan share)	Logit-transformed main bank loan share, i.e., ln(MB loan share /(1 - MB loan share)). The share is replaced with 0.9999 if it is one, and with 0.0001 if it is zero.
borrow/asset	Total loan outstanding / total assets of each firm at the end of the accounting year.
MB large	A dummy variable, which equals one if the main bank is a large bank or zero otherwise. Large banks includes city banks and trust banks.
MB's capital ratio	Risk-adjusted capital adequacy ratio minus the regulatory required ratio of the main bank (%) as of March in the year in which the accounting year of a sample firm ends. The regulatory required ratio is 8% for banks engaging international operations or 4% for others.
MB's ROA	Net profit after tax / total assets*100 of the main bank (%) as of March in the year in which the accounting year of a sample firm ends.
MB's NPL ratio	(Non-performing loans / total loans × 100) of the main bank (%) as of March in the year, in which the accounting year of a sample firm ends. Trust accounts are excluded. Non-performing loans are defined by the risk management loans.

Table 2: (cont.)

Variable	Definition
MB's SME ratio	(Loans to SMEs / total loans × 100) of the main bank as of March in the year in which the accounting year of a sample firm ends. The values for cooperative banks are set at 100.
#lenders	The number of private banks (max 4).
credit rating	Internal rating of the SME unit of the Japan Finance Corporation (1: least credit-worthy,.., 12: most credit-worthy).
Δcredit rating	Annual change of credit rating.
Δln(sales)	Annual difference of ln(total sales (mil JPY)) of a firm.
ln(asset)	Natural logarithm of the total asset of a firm (mil JPY).
ln(firm age)	Natural logarithm of the years after the startup of a firm.
profitability	EBITDA/sales of a firm. EBITDA equals (operating profit) +(depreciation).
tangibility	(Land + building + construction in progress + other tangible assets) /(total assets) of a firm.
int.cover	EBITDA/interest costs of a firm.
ln(int.cover)	Natural logarithm of (EBITDA/interest costs+1). EBITDA is replaced with zero if it is negative.
liquid.short	The liquidity shortage of a firm defined by max(0, - (Operating Cash Flow[t] - Operating Cash Flow[t-1]) + cash and deposit [t-1]), where Operating Cash Flow equals EBITDA minus the increase in the working capital from the previous year. Working capital equals (inventory) + (bills receivable) - (bills payable). million JPY.
ln(liquid.short)	Logarithm of liquid.short plus 1.

Table 3: Descriptive Statistics

variable	N	mean	sd	min	p10	p50	p90	max
MB loan share	150,296	0.337	0.242	0.000	0.000	0.316	0.680	1.000
MB deposit share	148,596	0.290	0.151	0.000	0.074	0.298	0.485	1.000
Gov. bank for SMEs share	151,416	0.335	0.252	0.000	0.058	0.279	0.700	1.000
MB's capital ratio	151,586	6.997	3.521	-3.940	3.770	6.650	10.280	63.760
MB's ROA	151,586	0.143	0.500	-5.622	-0.246	0.214	0.414	5.803
MB's NPL ratio	151,586	3.831	2.402	0.484	1.667	3.261	6.583	31.798
MB's SME ratio	148,229	0.750	0.148	0.252	0.566	0.731	1.000	1.000
borrow/asset	151,586	0.536	0.236	0.000	0.198	0.556	0.839	1.000
#lenders	151,586	3.310	0.920	1	2	4	4	4
firm asset	151,586	1545.74	2984.77	3.70	185.90	770.00	3428.80	225251.40
age	151,586	51.28	32.19	1	19	47	86	1003
credit rating	151,586	9.269	2.506	1	6	10	12	12
Δcredit rating	151,586	-0.102	1.466	-10	-2	0	1	11
Δln(sales)	151,586	-0.025	0.243	-6.248	-0.244	-0.011	0.181	4.865
profitability	151,586	0.071	0.334	-69.000	-0.011	0.046	0.193	1.090
tangibility	151,586	0.449	0.241	0.000	0.139	0.431	0.796	1.000
int.cover	151,586	12.65	67.55	0	0	3.86	22.02	7927.33
liquid.short	151,586	26.55	233.78	0.00	0.00	0.00	28.10	25271.60

Table 4: Number of Sample Firms by Year and Main Bank Type

(Note) Year is the year at the end of the accounting year of each firm. Regional banks include regional banks and cooperative institutions. Large banks include city banks and trust banks.

Year	Regional banks	Large banks	Total
2007	23,714	8,364	32,078
2008	23,111	8,025	31,136
2009	22,215	7,711	29,926
2010	21,582	7,778	29,360
2011	21,217	7,869	29,086
Total	111,839	39,747	151,586

Table 5: Frequency of Switching Main Banks

(Note) The sample firms with information about their main bank in the previous year are used among those in the dataset used for the regression (1) in Table 7.

		Type of the main bank in the previous year					
	From the	(a) Regional banks		(b) Large banks		(c) All	
	previous year	#obs	(ratio of ii)	#obs	(ratio of ii)	#obs	(ratio of ii)
2007	i. no switch	23,082		8,171		31,253	
	ii. switch	474	2.1%	283	3.5%	757	2.4%
2008	i. no switch	22,517		7,835		30,352	
	ii. switch	446	2.0%	286	3.7%	732	2.4%
2009	i. no switch	21,489		7,499		28,988	
	ii. switch	567	2.6%	304	4.1%	871	3.0%
2010	i. no switch	20,874		7,579		28,453	
	ii. switch	490	2.3%	327	4.3%	817	2.9%
2011	i. no switch	20,367		7,594		27,961	
	ii. switch	282	1.4%	190	2.5%	472	1.7%

Table 6: Firm Characteristics by Main-Bank Type in 2009

	(i) Main bank is a large bank				(ii) Otherwise		
variable	N	mean		med	N	mean	med
ΔMB loan share	7,428	-1.324	***	0.000	21,106	-0.573	0.000
ΔMB deposit share	7,559	-0.584	***	0.000	21,773	-0.061	0.000
ΔGov. bank for SMEs share	7,676	0.451	***	-0.167	22,139	-0.227	-0.766
Δborrow/asset	7,708	0.024	**	0.012	22,206	0.021	0.009
Δ#lenders	7,708	0.007	***	0.000	22,204	-0.023	0.000
firm asset	7,711	2204.8	***	1153.6	22,215	1248.2	653.1
Δln(firm asset)	7,708	-0.032	***	-0.030	22,206	-0.022	-0.027
credit rating	7,711	9.657	***	10.000	22,215	9.084	10.000
Δcredit rating	7,711	-0.230	***	0.000	22,215	-0.165	0.000
Δln(sales)	7,711	-0.125	***	-0.080	22,215	-0.099	-0.061
profitability	7,711	0.060		0.038	22,215	0.061	0.040
Δprofitability	7,711	-0.019		-0.008	22,215	-0.016	-0.005
Δtangibility	7,711	0.009	**	0.002	22,215	0.007	0.001
Δint.cover.	7,688	-0.298	***	-0.096	22,146	-0.203	-0.036
Δliquid.short	7,644	0.280	***	0.000	21,994	0.185	0.000
electronics dummy	7,711	0.041	***		22,215	0.024	
trans. equip. dummy	7,711	0.020	**		22,215	0.017	
other mfg. dummy	7,711	0.430	***		22,215	0.380	

(Note) All descriptive statistics are calculated from the information as of the end of the accounting year ending in 2009. Δ indicates the difference from the previous accounting year. Electronics dummy, trans. equip. dummy, and other mfg. dummy are dummy variables to indicate that a firm is in the electronics sector, the transportation equipment sector, or the other manufacturing sectors, respectively. *, **, and *** on the right of mean indicates that the mean difference between the subsamples (i) and (ii) is statistically significant at a 1 %, 5%, and 10% significance level, respectively (two-sided t-test with the common variance between the subsamples).

Table 7: Share Regression

(notes) Dependent variables are indicated at the top of each row. The coefficients are estimated by the firm fixed-effect model. Standard errors are estimated by the firm cluster robust standard errors. The estimated constant term and the coefficients of the interaction terms of the sector dummies (communication, logistics, manufacturing(electronics), manufacturing (transportation equipment), manufacturing (other), real estate, retail, service, wholesale, and others) and the year dummies (FY2008-FY2011) are omitted from the table. *, **, and *** indicate that the estimated coefficient is different from zero at a 10%, 5%, and 1% statistical significance level, respectively (two-sided).

Dep. Var.	(1) ln(gov.bank for SMEs share)			(2) ln(MB loan share)			(3) borrow/asset		
Ind. Var.	Coef.	S.E.		Coef.	S.E.		Coef.	S.E.	
MB large	-0.075	0.066		-1.607	0.148	***	-0.0032	0.0032	
MB large×FY(2008)	0.053	0.025	**	-0.092	0.034	***	-0.0040	0.0009	***
MB large×FY(2009)	0.124	0.032	***	-0.117	0.042	***	-0.0060	0.0013	***
MB large×FY(2010)	0.171	0.040	***	-0.068	0.050		-0.0057	0.0016	***
MB large×FY(2011)	0.329	0.048	***	0.022	0.057		-0.0060	0.0017	***
FY(2008)	-0.151	0.042	***	0.043	0.050		0.0004	0.0017	
FY(2009)	-0.233	0.051	***	0.139	0.062	**	0.0098	0.0022	***
FY(2010)	-0.248	0.060	***	0.030	0.073		0.0133	0.0025	***
FY(2011)	-0.413	0.074	***	-0.179	0.085	**	0.0189	0.0028	***
MB's capital ratio	-0.002	0.004		-0.011	0.006	*	-0.0003	0.0002	*
MB's ROA	0.016	0.014		-0.037	0.018	**	-0.0015	0.0006	***
MB's NPL ratio	-0.002	0.007		-0.030	0.010	***	-0.0005	0.0003	*
#lenders	0.010	0.018		-0.183	0.023	***	0.0037	0.0007	***
credit rating	0.020	0.007	***	-0.035	0.008	***	-0.0122	0.0003	***
Δcredit rating	-0.028	0.005	***	0.044	0.006	***	0.0056	0.0002	***
Δln(sales)	-0.037	0.027		0.088	0.033	***	-0.0173	0.0013	***
ln(asset)	-0.476	0.078	***	1.030	0.081	***	0.0397	0.0041	***
ln(firm age)	-0.630	0.241	***	0.274	0.244		-0.0769	0.0083	***
profitability	0.027	0.030		0.055	0.037		0.0047	0.0019	**
tangibility	0.189	0.184		0.679	0.197	***	0.2287	0.0088	***
ln(int.cover)	0.119	0.015	***	-0.173	0.015	***	-0.0265	0.0005	***
ln(liquid.short)	0.005	0.003	*	-0.019	0.004	***	0.0018	0.0001	***
Firm fixed effect	yes			yes			yes		
N	151,416			150,296			151,586		
#groups	40,838			40,722			40,852		
R-sq: within	0.013			0.022			0.208		
between	0.051			0.093			0.254		
overall	0.046			0.084			0.252		

Table 8: Number of Observations by Bank Type and Year

	2007	2008	2009	2010	2011	Total
Large banks	31,296	33,362	33,088	31,927	30,274	159,947
Regional banks	73,459	75,185	74,040	71,001	65,550	359,235
Government banks for SMEs	60,677	61,633	60,247	57,519	54,663	294,739
Other government banks	479	490	486	461	440	2,356
Other institutions	74,610	74,469	74,211	70,305	65,891	359,486
Total	240,521	245,139	242,072	231,213	216,818	1,175,763

Table 9: Descriptive Statistics of Dependent Variable

Variable	N	mean	s.d.	min.	p10	med.	p90	max.
loan/asset	1,175,763	0.154	0.211	0.000	0.000	0.062	0.491	1.000
Δloan/asset	1,175,763	-0.002	0.072	-0.998	-0.049	0.000	0.049	1.000

Table 10: Baseline Regression

(Note) Dependent variable: Δloan/asset. The coefficients are estimated by the firm-year fixed-effect model. The numbers in parentheses are the firm-year cluster robust standard errors. The estimated constant term is omitted from the table. *, **, and *** indicate that the estimated coefficient is different from zero at a 10%, 5%, and 1% statistical significance level, respectively (two-sided). The base cell is the regional banks as of 2007. Column (3) is calculated by the sample firms who kept borrowing from a government bank for SMEs from 2007 to 2011.

	(1) baseline		(2) size of shock		(3) complete panel	
	coef.		coef.		coef.	
Ind. Var.	(s.e.)		(s.e.)		(s.e.)	
gov. bank for SMEs	-0.0056	***	-0.0054	***	-0.0040	***
	(0.0004)		(0.0004)		(0.0005)	
gov. bank for SMEs×FY(2008)	0.0007		0.0005		-0.0019	***
	(0.0005)		(0.0005)		(0.0006)	
gov. bank for SMEs×FY(2009)	0.0048	***	0.0051	***	0.0033	***
	(0.0005)		(0.0005)		(0.0006)	
gov. bank for SMEs×FY(2010)	0.0131	***	0.0134	***	0.0089	***
	(0.0005)		(0.0005)		(0.0006)	
gov. bank for SMEs×FY(2011)	0.0144	***	0.0142	***	0.0073	***
	(0.0005)		(0.0006)		(0.0006)	
gov. bank for SMEs×MB large	-0.0005		-0.0010	*	-0.0005	
	(0.0005)		(0.0005)		(0.0006)	
gov. bank for SMEs×FY(2008)	-0.0004		-0.0010		-0.0004	
×MB large	(0.0007)		(0.0007)		(0.0008)	
gov. bank for SMEs×FY(2009)	0.0019	***	0.0003		0.0027	***
×MB large	(0.0007)		(0.0008)		(0.0009)	
gov. bank for SMEs×FY(2010)	0.0025	***	0.0014	*	0.0019	**
×MB large	(0.0007)		(0.0008)		(0.0008)	
gov. bank for SMEs×FY(2011)	0.0002		0.0000		-0.0002	
×MB large	(0.0008)		(0.0008)		(0.0008)	
gov. bank for SMEs			0.0015	***		
×MB large×ln(liquid.short)			(0.0004)			
gov. bank for SMEs×FY(2008)			0.0010	**		
×MB large×ln(liquid.short)			(0.0005)			
gov. bank for SMEs×FY(2009)			0.0012	***		
×MB large×ln(liquid.short)			(0.0004)			
gov. bank for SMEs×FY(2010)			0.0016	***		
×MB large×ln(liquid.short)			(0.0005)			
gov. bank for SMEs×FY(2011)			0.0000			
×MB large×ln(liquid.short)			(0.0005)			
FY(2008)	0.0011	***	0.0014	***	0.0022	***
	(0.0004)		(0.0004)		(0.0004)	
FY(2009)	0.0049	***	0.0051	***	0.0061	***
	(0.0004)		(0.0004)		(0.0004)	
FY(2010)	-0.0052	***	-0.0049	***	-0.0025	***
	(0.0004)		(0.0004)		(0.0004)	
FY(2011)	-0.0064	***	-0.0056	***	-0.0006	*
	(0.0004)		(0.0004)		(0.0004)	

Table 10: (cont.)

	(1) baseline		(2) size of shock		(3) complete panel	
	coef.		coef.		coef.	
Ind. Var.	(s.e.)		(s.e.)		(s.e.)	
large bank	-0.0066	***	-0.0066	***	-0.0067	***
	(0.0004)		(0.0004)		(0.0005)	
large bank×FY(2008)	0.0018	***	0.0020	***	0.0030	***
	(0.0006)		(0.0006)		(0.0007)	
large bank×FY(2009)	-0.0005		-0.0003		0.0012	*
	(0.0006)		(0.0006)		(0.0007)	
large bank×FY(2010)	0.0024	***	0.0027	***	0.0035	***
	(0.0006)		(0.0006)		(0.0006)	
large bank×FY(2011)	0.0043	***	0.0044	***	0.0041	***
	(0.0006)		(0.0006)		(0.0006)	
other gov. bank	-0.0074	***	-0.0067	***	-0.0064	***
	(0.0020)		(0.0021)		(0.0019)	
other gov. bank×FY(2008)	-0.0027		-0.0043		-0.0061	**
	(0.0032)		(0.0034)		(0.0031)	
other gov. bank×FY(2009)	-0.0094	***	-0.0106	***	-0.0085	***
	(0.0033)		(0.0033)		(0.0026)	
other gov. bank×FY(2010)	0.0048		0.0053		0.0009	
	(0.0032)		(0.0034)		(0.0029)	
other gov. bank×FY(2011)	-0.0021		-0.0029		-0.0020	
	(0.0034)		(0.0035)		(0.0029)	
other institutions	-0.0055	***	-0.0063	***	-0.0052	***
	(0.0003)		(0.0003)		(0.0004)	
other inst.×FY(2008)	0.0043	***	0.0047	***	0.0030	***
	(0.0004)		(0.0004)		(0.0005)	
other inst.×FY(2009)	0.0104	***	0.0111	***	0.0108	***
	(0.0004)		(0.0004)		(0.0005)	
other inst.×FY(2010)	0.0050	***	0.0055	***	0.0021	***
	(0.0004)		(0.0004)		(0.0005)	
other inst.×FY(2011)	0.0068	***	0.0073	***	0.0049	***
	(0.0005)		(0.0005)		(0.0005)	
Firm-Year fixed effect	yes		yes		yes	
N	1,175,763		1,111,007		717,338	
#groups	60,056		58,698		32,160	
R-sq: within	0.0048		0.0054		0.006	
between	0.0021		0.0029		0.0041	
overall	0.0044		0.005		0.0056	

Table 11: Regression with the Interaction of the Characteristics of Large Banks

(Note) Dependent variable: Δloan/asset. The coefficients are estimated by the firm-year fixed-effect model. The numbers in parentheses are the firm-year cluster robust standard errors. The estimated constant term and the coefficient of FY(t) (t = 2008, ..., 2011), large bank, other gov.bank, other inst., and their interaction terms with FY(t) are omitted from the table. *, **, and *** indicate that the estimated coefficient is different from zero at a 10%, 5%, and 1% statistical significance level, respectively (two-sided). The base cell is the regional banks as of 2007. MB deposit share is as of the end of accounting year ending in 2007. MB SME ratio is as of March 2007.

	(1) relationship			(2) relationship & SME ratio		
	coef.	(s.e.)		coef.	(s.e.)	
gov. bank for SMEs	-0.0053	(0.0006)	***	-0.0083	(0.0015)	***
gov. bank for SMEs×FY(2008)	0.0011	(0.0008)		0.0009	(0.0020)	
gov. bank for SMEs×FY(2009)	0.0064	(0.0008)	***	0.0096	(0.0021)	***
gov. bank for SMEs×FY(2010)	0.0165	(0.0008)	***	0.0222	(0.0022)	***
gov. bank for SMEs×FY(2011)	0.0139	(0.0009)	***	0.0168	(0.0023)	***
gov. bank for SMEs ×MB deposit share	-0.0023	(0.0017)		-0.0025	(0.0018)	
gov. bank for SMEs×FY(2008) ×MB deposit share	0.0007	(0.0023)		0.0015	(0.0024)	
gov. bank for SMEs×FY(2009) ×MB deposit share	-0.0002	(0.0024)		-0.0012	(0.0026)	
gov. bank for SMEs×FY(2010) ×MB deposit share	-0.0065	(0.0025)	**	-0.0095	(0.0027)	***
gov. bank for SMEs×FY(2011) ×MB deposit share	-0.0047	(0.0026)	*	-0.0046	(0.0027)	*
gov. bank for SMEs ×MB SME ratio				0.0039	(0.0018)	**
gov. bank for SMEs×FY(2008) ×MB SME ratio				0.0002	(0.0024)	
gov. bank for SMEs×FY(2009) ×MB SME ratio				-0.0032	(0.0025)	
gov. bank for SMEs×FY(2010) ×MB SME ratio				-0.0058	(0.0027)	**
gov. bank for SMEs×FY(2011) ×MB SME ratio				-0.0032	(0.0028)	
Firm-Year fixed effect	yes			yes		
N	1,083,961			999,167		
#groups	53096			47672		
R-sq: within	0.005			0.0052		
between	0.0021			0.0022		
overall	0.0045			0.0047		