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# An Analysis of Unlisted Companies in Japan

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# Bank Health and Investment:
# An Analysis of Unlisted Companies in Japan*

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Abstract

To the extent that a borrower faces switching costs in a relationship with an individual bank, bank-specific financial health might affect a borrower's cost of funds. The costs would be particularly large for firms that have a close relationship with limited number of banks. The purpose of this paper is to investigate whether weakened financial conditions of banks reduced investment of small and medium firms in Japan. Estimating Tobin's Q investment functions, we examine the determinants of investment for unlisted Japanese companies in the late 1990s and the early 2000s. We find that several measures on bank-specific financial health have significantly large impacts on borrower's investment, even when observable characteristics relating to Tobin's Q, cash-flow, and leverage are controlled for. We also find that multiple banking relationships, which tend to have a negative impact on investment in general, may be beneficial in relieving a hold up problem when deteriorated bank health does matter.

Key words: Tobin's Q, Bank-firm relationship, Hold-up problem, Unlisted firms
JEL #: E22, G21, G31, G32

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1. Introduction

Empirical studies in corporate finance have long been interested in the effects of close bank relationships on borrowing firms' real activities. The effects have particularly been discussed in a country that has a bank-centered system or for small companies that have fewer alternatives to bank financing. One strand of research reveals indirect evidence on a positive side of bank-dependent borrowers. For a bank-centered system, Hoshi, Kashyap, and Scharfstein (1991) concluded that investment is less sensitive to cash-flow for firms that are members of a *keiretsu* by using firm-level data for Japan.[1] For small companies, Petersen and Rajan (1994) and a number of other studies suggested that a close bank relationship increases credit availability for small borrowers by using U.S. firm data set.[2]

Banking relationships, however, have a negative side. As a firm works more closely with a bank, it finds it harder to raise funds through other means and may be hold up by the bank (Sharpe [1990], Rajan [1992]). To the extent that a borrower faces switching costs in a relationship with an individual bank, bank-specific financial health might therefore affect a borrower's cost of funds, even when observable characteristics relating to borrower risk are controlled for. The costs would be particularly large for firms that have a close relationship with limited number of banks. The firms may benefit from multiple banking relationships over single when the banks are under distress. A strand of research has supported this view and concluded that replacing banking relationships is costly.[3]

Using Japanese firm-level data, Gibson (1995) found that firm investment in 1991–1992 was sensitive to the financial health of the firm's main bank, holding Tobin's Q and cash-flow constant. Kang and Stulz (2000) showed that firms that were more dependent on bank finance suffered significantly larger wealth losses during the first 3 years of the 1990s when the Japanese stock market fell dramatically. Klein, Peek, and Rosengren (2002) found that financial difficulties of Japanese banks were economically and statistically important in reducing the number of FDI projects by Japanese firms

[1] Weinstein and Yafeh (1998) argue that close bank-firm ties increase the availability of capital to borrowing firms but do not lead to higher profitability or growth in Japan. See also Hayashi (2000) for their reassessment.

[2] Other studies that used data set of U.S. firms include Berger and Udell (1995) and Hubbard, Kuttner, and Palia (2002). Studies such as Harhoff and Körting (1998) and Ferri and Messori (2000) reached a similar conclusion by using data on small European firms.

[3] For example, Slovin, Sushka, and Polonchek (1993) studied the effects of the de facto failure of Continental Illinois Bank during 1984 on the share prices of the bank's loan customers and concluded that the impending failure led to negative excess returns for firms with a lending relationship with Continental.

into the United States.[4] All of these studies, however, used the data set on listed firms. There is some controversy about the impact of a change in bank balance-sheet condition on investment of listed firms. A bank with an impaired balance-sheet might attempt to 'gamble for resurrection' and hence might increase risky lending to zombie firms. Some of recent studies therefore questioned robust negative impacts of bank health deterioration on investment or credit availability for listed companies.[5]

The purpose of this paper is to investigate how large impacts weakened financial conditions of banks have on investment of small and medium firms based on a matched sample of borrowers and banks in Japan. Estimating Tobin's Q investment functions, we examine the determinants of investment for unlisted Japanese companies in the late 1990s and the early 2000s.[6] If strong reliance on bank finance makes it harder to access alternative sources of funding, one would expect that firms that relied more on finance from troubled banks faced significantly larger constraints in financing their investment. Our empirical result supports this view, particularly when we use regulatory capital ratios and ratios of nonperforming loans as bank health measures.[7]

The use of the firm-level data of unlisted firms has several advantages in detecting the effects of bank health on its borrower's investment. First, we should be better able to identify the impacts of shocks to the banking sector on firms that have stronger reliance on bank finance. A series of financial liberalization reduced the role of banks for most of listed Japanese companies in the 1990s. Banks, in contrast, keep playing a dominant role in the financing of small and medium firms in Japan. It is thus worthwhile to focus on unlisted firms for which the role of bank is more important. Secondly, reverse causality from firms to banks will be less of a problem in a firm-level regression for unlisted firms than for listed firms. The borrower's performance may affect the bank financial health if the firm's loans from its bank were relatively large to the bank's capital. This is likely for listed firms but less likely for unlisted firms. The

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[4] In other related studies, Peek and Rosengren (2000) found that collateral damage of Japanese Banks had large impacts on real activity in the U.S. commercial real estate markets. Yamori and Murakami (1999) and Brewer, Genay, Hunter, and Kaufman (2003) find that the stock returns of customers of the bank unexpectedly declined at the time of the bank failure announcement in Japan. Authors such as Ito and Sasaki, (2002) and Woo (2003) explored the existence of "capital crunch" by using the data of individual Japanese Banks.

[5] These studies include Gibson (1997), Peek and Rosengren (2003), and Caballero, Hoshi, and Kashyap (2004).

[6] Some of recent studies that estimated Tobin's Q investment functions for listed firms in Japan include Sekine (1999), Ogawa and Suzuki (2000), Goyal and Yamada (2003), and Nagahata and Sekine (2004).

[7] Previous studies such as Motonishi and Yoshikawa (1999) explored the same topic by using macro data in Japan.

use of unlisted firms' data thus allows us to avoid possible simultaneous bias without using ad hoc instrument variables.

Investigating the effect of bank-firm relationships in Japan, we obtained a detailed financial data of unlisted companies and a list of their major lenders from Tokyo Shoko Research (TSR) Database Service. We matched the borrowers' financial data to relevant financial data of the major lenders that are available from various other data sources. To measure the bank health, we use four alternative measures: (i) regulatory capital ratios, (ii) ratios of nonperforming loans, (iii) stock prices, and (iv) bank defaults. Among the four measures, regulatory capital ratios and ratios of nonperforming loans are backward-looking and are only loosely related to a bank's economic value. However, deterioration of these two measures had more significant impacts on the borrowers' investment than the other two. This implies that deterioration of backward looking regulatory measures had been important in tightening the bank's lending attitude and in reducing the borrowers' investment under the financial turbulence in the late 1990s and the early 2000s in Japan.

Using the firm-level data of unlisted firms in Japan, some exceptional studies investigated investment of small and medium firms.[8] In particular, Ogawa (2003) investigated the relationship between financial distress and corporate investment in Japan by using firm-level data. His data set on financial distress was, however, based on industry-level data rather than on a matched sample of borrowers and banks. Our study is thus new in exploring whether several measures on bank-specific financial health have additional impacts on borrower's investment in Japan. In particular, we investigate whether multiple banking relationships, which tend to have a negative impact on investment in general, are beneficial in relieving a hold up problem.

In previous literature, there are mixed results on the effect of the intensity of banking relations on the cost and availability of credit. Coordination problems among debt-holders generally introduce investment inefficiencies in the workout process.[9] Borrowing from numerous banks would thus reduce a firm's ability to finance investment when the firm faces debt overhang. Petersen and Rajan (1994) also find that concentration of the banking relationship is negatively correlated with the borrowing costs and credit rationing for small borrowers in the U.S. firms. Berger, Klapper, and Udell (2001), in contrast, find that small firms choose the multiple banking relationships over single in reaction to the bank distress despite the increased

[8] The studies written in English include Harada and Honjo (2004).
[9] Bulow and Shoven (1978) and White (1980) are seminal studies that pointed out this possibility. Other related studies include Gertner and Scharfstein (1991) and references therein.

credit cost of credit using Argentinean firm bank data set. Our empirical results are consistent with all of these seemingly contradictory studies.

Our paper proceeds as follows. After presenting our hypothesis in Section 2, section 3 specifies the basic model and section 4 explains our data. Section 5 reports our main empirical results. Section 6 explores the impacts of the number of banks. Section 7 summarizes our main results and refers to their implications.

## 2. Hypothesis

After the crush of the stock market, the Japanese banking sector had faced considerable problems deteriorating their loans. The problems became particularly serious in the late 1990s when several major financial institutions turned out to be in default. To the extent that the bank health does matter, deterioration of the bank health would tighten the bank's lending attitude and might increase the borrowers' default risk. The diffusion index (DI) of the "Tankan Survey" of the Bank of Japan shows that lending attitude of financial institutions became very tight in the late 1990s. The tight attitude was, however, temporary for large companies. The tight attitude for small and medium companies, in contrast, persisted and showed slow recovery even in the early 2000s (Figure 1). The evidence supports the view that small and medium companies have more serious problem in finding alternative sources of funding under the financial turbulence.

The hypothesis we will test in the following analysis is how large impacts several health measures of the "main" bank had on investment of unlisted firms in Japan in the late 1990s and the early 2000s. In the analysis, we test directly the effects of a variety of health measures of the "main" bank on investment of unlisted borrowing firms in Japan. The Modigliani-Miller theorem, which proves the irrelevance of financial structure for real economic variables, suggests that weakened financial conditions of the "main" banks have no effect on investment under perfect capital markets. Many of previous empirical studies, however, show that investment is constrained by the amount of cash-flow. Some studies also show that high leverage as well as borrowing from multiple banks has a negative impact on investment under debt-overhang. In the following model, we include these borrower's financial variables as benchmark explanatory variables in a standard Tobin's Q investment function. We then add several bank-related variables to allow the identity of its "main" bank to affect a firm's investment.

To measure the health of the "main" bank, we use four alternative measures: (i) regulatory capital ratios, (ii) ratios of nonperforming loans, (iii) stock prices, and (iv) bank defaults. Regulatory capital in Japan is only loosely related to a bank's economic capital because of the importance of hidden reserves on stocks and land, government's capital injection, tax effect accounting, and so on. However, the "Basel Capital Accord" set minimum risk-based capital requirements (8%) for internationally-active banks, while the ratio of 4% is required for sound domestically operating banks in Japan. The regulatory capital adequacy ratios thus have been critical for many of the Japanese banks either to continue their international-activities or to avoid a possible recapitalization by the government. "Capital crunch" might thus reduce the borrowers' investment when deterioration of regulatory capital ratios would tighten the bank's lending attitude.

The second measure of the bank health is ratios of nonperforming loans. Like regulatory capital, nonperforming loans are only loosely related to the bank health because Japanese banks sometimes underreported the amount of nonperforming loans on their book in order to conceal the true extent of their problems. However, reported nonperforming loans started to increase in the early 1990s and kept accumulated until 2001, causing a large amount of losses on disposal of non-performing loans for most of the banks. As a result, market participants tended to regard the ratios of nonperforming loans as one of important indicators to measure the bank health in the late 1990s and in the early 2000s. In particular, the Japanese government repeatedly warned the banks that it was imperative to solve the non-performing loans problems in order to recover the confidence in the Japanese financial system. It is thus likely that increases in nonperforming loan ratios would decrease the borrowers' investment through tightening the banks' lending attitude.

The third measure is stock prices of the banks. Stock prices are indicators that reflect the market valuation of the banks. While regulatory capital ratios and ratios of nonperforming loans are backward-looking, stock prices are forward-looking. A forward-looking measure has a preferable property, since what matters to the firm is the availability of the bank's help if it gets into financial distress. To the extent that the forward-looking measure is important, a decline of the bank's stock price would have a negative impact on borrowers' investment even if the effects of the backward-looking health measures are controlled for.

The fourth measure is bank defaults. The number of bank defaults was highly limited even during the period of financial turbulence in Japan. The bank defaults, however, occurred in an extreme case where bank health had deteriorated dramatically. Other conditions being equal, the measure would thus capture the impact of catastrophic but very rare events on bank health deterioration. However, in exploring the impact, we need to note that the credit guarantee system in Japan provided special business stabilization guarantees (safety net guarantees) to small and medium companies when correspondent financial institutions went bankrupt or when their trading partners applied for reorganization. The credit guarantee system was particularly extended not only to small companies but also to medium companies in the late 1990s and in the early 2000s when the tight lending attitude persisted. The impacts of the fourth measure may thus provide an indirect test to see whether the credit guarantee system worked in the late 1990s and in the early 2000s. In the following analysis, we add default measures of parent companies and major trading partners as reference variables to compare the impact with that of bank defaults. The comparison may clarify how different impact bank defaults had on investment from defaults of the other major trading partners.

## 3. The Basic Model

In the following sections, we examine what effects various measures of bank health had on investment of Japanese unlisted firms. A basic equation we estimate in the following analysis is:

$$(1) \quad I_{i,t}/K_{i,t} = \alpha + \beta\, Q_{i,t-1} + \gamma\, CF_{i,t-1} + \delta DA_{i,t-1} + \varepsilon\, NB_{i,t} + \phi\, BH_{i,t-1}$$

where $I_{i,t}$ = the amount of investment, $K_{i,t}$ = the market value of capital stock, $Q_{i,t}$ = Tobin's Q, $CF_{i,t}$ = the amount of cash-flow, $DA_{i,t}$ = debt-asset ratio, $NB_{i,t}$ = the transformed number of lending banks, and $BH_{i,t}$= a vector of several bank health measures. Subscript $i$ is index of firm and subscript $t$ denotes time period $t$.

The first two explanatory variables are standard in literature. Under the assumption of perfect capital markets, financial structure is irrelevant for real economic variables, so that Tobin's Q would be the only relevant variable for investment. However, when either information or contract is incomplete, the inability of banks to perform their intermediary role would constraint the real economy by disrupting the flow of credit. Since cash-flow roughly corresponds to changes in available internal funds, higher investment-cash flow sensitivities can be considered evidence of greater liquidity constraints.[10] In the analysis, we normalize cash-flow dividing by the market

[10] However, cash-flow might be significant because it is correlated with firm profitability and thus serves as another proxy for Tobin's Q.

value of capital stock.

In equation (1), we add debt-asset ratio and the transformed number of lending banks to explanatory variables to capture negative impacts of debt overhang on investment. For firms with low growth opportunities, high leverage reduces a firm's ability to finance investment because conflicts among creditors make it difficult to restructure debt. In particular, large and persistent declines in land prices throughout the 1990s had a negative impact on firm investment in Japan through a change in land collateral valuation (see, for example, Ogawa et al. [1996] and Kiyotaki and West [2004]). The added debt-asset ratio would thus be expected to have a significantly negative impact on investment, particularly when Tobin's Q is low.

Borrowing from numerous banks would also reduce a firm's ability to finance investment when the firm faces debt overhang. Coordination problems among debt-holders generally introduce investment inefficiencies in the workout process, which become particularly serious when the number of lenders is large. The number of lending banks would thus be expected to have a significantly negative impact on investment because of transaction costs of bargaining among lenders. In the following analysis, we add the number of lending banks after transforming it by logistic function: $NB_{i,t} = \exp(\lambda(\chi_{i,t} - \theta))/[1 + \exp(\lambda(\chi_{i,t} - \theta))]$, where $\chi_{i,t}$ is the number of lending banks before the transformation. The logistic function allows us to capture non-linear impacts the number of lenders may have.

The explanatory vector $BH_{it}$ denotes a vector of several health measures of the "main" bank discussed in the last section. The health measures are key variables in the following analysis. We add ratios of nonperforming loans and stock prices after taking their logarithms. We, in contrast, add regulatory capital ratios after transforming them by logistic function: $CAR_{i,t} \equiv \exp(\rho(\eta_{i,t} - \omega_j))/[1 + \exp(\rho(\eta_{i,t} - \omega_j))]$, where $\eta_{i,t}$ is regulatory capital adequacy ratio before the transformation. The non-linearity of the logistic function allows us to penalize more the bank whose regulatory capital adequacy ratio is close to its minimum capital requirement. Since different minimum capital requirements are applied for internationally-active banks and for domestically operating banks, we allow $\omega_j$ to take different values for two types of banks depending on the minimum risk-based capital requirements.

We capture bank defaults by a dummy variable. The dummy variable takes one when the "main" bank defaulted and zero otherwise. In the analysis, we also add dummy variables for parent companies' defaults and major trading partners' defaults for comparison. Each of these dummy variables takes one when the parent companies or the major trading partners defaulted and zero otherwise.

## 4. The Data

### (i) The data of financial variables

To estimate equation (1), we need firm-level data on financial variables, data on the measures of the bank health, and information on the "main" bank, parent companies, and major trading partners. We collected the firm-level financial data of Japanese non-financial firms that are not listed on any stock exchange in Japan. The data are taken from Tokyo Shoko Research (TSR) Database Service. The database covers all available financial data of non-financial corporations with capital of 1 billion yen and over. We, however, excluded the data of public or semi-public firms, non-profit organizations, firms that had no borrowings from banks, and firms for which relevant financial variables are missing or seem unreliable. It allows us to use the data of 3,821 Japanese unlisted firms.

Unless the data are missing, the data set covers the period from 1984 through 2003. By using the perpetual inventory method developed by Hayashi and Inoue (1991), we converted the book values of capital stock and land into the market values (see Appendix 1 for its details). For the debt-asset ratio, we use debt outstanding divided by total assets, of which (a) buildings and structures, (b) machinery and equipment, (c) vessels and vehicles, and (d) land are adjusted to their market values by the perpetual inventory method. The market value of land enables us to take into account the fall in land prices after the bubble burst.

We calculated Tobin's Q based on the method of Abel and Blanchard (1986). Assuming AR processes, we estimated the expected values of future after-tax ordinary profits and calculated the present discount value of the profits for each firm. Tobin's Q is then obtained by dividing the present discount value by the market value of capital stock. Depending on the assumption of stochastic processes, we calculate two types of Tobin's Q: "the base-line Q" and "the reference Q". The base-line Q has a desirable property because it allows more general AR processes. The number of sampled firms for the base-line Q is, however, smaller than that for the reference Q because we excluded Tobin's Q if the estimated AR process is not stationary for the base line Q (see Appendix 2 for its details).

Table 1 reports average, standard deviation, minimum, median, and maximum of each financial variable. The average of Tobin's Q is greater than 2, which is higher than that of listed companied reported in previous literature. The median of Tobin's Q is, however, close to 1.58, which is reasonable in terms of the economic theory. Both the average and the median of the debt-asset ratio are not high. The maximum of the debt-asset ratio is, however, 17.13, implying that high leverage might have constrained investment of some heavily borrowed firms.

(ii) The data on measures of the bank health

As for four alternative measures of the bank health, we collected the data by the following steps. First, we identified the name of the firm's "main" bank based on CD Eyes supplied by TSR Database Service. CD Eyes provides a list of major lenders for each unlisted companies for each year. We defined the "main bank" as a bank that appeared first in the list for each year. We then collected the relevant financial data of the "main banks" from Financial Statements of All Banks published by Japanese Bankers Association, Financial Statements of Shinkin Banks (Credit Cooperatives) published by the National Association of Shinkin Banks, and Financial Statements of Shinyo Kumiai (Credit Unions) published by the Community Bank Shinyo Kumiai. The data set covers the period from 1997 through 2003.

To calculate a proxy for the ratios of nonperforming loans, we use the amount of risk management loans divided by total loans outstanding. Following the standards set by Federation of Bankers Associations of Japan, each bank discloses the amount of Risk Management Loans each year. The standards, covering a wider range of non-performing loans, are comparable to the United States SEC standards adopted for the public disclosure of bad loans. Specifically, Risk Management Loans comprise of Past Due Loans in arrears by 3 months or more, and Restructured Loans with changes in terms and conditions, as well as loans to borrowers in legal bankruptcy.

The stock prices we use in the following analysis are those at the end of each fiscal year. The data are from the data set contained in NEEDS-COMPANY by Nihon Keizai Shimbun. We took their logarithms after adjusting differences of their book values. Because of availability, the data covers only those for listed banks. Moreover, we excluded stock prices of defaulted banks in the analysis, even when they were kept listed before restructuring.

CD Eyes provides a list of parent companies and major trading partners for each unlisted companies. Some of the companies in the list are unlisted companies. We, however, use only listed companies as parent companies and major trading partners because reverse causality from the unlisted firm will be less of a problem when parent companies and major trading partners are listed firms. Default information of banks is based on the Financial Service Agency, while that of parent companies and major trade partners is based on Tokyo Shoko Research (TSR) Database Service.

Table 2-1 reports types of lending banks and distributions of the number of lending banks. It states that nearly 60% of the "main" banks are either city banks, long-term credit banks, or trust banks, and 33% of the "main" banks are the first regional banks. This implies that large banks still play dominant roles as "main" banks even for most of unlisted firms with capital of 1 billion yen and over in our sample. Almost all of the unlisted firms in our sample, however, borrow from multiple banks. The table shows that nearly 90% of the firms borrow from more than 3 banks and that nearly 65% of the firms borrow from more than 5 banks.

Table 2-2 reports basic statistics (i.e., average, standard deviation, minimum, median, and maximum) of regulatory capital adequacy ratios and nonperforming loan ratios of the "main" banks. The statistics are based on the data before taking transformation of logistic function or logarithm. Averaged capital adequacy ratios are high above the minimum capital requirements both for internationally-active banks and for domestically operating banks. However, some of the banks have capital adequacy ratios that are much below the minimum capital requirements. Average ratio of non-performing loans is 4.22%. In particular, some of the lending banks have very large ratios of non-performing loans that are high above 10%.

(iii) Dummy variables

We add several dummy variables to capture idiosyncratic effects that our bank health measures might reflect. These dummy variables are the dummy for no main-bank firms, the dummy for unlisted banks, and industry dummies. The dummy for no main-bank firms takes one when the firm has no "main" bank and zero otherwise. In our sample, about 3% of the firms have no "main" bank. By definition, we cannot obtain our bank health measures for the firms. The dummy for no main-bank firms thus not only captures the effect that a weak bank-firm relation may have but also identifies the impact that missing bank health measures may cause.

The dummy for unlisted banks takes one when the "main" bank is not listed on the stock exchange and zero otherwise. Among our bank health measures, the data of stock prices are available only for listed banks. Although most of the "main" bank are listed ones, the dummy for unlisted banks would capture the effect that missing stock prices may have. Since the size of non-listed banks is small, the dummy may also reflect the impact that may arise when the size of the "main" bank is small.

Some industry dummies are added to capture industry-specific effects on investment. The dummies may reflect various industry-specific factors that are not well captured by our explanatory variables. If the impacts of the bank health differ across industries, the dummies may pick up the impacts. Candidate industries for the dummies are all industries except for manufacturing. We, however, excluded industry dummies that turned out to be statistically insignificant in the analysis,.

## 5. Empirical Results

### (i) The basic results

The estimation results of our investment appear in Table 3. The estimation period is from 1997 through 2003.[11] Although some corporations' data were partially missing in the estimation period, we included their data by using the unbalanced panel analysis. In order to avoid the problem of instantaneity bias, we take a lag of one period for independent variables except for the number of lending banks and default dummies. Because the model is non-linear, we estimated parameters by the maximize likelihood method.

Before looking for the bank health effects, we quickly check whether the selected financial variables have sensible impacts on investment. Both Tobin's Q and cash-flow have positive impacts which are statistically significant. The result is consistent with previous empirical evidence in that a firm is likely to have a larger investment when its financial conditions are good. It also supports the existence of liquidity constraint.

"Debt-asset ratio" has a negative impact. The impact is not statistically significant for all firms but significant for firms whose Tobin's Q is less than one. The result, which is consistent with several previous studies, implies that high leverage reduces a firm's ability to finance investment for firms with low growth opportunities.[12] "The number of banks" has a statistically significant negative impact, although the impacts are non-linear. The estimates of the logistic function indicate that the number of lenders starts to have a negative impact when it exceeds five and the impact is accelerated until the number of lenders becomes around eight. The results are consistent with previous empirical evidence in that a firm is likely to have a smaller investment when it faces a problem of debt overhang.

More interesting results are observed when we look for the impacts of the four alternative measures of the bank health: (i) regulatory capital ratios, (ii) ratios of nonperforming loans, (iii) stock prices, and (iv) bank defaults. We can see that except

[11] Many companies close their books in March, but not all the companies covered by the analysis did so. Data are, thus, arranged on the basis of fiscal year when books were closed.

[12] See, for example, Lang, Ofek, and Stulz (1996) and Aivazian, Ge, and Qiu (2005).

for bank defaults, the measures on bank-specific financial health have expected impacts on investment, even if observable characteristics relating to these borrower's financial variables are controlled for. The coefficient of ratios of nonperforming loans was negative, while that of stock prices took positive signs. The estimates of the logistic function indicate that a decline of the regulatory capital ratios starts to have a perverse impact when they are less than thirteen for internationally-active banks and eight for domestically operating banks and that the perverse impact is accelerated until they fall into their minimum requirements. All of these estimates imply that when various measures of the bank health deteriorated, the bank's lending attitude was tightened and consequently the borrowers' investment declined in the late 1990s and the early 2000s.

As for the other dummy variables, some of the industry dummies have statistically significant impacts. In particular, the dummy for transportation and communication industry always has a statistically significant positive impact. The dummy for no main-bank firms and the dummy for unlisted banks are positive. However, their statistical significance levels are marginal.

(ii) The different impacts of four alternative bank health measures

In a bank-centered system like Japan, poor bank performance should be more costly because firms have fewer alternatives to bank financing. In particular, small and medium firms obtain most of their external financing from banks with which they established a relationship. It is thus highly possible that small and medium firms that relied more on bank finance could have constrained the borrowers' investment significantly when the bank health deteriorated. Our empirical results clearly support this view. However, when we compare the impacts, we see that their statistical significances differ across the four alternative measures.

Among the measures, both regulatory capital ratios and ratios of nonperforming loans have large and statistically significant impacts. It is worthwhile to note that both measures are only loosely related to the banks' economic values. The capital adequacy ratios, however, have been critical for many of the Japanese banks either to continue their international-activities or to avoid a possible recapitalization by the government. Solving the non-performing loans problems has also been regarded as one of important indicators to recover the confidence in the Japanese financial system. Our result supports the view that the banks' attempts to improve these regulatory measures decreased the borrowers' investment through tightening the banks' lending attitude.

The impact of stock prices took expected sign but its significance level was marginal.

The impact of stock prices is statistically significant if none of the other bank health measures are added to explanatory variables. The impact, however, becomes statistically insignificant if some of the other health measures are added. Stock prices are indicators that reflect the forward-looking market valuation of the banks, although the market valuation is very volatile. The result indicates that the banks' lending behavior in the late 1990s and the early 2000s was less responsive to the forward-looking valuation of bank health in Japan.

Finally, the dummy for bank defaults was not statistically significant. It did not take expected sign if we did not allow the lagged effects. The dummy of bank defaults took expected sign if we allow lagged effects for four years but it is still statistically insignificant. Other conditions being equal, the bank-firm relationship would imply that bank defaults have a negative impact on borrowing firm's investment. However, the credit guarantee system in Japan provided safety net guarantees to small and medium companies in the late 1990s and the early 2000s. In particular, when correspondent financial institutions went bankrupt, Credit Guarantee Corporations in each local government lent to the borrowing small and medium firms up to the amount of borrowings from the failed bank. The insignificant impact supports the view that the credit guarantee system was successful in mitigating the negative effects of the bank defaults.

The result is essentially the same for the impacts of parent companies' defaults and major trading partners' defaults. These impacts had expected sign even if we did not allow lagged effects. But neither of them was statistically significant. Comparing their impacts with those of bank defaults, we see no significant difference. The credit guarantee was also applied to small and medium companies when their trading partners applied for reorganization. The comparison gives another supports for the view that the credit guarantee system was successful in mitigating the negative effects of the major trading partners' defaults.

## 6. The Impacts of the Number of Banks

Financial intermediaries, particularly banks, exist at least in part to overcome information asymmetry and incomplete contract and to facilitate the flow of credit into most productive borrowers. The inability of banks to perform their intermediary role would damage the real economy by disrupting the flow of credit. Under these circumstances, the benefits from a bank-borrower relationship stem mainly from having a single bank with proprietary information about the borrower, which may make more credit available at lower cost. Relative to relationship lending by a single bank, borrowing from multiple banks is inefficient not only in reducing transaction costs and duplicated effort of monitoring but also in providing accurate information. The straightforward implication is that investment would be less sensitive to cash-flow if the number of banks is small.

Firms, however, borrow from multiple banks in order to avoid a “hold-up” problem in which a single bank may exploit its market power and extract excessive rents. In particular, informationally opaque firms have fewer alternatives to bank financing. To the extent that a borrower faces switching costs in a relationship with an individual bank, it would be costly to borrow from a single lender if its primary bank is in financial distress. This implies that investment would be more sensitive to our bank health measures if the number of banks is small.

In this section, we examine these implications based on our investment function. We estimate the following equation:

$$(2) \quad I_{i,t}/K_{i,t} = \alpha + \beta\, Q_{i,t-1} + (\gamma_1 + \gamma_2\, DNB(\mathrm{n})_{i,t})\, CF_{i,t-1} + \delta DA_{i,t-1} + \varepsilon\, NB_{i,t} + (\phi_1 + \phi_2\, DNB(\mathrm{n})_{i,t})\, CAR_{i,t} + (\varphi_1 + \varphi_2\, DNB(\mathrm{n})_{i,t})\, NPL_{i,t},$$

where $CAR_{i,t}$ = the transformed regulatory capital adequacy ratio, $NPL_{i,t}$ = logged ratio of non-performing loans, and $DNB(\mathrm{n})_{i,t}$ = dummy for the number of lending banks.

The dummy $DNB(\mathrm{n})_{i,t}$ takes one when the number of lending banks is equal to or less than $n$ and zero otherwise. After some grid searches to maximize the likelihood function, we use $DNB(4)_{i,t}$ for cash-flow and $DNB(\mathrm{n})_{i,t}$ for $CAR_{i,t}$ and $NPL_{i,t}$. Except that the three coefficient dummies are used, explanatory variables are not essentially different from those in equation (1). We, however, did not add stock prices of the “main” bank and default dummies because they were not statistically significant.

Table 4 reports the estimation result. Except for the effects of the three coefficient dummies, the estimated parameters are essentially the same as those in Table 3; Tobin’s Q and cash-flow have significantly positive impacts; “Debt-asset ratio” has a negative impact, particularly when $Q < 1$; Regulatory capital adequacy ratio has a significantly positive non-linear impact; Ratio of non-performing loans has a significantly negative impact.

As for the impacts of the coefficient dummies, $\gamma_2$ is significantly negative. This implies that investment would be less sensitive to cash-flow if the number of banks is equal to or less than four. In contrast, the coefficient $\phi_1$ is significantly positive, while $\varphi_2$ is negative. Although $\varphi_2$ is not statistically significant, both of the signs of the estimated coefficients are consistent with the view that investment would be more sensitive to our bank health measures if the firm's borrowing relies on a single bank.

Since the coefficient $\varepsilon$ is negative, multiple banking relationships tend to have a negative impact on investment in general. Since the coefficient $\gamma_2$ is negative, this is also true for firms that cash-flow constraints are large. However, since $\phi_2$ is positive and $\varphi_2$ is negative, multiple banking relationships may be beneficial in relieving a hold up problem when deteriorated bank health does matter.

In previous literature, there are several mixed results on the effect of the intensity of banking relations on the cost and availability of credit. Borrowing from numerous banks would reduce a firm's ability to finance investment when the firm faces debt overhang. Petersen and Rajan (1994) find that concentration of the banking relationship is negatively correlated with the borrowing costs and credit rationing for small borrowers in the U.S. firms. Berger, Klapper, and Udell (2001), in contrast, find that small firms choose the multiple banking relationships over single in reaction to the bank distress despite the increased credit cost of credit using Argentinean firm bank data set. Our empirical results are consistent with all of these previous studies.

## 7. Conclusions

Japan is a country where banks play a more important role in the financing of corporations than they do in the United States. Although the role of banks became smaller for larger companies in the 1990s, banks still played a dominant role in the financing of smaller Japanese firms. We should thus be better able to identify the impacts of shocks to the banking sector on the smaller firms. To the extent that imperfect information and incomplete contract are important, the inability of banks to perform their intermediary role will damage the real economy by disrupting the flow of credit. In particular, small and medium firms obtain most of their external financing from banks with which they established a relationship. It is thus highly possible that investment of small and medium firms tend to be constrained when the bank health deteriorated. Our empirical results support this view and find that several measures on bank-specific financial health have additional impacts on borrower's investment, even if observable characteristics relating to these borrower's financial variables are controlled for.

Needless to say, banking relationships can have both positive and negative sides in various dimensions. One dimension that was not discussed in the present paper is impacts of ownership structures. Morck, Nakamura, and Shivdasani (2000) argue that the relation between firms' ownership structures and q ratios in Japan reflects both costs and benefits of equity holdings by banks. Since ownership structures are more diversified for unlisted firms than for listed firms, it would be another interesting question to see the relevancy of their argument in our sampled companies.

Appendix 1. The Conversion into the Market Value

In calculating the market value of capital stocks, we follow Hayashi and Inoue (1991) and apply the perpetual inventory method for four types of capital stocks: (a) buildings and structures, (b) machinery and equipment, (c) vessels and vehicles, and (d) land. We added up the converted capital stocks to calculate the aggregate capital stocks of individual corporations.[13] Except for land, the values in the initial year were taken as the benchmark, on the assumption that this year's book values of individual capital stocks are equal to their market prices.

For deflators, we used Corporate Goods Price Index (CGPI) of commodity *i*, that is, $p^{Ii}_{t}$ for each investment goods *i*. Specifically, the CGPI of construction materials is used to deflate buildings and structures, the CGPI of machinery and tools to deflate machinery and equipment, and the CGPI of transportation equipment to deflate vessels and vehicles. Each nominal gross investment is calculated by the summing the increments of the book values of each fixed asset and their capital depreciation.[14] Dividing the nominal gross investment by the investment goods deflator results in the real gross investments ($I_{i,t}$) of each individual tangible fixed asset. The physical depreciation rates of each capital stock *i*, that is, $\delta^i$ follows previous studies. The rate of asset depreciation for buildings and adjunctive equipment is 0.047, that for machinery and equipment is 0.09489, and that for vessels and vehicles and transportation equipment is 0.1470.[15]

Based on these benchmarks for capital stocks, real gross investments, and depreciation rates, we calculate the real values of each individual capital stock *i* as follows:

(A1) $K_{i,t} = (1-\delta^i)K_{i,t-1} + I_{i,t}$

The market value of capital stocks ($p^{Ii}_{t}K_{i,t}$) can be obtained by multiplying the real stock values by the deflector of capital goods ($p^{Ii}_{t}$).

The series of land stock are also calculated using the perpetual inventory method. However, since the discrepancies between the market prices and book values were large,

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13 Tools, apparatus and fixtures are not included in capital stocks, because their values are much smaller than those of other capital stocks.

14 The TSR data base does not provide the book values of capital stock-specific depreciation. The book values of capital stock-specific depreciation were thus calculated by allocating the total book values of capital stock depreciation (net of land) in proportion to the book values of each individual capital stock.

15 For the depreciation rate of structures, we used a 0.047 rate identical to that of buildings and adjunctive equipment.

the benchmark for the market prices of land was obtained by multiplying the book values in the initial by a 5.27. The value of 5.27 is the average ratio of market price to book value calculated by Ogawa, Kitasaka, and et al. (1996). They obtained the ratio based on the Annual Report on National Accounts by the Economic Planning Agency and the Quarterly Corporations Statistics by the Ministry of Finance in Japan.

The increases in the market value of land are calculated by the increases in the book values. However, the decreases in the book value of land, i.e. sold-out land, are converted into market prices based on the LIFO (last-in-first-out) assumption that the sold-out land was purchased at the last purchase point of time. Hoshi and Kashyap (1990), and Ogawa and Suzuki (1997) used the similar assumption in previous studies. The land price ($p^L{}_t$) used for the deflator is the "national index of urban land" (the average price for overall purposes), excluding six major cities, based on the Index of Urban Land Price by Japan Real Estate Institute.

Define the increase in the book value of land by $ILAND_t$ and its decrease by $DLAND_t$. We can then calculate the market value of land investment ($NILAND_t$), the market value of land stock ($LANDY_t = p^L{}_t L_t$), and the real value of land net investment ($IL_t$) by the following equations:

(A2) $NILAND_t = ILAND_t \, (p^L{}_t / p^L{}_{t-1}) \, DLAND_t,$

(A3) $LANDY_t = (p^L{}_t / p^L{}_{t-1}) \, DLAND_{t-1} + NILAND_t,$

(A4) $IL_t = (ILAND_t / p^L{}_t) \, (DLAND_t / p^L{}_{t-1}),$

Appendix 2. The Calculation of Tobin's Q

We calculated Tobin's Q based on the method of Abel and Blanchard (1986). Depending on the assumption of stochastic processes, we calculated two types of Tobin's Q: "the base-line Q" and "the reference Q".

For the base-line Q, we assume that the first difference of after-tax ordinary profit follows an AR process. We chose the order of the AR process from 3 to 5 that minimizes AIC. We then used the estimated AR process to forecast a stream of future after-tax ordinary profits. The forecasted values of future after-tax ordinary profits $E\pi_{t+i}$ lead to the present discount value of the profits for each firm as follows:

(A5) $$V_t = \sum_{i=0}^{\infty} \left( \frac{1}{1+r} \right)^i E\pi_{t+i},$$

where $r$ is the discount rate. The discount rate for each firm is obtained by total interest payments divided by total debt outstanding. If the estimated AR process is not stationary, we excluded the data of the present discount value from our sample. The number of samples is thus reduced to 17,495 for the base line Q.

For the reference Q, we assume that after-tax ordinary profit follows a random walk process. The assumption follows Blanchard, Rhee, and Summers (1990). In this case, the expected value of future after-tax ordinary profits is equal to the current after-tax ordinary profit. The present discount value of the profits is thus obtained by dividing the current after-tax ordinary profit by the discount rate; $V_t = \pi_{t-1}/r$. For the reference Q, we used all available data to calculate $V_t$. The number of samples thus remains 24,242 in the reference case.

Tobin's Q is obtained by dividing the present discount value $V_t$ by the market value of capital stock($\Sigma p^{Ii}_t K_{i,t}$). In our analysis, we use the market value of capital stock without land. We thus calculate the Tobin's Q by deducting the market value of land ($p^L_t L_t$) from denominator.

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**TABLE 1. Summary Statistics of the Financial Variables.**

(a) Base-line Tobin's Q (N = 17,495).

| Variable | Mean | S.D. | Min. | Median | Max. |
|---|---|---|---|---|---|
| Investment/K | 0.08 | 0.54 | -0.98 | 0.00 | 19.06 |
| Tobin's Q | 2.22 | 2.40 | -18.83 | 1.58 | 20.00 |
| Cash-flow/K | 0.36 | 0.90 | -17.22 | 0.18 | 19.55 |
| Debt-asset ratio | 0.32 | 0.26 | 0.00 | 0.30 | 17.13 |

(b) Reference Tobin's Q (N = 24,242).

| Variable | Mean | S.D. | Min. | Median | Max. |
|---|---|---|---|---|---|
| Investment/K | 0.09 | 0.55 | -0.99 | 0.00 | 19.06 |
| Tobin's Q | 2.34 | 2.85 | -19.88 | 1.58 | 19.94 |
| Cash-flow/K | 0.39 | 1.02 | -15.92 | 0.19 | 19.81 |
| Debt-asset ratio | 0.31 | 0.26 | 0.00 | 0.29 | 17.13 |

**TABLE 2-1. Types of Lending Banks.**

(a) Base-line Tobin's Q (N = 17,495).

| Bank type | "Main" bank | Lending bank* |
|---|---|---|
| City, Long-term credit, Trust bank | 59.4% | 61.6% |
| The first regional bank | 33.1% | 17.9% |
| The second regional bank | 4.4% | 8.8% |
| Sinkin bank, Sinyo Kumiai | 3.1% | 11.7% |

(b) Reference Tobin's Q (N = 24,242).

| Bank type | "Main" bank | Lending bank* |
|---|---|---|
| City, Long-term credit, Trust bank | 59.3% | 66.0% |
| The first regional bank | 32.3% | 15.7% |
| The second regional bank | 4.7% | 7.4% |
| Sinkin bank, Sinyo Kumiai | 3.7% | 10.9% |

*excluding "main" bank

Distribution of the number of lendinf banks.

| The nunber of lending banks | (a) base-line sample | (b) reference sample |
|---|---|---|
| 1 | 1.8% | 2.6% |
| 2 | 5.5% | 6.3% |
| 3 | 10.6% | 11.2% |
| 4 | 14.2% | 14.1% |
| 5 | 14.7% | 15.0% |
| 6 | 14.4% | 13.9% |
| 7 | 11.3% | 10.8% |
| 8 | 9.8% | 9.0% |
| 9 | 8.1% | 7.3% |
| 10 | 6.7% | 6.1% |
| unknown | 2.8% | 3.8% |

**TABLE 2-2. Summary Statistics of the "Main" Bank Variables.**

(a) Base-line Tobin's Q (N = 17,495).

| Variable | Mean | S.D. | Min. | Median | Max. |
|---|---|---|---|---|---|
| i. Internationally-active banks (56.2%) | | | | | |
| Regulatory capital adequacy ratio | 10.88 | 9.55 | 2.99 | 10.85 | 21.01 |
| Nonperforming loan ratio | 4.22 | 1.63 | 1.43 | 4.01 | 15.99 |
| ii. Domestically operating banks (43.8%) | | | | | |
| Regulatory capital adequacy ratio | 6.88 | 6.51 | 0.27 | 5.76 | 22.95 |
| Nonperforming loan ratio | 4.22 | 4.54 | 1.88 | 4.07 | 26.86 |

(b) Reference Tobin's Q (N = 24,242).

| Variable | Mean | S.D. | Min. | Median | Max. |
|---|---|---|---|---|---|
| i. Internationally-active banks (56.2%) | | | | | |
| Regulatory capital adequacy ratio | 10.89 | 9.50 | 2.99 | 10.85 | 21.01 |
| Nonperforming loan ratio | 4.21 | 1.59 | 1.43 | 3.98 | 15.99 |
| ii. Domestically operating banks (43.8%) | | | | | |
| Regulatory capital adequacy ratio | 6.86 | 6.54 | 0.27 | 4.78 | 22.95 |
| Nonperforming loan ratio | 4.05 | 4.34 | 1.88 | 4.07 | 26.86 |

**TABLE 3. Estimation Results for the Basic Model**

(a) Base-line Tobin's Q

| Variable | | | | | |
|---|---|---|---|---|---|
| Tobin's Q | 0.0064 *** | 0.0064 *** | 0.0058 *** | 0.0058 *** | 0.0060 *** |
| | (0.0018) | (0.0018) | (0.0018) | (0.0018) | (0.0018) |
| Cash-Flow | 0.0572 *** | 0.0572 *** | 0.0576 *** | 0.0576 *** | 0.0577 *** |
| | (0.0048) | (0.0048) | (0.0048) | (0.0048) | (0.0048) |
| Debt-asset ratio: | | | | | |
| (all sample) | -0.0266 * | -0.0265 * | | | |
| | (0.0159) | (0.0159) | | | |
| (sample s.t. Q>1) | | | -0.0139 | -0.0138 | -0.0177 |
| | | | (0.0189) | (0.0189) | (0.0189) |
| (sample s.t. Q<1) | | | -0.0409 ** | -0.0409 ** | -0.0424 ** |
| | | | (0.0196) | (0.0196) | (0.0196) |
| The number of banks | -0.0261 *** | -0.0259 *** | -0.0270 *** | -0.0268 *** | -0.0279 *** |
| | (0.0095) | (0.0095) | (0.0095) | (0.0095) | (0.0095) |
| Bank health: | | | | | |
| Regulatory capital ratio | 0.0422 *** | 0.0416 *** | 0.0421 *** | 0.0416 *** | |
| | (0.0099) | (0.0099) | (0.0099) | (0.0098) | |
| Nonperforming loan ratio | -0.0396 *** | -0.0385 *** | -0.0400 *** | -0.0390 *** | |
| | (0.0136) | (0.0135) | (0.0136) | (0.0135) | |
| Stock price | 0.0041 | 0.0037 | 0.0042 | 0.0038 | 0.0079 * |
| | (0.0049) | (0.0049) | (0.0049) | (0.0049) | (0.0047) |
| Bank default | 0.0138 | | 0.0137 | | |
| | (0.0286) | | (0.0286) | | |
| Bank default (4) | | -0.0001 | | -0.0001 | |
| | | (0.0245) | | (0.0245) | |
| Dummies: | | | | | |
| Parent companies' default | -0.0341 | -0.0342 | -0.0345 | -0.0346 | |
| | (0.0321) | (0.0321) | (0.0321) | (0.0321) | |
| Major trading partners' default | -0.1191 | -0.1195 | -0.1191 | -0.1195 | |
| | (0.1201) | (0.1201) | (0.1201) | (0.1201) | |
| No "main" bank | 0.0238 | 0.0232 | 0.0240 | 0.0235 | |
| | (0.0276) | (0.0276) | (0.0276) | (0.0276) | |
| Unlisted bank | 0.0219 | 0.0205 | 0.0221 | 0.0207 | 0.0564 * |
| | (0.0322) | (0.0321) | (0.0322) | (0.0321) | (0.0310) |
| Industry dummies: | | | | | |
| Construction | -0.0188 * | -0.0184 * | -0.0188 * | -0.0185 * | -0.0192 * |
| | (0.0104) | (0.0104) | (0.0104) | (0.0104) | (0.0104) |
| Transportation & communication | 0.0527 ** | 0.0529 ** | 0.0544 ** | 0.0546 ** | 0.0526 ** |
| | (0.0215) | (0.0215) | (0.0215) | (0.0215) | (0.0215) |
| Constant | 0.0418 | 0.0438 | 0.0413 | 0.0433 | 0.0144 |
| | (0.0318) | (0.0317) | (0.0318) | (0.0317) | (0.0306) |
| Parameters in logit transformation: | | | | | |
| $\lambda$ | 5.609 | 5.618 | 5.615 | 5.624 | 5.401 |
| $\theta$ | 6.912 | 6.913 | 6.910 | 6.917 | 6.924 |
| $\rho$ | 3.011 | 3.121 | 3.078 | 3.154 | |
| $\omega$-(4 or 8) | 2.750 | 2.731 | 2.742 | 2.730 | |
| Firms | 2,615 | 2,615 | 2,615 | 2,615 | 2,615 |
| Observations | 17,495 | 17,495 | 17,495 | 17,495 | 17,495 |

Standard errors are provided in parenthesis below the coefficient estimates.
*, **, *** denotes significance at the 10%, 5%, 1% level respectively.

**TABLE 3 (continued). Estimation Results for the Basic Model**

(b) Reference Tobin's Q

| Variable | | | | | |
|---|---|---|---|---|---|
| Tobin's Q | 0.0044 *** | 0.0044 *** | 0.0039 *** | 0.0039 *** | 0.0038 *** |
| | (0.0013) | (0.0013) | (0.0013) | (0.0013) | (0.0013) |
| Cash-Flow | 0.0527 *** | 0.0527 *** | 0.0529 *** | 0.0529 *** | 0.0530 *** |
| | (0.0036) | (0.0036) | (0.0036) | (0.0036) | (0.0036) |
| Debt-asset ratio: | | | | | |
| (all sample) | -0.0108 | -0.0108 | | | |
| | (0.0140) | (0.0140) | | | |
| (sample s.t. Q>1) | | | 0.0025 | 0.0025 | -0.0004 |
| | | | (0.0164) | (0.0164) | (0.0164) |
| (sample s.t. Q<1) | | | -0.0271 | -0.0272 | -0.0293 * |
| | | | (0.0175) | (0.0175) | (0.0176) |
| The number of banks | -0.0212 *** | -0.0211 *** | -0.0221 *** | -0.0220 *** | -0.0259 *** |
| | (0.0079) | (0.0079) | (0.0079) | (0.0079) | (0.0079) |
| Bank health: | | | | | |
| Regulatory capital ratio | 0.0547 *** | 0.0545 *** | 0.0516 *** | 0.0513 *** | |
| | (0.0096) | (0.0096) | (0.0090) | (0.0090) | |
| Nonperforming loan ratio | -0.0334 *** | -0.0327 *** | -0.0335 *** | -0.0329 *** | |
| | (0.0117) | (0.0117) | (0.0117) | (0.0117) | |
| Stock price | 0.0072 * | 0.0069 | 0.0075 * | 0.0073 * | 0.0121 *** |
| | (0.0043) | (0.0043) | (0.0043) | (0.0043) | (0.0042) |
| Bank default | 0.0091 | | 0.0084 | | |
| | (0.0264) | | (0.0264) | | |
| Bank default (4) | | -0.0002 | | -0.0006 | |
| | | (0.0227) | | (0.0227) | |
| Dummies: | | | | | |
| Parent companies' default | -0.0291 | -0.0291 | -0.0294 | -0.0294 | |
| | (0.0284) | (0.0284) | (0.0284) | (0.0284) | |
| Major trading partners' default | -0.1090 | -0.1087 | -0.1088 | -0.1085 | |
| | (0.1003) | (0.1003) | (0.1003) | (0.1003) | |
| No "main" bank | 0.0961 *** | 0.0958 *** | 0.0954 *** | 0.0951 *** | |
| | (0.0213) | (0.0213) | (0.0213) | (0.0213) | |
| Unlisted bank | 0.0383 | 0.0373 | 0.0408 | 0.0398 | 0.0936 *** |
| | (0.0284) | (0.0284) | (0.0284) | (0.0283) | (0.0273) |
| Industry dummies: | | | | | |
| Transportation & communication | 0.0439 ** | 0.0439 ** | 0.0450 *** | 0.0451 *** | 0.0460 *** |
| | (0.0174) | (0.0174) | (0.0174) | (0.0174) | (0.0174) |
| Service | | | | | 0.0209 * |
| | | | | | (0.0113) |
| Constant | 0.0187 | 0.0201 | 0.0170 | 0.0183 | -0.0103 |
| | (0.0277) | (0.0276) | (0.0277) | (0.0276) | (0.0268) |
| Parameters in logit transformation: | | | | | |
| $\lambda$ | 5.361 | 5.363 | 5.266 | 5.265 | 5.307 |
| $\theta$ | 6.511 | 6.501 | 6.516 | 6.516 | 6.357 |
| $\rho$ | 1.945 | 1.954 | 2.449 | 2.466 | |
| $\omega$-(4 or 8) | 2.529 | 2.522 | 2.599 | 2.592 | |
| Firms | 3,821 | 3,821 | 3,821 | 3,821 | 3,821 |
| Observations | 24,242 | 24,242 | 24,242 | 24,242 | 24,242 |

Standard errors are provided in parenthesis below the coefficient estimates.

*, **, *** denotes significance at the 10%, 5%, 1% level respectively.

**TABLE 4. Estimation Results for the Model Including Dummy of the Number of Banks**

| Variable | (a) Base-line Tobin's Q | | (b) Reference Tobin's Q | |
|---|---|---|---|---|
| Tobin's Q | 0.0064 *** | 0.0058 *** | 0.0043 *** | 0.0038 *** |
| | (0.0018) | (0.0018) | (0.0013) | (0.0013) |
| Cash-Flow | 0.0644 *** | 0.0646 *** | 0.0620 *** | 0.0621 *** |
| | (0.0059) | (0.0059) | (0.0047) | (0.0047) |
| [Dummy for NB(4)] | -0.0183 ** | -0.0179 ** | -0.0206 *** | -0.0203 *** |
| | (0.0087) | (0.0087) | (0.0066) | (0.0066) |
| Debt-asset ratio: | | | | |
| (all sample) | -0.0289 * | | -0.0139 | |
| | (0.0158) | | (0.0140) | |
| (sample s.t. Q>1) | | -0.0171 | | -0.0018 |
| | | (0.0188) | | (0.0163) |
| (sample s.t. Q<1) | | -0.0421 ** | | -0.0290 * |
| | | (0.0195) | | (0.0175) |
| The number of banks | -0.0289 *** | -0.0296 *** | -0.0248 *** | -0.0255 *** |
| | (0.0096) | (0.0096) | (0.0080) | (0.0080) |
| Bank health: | | | | |
| Regulatory capital ratio | 0.0479 *** | 0.0476 *** | 0.0435 *** | 0.0437 *** |
| | (0.0127) | (0.0125) | (0.0107) | (0.0107) |
| [Dummy for NB(1)] | 0.3676 *** | 0.3582 *** | 0.4240 *** | 0.4256 *** |
| | (0.1055) | (0.1035) | (0.0699) | (0.0702) |
| Nonperforming loan ratio | -0.0164 ** | -0.0167 *** | -0.0111 * | -0.0113 ** |
| | (0.0065) | (0.0065) | (0.0057) | (0.0057) |
| [Dummy for NB(1)] | -0.0280 | -0.0277 | -0.0272 * | -0.0265 * |
| | (0.0218) | (0.0219) | (0.0149) | (0.0149) |
| Dummy: | | | | |
| No "main" bank | 0.0075 | 0.0076 | 0.0749 *** | 0.0752 *** |
| | (0.0272) | (0.0272) | (0.0209) | (0.0209) |
| Industry dummies: | | | | |
| Construction | -0.0185 * | -0.0186 * | | |
| | (0.0104) | (0.0104) | | |
| Transportation & communication | 0.0541 ** | 0.0556 *** | 0.0433 ** | 0.0443 ** |
| | (0.0215) | (0.0215) | (0.0173) | (0.0174) |
| Constant | 0.0786 *** | 0.0784 *** | 0.0760 *** | 0.0759 *** |
| | (0.0131) | (0.0131) | (0.0112) | (0.0112) |
| Parameters in logit transformation: | | | | |
| **λ** | 5.506 | 5.505 | 5.935 | 5.911 |
| **θ** | 6.883 | 6.886 | 6.306 | 6.342 |
| **ρ** | 2.052 | 2.048 | 17.412 | 16.269 |
| **ω**-(4 or 8) | 1.783 | 1.830 | 1.292 | 1.293 |
| Firms | 2,615 | 2,615 | 3,821 | 3,821 |
| Observations | 17,495 | 17,495 | 24,242 | 24,242 |

Standard errors are provided in parenthesis below the coefficient estimates.
*, **, *** denotes significance at the 10%, 5%, 1% level respectively.

**Figure 1. The "Tankan" DI: Lending Attitude**