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Forbearance Lending: A Case for Japanese Firms*

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Abstract

After the collapse of the asset price bubble, Japanese banks are said to have been reluctant to write off bad loans, even in cases where there is little prospect of borrower firms being able to repay the loans extended. This phenomenon is known as *forbearance lending*. We illustrate this using a simple model in which a bank is shown to have an incentive to engage in forbearance lending to a borrower firm whose debt-asset ratio exceeds a certain threshold as its liquidation value (or net worth) is eroded. Then, using corporate panel data, we test for non-linearity between loans and debt-asset ratios: i.e. whether loans were apt to increase to a firm whose debt-asset ratio was above a certain level. It is found that, after the bubble burst, this non-linearity became evident for non-manufacturing firms, especially those in the construction and real estate industries. Furthermore, an increase in loans to highly indebted firms in these industries is found to lower their profitability. These findings are consistent with the view that forbearance lending certainly took place in Japan, and that it suppressed the profitability of inefficient non-manufacturing firms.

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Keywords: forbearance lending, non-performing loan, dynamic GMM

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1 Introduction

This paper investigates under what conditions banks have an incentive to engage in forbearance lending; tests whether forbearance lending took place in Japan; and examines what effects it had on firm profitability.

Along with credit crunch issues, forbearance lending is often referred to as a phenomenon associated with the non-performing loan problems in Japan (see Corbett (1999), Kobayashi and Kato (2001), and Sekine, Tanemura, and Saita (2001)). For instance, Hoshi (2000) points out that even after the bursting of the bubble, bank loans to the real estate industry continued to swell until 1997, while those to the manufacturing industry declined significantly. He infers that the increase in loans to the real estate industry, whose profitability was severely hampered by the burst of the bubble, stemmed mainly from forbearance lending, and did not induce new investment. However, with the exception of Peek and Rosengren (1999) and Tsuru (2001), there have been very few empirical studies of this issue. As a result, little is known about the extent to which Japanese banks have engaged in forbearance lending, and what effects this might have had on real activities. This paper is an attempt to fill this gap in the literature using corporate panel data.[1]

Although there is no single definition of forbearance lending used universally among researchers, banks are said to engage in forbearance lending if they refinance all or part of loans (or even increase loans) to a borrower firm, even though they regard that firm as unlikely to be able to repay the outstanding loans. This definition, however, encounters several difficulties, both theoretical and empirical.

- On the theoretical side, the question may arise why banks should *rationally* choose such an action instead of simply writing off bad loans. In this regard, we rely on the soft-budget-constraint model of Berglöf and Roland (1997), in which a fall in the liquidation values of firms, caused by a decline in asset prices, prompts banks to engage in forbearance lending to non-profitable firms. The model was originally developed to account for the lack of financial discipline observed in former communist countries, such as the lax financing enjoyed by inefficient firms courtesy of state-owned banks. The model has also been applied to formerly state-owned banks in transition economies. However it appears particularly well-suited to several aspects of Japanese banks' current situation.

  Inspired by the Berglöf-Roland model, we construct a simple model which serves as a basis for the following empirical analysis. In general, a bank is expected to decrease its lending to a firm in response to a rise in the firm's debt-asset ratio, because the higher debt-asset ratio is likely to reflect a greater risk of bankruptcy. When the debt-asset ratio rises beyond a certain level, however, banks may engage

[1] Just before we completed this paper, we found Sugihara and Fueda (2002), who analyze forbearance lending using micro panel data of banks and firms. Although their sample and estimation procedure differ from ours, they derive a very similar result: forbearance lending was evident in the construction and real estate industries.

in forbearance lending. This is because the borrower firm's liquidation value (or net worth) is eroded as the debt-asset ratio increases.

- On the empirical side, a difficulty arises in that we cannot see, from observed data, whether banks had deemed borrower firms unable to repay the outstanding loans when they decided to roll them over. This difficulty determines our choice of the following strategy in testing for the existence of forbearance lending. First, by estimating a loan supply function, we examine whether the relationship between the borrower firm's debt-asset ratio and its outstanding loans is consistent with the prediction of the above theoretical model. If forbearance lending took place, the relationship should be non-linear: i.e. loans tend to increase to firms whose debt-asset ratios were above a certain level. Then, we examine the relationship between firms' debt-asset ratios and their returns on assets (ROA) to see whether, for a given increase in lending, the ROA tends to be lower for firms with heavier debt burdens. If these relationships are observed, we may conclude that banks continued to provide loans to firms with high debt-asset ratios, even though such borrower firms are less likely to be able to repay the loans, not only because they are at greater risk of bankruptcy, but also because their profitability tends to be lower.

  Although we can show that some firms were less likely to repay their loans, we cannot claim that banks had expected this ex ante. In other words, the above strategy tests a necessary but not a sufficient condition for forbearance lending. Indeed, some banks may have extended additional loans to a heavily indebted firm with the expectation that the loans would be repaid; they may claim that lower profitability, ex post, was due to an unexpected deterioration in macroeconomic conditions. However, even if we control for macroeconomic conditions, such as business cycles, it is found that additional loans to heavily indebted firms in the non-manufacturing sector, especially in the construction and real estate industries, tend to squeeze their ROA. As it is hard to imagine that banks had been unaware of this relationship for nearly a decade, we may reasonably claim that banks *knew* that additional loans to these firms were less likely to be repaid and thus that the additional lending can be deemed forbearance lending.

Forbearance lending adversely affects the economy by bailing out inefficient firms producing poor returns. Moreover, as the Berglöf-Roland model shows, not only do inefficient firms survive, but they also tend to lower their levels of effort since they anticipate that banks will bail them out: a moral-hazard problem. Furthermore, Kobayashi and Kato (2001) point out a risk of 'disorganization' in a sense of Blanchard and Kremer (1997): a bank with increased exposure would effectively control a borrower firm as if it were a dominant shareholder. As a 'dominant shareholder,' the bank might be tempted to intervene in the firm's investment decisions hindering the construction of firm specific business relationships. As a result, in Japan, forbearance lending is supposed to have spawned economic inefficiency at the expense of social welfare.

The rest of the paper is organized as follows: Section 2 introduces the model developed by Berglöf and Roland (1997), following a brief review of theoretical models which explain why forbearance lending takes place. It then derives a loan supply function which incorporates the possibility of forbearance lending. Section 3 examines the above relationship by estimating a loan supply function from Japanese corporate panel data. Section 4 turns to an investigation of the relationship between bank loans, firms' debt-asset ratios and their levels of profitability. Section 5 concludes the paper by discussing possible extensions of the research and policy implications. Appendix 1 examines interest payments at the time of forbearance lending, which is followed by Data Appendix (Appendix 2).

2 Theoretical Models

There are several models which try to reveal why or under what conditions banks have an incentive to engage in forbearance lending. For example, Kobayashi and Kato (2001) argue that a change in a bank's risk preferences renders it softer in providing additional loans. A bank becomes risk-loving once it increases its exposure to a firm and begins to control that firm as if it were a dominant shareholder.[2] Sakuragawa (2001) develops a model in which a bank, under an opaque accounting system, has an incentive to disguise its true balance-sheet so as to satisfy the BIS minimum capital requirement. In this case, a bank tries to put off disposal of non-performing loans in order to avoid decreasing its own capital in an accounting sense. Baba (2001), using real option theory, shows that uncertainties associated with the write-off of non-performing loans—the reinvestment return from freeing up funds by write-off, the liquidation loss and the possible implementation of a government subsidy scheme, etc.—induce a bank to delay writing off non-performing loans; in other words, uncertainties increase the option value of the wait-and-see strategy (including forbearance lending) compared with making aggressive write-offs.

All of these models may lend themselves well to explain why banks have an incentive to engage in forbearance lending—they are not mutually inconsistent with each other—and we will test for these hypotheses later. In this section, however, in order to derive a loan supply function, we start by introducing the soft-budget-constraint model developed by Berglöf and Roland (1997), which examines the effects of a decrease in asset prices and in a firm's liquidation value.

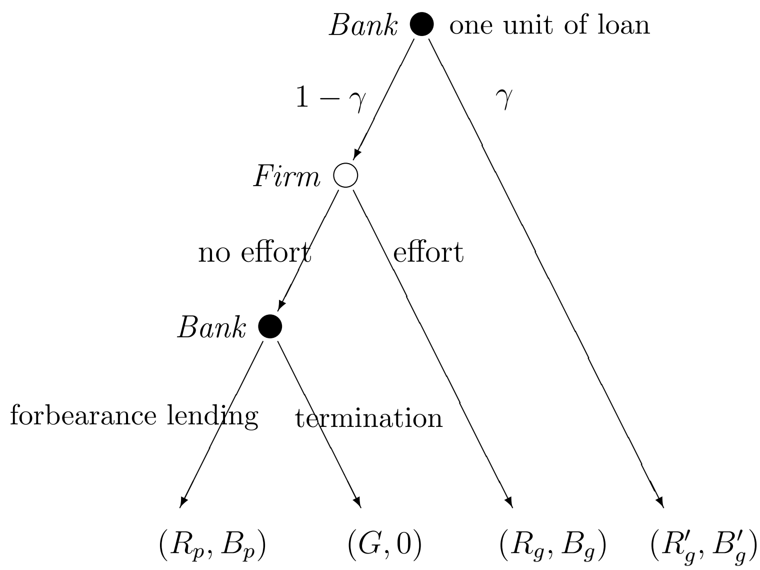
2.1 A Game of Forbearance Lending

Berglöf and Roland (1997) consider a game between a bank and a firm based on the following assumptions (Figure 1):

- The firm obtains one unit of bank lending to finance an investment project. The

[2] This is based on the following well-known argument from the corporate finance literature: if we assume that payoffs of a shareholder and a creditor depend on corporate profits respectively, a payoff function of the former becomes convex, while that of the latter becomes concave. Consequently, the former behaves as a risk lover, while the latter behaves as a risk avertor.

Figure 1: A Game of Forbearance Lending



Note: The first variables in parentheses are returns to the bank and the second variables are those to the firm.

loan contract and the project last for two periods. We assume both the bank and the firm are risk neutral and maximize expected returns.

- There are two types of firms. A proportion γ of firms are 'good', with high productivity and profitable projects, yielding returns (R'_g, B'_g)[3]. The rest are 'poor' due to low productivity. Poor firms have two types of projects: one yielding a high return (g) and the other yielding a low return (p). We assume $R'_g > R_p$ and $R_g > R_p$. For poor firms, additional efforts are required to engage in a project which yields a high return. Because making these efforts is costly for poor firms, net return from the low-yield project exceeds that of the high-yield project: $B_p > B_g$ where B_p and B_g are the nonverifiable, nontaxable, nontransferable private benefits accruing to poor firms from the low- and the high-yield projects, respectively. For this reason, poor firms prefer to undertake the low-yield project in order to avoid exerting additional efforts, which may lead to a moral hazard problem.

- We assume that neither the firm nor the bank can know, ex ante, whether the firm will turn out to be good or poor, since this depends on macroeconomic conditions. Furthermore, because of "asymmetric information," the bank is unable to find out whether or not the firm has chosen the high-yield project, until at least one period

[3]Hereafter, in this game, the first variable in parentheses represents returns to a bank, while the second represents those to a firm.

has elapsed.[4]

Suppose that, a period later, an unhappy bank discovers that the borrower firm is 'poor' and making no extra effort. The bank has to decide whether (i) to make an additional unit of 'forbearance loans' to the firm or (ii) to terminate loans to the firm and search for a new borrower. The net return accruing to the bank in the former case is $R_p - 1$ (where '-1' describes the additional unit of lending). The net return in the latter case is the sum of the liquidation value of the poor firm, G, and expected return from a new borrower, $\gamma(R'_g - 1) + (1-\gamma)(R_p - 2)$.[5] The point is that when the firm's liquidation value decreases, say, because of a considerable fall in land prices, the return from termination becomes lower than that from forbearance lending. Under such a circumstance, the poor firm chooses 'no effort' and the bank chooses 'forbearance lending.'

More generally, the above condition,

$$R'_g - R_p < \frac{1 - \gamma - G}{\gamma}, \tag{1}$$

is more likely to hold in cases where: land prices, G, are lower; either the difference between the returns from good and poor firms, $R'_g - R_p$, or the share of good firms, γ, is smaller. As long as condition (1) holds, it is optimal for the bank to engage in forbearance lending, even if the bank knows that the poor firm is not making additional effort—as in Dewatripont and Maskin (1995), the existence of sunk costs in existing loans may give rise to forbearance lending. Meanwhile, the poor firm continues to choose no effort since it expects the bank to refinance it even if it is discovered to be poor. Thus, (R_p, B_p) turns out to be the equilibrium of the game in the case of the poor firm.

Consider the case where condition (1) does not hold, say, because the fall in land prices is not large enough. Since the firm expects that it will be liquidated if it exerts no effort, it chooses to make the requisite 'efforts.' In this case, (R_g, B_g) in Figure 1 will be the equilibrium when the firm turns out to be poor. However, if condition (1) holds because of a large fall in land prices, the economy remains at (R_p, B_p), where 'forbearance lending' and 'continuation of the low-yield project' are optimally chosen. As a result, the economy is stuck with low productivity and low profitability due to misallocation of credit.

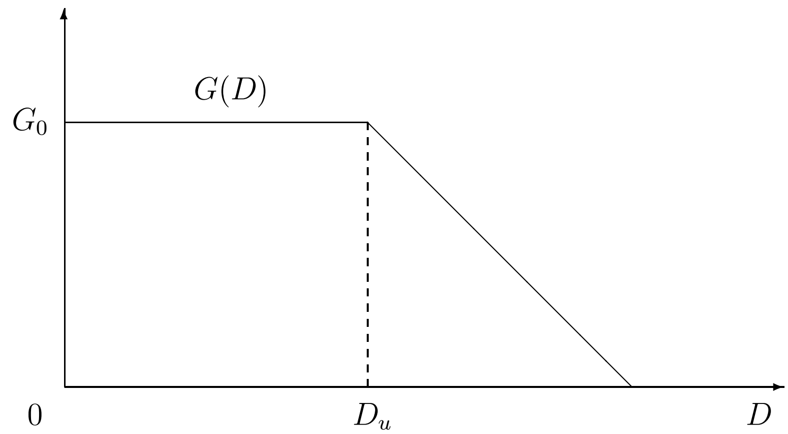
2.2 Loan Supply Function

In this section, we derive a loan supply function allowing for the possibility that banks engage in forbearance lending. The model is simple but shares some important features with the Berglöf-Roland model. It serves as a basis for the following empirical analysis.

[4]This assumption might seem at odds with the belief that the Japanese main bank system has overcome the asymmetric information problem. We simply assume that monitoring by main banks is not thus perfect.

[5]We assume that if the new borrower is poor and taking the low-yield project, the bank has no choice other than to make an additional unit of lending, which yields only R_p. This assumption is justified, even if we generalize the model into a repeated game. See Berglöf and Roland (1997) for further discussion.

Figure 2: Liquidation Value



In general, a bank is supposed to decrease its lending to a firm with a high debt-asset ratio, because of the higher risk of the firm's bankruptcy. However, in the above discussion we saw how a higher debt-asset ratio may induce the bank to engage in forbearance lending. This is because the borrower firm's liquidation value (or net worth) is eroded as its debt-asset ratio increases—a higher debt-asset ratio implies a decline in the capital adequacy ratio, which is proportional to the liquidation value per unit of asset.

In short, we would expect the loan supply to be negatively related with the debt-asset ratio under normal circumstances, but that this correlation diminishes or even that the loan supply increases when the debt-asset ratio exceeds a certain level.

Consider the bank's profit-maximization problem given the loan interest rate (or the loan-deposit interest rate spread). Let $C(L)$ be the costs incurred by the bank in order to make loan L. These costs include both the maintenance costs of lending which arise from asymmetric information and also the liquidity costs of repaying depositors, and we assume that $C'(L) > 0$ and $C''(L) > 0$. Let $p(L, D)$ denote the probability that a borrower defaults. The debt-asset ratio D is defined as the outstanding loan divided by the market-value of asset at the beginning of the present period or the end of the previous period; hence D is taken as given by the bank when it decides L in the current period. Larger L decreases the borrower's default risk, because the likelihood of its facing liquidity shortage declines: $p_L(L, D) < 0$. As the firm's debt asset ratio D rises, however, the default risk increases since the heavily indebted firm tends to be inefficient and its capital adequacy ratio $(1 - D)$ decreases: $p_D(L, D) > 0$.

When the firm goes bankrupt, the bank obtains the firm's liquidation value G, which we suppose to be a function of the debt-asset ratio D: i.e. $G = G(D)$. Forms of the function $G(D)$ differ across firms. For instance, if the borrower has a new and expanding business, the firm may increase D in order to introduce new production facilities which will raise its productivity. In this case, $G(D)$ is expected to be an increasing function of D. On the contrary, if the borrower has a more 'mature' business, the higher debt-asset ratio D may indicate that it has not met its debts on schedule because of its inefficiency. In this case, $G(D)$ becomes a decreasing function of D. Hence, whether the liquidation value is an increasing or a decreasing function of D depends on the nature of the firm's business. Here, we express $G(D)$ as the average liquidation value of all firms:[6]

$$G(D) = G_0 + n(D) - e(D), \tag{2}$$

where $n(D)$ represents the effect of the new and expanding business, and $e(D)$ that of the established mature business. Assuming diminishing return to capital, we express $n(D) = aD^\alpha$ where $0 < \alpha < 1$. On the other hand, inefficiency is assumed to be proportional to D: $e(D) = bD$. Then, equation (2) becomes

$$G(D) = G_0 + aD^\alpha - bD,$$

where $G(D)$ is increasing for small D, but decreasing for large D. To ease the following calculation, we assume that when D is smaller than a certain level D_u ($D < D_u$), $G(D)$ is constant irrespective of D; but when D is larger than D_u, $G(D)$ is decreasing in D (Figure 2). Thus,

$$G(D) = \max\{G_0 - G_1 \max\{D - D_u, 0\}, 0\}. \tag{3}$$

Under this condition, the bank maximizes its profit $\pi(L)$:

$$\max_L \pi(L) = (1 - p(L, D))(1 + r)L + p(L, D)G(D) - C(L).$$

The first-order condition for the bank's optimization problem is

$$(1 + r)(1 - p(L, D) - Lp_L(L, D)) + p_L(L, D)G(D) - C'(L) = 0. \tag{4}$$

For simplicity, we assume $p(L, D) = p_0 + p_1 D - p_2 L$ and $C(L) = C_0 + C_1 L + \frac{1}{2}C_2 L^2$. Substituting into equation (4), we get

$$L^* = \frac{1 - p_0 - p_1 D}{C_2 - 2(1 + r)p_2}(1 + r) - \frac{p_2}{C_2 - 2(1 + r)p_2}G(D) - \frac{C_1}{C_2 - 2(1 + r)p_2}. \tag{5}$$

Optimal L^* depends upon D as follows:

- When $D < D_u$, $G(D) = G_0$ from equation (3). Then equation (5) becomes

[6] To derive our loan supply function, we add up the firms' liquidation values $G(D)$ and then solve the bank's optimization problem. We are also able to obtain it by solving the bank's optimization problem for each firm and then adding up loan supplies with respect to the level of D. Since both ways produce qualitatively the same loan supply function, we use the former one for the sake of expository simplicity.

$$L^* = \frac{1 - p_0 - p_1 D}{C_2 - 2(1+r)p_2}(1+r) - \frac{C_1 + p_2 G_0}{C_2 - 2(1+r)p_2}. \quad (6)$$

At the limit when $D = 0$, $L^* = \frac{(1-p_0)(1+r) - C_1 - p_2 G_0}{C_2 - 2(1+r)p_2}$. In order to claim this is a loan supply function, L should be positive when $D = 0$ and be an increasing function of r. Therefore, taking $C_1 + p_2 G_0$ to be relatively small, we assume

$$C_2 - 2p_2(1+r) > 0,$$

to hold. Given these conditions, from equation (6), optimal loans L^* are decreasing in D.

- When $D > D_u$, $G(D) = G_0 - G_1(D - D_u)$ from equation (3). In this case, equation (5) gives us

$$L^* = \frac{1}{C_2 - 2(1+r)p_2}[(1 - p_0 - p_1 D)(1+r) + p_2\{G_1(D - D_u) - G_0\} - C_1]. \quad (7)$$

  Provided that $p_2 G_1 - p_1(1+r) > 0$, optimal loans $L^*(D)$ are increasing in D.

  This can be explained as follows: in this model, with a unit increase in D, the default risk rises by p_1 and the firm's liquidation value decreases by G_1. On the other hand, ceteris paribus, provision of one unit of loans yields the return $(1+r)$ as well as decreasing the default risk by p_2. When the bank makes a financing decision, suppose a borrower firm's D happens to be a unit larger than before:

  - an additional unit of loans increases the bank's expected profit by $p_2 G_1$ through a reduction in the likelihood of a decline in the liquidation value; meanwhile,
  - an additional unit of loans reduces the bank's expected profit by $p_1(1+r)$ through a rise in the opportunity cost of the firm's bankruptcy.

  If the net change in expected profit is positive—which it will be if the condition $p_2 G_1 > p_1(1+r)$ holds—then the bank has an incentive to increase lending to the firm.

  This shows that the bank has an incentive to increase its exposure toward a firm whose liquidation value is eroded along with a higher D. Thus, this model is consistent with the outcome of the Berglöf-Roland model in that the lower liquidation value of the firm increases the probability that the bank will refinance it.[7]

[7] When D is sufficiently large, $G(D) = 0$. In this case, the first-order condition is

$$L^* = \frac{1 - p_0 - p_1 D}{C_2 - 2(1+r)p_2}(1+r) - \frac{C_1}{C_2 - 2(1+r)p_2},$$

where optimal loans $L^*(D)$ turn out to be decreasing in D again. However, we suspect that the bank would not make additional loan available to a firm whose liquidation value had dropped to nil.

In sum, when D is small, optimal loans $L^*(D)$ are decreasing in D; but as D rises beyond a certain threshold D_u, it is conceivable that $L^*(D)$ is increasing in D as the bank tries to avert the firm's bankruptcy. To be precise, whether $L^*(D)$ is increasing/decreasing in D depends on the sign of $p_2G_1 - p_1(1+r)$; however, even if it remains a decreasing function, the negative sensitivity becomes smaller by $p_2G_1/(C_2 - 2p_2(1+r))$ in equation (7). In other words, if forbearance lending takes place, the loan supply function is expected to be non-linear with respect to the debt-asset ratio.

3 Empirical Analysis

3.1 Data

For the remaining analyses, we exploit corporate finance data from the Corporate Finance Data Set compiled by the Development Bank of Japan, which includes balance sheets and income statements for Japanese non-financial firms listed in the first and second sections of the Tokyo, Osaka and Nagoya stock exchanges or in the over-the-counter market. The database contains both consolidated and unconsolidated data. We choose the unconsolidated data, which contains more detailed time series data than the consolidated data.

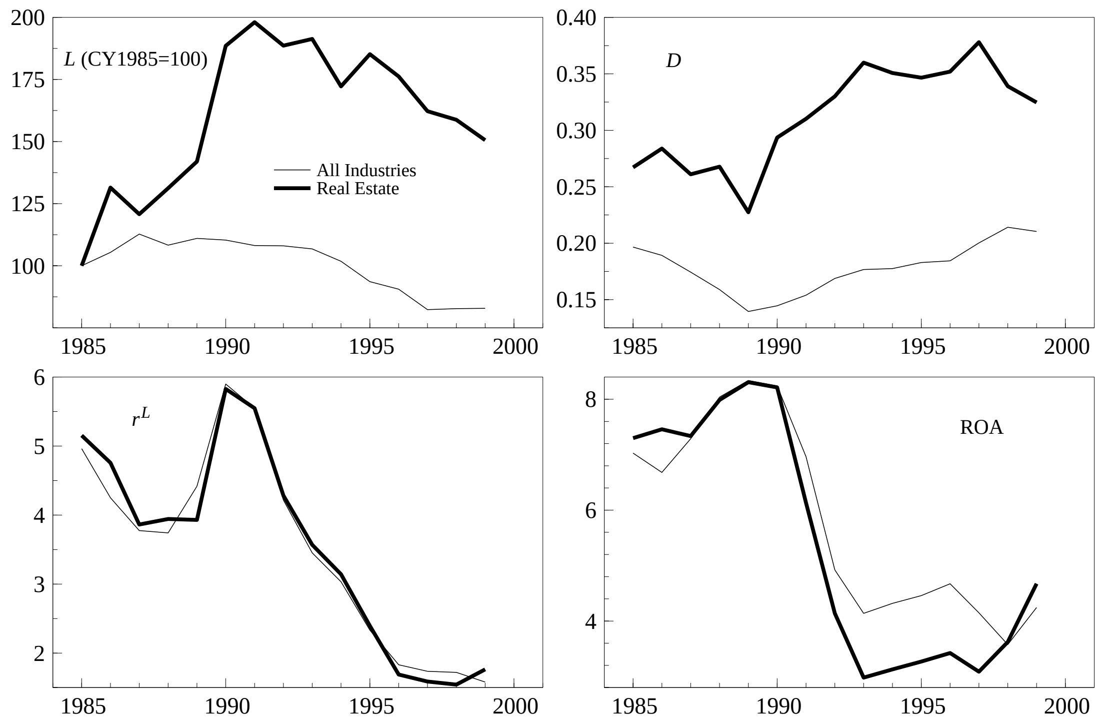
First, we check whether or not our samples in the real estate industry reveal features similar to those described in Hoshi (2000). Figure 3 uses major financial indicators to compare the real estate industry with all industries. Around 1990, outstanding loans L to the real estate industry swelled to a level more than twice as high as before the bubble period, and remained very high throughout the 1990s (upper left panel).[8] The debt-asset ratio[9] D soared in the 1990s for the real estate industry, the market-value of whose assets plunged due to a fall in land prices (upper right panel). As for the lending interest rate r^L, there were no significant differences between the real estate industry and all industries (bottom left panel). ROA for the real estate industry was lower than that for all industries after the bubble burst (bottom right panel). In short, even after the bursting of the bubble, banks continued to provide loans to the real estate industry at interest rates which did not reflect the firms' credit risks. This finding seems to suggest that banks engaged in forbearance lending as Hoshi (2000) discusses.

The following sample selection rules are applied to all the records from FY1970 to FY1999: (i) to exclude firms in the electricity industry, which are quasi-public enterprise

[8]In our sample, outstanding loans to the real estate industry reached their peak in 1991 whereas broader statistics such as "Loans and Discounts Outstanding by Sector," (*Financial and Economic Statistics,* Bank of Japan) peaked out in 1997. This may be due to our sample containing mainly large companies, which have alternative financial channels to bank lending.

[9]The debt-asset ratio is calculated as outstanding bank loans divided by total assets, of which (i) inventory; (ii) land; (iii) machinery and (iv) non-residential buildings and structures are adjusted to their market values by perpetual inventory methods, so that we can take account of a fall in asset prices. See the Data Appendix for more details.

Figure 3: Loans Outstanding to the Real Estate Industry



in nature; (ii) to select firms which continuously borrowed both short- and long-term loans over the period FY1984-FY1999;[10] and (iii) to exclude outliers which are defined as firms whose interest rates belong to the upper 1 percentile, or whose ROAs belong to the upper or the lower 0.5 percentiles. These sample selection rules leave 580 firms—384 manufacturing firms and 196 non-manufacturing firms—and hereafter, unless otherwise noted, our analyses are based on these firms.

Table 1 (1) and (2) summarize sample properties and sample correlations among variables used for the following analyses. As evident in the statistics for means, non-manufacturing firms have lower ROAs and higher debt-asset ratios D than manufacturing firms—an observation which is thought to reflect the influence of the real estate industry. Loans L and capital stock K are larger for non-manufacturing firms on average. The debt-asset ratio and ROA are highly correlated with other financial indicators frequently used for credit ratings (Table 1 (3)).[11] Therefore, we may use these variables as proxy measures of safety and profitability in the credit ratings analysis.

Turning to the distribution of firms' debt-asset ratios, we observe how the proportion of heavily indebted firms increased after the bubble burst (Figure 4). The mean (median)

[10] Admittedly, this may cause survival biases in our analyses. Presumably, it may favor the discovery of forbearance lending, as excluded bankrupt firms may be assumed not to have received forbearance lending.

[11] For the recent usage of credit ratings in Japanese banks, see Bank of Japan (2001b).

Table 1: Sample Properties

(1) Sample Properties

	Mean			Std. Dev.		
	All industries	Manufacturing	Nonmanufacturing	All industries	Manufacturing	Nonmanufacturing
r^L	3.65	3.53	3.90	1.90	1.89	1.90
D	0.19	0.17	0.23	0.12	0.10	0.14
ROA	5.16	5.19	5.08	3.27	3.50	2.77
$\ln L$	16.73	16.40	17.39	1.61	1.50	1.62
$\ln K$	18.07	17.88	18.43	1.49	1.49	1.41

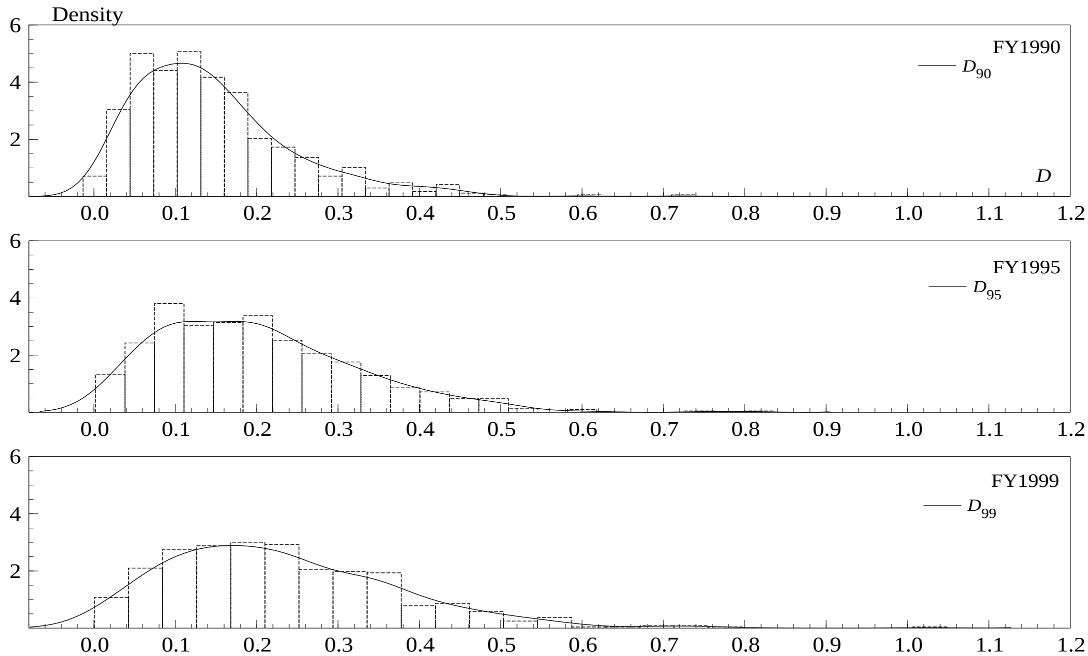
(2) Correlation coefficients

	r^L	D	ROA	$\ln L$	$\ln K$
r^L	1.00				
D	0.02	1.00			
ROA	0.37	-0.29	1.00		
$\ln L$	0.18	0.39	-0.12	1.00	
$\ln K$	0.20	-0.08	0.03	0.85	1.00

(3) Correlations with other financial indicators

	D	ROA
Capital adequacy ratio	-0.58	0.19
Liquidity ratio	-0.37	0.16
Business profits to sales ratio	-0.12	0.61
Operating profits to revenue ratio	-0.32	0.74
Operating profits to capital ratio	-0.12	0.40
Interest coverage ratio	-0.34	0.38

Figure 4: Histograms of Debt-Asset Ratio D



Note: Lines in each panel are densities estimated by Gaussian Kernels (See Doornik and Hendry (2001) for details.)

of the debt-asset ratio increased from 0.15 (0.13) in FY1990 to 0.23 (0.21) in FY1999. Its standard deviation also increased from 0.097 in FY1990 to 0.141 in FY1999. Thus not only did the mean of the distribution shift to the right, but its tail also spread wider. The non-performing loan problem for banks and the debt-overhang problem for firms are different sides of the same coin. The change in the distribution indicates that Japanese firms suffered from increasingly serious debt-overhang problem in that not only did average firms face higher debt-asset ratios, but also firms with high debt-asset ratio ended up with more severe debt-overhangs.

3.2 Estimated Equation

To investigate whether banks engaged in forbearance lending, we estimate a loan supply function for firm i at time t as follows:[12]

$$L^s_{it} = \alpha_0 L_{i,t-1} + \alpha_1 r_{it} + \alpha_2 D_{i,t-1} + \alpha_3 D^2_{i,t-1} + \alpha_4 ROA_{i,t-1} + \alpha_5 + \varepsilon_{it}, \tag{8}$$

[12]Equation (8) ignores heterogeneity among banks providing loans to a firm i. We try to incorporate it later in Section 3.3.3 where, despite severe data limitations, we estimate loan supply functions for each individual bank.

where r_{it} is the loan-deposit interest rate spread $(r_{it}^L - r_t^M)$ and we expect to observe $\alpha_1 > 0$. D_{it} and ROA_{it} are supposed to capture the individual firm's safety and profitability respectively, and the expected signs are $\alpha_2 < 0$ and $\alpha_4 > 0$. If banks engaged in forbearance lending, we would expect to see $\alpha_2 < 0$ and $\alpha_3 > 0$. That is, when D is small, banks squeeze loans as D increases. However, as discussed in Section 2, when D exceeds a certain level, banks squeeze loans less hard (or even increase loans, if D is sufficiently large) owing to forbearance lending.[13] ε_{it} are the estimated residuals of the supply function.

Turning to the demand side, we assume that loan demand takes the following form:

$$L_{it}^d = \beta_0 L_{i,t-1} + \beta_1 r_{it}^L + \beta_2 K_{it} + \beta_3 + u_{it}, \tag{9}$$

where u_{it} are the estimated residuals of the demand function. Expected signs are $\beta_1 < 0$ and $\beta_2 > 0$.

We further assume that the loan market is in equilibrium.[14]

$$L_{it} = L_{it}^s = L_{it}^d, \tag{10}$$

Solving equations (8)-(10) with respect to r^L, we have

$$\begin{aligned} r_{it}^L \;=\; & \frac{\alpha_0 - \beta_0}{\beta_1 - \alpha_1} L_{i,t-1} + \frac{\alpha_1}{\beta_1 - \alpha_1} r_t^M + \frac{\alpha_2}{\beta_1 - \alpha_1} D_{i,t-1} + \frac{\alpha_3}{\beta_1 - \alpha_1} D_{i,t-1}^2 + \frac{\alpha_4}{\beta_1 - \alpha_1} ROA_{i,t-1} \\ & - \frac{\beta_2}{\beta_1 - \alpha_1} K_{it} + \frac{\alpha_5 - \beta_3}{\beta_1 - \alpha_1} + \frac{1}{\beta_1 - \alpha_1} \varepsilon_{it} - \frac{1}{\beta_1 - \alpha_1} u_{it}. \end{aligned} \tag{11}$$

From the expected signs of the parameters, $\alpha_2/(\beta_1 - \alpha_1) > 0$ and $\alpha_3/(\beta_1 - \alpha_1) < 0$. The loan interest rate starts to decline once the debt-asset ratio exceeds a certain level. That is, in the case of forbearance lending, the bank has an incentive to give the firm a discount on its interest payments as well.

A number of issues arise in estimating equation (8). First of all, we need to take into account possible biases associated with individual effects, usually considered to be contained in the estimated residuals ε_{it}. In general, ε_{it} can be expressed as

$$\varepsilon_{it} = \eta_i + d_t + \nu_{it},$$

where η_i are individual effects, d_t are time specific effects and ν_{it} are idiosyncratic shocks. If η_i and the variables on the right-hand-side are correlated, estimators are biased. In

[13] $\partial L/\partial D = \alpha_2 + 2\alpha_3 D$. An increase in D raises the firm's outstanding loans, once D exceeds $-\frac{\alpha_2}{2\alpha_3}$.

[14] Ito (1985) and Baba (1996) assume that the loan market is in disequilibrium. In this case, the equilibrium condition (10) is replaced with a short-side-principle such as:

$$L_{it} = \min(L_{it}^s, L_{it}^d).$$

They estimate the above equation and equations (8)-(9) simultaneously by using a switching regression algorithm. Since we are interested in equation (8) itself, we do not rely on a switching regression, which might be heavily affected by a specification error in equation (9).

the case of equation (8), the auto-regressive (AR) term $L_{i,t-1}$ is certainly correlated with η_i,[15] so its estimated coefficient is biased. Furthermore, we also need to take into account an endogeneity bias: since r^L_{it} depends on ε_{it}, (equation (11)), they are correlated, $\text{Cov}(r^L_{it}, \varepsilon_{it}) \neq 0$. The estimated coefficient on endogenous variables such as r^L_{it} is biased.

To overcome these problems, we adopt GMM (Generalized Method of Moments) estimation, using instrumental variables.

- The endogeneity bias can be eliminated by applying instrumental variables obtained from the demand function in equation (9)—see, for instance, Hayashi (2000), Chapter 3. K in the demand function is correlated with r^L_{it} (as shown in equation (11) $\text{Cov}(r^L_{it}, K_{it}) \neq 0$), but not with ε_{it}, the residuals of the supply function. Thus, K can be used as an instrumental variable in estimation of the supply function (8).

- To solve the problem arising from individual effects and the AR term, we apply the dynamic GMM estimation technique. We use the system GMM estimator developed by Blundell and Bond (1998).

  A "system" consists of first-differenced and level equations. Taking for example, a simple AR(1) model, and dropping the other explanatory variables and time specific effects from equation (8), we have the following equation in levels:

  $$L_{it} = \alpha L_{i,t-1} + \eta_i + \nu_{it}.$$

  Taking first-differences, we get:

  $$\Delta L_{it} = \alpha \Delta L_{i,t-1} + \Delta \nu_{it}.$$

  As proposed by Arellano and Bond (1991), we can employ instrument variables, $L_{i,t-2}$, $L_{i,t-3}$, ... for estimation of α in the first-differenced equation, since they are not correlated with $\Delta \nu_{it}$. In addition, Blundell and Bond (1998) suggest using $\Delta L_{i,t-1}$ for estimation of α in the level equation since it is not correlated with η_i or ν_{it}. Thus, by estimating this system of two equations simultaneously, the Blundell-Bond system GMM estimator is exploiting more instruments than the Arelleno-Bond GMM estimator. It is reported that the system GMM estimator is both more efficient and more robust.

[15] Taking lags on both sides of equation (8), we have

$$L_{i,t-1} = \alpha_0 L_{i,t-2} + \alpha_1 r^L_{i,t-1} + \cdots + \eta_i + d_{t-1} + \nu_{i,t-1}.$$

Since $L_{i,t-1}$ depends on η_i, they are correlated: i.e. $\text{Cov}(L_{i,t-1}, \eta_i) \neq 0$.

3.3 Estimation Results

3.3.1 Basic specification

Table 2 summarizes the results of estimating equation (8) using the system GMM and the instruments discussed above.[16] We divide the sample period into two sub-samples: (A) the second half, FY1993-FY1999, when non-performing loan problems became serious; and (B) the first half, FY1986-FY1992, when asset prices rocketed and then peaked out. Various studies consider non-performing loan problems to have started to affect the real activities from around 1992-1993, when the CCPC (Cooperative Credit Purchasing Company) began operation and banks began to disclose their outstanding non-performing loans—see for example, Miyagawa and Ishihara (1997) and Sekine (1999). This paper broadly follows their sample division.

For all industries and for the non-manufacturing industry, coefficients on the squared debt-asset ratio D^2_{-1} are positive and significant in the second half of the sample period. These positive coefficients are consistent with forbearance lending. However, these coefficients are insignificant in the first half of the sample period. This is partly because, during the bubble period, debt-asset ratios were so low on average that they were not likely to exceed the threshold level. It is also because banks took credit risks aggressively during the period, as evidenced by the increase in the land collateral ratio. The threshold itself was therefore likely to be higher. At that time, the euphoric sentiment prevailing in the economy led people to anticipate further rises in asset prices. By contrast, in the second half of the sample period, as firms' debt-overhang problem became serious, average debt-asset ratios increased and the threshold declined[17] so that forbearance lending became pervasive.

Decomposing samples of the non-manufacturing industry further into those of construction, real estate and other non-manufacturing, we find that in the second half of the sample period, the coefficient on D^2_{-1} is positive and significant for the construction and real estate industries. The coefficient is also positive for other non-manufacturing industries, but it is not significant. Although the estimation is based on a small sample (51 firms), it strongly supports the view that banks provided forbearance loans particularly intensively to firms in the construction and real estate sectors. This finding accords with the results of previous studies including Hoshi (2000), Sasaki (2000) and Tsuru (2001).

Coefficients on ROA are positive and significant in the second half of the sample period, while they are negative and significant in the first half. This may be because banks began to pay more attention to firms' profitability in the 1990s. However, the issue may be moot, since these coefficients turn out to be negative in the second half, if we

[16] Lagged D and ROA are also added to the instrument set (their first lags are added with the assumption that they are predetermined variables). Hereafter, all estimations are conducted using *DPD for Ox* (Doornik, Arellano, and Bond (1999)).

[17] This phenomenon can be explained by the model in Section 2 as follows. For $G(D) = G_0 + aD^\alpha - bD$, the threshold D_u declines, if the parameter a (capital productivity) decreases due to prospects of a fall in land prices after the burst of the bubble. Since $D_u = \left(\frac{\alpha a}{b}\right)^{\frac{1}{1-\alpha}}$, a decline in a reduces D_u.

employ within group estimation, as we will see below. As for coefficients on the interest rate spread, they tend to be less significant in the second half. This implies that banks continued to make loans irrespective to their interest rate margins.

Non-linearity with respect to the debt-asset ratio is also found for the share of short-term loans: i.e. banks relied more on short-term lending once debt-asset ratios exceeded a certain level (Table 3).[18] This suggests that forbearance loans were mainly provided by rolling over short-term loans, since banks hesitated to provide long-term loans to heavily indebted firms. Lack of long-term finance may have prevented these firms from investing in facilities which would enhance their long-run productivity. In this way, the profitability of these borrowers might have dropped still further, in turn contributing to an accumulating debt-overhang.

3.3.2 Robustness check

We first try to check our specification, since in the second half of the sample period, estimations for neither all industries nor non-manufacturing industries pass the Sargan test at 5%. For non-manufacturing industries, however, if we exclude ROA from both explanatory and instrumental variables, we can improve the Sargan test and raise the significance level of D^2_{-1} (the first column in Table 4).

Next, we want to carry out an explicit check for nonstationarity, since all the coefficients on $\ln L_{-1}$ are very close to one in Table 2. In principle, we do not have to worry about unit-root problems or spurious correlation, since the Blundell-Bond GMM estimator imposes a first difference restriction: the estimator derives coefficients from the first-differenced equation as well as the level equation. As a robustness check, however, we re-estimate the equation imposing a unit root restriction more explicitly. From equation (8), if we assume $\alpha_0 = 1$, we can transpose $L^s_{i,t-1}$ to the left-hand-side as:

$$\Delta L^s_{it} = \alpha_1 r_{it} + \alpha_2 D_{i,t-1} + \alpha_3 D^2_{i,t-1} + \alpha_4 ROA_{i,t-1} + \alpha_5 + \varepsilon_{it}.$$

Estimation of this equation gives us coefficients almost identical to those in Table 2, as indicated in the second column of Table 4.

In addition, to check if estimation results differ with the estimation procedure adopted, we estimate the equation using the within group method. When a unit root constraint is imposed, problems associated with dynamic GMM are eliminated since the AR term is excluded from the right-hand-side. (Note that, within group estimation, which does not incorporate instrument variables, still leaves us with an endogeneity bias problem.) The results are shown in the third column of Table 4. Although the sign of the coefficient on ROA differs from that in Table 2, the signs of the coefficients on D_{-1} and D^2_{-1} remain the same (at a much higher significance level).

[18] In order to derive this conclusion, it would be helpful if we could estimate the loan supply function by maturities. However, we cannot estimate short- and long-term loan supply functions separately owing to a lack of the relevant interest rate data.

Table 2: Loan Supply Function: Basic Specification

Industry	All industries	Manufacturing	Nonmanufacturing	Construction & real estate	Other nonmanufacturing
Dependent	$\ln L$	$\ln L$	$\ln L$	$\ln L$	$\ln L$
			(A) Sample Period: 1993-1999		
$\ln L_{-1}$	0.98 (37.3)***	0.95 (32.5)***	1.02 (28.2)***	0.94 (17.0)***	0.99 (28.3)***
r	0.02 (0.06)	0.11 (2.40)**	0.04 (0.77)	0.12 (1.36)	0.06 (1.75)*
D_{-1}	-1.58 (1.94)*	-0.15 (0.63)	-2.69 (2.11)**	-2.36 (2.66)***	-1.25 (1.05)
D^2_{-1}	3.12 (1.92)*	-0.39 (0.25)	3.12 (1.80)*	2.08 (2.09)**	1.38 (1.01)
ROA_{-1}	0.01 (2.37)**	0.01 (1.26)	0.02 (1.70)*	0.03 (1.08)	0.01 (0.53)
Observations	4,640	3,072	1,568	408	1,160
Firms	580	384	196	51	145
SE^2	0.06	0.06	0.07	0.08	0.05
AR(2)	-0.34 [0.74]	0.40 [0.69]	-0.95 [0.34]	-1.51 [0.13]	-0.26 [0.79]
Sargan	119.8 [0.04]	107.7 [0.18]	122.4 [0.03]	40.62 [1.00]	112.5 [0.11]
			(B) Sample Period: 1986-1992		
$\ln L_{-1}$	0.99 (33.4)***	0.98 (34.4)***	1.00 (36.1)***	0.99 (26.4)***	0.98 (33.0)***
r	0.05 (2.80)***	0.05 (2.59)***	0.05 (2.43)**	0.12 (3.95)***	0.10 (3.92)***
D_{-1}	-0.49 (0.88)	-1.25 (0.97)	-0.55 (0.25)	-3.38 (1.59)	0.38 (0.72)
D^2_{-1}	0.57 (0.59)	1.86 (0.65)	-0.15 (0.42)	3.39 (0.86)	-1.53 (1.37)
ROA_{-1}	-0.01 (1.83)*	-0.02 (2.26)**	0.005 (0.53)	0.01 (0.49)	-0.004 (0.51)
Observations	4,640	3,072	1,568	408	1,160
Firms	580	384	196	51	145
SE^2	0.06	0.07	0.05	0.07	0.05
AR(2)	-0.31 [0.76]	-0.08 [0.94]	-0.51 [0.61]	-0.51 [0.61]	0.81 [0.42]
Sargan	109.8 [0.14]	100.8 [0.32]	108.6 [0.16]	35.17 [1.00]	102.8 [0.28]

Notes:

1. System GMM Estimation. Coefficients on constants and time dummies are omitted.
2. Estimated coefficients are obtained from two-step estimators. Figures in parentheses are t-values calculated from one-step estimators. "***", "**" and "*" denote statistical significance at the 1%, 5% and 10% level, respectively.
3. AR(2) is a test for second-order residual serial correlation, obtained from one-step estimators (the null hypothesis is no serial correlation). Sargan is a test for over-identifying restrictions (the null hypothesis is to satisfy over-identification). Figures in squared brackets are p-values.
4. Instruments for first-differenced equations are $\ln L_{t-2,\dots,t-5}$, $\ln K_{t,\dots,t-5}$, $D_{t-1,\dots,t-5}$ and $ROA_{t-1,\dots,t-5}$. Those for level equations are $\Delta \ln L_{t-1}$, ΔD_{t-1}, and ΔROA_{t-1}.

Table 3: Share of Short-Term Loan Outstanding

Industry	All industries	Manufacturing	Nonmanufacturing
Dependent	L^s/L	L^s/L	L^s/L
D_{-1}	-0.88 (9.37)***	-1.01 (8.04)***	-0.66 (4.24)***
D^2_{-1}	1.43 (9.29)***	1.63 (6.78)***	1.25 (5.66)***
Sample period	1993-1999	1993-1999	1993-1999
Observations	4,640	3,072	1,568
Firms	580	384	196
SE^2	0.01	0.01	0.01
R^2	0.05	0.05	0.07

Notes:

1. Within group estimation. Coefficients on time dummies are omitted.
2. Figures in parentheses are t-values.

Table 4: Loan Supply Function: Robustness Check (1)

Industry	Nonmanufacturing	Nonmanufacturing	Nonmanufacturing
Dependent	$\ln L$	$\Delta \ln L$	$\Delta \ln L$
Estimation	GMM	GMM	Within Group
$\ln L_{-1}$	1.02 (23.4)***		
r	0.05 (0.56)	0.04 (0.76)	0.08 (7.24)***
D_{-1}	-4.07 (2.74)***	-2.45 (2.26)**	-3.90 (13.0)***
D^2_{-1}	5.41 (2.49)**	2.90 (1.82)*	3.51 (8.54)***
ROA_{-1}		0.02 (1.70)*	-0.01 (2.61)***
Sample period	1993-1999	1993-1999	1993-1999
Observations	1,568	1,568	1,568
Firms	196	196	196
SE^2	0.07	0.06	0.04
AR(2)	-1.23 [0.22]	-0.95 [0.34]	
Sargan	81.75 [0.08]	124.3 [0.03]	

Note: See notes for Table 2

Table 5: Loan Supply Function: Robustness Check (2)

Dependent	$D < 0.4$ $\Delta \ln L$	$D > 0.4$ $\Delta \ln L$	$D < 0.4$ $\Delta \ln L$	$D > 0.4$ $\Delta \ln L$
r	0.10 (13.9)***	0.04 (2.04)**	0.09 (11.0)***	0.06 (2.30)**
D_{-1}	-2.31 (24.2)***	-0.52 (2.76)***	-2.92 (22.7)***	0.02 (0.06)
ROA_{-1}	-0.01 (6.65)***	0.001 (0.15)	-0.01 (6.58)***	-0.003 (0.35)
Sample period	1993-1999	1993-1999	1993-1997	1993-1997
Observations	4,325	285	3,283	177
Firms	568	63	563	45
SE^2	0.05	0.02	0.05	0.02
R^2	0.22	0.11	0.23	0.14

Note: See notes for Table 3

The non-linear relationship with respect to D can be confirmed by splitting the sample. The change in loans outstanding, $\Delta \ln L_{it}$, is regressed on $D_{i,t-1}$, r_{it} and $ROA_{i,t-1}$ using within group estimation,[19] where the sample is divided into those having a "high" debt-asset ratio ($D_{i,t-1} > 0.4$) and those with a "low" ratio ($D_{i,t-1} < 0.4$). As evident in Table 5, coefficients on $D_{i,t-1}$ are much smaller in the "high" category than in the "low." Shortening the sample period to FY1997, so that we can include banks which failed or were nationalized after that date and which may also be considered likely to have engaged in forbearance lending, we discover a larger difference between the coefficients in the "high" and "low" categories.

3.3.3 Impact of the BIS regulations

We would like to see, in our sample, how various measures of bank health, including the BIS capital adequacy ratio, affected bank loan provision. As Sakuragawa (2001) emphasizes, banks might put off disposing of non-performing loans so as to satisfy the BIS minimum capital requirement. Under an opaque accounting system, bank managers, aiming to maximize their private profits, have an incentive to postpone writing off non-performing loans in order to disguise the true state of their balance-sheet. Sasaki (2000) points to a possible case of forbearance lending based on her finding that in the 1990s, for the construction industry, there was a positive relationship between bank loans and the share of non-performing loans in overall outstanding loans. The finding is in contrast with the results of Miyagawa, Nosaka, and Hashimoto (1995) and Woo (1999), who claim

[19] Dynamic GMM tends to create unstable estimation results, presumably because of the very short sample period. Note that dividing the sample according to D leaves us with an unbalanced panel, in which some samples have only one data period, because they may switch categories from time to time if their debt-asset ratios are just around 0.4.

Table 6: Loan Supply Function: Impacts of the BIS Regulation

Industry Dependent	All industries $\Delta \ln L$	Manufacturing $\Delta \ln L$	Nonmanufacturing $\Delta \ln L$
r	-0.35 (2.69)***	-0.11 (0.84)	-0.16 (1.12)
D_{-1}	-5.16 (2.10)**	2.38 (2.06)**	-6.00 (1.96)**
D^2_{-1}	9.34 (2.01)**	-5.60 (2.20)**	9.60 (1.79)*
ROA_{-1}	0.01 (3.05)***	0.01 (2.25)**	0.01 (1.25)
BIS_{-1}	0.01 (1.39)	0.005 (0.45)	0.02 (2.44)***
Sample period	1998-1999	1998-1999	1998-1999
Observations	9,317	4,887	4,430
SE^2	0.40	0.26	0.33
Sargan	6.30 [0.71]	18.83 [0.03]	9.06 [0.43]

Notes:

1. See notes for Table 2.
2. Unbalanced panel. AR(2) test is not calculated due to the short sample period.
3. Instrumental variables are $\ln K_t$, $\ln K_{t-1}$, D_{t-1}, ROA_{t-1}, and BIS_{t-1}.

that impaired bank health leads to a contraction in bank loans extended (i.e. a credit crunch).

We can estimate loan supply functions for individual banks to each firm, since the Corporate Finance Data Set contains data on loans outstanding to each firm from individual banks.

Estimated loan supply functions take the form of:

$$\Delta \ln L_{ijt} = \alpha'_1 r_{it} + \alpha'_2 D_{i,t-1} + \alpha'_3 D^2_{i,t-1} + \alpha'_4 ROA_{i,t-1} + \alpha'_5 BIS_{j,t-1} + \alpha'_6 + \varepsilon_{ijt},$$

where i, j and t denote firms, banks and time respectively. If the BIS capital adequacy ratio, BIS, had some impact on forbearance lending, we expect $\alpha'_5 < 0$ since banks would increase their lending when BIS deteriorated. The sample period is FY1998-FY1999 because the data on the short-term loans of individual banks are not available before FY1997.[20] The short sample period does not allow us to apply the dynamic GMM procedure; we estimate the equation using GMM, but without employing the first differenced equation.

The results are shown in Table 6. Although the short sample period results in some loss of reliability—coefficients on r turn out to be negative and coefficients on D_{-1} and D^2_{-1}

[20] We choose firms which have $L_{ijt} > 0$ for more than two periods from FY1997 to FY1999. Banks j are city banks and long-term credit banks, which are supposed to perform the role of main banks in Japan.

differ significantly from the above results—the positive signs of the coefficients on BIS_{-1} indicate that banks tend to increase loans as their capital adequacy ratios improve. This is inconsistent with the hypothesis that banks increase loans to avoid making write-offs and so satisfy their BIS minimum capital requirements.

We further explore the possibility that bank health and forbearance lending are connected by replacing the BIS capital adequacy ratio with other bank health indicators. These include (i) $Default$: the likelihood of default for each bank, calculated from its balance-sheet and share price using option pricing theory (see Oda (1999) and Fukao (2000) for details of the calculation); (ii) Cap: the adjusted capital adequacy ratio, which takes into account non-performing loans and capital gains/losses;[21] and (iii) $A2, ..., Baa3$: banks' rating dummies obtained from Moody's.

The results are similar to those estimated using the BIS capital adequacy ratio (Table 7) in that impaired bank health tends to induce a squeeze in lending. The negative coefficient on $Default_{-1}$ implies that banks decrease their loans to firms as their own default risk increases. The positive coefficient on Cap_{-1} suggests that when banks are financially distressed through a decline in the value of their own capital, they decrease their lending. The larger negative coefficients on inferior ratings indicate that banks with such ratings typically reduce lending.

Over the course of the financial crisis which began at the end of 1997, the Financial Services Agency strengthened their monitoring of banks through implementation of the Financial Inspection Manual after the passage of the Financial Reconstruction Law through the Diet in 1998. As a result, it might be the case that banks were left with less maneuvering room with which to disguise their true balance-sheets. Also, there seemed only weaker incentives for banks to manipulate their BIS adequacy ratios, which improved considerably after a series of public money injections in 1998. We should note that the estimation by Sasaki (2000) is based on pre-1997 data (from FY1989 to FY1996), and that a connection between bank health and forbearance lending is more likely to be observed before 1997.

3.3.4 Effect of uncertainty

To see the effect of uncertainty on loans outstanding pointed out by Baba (2001), we add the volatilities of the debt-asset ratio and ROA to the basic specification. The volatility of variable x_{it} is calculated as follows.

$$Vol(x)_{it} = \frac{1}{4} \sum_{j=t-1}^{t-4} (\Delta x_{ij} - 0.25\Delta_4 x_{ij})^2,$$

where Δ and Δ_4 are the first- and fourth-difference operators respectively, $\Delta_4 x_{it} = \sum_{j=t}^{t-3} \Delta x_{ij}$.

[21] (Shareholders' equity + Capital gains/losses from securities + Loan-loss provisioning - Risk management assets - Deferred tax assets)/Assets. See Fukao (2000) for more details.

Table 7: Loan Supply Function: Impacts of Bank Health

Industry Dependent	Nonmanufacturing $\Delta \ln L$	Nonmanufacturing $\Delta \ln L$	Nonmanufacturing $\Delta \ln L$
r	-0.13 (0.62)	-0.13 (0.74)	-0.09 (0.52)
D_{-1}	-5.33 (1.61)	-6.18 (1.77)*	-5.01 (1.71)*
D^2_{-1}	8.49 (1.45)	9.90 (1.61)	7.90 (1.54)
ROA_{-1}	0.01 (0.81)	0.01 (0.79)	0.003 (0.57)
$Default_{-1}$	-0.43 (6.34)***		
Cap_{-1}		0.02 (4.24)***	
$A2_{-1}$			0.01 (0.83)
$A3_{-1}$			-0.04 (1.93)**
$Baa1_{-1}$			-0.15 (6.41)***
$Baa3_{-1}$			-0.13 (3.63)***
Sample period	1998-1999	1998-1999	1998-1999
Observations	4.457	4,457	4,457
SE^2	0.31	0.33	0.29
Sargan	11.96 [0.22]	7.35 [0.60]	23.28 [0.08]

Notes:

1. See the notes for Table 6.
2. Instrumental variables are $\ln K_t$, $\ln K_{t-1}$, D_{t-1}, ROA_{t-1}, $Default_{t-1}$ or Cap_{t-1} or $A2_{t-1}, ..., Baa3_{t-1}$.
3. The rating dummies are normalized so that $Baa2 = 0$.

The estimation results are reported in Table 8. The coefficient on the volatility of ROA is positive and significant for the manufacturing industry, and negative and significant for the non-manufacturing industry. The sign should be positive if a bank engaged in forbearance lending in response to increased uncertainty. Since, as seen above, forbearance lending was more evident in the non-manufacturing industry, it seems more plausible to us that the positive sign for the manufacturing industry reflects factors other than forbearance lending.

The reason why we cannot find clear evidence regarding the impact of uncertainty on forbearance lending might lie in its theoretical ambiguity. Just as the impact of uncertainty on the firm's investment decision is theoretically ambiguous, so too its impact on bank loan provision may not be simple. While uncertainty regarding a firm's future profits may induce banks to engage in forbearance lending, it may also prompt them to cut loans. Consequently, a hike in uncertainty may exert both upward and downward pressures on banks' loan provision. It seems to us that more work is needed before it is possible to derive any conclusion regarding the relationship between uncertainty and forbearance lending. Such work should also give more thought to whether there is some more appropriate measure for capturing uncertainty than volatilities.[22]

4 Firm Profitability

How does firm profitability relates to the debt-asset ratio and additional lending? As discussed at the beginning of this paper, one of the key conditions for distinguishing forbearance lending from other lending is whether or not banks deem firms capable of repaying their debts, and this in turn depends on their profitability. Furthermore, the model developed by Berglöf and Roland (1997) predicts the emergence of a moral hazard problem in which profitability may deteriorate at the time of forbearance lending, because firms rationally choose no effort. In fact, correlation coefficients show that both debt-asset ratios and loans outstanding are negatively correlated with ROA (Table 1 (2)). The negative correlations are also evident in Figure 5. Thus, firms with higher debt-asset ratios or faster loan growth are likely to have lower ROA.

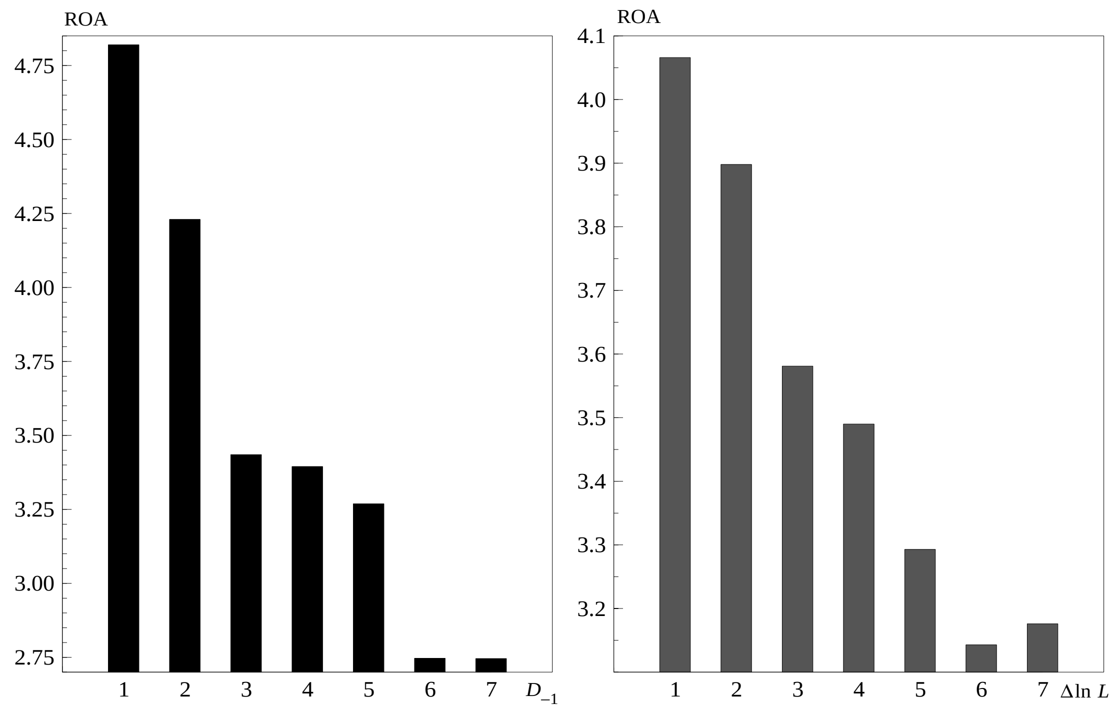
[22] We find some evidence consistent with the hypothesis discussed in footnote 2 that banks effectively become dominant shareholders and act as "risk-lovers." Banks' loan shares tend to become more concentrated along with a hike in firms' debt-asset ratios.

$$\Delta H_{it} = \underset{(5.31)}{0.19} D_{i,t-1},$$

$$T = 1993 - 1999, \text{ Obs.} = 9{,}672,\ R^2 = 0.01,\ \text{SE}^2 = 0.02$$

where H_{it} is the Herfindahl index ($H_{it} = \sum_j (L_{ijt} / \sum_j L_{ijt})^2$), a measure of loan share concentration for firm i. The loan share is based only on long-term loans (of city banks and long-term credit banks) due to data availability. Within group estimation is applied.

Figure 5: Debt-Asset Ratio, Loans and ROA



Note: Firms are ordered in accordance with their debt-asset ratios in the previous period (D_{-1}) and changes in loans outstanding in the current period ($\Delta \ln L$), and are divided into seven equal-sized groups for each year from FY1993 to FY1999. Then, period averages are taken for each group. Higher numbered groups have larger debt-asset ratios and faster loan growth respectively.

Table 8: Loan Supply Function: Effect of Uncertainty

Industry Dependent	All industries $\ln L$	Manufacturing $\ln L$	Nonmanufacturing $\ln L$
$\ln L_{-1}$	0.98 (34.3)***	0.92 (27.2)***	1.00 (27.0)***
r	0.02 (0.33)	0.15 (2.54)**	0.04 (1.08)
D_{-1}	-1.54 (2.20)**	-0.86 (1.19)	-2.70 (1.86)*
D^2_{-1}	3.04 (2.03)**	0.91 (0.68)	3.34 (1.67)*
ROA_{-1}	0.02 (2.38)**	0.01 (0.85)	0.02 (1.26)
$Vol(D)_{-1}$	11.2 (1.47)	-14.6 (0.22)	-6.07 (0.02)
$Vol(ROA)_{-1}$	-0.001 (0.44)	0.01 (2.38)**	-0.02 (1.79)*
Sample period	1993-1999	1993-1999	1993-1999
Observations	4,632	3,067	1,565
Firms	580	384	196
SE^2	0.06	0.07	0.07
AR(2)	-0.63 [0.53]	0.56 [0.58]	-1.28 [0.20]
Sargan	112.8 [0.08]	91.34 [0.53]	113.4 [0.07]

Note: See notes for Table 2

Regressing the change in ROA on a cross term of the lagged debt-asset ratio D_{-1} and the current loan growth $\Delta \ln L$, we find that the term becomes negative and significant for the non-manufacturing industry (and for the construction and real estate industries in particular), to which banks provided forbearance loans in the 1990s (Table 9). In our regressions, we control for the share of sales in the corresponding industry ($Share_{it}$), which is found to be significant in Kitamura (2001) and Weinstein and Yafeh (1998). Time dummies are added to control for macroeconomic effects such as business cycles and changes in asset prices.[23] Therefore, we are able to observe that even taking into account macroeconomic effects, additional loans to heavily indebted firms tend further to reduce their ROA. The result appears consistent with the existence of a moral hazard problem at the time of forbearance lending.

5 Conclusion

Japanese banks are said to refinance firms even in cases where there is little prospect of firms repaying the loans extended. This phenomenon is known as forbearance lending. We illustrate this using a simple model in which a bank is shown to have an incentive to engage in forbearance lending to a borrower firm whose debt-asset ratio exceeds a certain threshold as its liquidation value (or net worth) is eroded. Then, using corporate panel

[23]Time dummies are added to the other regressions in this paper.

Table 9: Firm Profitability

Industry	All industries	Manufacturing	Nonmanufacturing	Construction & real estate	Other nonmanufacturing
Dependent	ΔROA	ΔROA	ΔROA	ΔROA	ΔROA
$\Delta \ln L \cdot D_{-1}$	-0.35 (0.44)	0.92 (0.80)	-2.44 (2.84)***	-4.89 (3.60)***	-0.67 (0.61)
$\Delta Share$	0.16 (3.16)***	0.31 (3.91)***	0.05 (1.03)	-0.53 (3.17)***	0.10 (2.09)**
Sample period	1993-1999	1993-1999	1993-1999	1993-1999	1993-1999
Observations	4,640	3,072	1,568	408	1,160
Firms	580	384	196	51	145
SE^2	4.46	5.49	2.14	1.96	2.14
R^2	0.06	0.09	0.06	0.20	0.04

Note: See notes for Table 3

data, we test for non-linearity between loans and debt-asset ratios: i.e. whether loans were apt to increase to a firm whose debt-asset ratio was above a certain level. It is found that, after the bubble burst, this non-linearity became evident for non-manufacturing firms, especially those in the construction and real estate industries. Furthermore, an increase in loans to highly indebted firms in these industries is found to lower their profitability. These findings are consistent with the view that forbearance lending certainly took place in Japan, and that it suppressed the profitability of inefficient non-manufacturing firms.

The paper presents clear evidence of a link between debt-asset ratios and forbearance lending, but the results of our investigation into the effects of the BIS regulation and uncertainty are less conclusive. These effects are worthy of further investigation in the future.

There is no doubt that the non-performing loan problem hampered real activities through a sharp credit contraction during the 1997-1998 financial crisis. However this paper shows in addition that, even in the absence of this crisis, the non-performing loan problem was stifling Japanese economic growth through the practice of forbearance lending. Forbearance lending not only props up inefficient firms, it also encourages inefficient firms to avoid making the efforts necessary to raise their profitability. Maeda, Higo, and Nishizaki (2001) point out that the stagnation of Japan's economy in the 1990s was rooted in a wide range of "structural" deficiencies including lack of flexibility in corporate management and inefficient use of fiscal spending, amongst others. In our view, forbearance lending should be added to this list of structural deficiencies in the Japanese economy. Similarly, Saita and Sekine (2001) show how weakened financial intermediation, manifesting itself in the form of a credit crunch and the practice of forbearance lending, caused Japanese economic growth to stagnate through declining sectoral credit shifts in the 1990s.

In this paper, since we heavily rely on Berglöf and Roland (1997), we stress that each bank chooses to engage in forbearance lending as the rational result of its profit maximization. However, we do not deny the possibility that forbearance lending might have been the result of bank managers' private profit maximization, nor do we suggest that forbearance lending should be ignored. Instead, we would like to emphasize the need to remove both the incentive and the opportunity for banks to practise forbearance lending, the key to achieving which is found in economic structural reforms. These would include: (i) increasing the market share of profitable firms by encouraging the smooth exit of inefficient firms; (ii) mitigating information asymmetries by enhancing the transparency of the corporate accounting system as well as improving banks' screening and monitoring functions. It would also be important to streamline bankruptcy procedure and to enhance flexibility in the labor market, although our model does not explicitly take these factors into consideration.

In addition, since this paper focuses on firms' debt-asset ratios (= bank loans outstanding/the market-value of assets), our findings are also relevant to the debt-overhang problem. After all, the non-performing loan problem for banks and the debt-overhang problem for firms are different sides of the same coin. In order to overcome these problems, firms have to reduce their debt-asset ratios to an appropriate level by cutting their debts outstanding or increasing their market values.

Appendix 1: Forbearance Lending and Discount on Interest Payments

In this appendix, we investigate interest payments at the time of forbearance lending.

First, we would like to confirm that the interest rates calculated from our sample replicate the distribution of contracted interest rates for all domestically licensed banks. As shown in Figure 6, the distributions of both interest rates are curtailed around four percent. Also the average of r^L seems slightly lower than that of contracted interest rates. Presumably, this is because our sample is biased towards relatively large companies.

The truncation of higher interest rates is often cited as evidence of credit crunch (Watanabe (2001)) or adverse selection under asymmetric information (Baba (1996)). It might also be due to competition with public financial institutions which tend to offer attractively low interest rates (Fukao (2000)). As a result, banks did not manage to raise their loan interest rates to a level which would have enabled them to cover the costs associated with credit risks. This is one reason why bank profits plummeted in the 1990s (Shiratori and Oyama (2001)).

In the case of forbearance lending, banks might also offer discounts on interest payments as another means of supporting borrower firms. As seen in equation (11), the loan interest rate r^L is expected to be lower, once the debt-asset ratio D exceeds a certain threshold.

In fact, estimation of equation (11) gives:[24]

$$\begin{aligned} r^L_{it} &= \underset{(2.37)}{11.92 D_{i,t-1}} - \underset{(1.78)}{13.49 D^2_{i,t-1}} + \underset{(2.65)}{0.69 \ln K_{it}} - \underset{(2.48)}{0.64 \ln L_{i,t-1}}, \end{aligned}$$

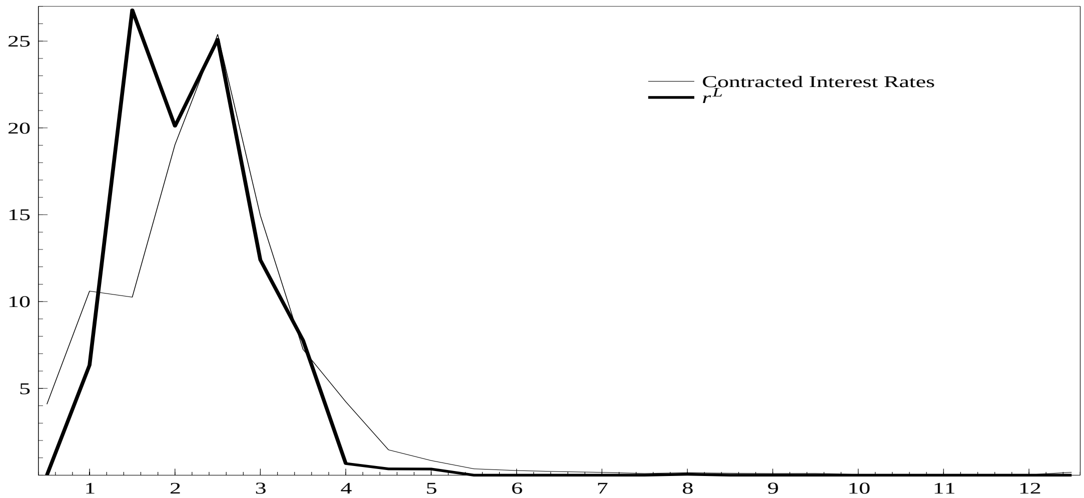
$T = 1993 - 1999$, Obs. = 4,640, Firms = 580, $\text{SE}^2 = 0.83$,
AR(2)= 2.16 [0.03], Sargan= 76.77 [0.05].

Although we must be cautious about deriving any firm conclusions from this estimation, since the AR(2) test is rejected at the 5% level and the Sargan test is accepted marginally at the 5% level,[25] the signs of the coefficients on D_{-1} and D^2_{-1} are just as expected. This seems to suggest that banks also accepted discounts on interest payments at times when they engaged in forbearance lending. Although this is a big if (firms may have gone bankrupt if banks had raised interest rates), if banks had been able to raise their lending rates in proportion to the risk indicated by high debt-asset ratios, the coefficient on D^2_{-1}

[24]See notes for Table 2. r^M_t is absorbed into the time dummies. ROA is dropped from the equation because it is not significant. Instruments used are $\ln K_{t-1,\ldots,t-5}$ and $D_{t-1,\ldots,t-5}$ for the first-differenced equation, and $\Delta \ln K_{t-1}$ and ΔD_{t-1} for the level equation.

[25]The violation of diagnostic tests may be due to misspecification of equation (9). Estimation of equation (11) is sensitive to misspecification of equation (9), because equation (11) is derived using equation (9). As discussed in footnote 14, however, we have some reservations on the specification of equation (9).

Figure 6: Histograms of r^L and Contracted Interest Rates



Notes: r^L and D are as of FY1999. Contracted interest rates are as of March, 2000.

should become insignificant. Thus, we can observe that forbearance lending also squeezed bank profits through a narrower spread between loan and deposit interest rates.[26]

[26]Bank of Japan (2001a) estimates that lending rates charged to firms in the "in danger of bankruptcy" and "bankrupt and effectively bankrupt" borrower categories were such that banks' spreads were reduced by 0.1 percentage points. The theoretical models in this paper show that forbearance lending is chosen as a result of banks' profit maximization, and one may therefore wonder how forbearance lending can squeeze bank profits. In fact, in the model of Berglöf and Roland (1997), banks are able to increase profits further by inducing the firms to make 'efforts,' say, through better monitoring.

Appendix 2: Data Appendix

Figures starting with 'K' are code numbers corresponding to the relevant items in the Corporate Finance Data Set.

Interest rates

The interest rates on bank loans r^L are supposed to be the same as the interest rates paid by firms.

$$\text{Paid interest rate} = \frac{\text{Interest payments and fees for discount (K3160)}}{\text{Interest-bearing debt outstanding in the previous period}},$$

where interest-bearing debt outstanding (excluding CPs and bonds) is the sum of items K1910, K1950, K2000, K2010, K2100, K2120, K2210, K2340, K2380, K2440, K2450, K2460, K5500 and K5440.

The deposit interest rates r^M are derived as a weighted average of interest rates on demand deposits, time deposits and CDs (new issues, 3-month), where the weights are from the flow-of-fund statistics.

Debt-Asset Ratio

$$\text{Debt-asset ratio } D = \frac{\text{Short-term bank loans (K1960)} + \text{Long-term bank loans (K2350)}}{\text{Market-valued assets}},$$

where the market-value of assets is obtained by substituting the market-value of capital stocks K with the corresponding items in total assets (K1880).

Capital stock

Capital stock K consists of inventory, land, machinery, and non-residential buildings and structures. Their market values are calculated by perpetual inventory methods, which are often used for calculating average q for investment functions (see, inter alia, Hoshi and Kashyap (1990) and Hayashi and Inoue (1991)).

The perpetual inventory method can be expressed as:

$$K_{it} = \frac{P^K_t}{P^K_{t-1}} K_{i,t-1}(1-\delta) + I_{it}. \tag{12}$$

The first term on the right-hand-side is the capital stock remaining from the previous period (δ is the depreciation rate), which is re-evaluated at current prices by multiplying it by the change in capital stock prices, P^K_t/P^K_{t-1}. The current capital stock is obtained by adding the newly invested capital stock I_{it} to the existing capital stock. As for the initial market-value, it is assumed to be same as the book-value in 1970 or the earliest available book-value after 1970.[27]

Based on equation (12), we conduct the following calculation for each capital stock (see Sekine (1999) for more details).

1. **Inventory**: The book-value of inventory stock is obtained from the sum of items K1030, K1040, K1050, K1060, K1070, K1080, K1090, K1100, K1110 and K1120. If a firm uses a LIFO, the market-value is calculated using the perpetual inventory method. Otherwise, the market-value is set equal to the book-value. For equation (12), we assume $\delta = 0$ and I_{it} is the change in the book-value of stocks. P_t^K is obtained from the Wholesale Price Index (WPI), the Input-Output Price Index and the SNA.

2. **Land**: The book-value is K1390. The Land Price Index (all purposes, six major cities) is used for P_t^K. We assume $\delta = 0$ and I_{it} is the change in the book-value of stocks. When I_{it} becomes negative, we multiply by (P_t^K/P_{t*}^K) where P_{t*}^K is the price at which land was last purchased (i.e. when the book-value of land stock increased).

3. **Depreciable assets (machinery, non-residential buildings and structures)**: The book-value is the sum of items K1300, K1310, K1320, K1330, K1340, K1350, K1360, K1370 and K1380. P_t^K is chosen from appropriate items from the WPI. Following Hayashi and Inoue (1991), we set the depreciation rate δ as 4.7% (non-residential buildings), 5.64% (structures), 9.489% (machinery), 14.70% (transportation equipment), and 8.838% (instruments and tools). I_{it} is the sum of changes in the book-value of stock and depreciation in the current period (K6630-K6700). Since the current period depreciations for each item are only available from 1977, for the pre-1977 data, we calculate them as

$$\frac{\text{Accumulated depreciation for each item}}{\text{Total accumulated depreciation (K6520)}} \times \text{Total current depreciation (K6610)},$$

where accumulated depreciation for each item corresponds to K6530-K6600.

ROA

$$ROA = \frac{\text{Operating profits (K2980)} + \text{Non-operating income (K2990)}}{\text{Total assets (K1880) in the previous period}}.$$

[27] For land stock, since its market-value differs considerably from the book-value, we adjust the initial market-value by multiplying it by the market-to-book ratio obtained from the SNA and the Corporate Statistics.

References

ARELLANO, M., AND S. BOND (1991): "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations," *Review of Economic Studies*, 58, 277–297.

BABA, N. (1996): "Empirical Studies on the Recent Decline in Bank Lending Growth: An Approach Based on Asymmetric Information," Bank of Japan IMES Discussion Paper, No. 96-E-10.

——— (2001): "Optimal Timing in Banks' Write-Off Decisions under the Possible Implementation of a Subsidy Scheme: A Real Options Approach," *Bank of Japan Monetary and Economic Studies*, 19(3), 113–141.

BANK OF JAPAN (2001a): "Developments in Profits and Balance Sheets of Japanese Banks in Fiscal 2000 and Banks' Management Tasks," *Bank of Japan Quarterly Bulletin*, 9(4), 73–130.

——— (2001b): "Shinyou Kakuzuke wo Katsuyou-shita Shinyou Risuku Kanri Taisei no Seibi (Improvement in Credit Risk Management and the Use of Credit Ratings)," *Nihonginkou Chousa Geppou*, pp. 57–84, October, (in Japanese).

BERGLÖF, E., AND G. ROLAND (1997): "Soft Budget Constraints and Credit Crunch in Financial Transaction," *European Economic Review*, 41, 807–817.

BLANCHARD, O., AND M. KREMER (1997): "Disorganization," *Quarterly Journal of Economics*, 112(4), 1091–1126.

BLUNDELL, R., AND S. BOND (1998): "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models," *Journal of Econometrics*, 87, 115–143.

CORBETT, J. (1999): "Crisis? What Crisis? The Policy Response to Japan's Banking Crisis," in *Why Did Japan Stumble? Causes and Cures*, ed. by C. Freedman, pp. 191–229. Edward Elgar, Cheltenham.

DEWATRIPONT, M., AND E. MASKIN (1995): "Credit and Efficiency in Centralized and Decentralized Economies," *Review of Economic Studies*, 62, 541–555.

DOORNIK, J. A., M. ARELLANO, AND S. BOND (1999): "Panel Data Estimation Using DPD for Ox," available from http://www.nuff.ox.ac.uk/users/doornik/.

DOORNIK, J. A., AND D. F. HENDRY (2001): *GiveWin: An Interface to Empirical Modelling*. Timberlake Consultants, London.

FUKAO, M., AND JAPAN CENTER FOR ECONOMIC RESEARCH (2000): *Kinyuu Fukyou no Jissyou Bunseki (Empirical Analyses of Financial Recession)*. Nihon Keizai Shimbun-sya, Tokyo, (in Japanese).

Hayashi, F. (2000): *Econometrics*. Princeton University Press, Princeton.

Hayashi, F., and T. Inoue (1991): "The Relation Between Firm Growth and Q with Multiple Capital Goods: Theory and Evidence from Panel Data on Japanese Firms," *Econometrica*, 59, 731–753.

Hoshi, T. (2000): "Naze Nihon wa Ryuudousei no Wana kara Nogarerarenainoka? (Why Is the Japanese Economy Unable to Get Out of a Liquidity Trap?)," in *Zero Kinri to Nihon Keizai (Zero Interest Rate and the Japanese Economy)*, ed. by M. Fukao, and H. Yoshikawa, pp. 233–266. Nihon Keizai Shimbun-sha, Tokyo, (in Japanese).

Hoshi, T., and A. Kashyap (1990): "Evidence on q and Investment for Japanese Firms," *Journal of the Japanese and International Economies*, 4, 371–400.

Ito, T. (1985): *Fukinkou no Keizai Bunseki (Economic Analyses of Disequilibrium)*. Toyo Keizai Shimpo-sha, Tokyo, (in Japanese).

Kitamura, Y. (2001): "Corporate Finance and Market Competition: Evidence from the Basic Survey of Japanese Business Struture and Activities in the Late 1990s," mimeo.

Kobayashi, K., and S. Kato (2001): *Nihon Keizai no Wana (Trap of the Japanese Economy)*. Nihon Keizai Shimbun-sha, Tokyo, (in Japanese).

Maeda, E., M. Higo, and K. Nishizaki (2001): "Waga Kuni no "Keizai Kouzou Chousei" nituite no Ichi-Kousatsu (On "Structural Adjustment" of Japan's Economy)," *Nihonginkou Chousa Geppou*, pp. 75–133, July (in Japanese).

Miyagawa, T., and H. Ishihara (1997): "Kinyuu Seisaku, Ginkou Koudou no Henka to Makuro Keizai (Changes in Monetary Policy and Banks' Behavior, and Macro-Economy)," in *Gendai Makuro Keizai Bunseki—Tenkanki no Nihon Keizai (Contemporary Macroeconomic Analysis: The Japanese Economy During a Transition Period)*, ed. by K. Asako, S. Fukuda, and N. Yoshino, pp. 151–191. Tokyo University Press, Tokyo, (in Japanese).

Miyagawa, T., H. Nosaka, and M. Hashimoto (1995): "Kinyuu Kankyou no Henka to Jittai Keizai (Changes in Financial Environment and Real Activities)," *Chousa*, No. 203, Japan Development Bank, (in Japanese).

Oda, N. (1999): "Estimating Fair Premium Rates for Deposit Insurance Using Option Pricing Theory: An Empirical Study of Japanese Banks," *Bank of Japan Monetary and Economic Studies*, 17(1), 133–170.

Peek, J., and E. S. Rosengren (1999): "Have Japanese Banking Problems Stifled Economic Growth?," mimeo.

Saita, Y., and T. Sekine (2001): "Sectoral Credit Shifts in Japan: Causes and Consequences of Their Decline in the 1990s," Bank of Japan Research and Statistics Department Working Paper, No. 01-16.

Sakuragawa, M. (2001): ""Oigashi" no Keizai Bunseki: Riron to Jissyou (Economic Analysis of "Forbearance Lending": Theory with Empirical Work)," mimeo. (in Japanese).

Sasaki, Y. (2000): "Jiko Shihon Hiritsu Kisei to Furyou Saiken no Ginkou Kashidashi e no Eikyou (Impact of the BIS Regulation and Bad Loans on Banks' Loan Provision)," in *Kinyuu Shisutemu no Keizaigaku—Shakaiteki Kyoutsuu Shihon no Shiten kara (Economics of Financial Systems: From the Perspective of Social Overhead Capital)*, ed. by H. Uzawa, and M. Hanazaki, pp. 129–148. Tokyo University Press, Tokyo, (in Japanese).

Sekine, T. (1999): "Firm Investment and Balance-Sheet Problems in Japan," IMF Working Paper, WP/99/111.

Sekine, T., T. Tanemura, and Y. Saita (2001): "Furyou Saiken Mondai no Keizaigaku—Riron to Jissyou Bunseki no Tenbou (Economics of Non-Performing Loan Problems: A Survey of Theoretical Models and Empirical Studies)," mimeo. (in Japanese).

Shiratori, T., and T. Oyama (2001): "Kinnen ni okeru Hougin no Syuueki Teimei no Haikei to Kongo no Kadai—Yotai Rizaya no Torendo kara Mita Bunseki (Background of the Recent Stagnation in Japanese Banks' Profits and Their Tasks: An Analysis of Trends in the Deposit and Loan Interest Rate Spread," Bank of Japan Bank Examination and Surveillance Department Discussion Paper, No. 01-J-1 (in Japanese).

Sugihara, S., and I. Fueda (2002): "Furyou Saiken to Oigashi (Bad Loans and Forbearance Lending)," *JCER Economic Journal*, (44), 63–87, (in Japanese).

Tsuru, K. (2001): "The Choice of Lending Patterns by Japanese Banks During the 1980s and 1990s: The Causes and Consequences of a Real Estate Lending Boom," Bank of Japan IMES Discussion Paper, No. 2001-E-8.

Watanabe, Y., and Heisei Kinyuu Mondai Kenkyuu-Kai (2001): *Han-Shisan Defure no Seiji Keizai-Gaku (Political Economics of Anti-Asset Price Deflation)*. Toyo Keizai Shimpo-sha, Tokyo, (in Japanese).

Weinstein, D. E., and Y. Yafeh (1998): "On the Costs of a Bank-Centered Financial System: Evidence from the Changing Main Bank Relations in Japan," *Journal of Finance*, LIII, 635–672.

Woo, D. (1999): "In Search of "Capital Crunch": Supply Factors Behind the Credit Slowdown in Japan," IMF Working Paper, WP/99/3.