

# DETERIORATING BANK HEALTH AND LENDING IN JAPAN: EVIDENCE FROM UNLISTED COMPANIES UNDERGOING FINANCIAL DISTRESS \*

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## **Abstract**

When a borrower faces an informational hold-up problem, deteriorating bank health might reduce a borrower's credit availability. However, a bank with an impaired balance sheet might attempt to "gamble for resurrection" and hence increase risky lending to "zombie" firms. The purpose of this paper is to investigate what impacts the weakened financial conditions of banks had on loans outstanding to medium-size firms in Japan. Estimating lending functions, we examine the determinants of lending to unlisted Japanese companies in the late 1990s and early 2000s. We find that two alternative measures of bank health—regulatory capital adequacy ratios and ratios of non-performing loans (NPLs)—had opposite impacts on lending. In the case of regulatory capital adequacy ratios, its deterioration had a perverse impact on lending. The deteriorating NPL ratios, however, increased lending to troubled firms to keep otherwise economically bankrupt firms alive.

Key words: Bank-firm relationship, Credit crunch, Misallocation, Unlisted firms

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## 1. Introduction

Bank-firm relationships are more important in Japan than in other developed countries such as the United States, United Kingdom, and Australia. Many studies have long been interested in the effects of the relationships on borrowing firms' real activities in Japan. One strand of research reveals indirect evidence on the positive sides of bank-dependent borrowers in Japan. For example, Hoshi, Kashyap, and Scharfstein (1991) concluded that investment is less sensitive to cash-flow for firms that are members of a *keiretsu* (corporate group linked through one main bank) by using firm-level data. The main bank takes primary responsibility for monitoring the firm, which serves as a form of corporate governance. The role of the main bank is especially important during times of distress, when it typically changes the affiliated firm's management and board directors (see, for example, Hoshi, Kashyap, and Scharfstein [1990]).

Banking relationships, however, have at least two negative sides (see section 4 in Boot [2000]). First, as a firm works more closely with a bank, it becomes harder to find alternatives for funding, and it may be "held up" by the bank (Sharpe [1990], Rajan [1992]). The hold-up problem has to do with the information monopoly the bank generates in the course of lending. To the extent that the information monopoly increases the borrower's costs of switching banking relationships, bank-specific financial health would reduce a borrower's credit availability, even when observable characteristics relating to borrower risk are controlled for. The costs would be especially large for small and medium firms, which tend to be far more reliant on bank financing.

Second, a bank with an impaired balance sheet might attempt to "gamble for resurrection" and hence increase risky lending to "zombie" firms. The bank could reduce the reported amount of nonperforming loans on its books and inflate its reported capital, as long as it makes sufficient credit available to the firm to enable it to make interest payments on the outstanding loans from the bank. Consequently, the bank may continue lending to troubled firms to provide sufficient financing to keep otherwise economically bankrupt firms alive.<sup>1</sup>

Two strands of empirical studies supported these negative sides of bank-firm relations in Japan in different frameworks. Gibson (1995) found that firm investment in 1991–1992 was sensitive to the financial health of the firm's main bank, holding Tobin's

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<sup>1</sup> This issue is similar to the debate on the problem of "soft budget constraints" discussed by Dewatripont and Maskin (1995) and Berglöf and Roland (1995).

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 three years of the 1990s, when the Japanese stock market fell dramatically. Klein, Peek, and Rosengren (2002) found that the financial difficulties of Japanese banks were economically and statistically important in reducing the number of FDI projects by Japanese firms into the United States.

Other strands of studies, however, questioned the negative impacts of bank health deterioration on credit availability for borrowing firms. Sekine, Kobayashi, and Saita (2003) (hereafter SKS) found that outstanding loans were apt to increase to a firm whose debt-asset ratio exceeded a certain level for non-manufacturing firms. Peek and Rosengren (2003) showed that troubled Japanese banks allocated credit to severely impaired borrowers to avoid the realization of losses on their own balance sheets. Caballero, Hoshi, and Kashyap (2004) confirmed that zombie-dominated industries exhibit more depressed job creation, lower productivity, and greater excess capacity.<sup>2</sup> Fukuda and Koibuchi (2005) found that a lack of “shock therapy” was a source of the prolonged bad loan problem during Japan’s banking crisis.

The two strands of studies, however, provide mutually contradictory evidence about the impact of a change in bank balance sheet condition on the credit availability of borrowing firms. More importantly, all of these studies used the data set of listed firms. A series of financial liberalization measures in the 1990s reduced the role of banks for most listed Japanese companies. Banks, in contrast, keep playing dominant roles in the financing of small and medium firms in Japan. It is thus worthwhile to focus on unlisted firms, for which the role of banks is more important. In previous studies, it is far from clear what impacts deteriorating bank health had on lending to small and medium firms.

The purpose of this paper is to extend our previous work on the investment function of unlisted firms in Japan (Fukuda, Kasuya, and Nakajima [2005] hereafter FKN) and to investigate what impacts weakened financial conditions of banks had on outstanding loans to medium-size firms based on a matched sample of borrowers and banks in Japan. By estimating lending functions, we examine the determinants of lending to unlisted Japanese companies in the late 1990s and the early 2000s. 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 investments. However, if banks with an impaired

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<sup>2</sup> Hosono and Sakuragawa (2003) and Ahearne and Shinada (2005) also reached similar conclusions.

balance sheet attempt to refinance firms that had little prospect of repaying the extended loans, firms would continue borrowing from the troubled banks.

A basic equation we estimate in the following analysis relates the growth rate of outstanding loans to a vector of profit rates, debt-asset ratios, and a vector of several bank health measures. The first two explanatory variables are health measures of borrowing firms, which capture profitability and the individual firm's default risk, respectively. Like previous work by SKS on listed companies, we find that outstanding loans were apt to increase to a firm whose debt-asset ratio exceeded a certain threshold level. However, unlike the previous work on listed companies, the number of firms whose debt-asset ratio exceeded the threshold level was very small. The result implies that weakened financial conditions of borrowing firms usually reduced credit availability and rarely increased risky lending to zombie firms.

In contrast, two alternative measures of the bank health—regulatory capital adequacy ratios and ratios of NPLs—had significant but opposite impacts on lending. In the case of regulatory capital adequacy ratios, its deterioration had a perverse impact on bank lending. The deterioration of NPL ratios, however, increased increase risky lending to zombie firms. Before the Financial Services Agency strengthened its inspections of banks, bank regulation and supervision policies in Japan provided the banks that have significant NPL few incentives to be strict with troubled borrowers. When their non-performing loans were piled up, the banks therefore followed a policy of forbearance with their problem borrowers to avoid pressure on the banks to increase their own loan loss reserves, further impairing their capital. This leads to further credit to a troubled firm to enable the firm to make interest payments on outstanding loans and avoid or delay bankruptcy. The banks were, however, less likely to follow the policy of forbearance when their deteriorating regulatory capital adequacy ratios approached the minimum requirements. The banks came under increasing pressure to meet capital ratio requirements during the 1990s. The “Basel Capital Accord” set minimum risk-based capital requirements (8 percent) for internationally active banks, while a ratio of 4 percent was 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. A “capital crunch” would therefore be more likely to happen when a deterioration of regulatory capital ratios tightens the bank's lending attitude.<sup>3</sup>

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<sup>3</sup> Authors such as Ito and Sasaki, (2002) and Woo (2003) showed that deteriorating capital adequacy ratios of Japanese banks caused the “capital crunch” in the 1990s.

By 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 bank health, we used three alternative measures: (i) regulatory capital adequacy ratios, (ii) ratios of NPLs, and (iii) bank failures. These measures are backward-looking; they are only loosely related to a bank's economic value. However, deterioration of these measures had significant impacts on changes of loans. This implies that deterioration of backward-looking regulatory measures had been important in tightening or weakening bank lending attitudes under the financial turbulence in the late 1990s and early 2000s in Japan.

In previous studies, by using a U.S. firm data set, Petersen and Rajan (1994) among a number of other studies, suggested that a close bank relationship increases credit availability for small borrowers. Studies such as Harhoff and Körting (1998) and Ferri and Messori (2000) reached similar conclusions by using data on small European firms. These previous studies, however, did not explore the impacts weakened financial conditions of banks had on lending to small and medium firms, particularly focusing on the two negative sides of bank-firm relationships. Our previous work (FKN) is an exceptional one that investigated the relationship between bank health and corporate investment in Japan by using firm-level data in Japan. By using the same data set, Fukuda, Kasuya, and Akashi (2005) examined the relationship between bank health and default risk. They were new in exploring whether several measures on bank-specific financial health had negative impacts on a borrower's performance in Japan. They did not, however, investigate the negative side of bank-firm relationships, in which a bank with an impaired balance sheet might increase risky lending to troubled firms.

After the crash of the stock market, the Japanese banking sector faced considerable problems dealing with their deteriorating their loans. The problems became particularly serious in the late 1990s, when several major financial institutions turned out to be in default. A noteworthy implication of this paper is that the impacts of the problems on loans outstanding to medium-size firms took different features; part of the bank balance sheet was impaired during the financial turbulence. One policy implication is that banks should be given two types of incentives to avoid tightening and weakening their lending attitudes. Such actions, however, would be unlikely outside of a more thorough reform of the financial sector that restructures the deteriorating bank balance sheets.

Our paper proceeds as follows. Section 2 provides some macroeconomic evidence, and explains two alternative views on bank lending. After explaining our bank health measures in Section 3, Section 4 specifies the basic model, and section 5 explains our data. Section 6 reports our main empirical results. Sections 7 and 8 provide empirical results for sub-sample periods and for different industries respectively. Section 9 summarizes our main results and refers to their implications.

## 2. Some Macroeconomic Evidence: Two Alternative Views

After the collapse of the asset price bubble, Japanese banks continued to accumulate bad loans, causing a large amount of losses on the disposal of non-performing loans up until the early 2000s. To the extent that the informational hold-up problem does matter, deterioration of bank health would tighten the lending attitudes of banks. Several alternative surveys from borrowing firms show that lending attitudes of financial institutions became very tight in the late 1990s in Japan (see, for example, various issues of White Paper on Small and Medium Enterprises in Japan). The tight attitudes tended to be temporary for large companies. The tight attitudes for small and medium companies, in contrast, persisted, and showed slow recovery even in the early 2000s. The evidence supports the view that small and medium companies had more serious problems in finding alternative sources of funding during the financial turbulence.

However, when we look at the total amount of outstanding loans in Japan, we see that they grew dramatically during the bubble period, and remained very high throughout the 1990s. Based on Financial Statements Statistics of Corporations by Industry published by the Ministry of Finance, Figure 1 shows the quarterly movements of total outstanding loans to Japanese corporations with different capital sizes in the manufacturing and non-manufacturing sectors. Except for large manufacturing firms, outstanding loans around 1990 swelled to a level almost twice as high as before the bubble period, and remained high until the early 2000s. This was true not only for large firms (corporations capitalized at one billion yen or more) but also for medium-size firms (corporations with capital of more than 100 million yen and less than one billion yen) and small firms (corporations with capital of 100 million yen or less). The evidence does not seem to imply that small and medium companies had more serious problems in finding sources of funding during the financial turbulence.

### 3. Bank Health Measures

The purpose of the following analysis is to describe the impacts several health measures of the “main” bank had on the amount of lending to unlisted firms in Japan in the late 1990s and early 2000s. In the analysis, we directly tested the effects of a variety of health measures of the “main” bank on the amount of lending to unlisted borrowing firms in Japan. The use of firm-level data of unlisted firms has several advantages in detecting the effects of bank health on the amount of lending. 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. Second, reverse causality from firms to banks will be less of a problem in a firm-level regression for unlisted firms than it will be for listed firms. The borrower’s performance may affect the bank’s financial health if the firm’s loans from its bank were relatively large compared to the bank’s capital. This is likely for listed firms but less likely for unlisted firms. The use of unlisted firms’ data thus allows us to avoid possible simultaneous bias without using ad hoc instrument variables.

To measure the health of the “main” bank, we use three alternative measures. The first is regulatory capital adequacy ratios. Regulatory capital in Japan is only loosely related to a bank’s economic capital. However, the regulatory capital adequacy ratios have been critical for many of the Japanese banks either to continue their international-activities or to avoid a possible recapitalization by the government. The banks would be more likely to tighten their lending attitudes when their regulatory capital ratios are impaired.

The second measure of bank health is NPL ratios. Like regulatory capital, market participants tended to regard the ratios of nonperforming loans as an important indicator to measure bank health in the late 1990s and early 2000s. In particular, the Japanese government repeatedly warned the banks that they must solve their non-performing loans problems to recover confidence in Japan’s financial system. However, before the Financial Services Agency established the basic guidelines for financial inspections and strengthened its inspections of banks, the standards—which cover a wider range of non-performing loans—had been subject to change. Japanese banks could underreport the amount of nonperforming loans on their books to conceal the true extent of their problems. It is thus likely that the banks continued to provide financial support for inefficient, debt-ridden companies, commonly referred to as “zombie” firms.

The third measure is bank failures. The number of bank failures was highly limited

even during the period of financial turbulence in Japan. The bank failures, however, occurred in an extreme case in which 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. In the following analysis, we add a dummy of main bank failure. We also add a default dummy of major trading partners as a reference variable to compare the impact with that of bank failures. The comparison may clarify how different the impact of bank failures was from those of the major trading partners' defaults.

#### 4. The Basic Model

In the following sections, we examine how various measures of bank health changed the amount of loans outstanding to Japanese unlisted firms. A basic equation we estimate in the following analysis is:

$$(1) \quad \Delta L_{i,t}/L_{i,t} = \alpha + \beta \Pi_{i,t-1} + \gamma DA_{i,t-1} + \delta(DA_{i,t-1})^2 + \phi BH_{i,t-1} + \varepsilon NB_{i,t}$$

where  $\Delta L_{i,t}/L_{i,t}$  = growth rate of loans outstanding,  $\Pi_{i,t}$  = a vector of profit rates,  $DA_{i,t}$  = debt-asset ratio,  $BH_{i,t}$  = a vector of several bank health measures, and  $NB_{i,t}$  = the number of lending banks. Subscript  $i$  is index of firm and subscript  $t$  denotes time period  $t$ .

The two explanatory variables,  $\Pi_{i,t-1}$  and  $DA_{i,t-1}$ , are the health measures of borrowing firms; they capture the individual firm's profitability and default risk, respectively. As for proxies of the individual firm's profit rate, we use operating profit and special loss. To the extent that banks increase lending to firms with higher profitability, we expect that  $\beta > 0$  for operating profit and  $\beta < 0$  for special loss. In contrast, high leverage reduces a firm's ability to finance investment because of increased default risk. In particular, large and persistent declines in land prices throughout the 1990s had increased the default risk of firms in Japan through a change in land collateral valuation. The added debt-asset ratio would thus be expected to have a significantly negative impact on loans outstanding; that is,  $\gamma < 0$ . However, if banks continue lending to troubled firms, the relationship between loans outstanding and debt-asset ratios would be non-linear. That is, banks squeeze loans as  $DA_{i,t}$  increases when  $DA_{i,t}$  is small, while banks squeeze loans less hard and eventually increase loans to firms with sufficiently large debt-asset ratios when  $DA_{i,t}$  exceeds a certain level.



Under a nonlinear relationship, we would expect to see  $\gamma < 0$  and  $\delta > 0$ .

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 NPLs without any transformation. We also, however, add regulatory capital adequacy ratios after transforming them by logistic function:  $CAR_{i,t} \equiv \exp(\rho(\eta_{i,t} - \omega - \pi_{\eta}))/[1 + \exp(\rho(\eta_{i,t} - \omega - \pi_{\eta}))]$ , where  $\eta_{i,t}$  is the 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  $\pi_{\eta}$  to take either four or eight, depending on the minimum requirements. In the estimation, we set  $\rho = 10$  and  $\omega = 3.5$ . We choose the parameters by the grid search method so as to maximize the likelihood of equation (1).

We capture bank failures by a dummy variable. The dummy variable takes a value of one when the “main” bank failed, and zero otherwise. In the analysis, for comparison we also add a dummy variable for major trading partners’ defaults. The dummy variable takes one when the major trading partners defaulted and zero otherwise.

The last explanatory variable in equation (1) is the number of lending banks. 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. Coordination problems among debt-holders generally introduce inefficiencies in the workout process, which become particularly serious when the number of lenders is large. The number of lending banks would be expected to have a negative impact if the inefficiencies squeeze lending, but would have a positive impact if the inefficiencies expand lending.

## 5. The Data

### (i) Data of Financial Variables

To estimate equation (1), we need firm-level data on financial variables, data on the measures of the bank health, information on the “main” bank, and information of 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 the

Tokyo Shoko Research (TSR) Database Service. The database covers all available financial data of non-financial corporations with capital of 100 million 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<sup>4</sup>. It allows us to use the data of 3,644 Japanese unlisted firms.

In the analysis, we normalize both operating profit and special loss, dividing by the market value of capital stock. In calculating the market value of capital stock, we convert the book values of capital stock and land using the perpetual inventory method developed by Hayashi and Inoue (1991) (see Appendix 1 of FKN for its details). Unless the data are missing, we use the data set that covers the period from 1984 through 2002. For the debt-asset ratio, we use loans outstanding divided by total assets, of which capital stock and 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.

**Table 1** reports the mean, standard deviation, minimum, median, and maximum of each financial variable. The growth rate of outstanding loans is negative on average, reflecting prolonged recessions during the 1990s. Its maximum, however, is high, implying that the amount of lending increased substantially, at least to some firms. The profit rate is positive on average, but its standard deviation is very large. Neither the mean nor the median of the debt-asset ratio are high. The maximum of the debt-asset ratio, however, amounts to 6.979, implying that a limited number of firms heavily borrowed from banks.

#### (ii) Data on Measures of Bank Health

As for three alternative measures of the bank health, we constructed 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 company 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 the Japan Bankers Association, *Financial Statements of Shinkin Banks (Credit Cooperatives)*

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<sup>4</sup> We regarded the data as outliers when the growth rate of outstanding loans exceeds 200 percent, the absolute value of the normalized profit is greater than 20, and the absolute value of the debt-asset ratio exceeds 10.

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 1996 through 2002.

To calculate a proxy for the ratios of NPLs, we use the amount of risk management loans divided by total loans outstanding. Following the standards set by the 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 US SEC standards adopted for the public disclosure of bad loans. Specifically, risk management loans are comprised of “overdue loans” in arrears by three months or more, and “restructured loans” with changes in terms and conditions, as well as loans to borrowers in legal bankruptcy.

Information of bank failures is based on figures from the Financial Services Agency (FSA). To allow for the lagged effects, we define the year of “bank failures” by not only the year of the FSA’s declaration, but also by the year before. Information of major trade partners is based on the Tokyo Shoko Research (TSR) Database Service. *CD Eyes* provides a list of the major trading partners of each unlisted company for each year. Some of the companies in the list are unlisted companies. We, however, use only listed companies as major trading partners, because reverse causality from the unlisted firm will be less of a problem when the major trading partners are listed firms.

In our data set, nearly 60 percent of the “main” banks are either city banks, long-term credit banks, or trust banks, and 33 percent of the “main” banks are first regional banks. This implies that large banks still play dominant roles as “main” banks, even for most unlisted firms capitalized at 100 million yen and over in our sample. Almost all of the unlisted firms in our sample, however, borrow from multiple banks; nearly 90 percent of the firms borrow from more than three banks, and nearly 65 percent of the firms borrow from more than five banks.

### (iii) Dummy Variables

We add several dummy variables to capture idiosyncratic effects that our bank health measures might not capture. These dummy variables are the dummy for no main-bank firms, the dummy for firms that had their loans written off, and industry dummies. The dummy for no main-bank firms takes a value of one when the firm had no main bank, and zero otherwise. In our sample, about 3 percent of the firms had no main bank. By definition, then, 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 firms that had their loans written off is included because the book value of loans outstanding declines when the loans are written off. Information on write-off loans is based on *CD Eyes*. In our sampled firms, three firms experienced write-offs of their loans.

Seven industry dummies are added to capture industry-specific effects on lending. The dummies may reflect various industry-specific factors that are not well captured by our explanatory variables. If the impacts of bank health differ across industries, the dummies may pick up the impacts. We choose the manufacturing industry as a benchmark, and add dummies for the other seven industries: agriculture, mining, construction, wholesale-retail, real estate, transportation-communication, and service.

## 6. Empirical Results

### (i) Basic Results

The estimation results of our lending function appear in [Table 2](#). The estimation period is from 1997 through 2002.<sup>5</sup> Although data from some corporations were partially missing, we included them by using unbalanced panel analysis. To avoid the problem of instantaneity bias, we took a lag of one period for independent variables, with the exception of the default dummies.

Before looking for the bank health effects, we checked whether the selected financial variables have sensible impacts on lending. Ordinary profit has a significantly positive impact, while special loss has a significantly negative impact. The result implies that the amount of loan tended to increase when the borrowing firm was profitable.

The coefficient of the debt-asset ratio is significantly negative, while the coefficient of the squared debt-asset ratio is significantly positive. The statistically significant non-linear relation implies that banks continued lending to some troubled firms to provide sufficient financing to keep them alive. However, unlike previous work on listed companies, the threshold above which banks increase loans to firms with large debt-asset ratios is about 2.8.<sup>6</sup> This very high threshold implies that the number of

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<sup>5</sup> 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.

<sup>6</sup> In equation (1), the threshold is equal to  $-\gamma/(2\delta)$ . Estimating similar equations, SKS

firms whose debt-asset ratio exceeded the threshold level was very small. Weakened health measures of borrowing firms themselves usually constrained credit availability and rarely increased risky lending to zombie firms.

“The number of banks” has a positive but statistically insignificant impact. This implies that the coordination problems among lenders might have expanded lending, but not significantly. As for the other dummy variables, the dummy for firms that had their loans written off has a negative impact, as expected. Some of the industry dummies have statistically significant impacts. In particular, the dummies for construction, real estate, and service are negative, and statistically significant. The dummy for no main-bank firms is positive, but not statistically significant.

#### (ii) Different Impacts of Three Alternative Bank Health Measures

In [Table 2](#), more noteworthy results are observed when we look at the impacts of the alternative measures of bank health. In particular, we can see that both regulatory capital adequacy ratios and ratios of NPLs have significantly positive impacts on lending, even if observable characteristics relating to these borrower’s financial variables are controlled for. The implications of the positive impacts are, however, very different between the two measures.

The estimates of the logistic function indicate that a decline of the regulatory capital adequacy ratios starts to have a perverse impact when they are less than 12 for internationally active banks, and eight for domestically operating banks; the perverse impact is accelerated until they fall into their minimum requirements. This implies that when the regulatory capital adequacy ratios deteriorated, the bank’s lending attitude was tightened, and consequently the client firms’ borrowings declined in the late 1990s and early 2000s.

In contrast, the positive impact of NPL ratios implies that a bank with impaired NPLs increased risky lending to zombie firms. Balance sheet cosmetics were important, insofar as the banks could reduce the reported amount of nonperforming loans on their books and inflate their reported capital. Consequently, the bank may continue lending to troubled firms and prevent the needed restructure of non-financial firms. Our result supports the view that the banks’ attempts to improve their NPL ratios extended further credit in the hope of recovering previous loans.

Finally, the dummy for bank failures is negative, implying that a bank failure had a negative impact on its client’s borrowing. It is, however, not statistically significant.

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showed that the threshold was less than 0.5 for listed firms in Japan.

In Japan, 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 when correspondent financial institutions went bankrupt. The insignificant impact may support the view that the credit guarantee system was successful in mitigating the negative effects of the bank failures. The dummy of major trading partners' defaults is, in contrast, not only negative but statistically significant. Its absolute value is larger than that of the bank failure dummy. This implies that the default of a major trading partner had a larger and more significant negative impact on its client's borrowing than did a bank failure.

## 7. Estimation Results for Different Sub-sample Periods

In a bank-centered system like Japan's, poor bank performance should be more costly, because firms have fewer alternatives to bank financing. This is particularly true for small and medium firms, which obtain most of their external financing from banks with which they've established a relationship. It is thus highly possible that small and medium firms that relied more on bank finance could have faced borrowing constraints when bank health deteriorated. Our empirical results, however, support this view only when capital adequacy ratios were weakened. The deterioration of NPL ratios, in contrast, might have sweetened the incentives to increase risky lending to zombie firms. The results imply that the different measures of bank health have different implications for bank lending during the financial turbulence in Japan.

The purpose of this section is to explore robustness of our results through dividing our estimation period into three sub-periods: (a) 1997-1998, (b) 1999-2000, and (c) 2001-2002. Sub-period (a) is the period when the financial crisis started in Japan. Hokkaido Takushoku Bank (HTB) failed on November 17, 1997. In the days immediately after HTB's failure, the Japanese financial market experienced significant turbulence. Despite the large extent of liquidity provision by the Bank of Japan, stock prices of financial institutions dropped significantly. Yamaichi Securities, one of the four large securities houses, was among the institutions that suffered the most; it closed its doors on November 25, 1997. In 1998, two larger and more visible Japanese banks failed: the Long-term Credit Bank of Japan on October 23, 1998, and the Nippon Credit Bank on December 13, 1998. The resolution of these banks revealed that Japanese regulators would no longer use "too-big-to-fail" policies.

Sub-period (b) is the period when new bank regulation and supervision policies

gradually started. The Financial Services Agency (FSA) established the basic guidelines for financial inspections after the passage of the Financial Reconstruction Law through the Diet in 1998. Regardless of the new policies, however, the financial crisis still persisted during the period. Non-performing loans kept accumulating until 2001, causing a large amount of losses on the disposal of non-performing loans. It was still likely that the standards, which cover a wider range of non-performing loans, had been subject to change, so that Japanese banks could underreport the amount of nonperforming loans on their books to conceal the true extent of their problems.

Sub-period (c) is, in contrast, the period when the financial crisis was almost stabilized. The enforcement of the Civil Rehabilitation Law in April 2000 made reconstruction of troubled firms easier. Since the FSA engaged in strict financial inspections of banks, banks came to have less maneuvering room to overstate their true balance sheet. The FSA repeatedly warned the banks that it was imperative to solve the non-performing loans problems to recover confidence in Japan's financial system. It is therefore less likely that the banks followed a policy of forbearance with their problem borrowers during this sub-period.

**Table 3** reports the estimation results for each sub-period. As for the selected financial variables of borrowing firms, neither ordinary profit nor special loss is statistically significant in the sub-period 1999-2000. This suggests that lending to some less profitable firms existed during this period. However, setting aside statistical significance, the impacts for each sub-period are essentially the same as those in **Table 2**; ordinary profit has a positive impact, while special loss has a negative impact. The threshold above which banks increase loans to firms with large debt-asset ratios is very high, particularly in the sub-period 2001-2002. This implies that health measures of borrowing firms themselves rarely increased risky lending to zombie firms throughout our sample period.

**Table 3**, in contrast, indicates that the two alternative measures of bank health—regulatory capital adequacy ratios and NPL ratios—have different impacts across different sub-periods. Both measures have large and significant impacts in the sub-period 1999-2000, while neither has significant impacts in the sub-period 2001-2002. In the sub-period 1997-1998, only the NPL ratios have a significant impact.

It is noteworthy that the growth rate of loans outstanding is regressed on the lagged two bank health measures in our model. This indicates that significant impacts were observed in the sub-period 1999-2000, because regulatory capital ratios and NPL ratios deteriorated dramatically from 1998 through 1999. Under the financial turbulence,

the banks that piled up non-performing loans followed a policy of forbearance with their problem borrowers to avoid pressure on the banks to increase their own loan loss reserves. This leads to further credit to a troubled firm to enable the firm to avoid or delay bankruptcy. The banks, however, experienced increasing pressure to meet capital ratio requirements during the 1990s. The regulatory capital adequacy ratios have been critical for many of the Japanese banks either to continue their international activities or to avoid a possible recapitalization by the government. A “capital crunch” would thus be more likely to happen when the deterioration of regulatory capital ratios tightens the bank’s lending attitude.

In contrast, after the late 1990s, the standards on non-performing loans gradually became comparable to the US SEC standards adopted for the public disclosure of bad loans. In particular, after 2000, the FSA applied strict supervision policies to most Japanese banks. It would thus be natural that the impacts of two alternative measures of the bank health had no significant impact for the sub-period 2001-2002.

## 8. Estimation Results for the Manufacturing and Non-manufacturing Industries

In previous sections, we estimated the lending functions without distinguishing loans to the non-manufacturing sector from those to the manufacturing sector. Several previous studies on listed companies, however, suggest that the banks provided forbearance loans more intensively to firms in non-manufacturing, particularly to those in construction and real estate, than to those in the manufacturing sector. The purpose of this section is to explore whether our results support the previous results, through dividing our sampled firms into those in the manufacturing sector and those in non-manufacturing.

The estimation results of our lending function appear in [Table 4](#). As for the selected financial variables of borrowing firms, their impacts for each sector are essentially the same as those in [Table 2](#); ordinary profit has a significantly positive impact, while special loss has a negative impact. The coefficient of the debt-asset ratio is significantly negative, while the coefficient of the squared debt-asset ratio is significantly positive. In these impacts, we cannot see any significant difference between manufacturing and non-manufacturing sectors. In particular, the threshold above which banks increase loans to firms with large debt-asset ratios is very high, even for the construction and real estate sectors. This implies that, unlike listed firms, the number of firms whose debt-asset ratio exceeded the threshold level is very small, even



for in construction and real estate.

However, as for the impacts of two alternative measures of bank health, the results are in marked contrast between the manufacturing and non-manufacturing sectors in [Table 4](#). The positive impacts of two bank health measures are large and significant for non-manufacturing firms, especially those in the construction, real estate, and wholesale-retail industries. They are, however, small and insignificant for manufacturing firms. They are partly consistent with previous studies on listed firms, in the sense that the banks with large NPL ratios provided forbearance loans more intensively to non-manufacturing firms. They are, however, inconsistent with the previous studies because the bank's lending attitude was tightened, even for the construction and real estate sectors, when the regulatory capital adequacy ratios deteriorated in our estimation results.

One negative aspect of banking relationships is that a bank with an impaired balance sheet might face soft budget constraints, in which the bank accepts the request for debt forgiveness and keeps pouring loans into insolvent client firms. Some of the incentives are internal to the banks, emanating from financially weak banks attempting to limit growth in reported problem loans on their balance sheets to maintain the required capital ratios, as well as perceived obligations to come to the aid of firms affiliated with the bank through its main bank relationships. Other incentives are external to the banks, emanating from government pressure on banks to continue lending to financially weak firms in order to avoid an even larger surge in unemployment and firm bankruptcies, as well as limiting the financial costs associated with massive bank bailouts or failures. The political concerns provided bank supervisors with the incentive to continue their forbearance policies toward banks. The political concerns were, however, more important for larger firms than for smaller firms. Some differences of the implications between ours and previous studies might be attributable to the relative importance of the political concerns between firms with different sizes.

## 9. Conclusions

While firms may be constrained by their balance sheet positions, they may also be constrained by a reduction in the willingness of lenders to provide credit. Japan is a country in which banks play an important role in the financing of corporations. Although the historically close ties between firms and banks began to break down 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 roles will damage the ability of firms to raise external funds. The damage would be particularly large for small and medium firms that obtain most of their external financing from banks with which they have established a close relationship. The severe economic crisis, associated with the collapse of asset prices and the dramatic deterioration in the health of the banking sector, represents one of the major economic events of the late 1990s in Japan. It is thus highly possible that lending to small and medium firms tends to be constrained when some of the bank health measures deteriorated. Our empirical results, however, support this view only for deterioration of capital adequacy ratios. The deterioration of NPL ratios actually increased risky lending to zombie firms. The results imply that the different measures of bank health have different implications for bank lending during the financial turbulence in Japan.

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

Variable	Mean	S.D.	Min.	Median	Max.
Growth rate of outstanding loan	-0.007	0.280	-0.998	-0.029	2.000
Operating profit	0.429	1.358	-16.680	0.183	19.975
Debt-asset ratio	0.351	0.236	0.000	0.326	6.979
Special loss	0.016	0.080	0.000	0.005	8.823

**TABLE 2. Estimation Results of lending function.**

Dependent variable: Growth rate of outstanding loan	
Variable	Coefficient (S.E.)
Operating profit	0.0061 (0.0020) ***
Debt-asset ratio	-0.0762 (0.0129) ***
(Debt-asset ratio) <sup>2</sup>	0.0136 (0.0044) ***
Special loss	-0.0580 (0.0284) **
Regulatory capital adequacy ratio	0.0087 (0.0047) *
Ratios of NPLs	0.0022 (0.0007) ***
Dummy for Bank default	-0.0175 (0.0180)
The number of banks	0.0003 (0.0008)
Dummy for Major trading partners' default	-0.0769 (0.0360) **
Dummy for No "main" bank	0.0098 (0.0126)
Dummy for Write-off loans	-0.1534 (0.0923) *
Industry dummies:	
Agriculture	0.0352 (0.0241)
Mining	-0.0675 (0.0427)
Construction	-0.0247 (0.0058) ***
Wholesale-retail	-0.0016 (0.0046)
Real estate	-0.0292 (0.0102) ***
Transportation & communication	0.0066 (0.0082)
Service	-0.0187 (0.0080) **
Constant	0.0475 (0.0089) ***
Firms	3,644
Observations	19,870

Standard errors are provided in parentheses.

Each of \*, \*\*, \*\*\* denotes statistical significance at the 10%, 5%, 1% level respectively.

**TABLE 3. Estimation Results of lending function (sub-sample periods).**

Dependent variable: Growth rate of outstanding loan			
Period:	(a) 1997-1998	(b) 1999-2000	(c) 2001-2002
Variable	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)
Operating profit	0.0061 (0.0035) *	0.0046 (0.0035)	0.0073 (0.0029) **
Debt-asset ratio	-0.1609 (0.0290) ***	-0.0410 (0.0217) *	-0.0323 (0.0212)
(Debt-asset ratio) <sup>2</sup>	0.0518 (0.0163) ***	0.0122 (0.0065) *	0.0017 (0.0045)
Special loss	-0.0562 (0.0466)	-0.0945 (0.0611)	-0.0526 (0.0339)
Regulatory capital adequacy ratio	-0.0005 (0.0086)	0.0230 (0.0086) ***	0.0055 (0.0074)
Ratios of NPLs	0.0018 (0.0010) *	0.0031 (0.0015) **	0.0019 (0.0014)
Dummy for Bank default	-0.0090 (0.0242)	-0.0340 (0.0234)	-0.0698 (0.0208) ***
The number of banks	0.0009 (0.0012)	-0.0012 (0.0013)	0.0009 (0.0014)
Dummy for Major trading partners' default	0.0075 (0.0531)	0.0194 (0.0366)	-0.1225 (0.0485) **
Dummy for No "main" bank	0.0126 (0.0171)	0.0305 (0.0246)	-0.0335 (0.0285)
Dummy for Write-off loans	0.0609 (0.0140) ***	-0.2595 (0.0577) ***	
Industry dummies:			
Agriculture	0.0415 (0.0549)	0.0033 (0.0134)	0.0597 (0.0140) ***
Mining	-0.0180 (0.0574)	-0.0439 (0.0320)	-0.1553 (0.0637) **
Construction	-0.0360 (0.0090) ***	-0.0247 (0.0101) **	-0.0080 (0.0112)
Wholesale-retail	-0.0163 (0.0071) **	0.0159 (0.0081) **	0.0023 (0.0084)
Real estate	-0.0402 (0.0127) ***	-0.0286 (0.0202)	-0.0148 (0.0162)
Transportation & communication	-0.0013 (0.0131)	0.0177 (0.0130)	0.0054 (0.0137)
Service	-0.0234 (0.0124) *	-0.0284 (0.0125) **	-0.0013 (0.0135)
Constant	0.0740 (0.0136) ***	-0.0267 (0.0153) *	-0.0326 (0.0145) **
Firms	3,400	3,404	3,342
Observations	6,643	6,681	6,546

Standard errors are provided in parentheses.

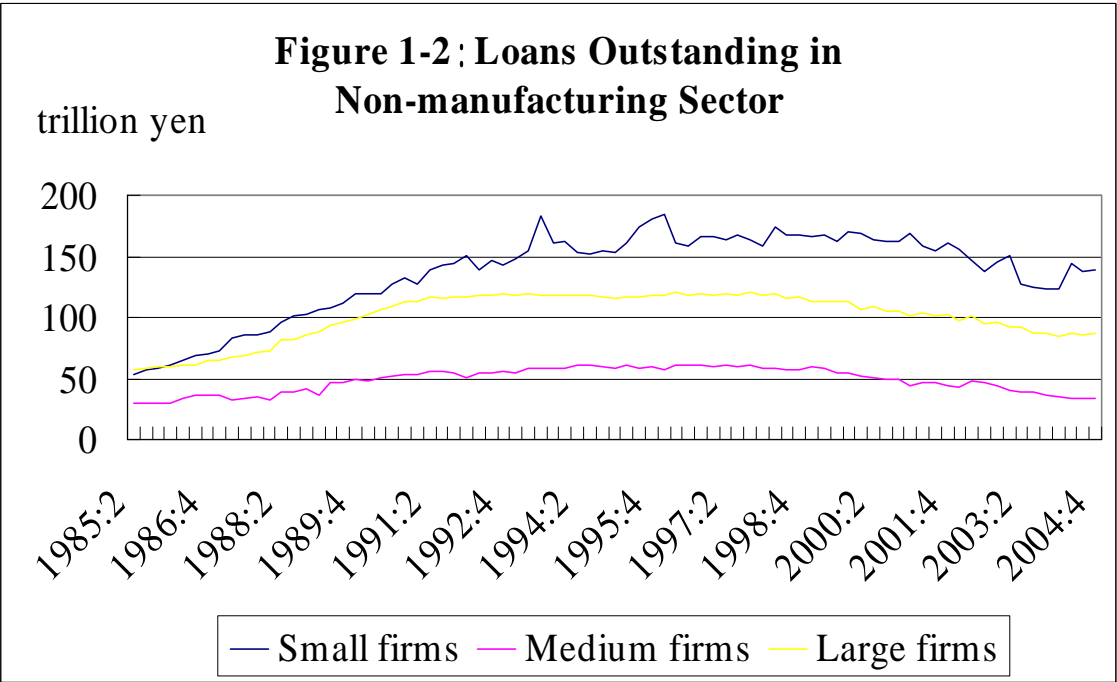
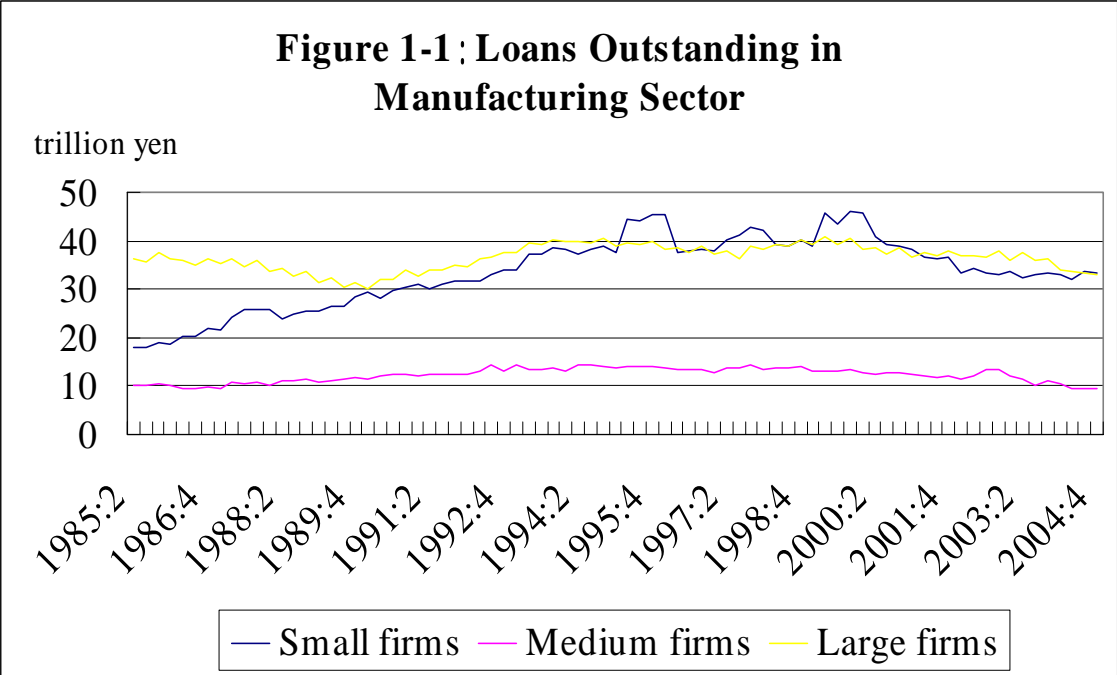
Each of \*, \*\*, \*\*\* denotes statistical significance at the 10%, 5%, 1% level respectively.

**TABLE 4. Estimation Results of lending function (manufacturing and non-manufacturing industries).**

Dependent variable: Growth rate of outstanding loan			
Industries:	Manufacturing	Non-manufacturing	Construction, real estate & wholesale-retail
Variable	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)
Operating profit	0.0125 (0.0054) **	0.0055 (0.0021) **	0.0060 (0.0022) ***
Debt-asset ratio	-0.1279 (0.0390) ***	-0.0666 (0.0159) ***	-0.0926 (0.0196) ***
(Debt-asset ratio) <sup>2</sup>	0.0584 (0.0272) **	0.0113 (0.0045) **	0.0145 (0.0045) ***
Special loss	-0.0677 (0.0702)	-0.0552 (0.0298) *	-0.0457 (0.0272) *
Regulatory capital adequacy ratio	0.0041 (0.0073)	0.0109 (0.0061) *	0.0112 (0.0068)
Ratios of NPLs	0.0011 (0.0014)	0.0025 (0.0008) ***	0.0023 (0.0009) **
Dummy for Bank default	0.0237 (0.0432)	-0.0289 (0.0182)	-0.0328 (0.0209)
The number of banks	-0.0009 (0.0014)	0.0009 (0.0010)	0.0017 (0.0011)
Dummy for Major trading partners' default	-0.0411 (0.0524)	-0.0910 (0.0456) **	-0.0960 (0.0565) *
Dummy for No "main" bank	0.0190 (0.0265)	0.0104 (0.0144)	0.0340 (0.0176) *
Dummy for Write-off loans		-0.1541 (0.0965)	-0.1493 (0.0957)
Industry dummies:			
Mining		-0.1014 (0.0487) **	
Construction		-0.0578 (0.0252) **	
Wholesale-retail		-0.0347 (0.0250)	0.0228 (0.0061) ***
Real estate		-0.0634 (0.0266) **	-0.0027 (0.0115)
Transportation & communication		-0.0282 (0.0259)	
Service		-0.0520 (0.0258) **	
Constant	0.0515 (0.0157) ***	0.0825 (0.0270) ***	0.0279 (0.0131) **
Firms	1,309	2,355	1,838
Observations	7,319	12,551	9,879

Standard errors are provided in parentheses.

Each of \*, \*\*, \*\*\* denotes statistical significance at the 10%, 5%, 1% level respectively.



Sources) *Financial Statements Statistics of Corporations by Industry* published by the Ministry of Finance.