Non-performing loans and the real economy: Japan's experience

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1. Introduction

Taking stock of a number of related studies[2] conducted within the Bank of Japan, our intention in this paper is to discuss the interrelationship between the increase in non-performing loans (NPLs) and the performance of the real economy in Japan since the 1990s.

Since the bursting of the asset price bubble in the early 1990s, NPL problems have been a central issue for researchers and policymakers in Japan. It is an issue that includes a whole range of topics, such as the extent of the NPLs residing on balance sheets in the financial sector; whether or not there was any credit crunch; how bank health should be restored, and whether this should involve injections of public funds; and the severity of the adjustment process - say, how far the already high unemployment rate would go up - over the course of restructuring.

Given this wide range of issues (and the limitations of space), we focus our attention on issues that relate directly to the interaction between NPLs and the real side of the economy.

Even within this narrower scope, our coverage in this paper is selective. We do not discuss, for instance, the increase in precautionary saving after the 1997-98 banking crises. This is not because the negative impact of these was negligibly small. Rather, it is because there is general agreement among economists concerning the huge cost associated with these banking crises. Our interest here, therefore, is in the more contentious issue of whether, when we abstract from these banking crises, there remains a significant link between NPLs and the real economy.

The remainder of the paper is organised as follows. Section 2 considers how the performance of the real economy affected the emergence of NPLs. Sections 3 to 5 then discuss how the increase in NPLs, in turn, distorted the performance of the real economy via malfunctioning in the banking sector. Finally, Section 6 concludes the paper.

2. Emergence of NPLs

2.1 Definitions of NPLs

First of all, we briefly review the definitions and recent status of NPLs.

For those who are not familiar with the NPL problems in Japan, definitions of NPLs have often been the source of confusion. This is because there are at least three definitions that are referred to, and these definitions have been changed over time (Figures 1 and 2).

- *Risk management loans* and *loans disclosed under the Financial Reconstruction Law* (*FRL*) *classification* are officially published NPLs in the sense that they are based on the criteria specified by a law or bylaw. Although they have different breakdowns, their two definitions

[1] We are grateful to Yumi Saita for her assistance and for allowing us to make use of the results of her research. The views expressed in this paper do not necessarily reflect those of the Bank of Japan.

[2] We leave technical details to background papers (Nagahata and Sekine (2002), Sekine et al (2003), Saita and Sekine (2001)).

broadly coincide, and hence produce similar figures for outstanding loans (¥34.8 trillion and ¥35.3 trillion, respectively, at end-March 2003).

- *Loans subject to self-assessment* are classified, depending upon borrower creditworthiness, in line with guidelines (the "Inspection Manual") produced by the Financial Services Agency (FSA):
  - Loans that, according to the terms of the *self-assessment*, are to "bankrupt" and "de facto bankrupt" borrowers correspond to "unrecoverable or valueless" loans under the *FRL classification*, while those to borrowers that the *self-assessment* classifies as "in danger of bankruptcy" correspond to "risk" loans under the *FRL classification*.
  - Loans to borrowers classified in the self-assessment as needing "attention" include a subcategory of loans to borrowers needing "special attention". Loans to borrowers that "need special attention" roughly correspond to loans requiring "special attention" under the *FRL classification*.[3] Since the figure for loans to borrowers that "need attention" but not "special attention" is substantial, outstanding loans to borrowers whom the *self-assessment* categorises as of or below the standard of needing "attention" (¥90.1 trillion at the end of March 2003) far exceed the apparently comparable figures for *risk management loans* and *FRL classified loans*.
- These definitions have substantially changed over time. As summarised in Figure 3, the criteria became tougher and their coverage became wider in response to public demand for better disclosure.

In this paper, in order to avoid ambiguity, when we refer to NPLs we are talking about *risk management loans* and *FRL classified loans*. As explained above, these broadly correspond to loans to borrowers classified in the *self-assessment* as being of or below the standard of needing "special attention". We consider loans to borrowers that "need attention" but not "special attention" to be quasi-NPLs.

In what follows, we define borrower **firms' ratings** by reclassifying the *self-assessment* ratings to get (i) "normal" borrowers (these remain the same as in the *self-assessment*); (ii) "doubtful" borrowers (those classified within the *self-assessment* as needing "attention" but not "special attention"); and (iii) "bad" borrowers (those who "need special attention", or are "in danger of bankruptcy", "de facto bankrupt", or "bankrupt" according to the *self-assessment* ratings). As described above, this category of "bad" borrowers basically captures NPLs, while "doubtful" borrowers correspond to quasi-NPLs.

Although declining, NPLs remain high. Under the current government initiatives, banks are required to dispose of loans that fall into or below the category "in danger of bankruptcy" within three years of their emergence.[4] By active sales of their NPLs (including to the Resolution and Collection Corporation) and debt forgiveness at times of corporate restructuring, banks had decreased their *risk management loans* in March 2003 by more than ¥8 trillion from a year earlier (Bank of Japan (2003a)). However, the NPL ratio (*FRL classified loans* divided by total loans outstanding) of major banks in March 2003 was 7.2%, which was still significantly higher than 4%, the target ratio to be achieved by March 2005 (FSA, "Program for Financial Revival", October 2002).

2.2 Link from the real economy to NPLs

So far, despite active debate in the media, there is little empirical research available relating the performance of the real economy to the emergence of NPLs. Some argue that it is the long-lasting recession that has been responsible for the increase in NPLs. Others appeal to the debt-deflation theory of Irving Fisher (1933) and insist on deflation (in the sense of a decline in general prices) as the

[3] To be precise, the figure for loans to borrowers whom the *self-assessment* determines as requiring special attention is larger than the comparable figure for *FRL classified* special attention loans. This is because the former counts loans to borrowers in their entirety, even if only part of these borrowings requires special attention.

[4] "Emergency Economic Package", April 2001. Banks are also required to dispose of 50% of these loans within one year of their emergence and about 80% within two years (FSA, "Measures for a Stronger Financial System", April 2002).

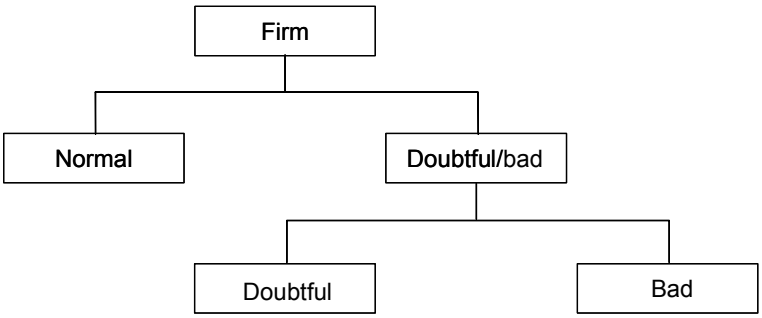
prime cause. The lack of adequate empirical research prevents economists from reaching any consensus on this issue.

However, it seems obvious that the sharp fall in asset prices, especially land prices,[5] is one of the dominant causes of NPLs. *Risk management loans* are heavily concentrated in real estate related industries, ie in construction and real estate, as well as among retailers and wholesalers (Figure 4).[6] During the bubble era of the late 1980s, firms in these industries were aggressive in their purchases of real estate properties, including countryside forests in order to develop then-lucrative resort areas such as golf courses (Figure 5).[7] The collapse of land prices after the bursting of the bubble severely impaired their balance sheets and made some of them insolvent.

In order to further investigate this issue, we believe that we need to exploit cross-sectional information on individual firms such as borrower firms' ratings (good/doubtful/bad) and their financial condition. For instance, the following calibration would create consistent data for NPLs and enable us to see the effects of the real economy. As seen in the previous section, due to frequent changes in the definitions, there is no such time series, which at least partly explains the scarcity of empirical research on this issue.

(i) First, a cross section model of individual borrower firms' current ratings is estimated by regressing them on various financial indicators obtained from their income statements and balance sheets.

More specifically, as such a cross section model, we believe it promising to use a nested logit model whose tree structure is as described below. A nested logit model is desirable because it is expected to fit the actual ratings better than an ordered probit model, which is the alternative often used in the related literature. Improved fit is likely to be achieved courtesy of one of the advantages of the nested logit model, namely that we can use different sets of explanatory variables for each nest, ie the explanatory variables for the choice between "normal" and "doubtful/bad" could differ from those used when looking at the choice between "doubtful" and "bad".



(ii) Then, individual borrower firms' ratings in the past are calibrated, using the coefficients obtained in the above step and historical data on selected explanatory variables.

Provided that the estimated nested logit model offers a reasonable fit, the calibration gives us an insight into the ratings firms would have received had they been subject to the recent borrower classification criteria. In providing such ratings, the calibration creates consistent data for NPLs, where "consistent" means NPLs are classified according to the same criteria.

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[5] Land price indices in the Tokyo metropolitan area have fallen to 40-50% of their 1992 levels see Figure 13. In fact, hedonic estimation of judicial auction prices reveals that the price of land used as collateral for NPLs has fallen even more sharply (Saita (2003)).

[6] In one of the few pieces of empirical research on this subject, Ueda (2000) finds a significant correlation between the NPL ratios of individual banks and the fluctuation of land prices in the capital cities of prefectures where banks' headquarters are located.

[7] Trading houses belong to the retail and wholesale industries. In addition to various goods and services, they are also known to deal actively in real estate properties. See Tachibana and Sekine (2003) on how to estimate land investment carried out by these industries.

Note that such data in the longer term do not exist in reality, because, as seen in Figure 3, aggregated figures for self-assessments are only available from 1997, and there have even been changes since then, with the criteria for self-assessment said to have changed when the "Inspection Manual" was introduced.

As a very preliminary stage of research, we have estimated the cross section model using the most recently available data and calibrated borrower firms' ratings in the 1990s in the way described above. We find that, in the nested logit model, the choice between "normal" and "doubtful/bad" mostly depends on procyclical variables obtained from income statements (eg sales growth, the interest coverage ratio), while the choice between "doubtful" and "bad" mostly depends on non-cyclical variables obtained from balance sheets (eg the debt/asset ratio, which mainly reflects land price developments because the asset values that constitute its denominator are revalued at market prices). As a result, the share of the calibrated numbers of "doubtful" is characterised by cyclical fluctuation resembling business cycles in Japan, while the share of "bad" borrowers steadily increases somewhat. Calculating transition matrices with the calibrated borrower ratings, it turns out that the matrix in recessionary periods significantly differs from that in expansionary periods.[8]

In sum, we tentatively conclude that two different real factors are responsible for the increase in NPLs. One is a trend factor, which directly affected the numbers of "bad" borrowers. The other is a cyclical factor, which acted to increase NPLs indirectly, by increasing quasi-NPLs. Given that (i) NPLs have been concentrated in real estate related industries, and (ii) the choice between "doubtful" and "bad" in the nested logit model is dependent upon balance sheet variables like the debt/asset ratio, the trend factor is thought to be associated with the deterioration in firms' balance sheets that accompanied the fall in land prices. Meanwhile, the fall in land prices is thought to have reflected the bursting of the bubble as well as ongoing structural changes.

3. Firms' balance sheet condition vs banks' balance sheet condition

In Sections 3 and 4, we discuss how the increase in NPLs affected real economic activity in Japan. First, in Section 3, we examine the respective roles played by firms' and banks' balance sheet condition in determining firm investment and bank lending. Then, in Section 4, we consider another problem associated with NPLs, namely forbearance lending.

It is an issue of some contention among economists whether or not banks, faced with a deterioration in their balance sheet condition, restrained their lending and so hampered investment. Theoretically, as pointed out by Krugman (1998), banks with damaged balance sheets might have an incentive to favour risky projects - this is known as "gambling for resurrection". In opposition to this, Van den Heuvel (2001) shows how a bank with an impaired balance sheet might decrease its lending in order to satisfy the risk-based capital requirements of the Basel Accord. There is also an empirical difficulty in distinguishing the respective roles played by firms' and banks' balance sheet condition. Identification of distinct roles for each is problematic because, at the macro level, firms' balance sheets and banks' balance sheets are different sides of the same coin.

In order to overcome this empirical difficulty, we rely on micro panel data. At the level of a diversified micro data set we can distinguish between the roles of firms' and banks' balance sheets, provided that there is a sufficient number of firms whose own balance sheets are in good condition but whose main banks' balance sheets are not, and vice versa.

The basic strategy below is to augment conventional forms of firm investment and bank lending functions with variables that represent firms' and banks' balance sheet condition, and then to check whether coefficients on these variables are significant.[9]

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[8] Using Moody's and S&P's data, Nickell et al (2000) and Bangia et al (2002) find that the transition matrices differ depending on whether a given business cycle period is expansionary or recessionary.

[9] See Chatelain et al (2001) and Ehrmann et al (2001) for recent examples of firm investment functions and bank lending functions using micro panel data.

3.1 Firm investment

We estimate the following error-correction specification of a firm investment function, using micro panel data on 1,078 listed firms:

$$\left(\frac{I_{it}}{K_{i,t-1}}\right) = \rho\left(\frac{I_{i,t-1}}{K_{i,t-2}}\right) + \sum_{h=0}^{1}\beta_h \Delta y_{i,t-h-1} + \sum_{h=0}^{1}\gamma_h \Delta j_{i,t-h-1} + \lambda_0 (k-y)_{i,t-2} + \lambda_1 y_{i,t-2} + \lambda_2 j_{i,t-2}$$

$$+ \theta CF_{it} + \phi\left(\frac{D}{A}\right)_{i,t-1} + \varphi Cap_{it} + u_{it}$$

where I_{it} is the real investment of firm i at time t; K_{it} is its real capital (small k denotes its logarithm); y_{it} is the log of its real output; j_{it} is the log of its user cost of capital; CF_{it} is its cash flow divided by its nominal capital; and u_{it} is an error term. Δ denotes the first difference operator.

Firms' and banks' balance sheet condition is represented by the following variables. First, each firm's balance sheet condition is captured by its debt/asset ratio, D/A, where assets A are revalued at market prices using the perpetual inventory method. Then, each bank's balance sheet condition is captured by an adjusted capital adequacy ratio, *Cap*, which takes into account NPLs, capital gains/losses and deferred tax assets.[10] For each firm, *Cap* is calculated as a weighted average of its main banks' *Cap*, where the weights represent the main banks' shares of long-term loans. Main banks are defined to be the three city/long-term credit banks whose long-term loans are the largest.

Following Gibson (1997), we split our sample into two subsamples according to whether or not firms have ever issued bonds. Non-bond-issuing firms are supposed to face tighter financial constraints than bond-issuing firms, because they have fewer external funding options and are hence more dependent on bank lending.

Figure 6 summarises the estimation results. Insignificance of the cash flow terms aside, signs and sizes of estimated coefficients are largely in line with prior expectations.[11] The points to be noted are:

- Firms' balance sheet condition, D/A, is negative and significant for both bond-issuing and non-bond-issuing firms; while
- Banks' balance sheet condition, *Cap*, is positive and significant only for non-bond-issuing firms.

What this implies is that, after the collapse of the asset price bubble, firms restrained their investment in order to reduce the burden of existing debts. Moreover, it indicates that, faced with erosion of their capital adequacy, banks restrained their lending and hence hampered the investment of firms without access to the capital market. This finding is consistent with the story of a "credit crunch".

In Figure 7, contributions to changes in I/K_{-1} are calculated from the sample averages of the variables of interest (D/A and *Cap*) and their coefficients. Firms' balance sheet condition is found to have had a relatively large negative impact throughout the 1990s. Meanwhile, the negative impact of banks' balance sheet condition is particularly large for non-bond-issuing firms during the FY1996-98 subperiod, which spans the occurrence of the banking crises in Japan. However, even prior to that subperiod, a non-negligible negative impact is observed for non-bond-issuing firms.

In short, NPLs hampered firm investment via a deterioration in both firms' and banks' balance sheet condition.[12] In a sense, the deterioration in banks' balance sheet condition may be said to have had a propagation effect, because it distorted the investment of bank-dependent firms, even when the balance sheets of the latter were in good condition.

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[10] (Shareholders' equity + capital gains/losses from securities + loan-loss provisioning – risk management assets – deferred tax assets)/assets.

[11] See Nagahata and Sekine (2002) for a discussion of the insignificant cash flow terms. Also, see Bank of Japan, Research and Statistics Department (2003) for a more general exposition of weak business fixed investment in the 1990s.

[12] Ogawa (2001) and Sekine (1999) also find both firms' and banks' balance sheet condition mattered for firm investment.

3.2 Bank lending

In order to check the robustness of the above findings, it would be desirable to see whether a similar story holds for bank lending. In the context of a putative credit crunch, it is important to check whether deteriorating bank balance sheets acted to reduce bank lending, something which is not directly observed in the above estimation.

The role of bank balance sheets can be checked by estimating the following reduced-form bank lending function using micro panel data on banks:

$$\Delta l_{it} = \sum_{j=1}^{3} \gamma_j \Delta l_{i,t-j} + \mu \Delta d_{it} + \sum_{j=0}^{3} \theta_j \Delta r_{t-j} + \sum_{j=0}^{3} \rho_j DI_{i,t-j} + \sum_{j=0}^{4} \lambda_j \left(\frac{D}{A} \right)_{i,t-j} + \varphi Liq_{i,t-1} + \phi Cap_{i,t-1} + u_{it}$$

where l_{it} is the log of outstanding loans of bank i at time t; d_{it} is the log of outstanding deposits; r_t is the short-term interest rate; DI_{it} is the diffusion index of business conditions in the survey conducted on firms; and Liq_{it} is the bank's liquidity ratio.[13] Again, to capture firms' and banks' balance sheet condition, firms' debt/asset ratios $(D/A)_{it}$ and banks' adjusted capital adequacy ratios Cap_{it} are included. Both DI_{it} and $(D/A)_{it}$ for each bank are obtained as weighted averages of D/A and DI at the industry level, where the weights are the industry shares of outstanding loans at each bank.

We have preliminarily estimated the above function using data on individual banks in the 1990s. All the long-run coefficients are found to be significant and have expected signs - thus that on D/A is negative and significant and that on Cap is positive and significant. Calculating contributions to annual growth in bank lending, using the sample averages of variables, movements in both D/A and Cap make large negative contributions to bank lending, just as in the investment function above.[14]

These results are in line with the findings for firm investment, in that both firms' and banks' balance sheet condition matters.

3.3 Implications for monetary policy

In the above firm investment function, the coefficients on the interest rates are negative and significant. For instance, in Figure 6, most of the user costs of capital (j is its level and Δj is its first difference), which are calculated from the yield on 10-year JGBs, are negative and significant. Also in the above bank lending function, the change in short-term interest rate Δr_t is found to be negative and significant.

These findings imply that a conventional transmission channel was working even after the bubble burst. This is contrary to the widely held belief that monetary policy was largely ineffective - a belief borne out, for example, by the simple correlation between changes in loans outstanding and the call rate, which turned out to be positive after the bubble burst (Figure 8). Our finding suggests, however, that the positive impact of lowering the interest rate was obscured by the negative impact of the deterioration in firms' and banks' balance sheet condition.

In order to further investigate the issue, we can re-estimate the bank lending function by splitting the sample period into two subperiods, say at 1997 Q4. The latter subperiod contains the introduction of both the zero interest rate policy (1999 Q1) and the quantitative easing policy (2001 Q1).

We preliminarily find that the coefficient on the short-term interest rate is negative and significant in the former subperiod but it turns out to be positive and significant in the latter subperiod (ie interest rate cuts acted to decrease bank lending). Even when we replace the short-term interest rate with a quantitative measure such as base money, the coefficient on base money is negative and significant in the latter subperiod (ie increases in base money act to decrease bank lending).

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[13] (Cash and deposits + call loans + government securities)/debts outstanding.

[14] Explanatory variables in levels (DI, D/A, Liq and Cap) are subject to normalisation. This makes use of either their historical averages or of constant terms obtained from regressions on other macro variables such as the real growth rate.

Although we cannot dismiss the possibility that the wrong signs are due to some misspecification, this result coincides with Kimura et al (2003) and Fujiwara (2003), who also fail to find theoretically consistent monetary policy effects in recent years.

4. Forbearance lending

Recently economists have been paying more attention to another phenomenon associated with NPLs, namely "forbearance lending" (or what Peek and Rosengren (2003) term "ever-greening policy" and Caballero et al (2003) term "zombie lending"). Japanese banks are said to have been reluctant to write off NPLs and to have rolled over their lending, even in cases where there was little prospect of the borrower firm being able to repay the loans extended.

There are several theoretical models which try to reveal why or under what conditions banks have an incentive to engage in forbearance lending. In reality, some or all of these models may well be thought to hold at the same time. This is because, as seen below, they are not mutually inconsistent.

- Kobayashi and Kato (2001), along somewhat similar lines to Krugman (1998), argue that a change in banks' risk preferences makes them softer about providing additional loans. Once a bank increases its exposure to a firm, the bank becomes risk-loving and begins to control that firm as if it were a dominant shareholder.
- Sakuragawa (2002) develops a model in which a bank without sufficient loan loss provisioning has an incentive to disguise its true balance sheet so as to satisfy the minimum capital requirement.
- Berglöf and Roland (1997), applying a soft budget constraint model, consider a game between a bank and a firm in which the bank continues to provide loans to the firm even after the latter's liquidation value plunges following a decrease in asset prices.
- Baba (2001), using real option theory, shows that uncertainties associated with the write-off of NPLs - such as the reinvestment return from freeing up funds by write-off, the liquidation loss, and the possible implementation of a government subsidy scheme, etc - induce banks to delay writing off NPLs.

In order to see whether banks have been engaging in forbearance lending, we investigate the relationship between firms' debt/asset ratios *D*/*A* and their outstanding loans. In a preliminary estimation of a cross section model in Section 2, we find that loans to firms with higher debt/asset ratios tend to become NPLs. If banks have indeed been engaging in forbearance lending, loans would have been apt to increase to firms whose debt/asset ratios were above a certain level.

More specifically, using micro panel data on 580 firms, we test the above inference by estimating the following function:

$$l_{it} = \alpha_0 l_{i,t-1} + \alpha_1 i_{it} + \alpha_2 \left(\frac{D}{A}\right)_{i,t-1} + \alpha_3 \left(\frac{D}{A}\right)^2_{i,t-1} + \alpha_4 ROA_{i,t-1} + \alpha_5 + u_{it}$$

where i_{it} is the loan/deposit interest rate spread for firm i at time t; and ROA_{it} is the return on assets, which controls the firm's profitability.

If banks have been engaging in forbearance lending, α_2 would be negative and α_3 positive. That is, when *D*/*A* is small, banks would squeeze loans as *D*/*A* increases. However, when *D*/*A* exceeds a certain level, banks would start to squeeze loans less hard (or would conceivably even increase loans, if *D*/*A* were sufficiently large).

This turns out to have been the case for the construction and real estate industries after the bubble burst (Figure 9). In the subperiod from FY1993-99, the coefficient on the squared debt/asset ratio is positive and significant for the construction and real estate industries, which make up a large share of NPLs (Figure 4). This supports the view that banks provided forbearance loans to firms in these industries.

Forbearance lending is supposed to suppress the profitability of Japan's economy by bailing out inefficient firms producing poor returns. Moreover, the theory suggests that not only do inefficient firms

survive, but they also reduce their levels of effort since they anticipate that banks will bail them out (Berglöf and Roland (1997)).

In the construction and real estate industries, firms with higher debt/asset ratios or faster loan growth are likely to have lower *ROA*. In Figure 10, *ROA* is regressed on a cross term comprising loan growth and the debt/asset ratio as follows:

$$ROA_{it} = \gamma_1 ROA_{i,t-1} + \gamma_2 \Delta l \cdot \left(\frac{D}{A}\right)_{i,t-1} + \gamma_3 \Delta share_{it} + \gamma_4 + u_{it}$$

where $share_{it}$ denotes firm i's share of its industry sales. The coefficient on the cross term is negative and significant for the construction and real estate industries, to which banks are supposed to have provided forbearance loans. This seems to indicate the presence of moral hazard among these firms, in the sense of Berglöf and Roland (1997).

As long as banks continue to provide forbearance loans and do not dispose of their NPLs, the quality of their loan portfolios will decline and they themselves will remain vulnerable.

5. Inefficient resource allocation

So far, we have observed the reluctance of banks to extend credit to potentially profitable firms, thus hindering the emergence of more efficient firms (Section 3); and also their reluctance to write off bad loans to non-profitable firms, thus securing the survival of inefficient firms (Section 4). Although at first sight these two phenomena look quite different, in that one involves failing to *expand* credit whereas the other involves failure to *shrink* credit, both have the same effect: they prevent credit from shifting to relatively efficient sectors. In other words, both the credit crunch and forbearance lending are symptoms of the malfunctioning Japanese banking sector.

In what follows, we provide evidence which supports the view that financial intermediation has indeed been weakened since the bubble burst.

5.1 *Tankan* survey

Figure 11 offers evidence from the *Tankan*'s Diffusion Index of lending attitudes at financial institutions. The horizontal axis describes the share of firms replying that lending attitudes are "severe", while the vertical axis gives the share of firms replying that they are "accommodative". Under normal circumstances, we expect the trade-off between the two shares to trace out a curve running from southeast to northwest.

Weakening financial intermediation should be captured in this setting by a northward shift of the curve, since the share of firms replying "severe" would not decline even in the face of monetary easing. In an analogy with the Beveridge curve for the labour market, an outward shift of the curve implies less efficient financial intermediation.

In fact, there was an apparent northward shift in the curve in the early 1990s. Since then, the curve has not shifted back. This indicates a weakening of financial intermediation around the middle of the 1990s.

5.2 Sectoral credit shifts

In order to confirm the above result, we use the following measure to capture credit shifts across sectors:[15]

[15] In fact, the idea of the sectoral shift measure comes from Lilien (1982), who calculates a measure of sectoral labour shifts. Lilien uses this measure as a proxy for the size of sectoral shocks.

$$\sigma_t^L = \left[\sum_{i=1}^{n} \left(\frac{L_{it}}{L_t} \right) (\Delta_4 \ln L_{it} - \Delta_4 \ln L_t)^2 \right]^{1/2}$$

where L_{it} is outstanding loans to industry i at time t and L_t denotes aggregate outstanding loans at time t ($L_t = \sum_i L_{it}$), and Δ_4 is the fourth-order difference operator.

When a large amount of credit is reallocated from one industry to another, σ^L is expected to increase. This is because such a reallocation would be expected to increase the dispersion of credit growth across sectors, implying a greater difference between $\Delta_4 \ln L_{it}$ and $\Delta_4 \ln L_t$.

In fact, σ^L declined significantly from the 1980s to the 1990s (Figure 12). Given that sectoral shocks increased during the 1990s, as illustrated by another Lilien-type measure based on sectoral job vacancies (Osawa et al (2002)), this decline in the sectoral credit shift measure indicates the inefficiency of resource allocation through financial intermediation.

6. Conclusion

In this paper, we have taken stock of related research carried out within the Bank of Japan in order to discuss the interrelationship between the increase in NPLs and real economic performance in Japan since the 1990s. The main points can be summarised as follows:

- The deterioration in firms' balance sheets due to the collapse of land prices was responsible for the increase in NPLs. Cyclical downturns seemed to be also responsible, albeit indirectly, in that they increased quasi-NPLs.
- The increase in NPLs, in its turn, distorted real economic performance via malfunctioning in the banking sector. Both a "credit crunch" and "forbearance lending" took place, and these caused a decline, through the banking sector, in the efficiency of its resource allocation.

In tandem with the government, the Bank of Japan has endeavoured to restore bank health through bank supervision. Recent measures include its advocacy of the discounted cash flow) methodology for provisioning (Bank of Japan (2002, 2003b)), as well as the purchases of equities from the banking sector aimed at reducing banks' equity exposure and keeping it down at the level of their Tier 1 capital. The Bank has also made efforts to strengthen the monetary transmission mechanism. As part of its efforts in this direction, the Bank decided to purchase asset-backed securities.

As a next step, we believe that more research investigating the process of asset price deflation is warranted. The research reviewed in this paper gives us to understand that the fall in land prices was responsible for the increase in NPLs that ended up suppressing the real growth of Japan's economy. However, we do not know why land prices fell so far. Although the fall in land prices is generally thought to have reflected the bursting of the bubble as well as ongoing structural changes (eg rapid ageing, hollowing out, etc), we do not have any quantitative sense of the extent of each factor's contribution.

We also believe that more work is needed on banks' profitability, since bank health cannot be restored unless banks become reasonably profitable. Uncovering the causes of banks' currently low profitability is vital. The weakness of the real economy, excessive competition due to overbanking, competition from government financial institutions and problems in bank management are often cited as reasons for low profits, and sensible policymaking requires a clear ranking of the degree to which each of these is responsible.

Figure 1

Non-performing loan classifications in Japan

At end-March 2003, in trillions of yen

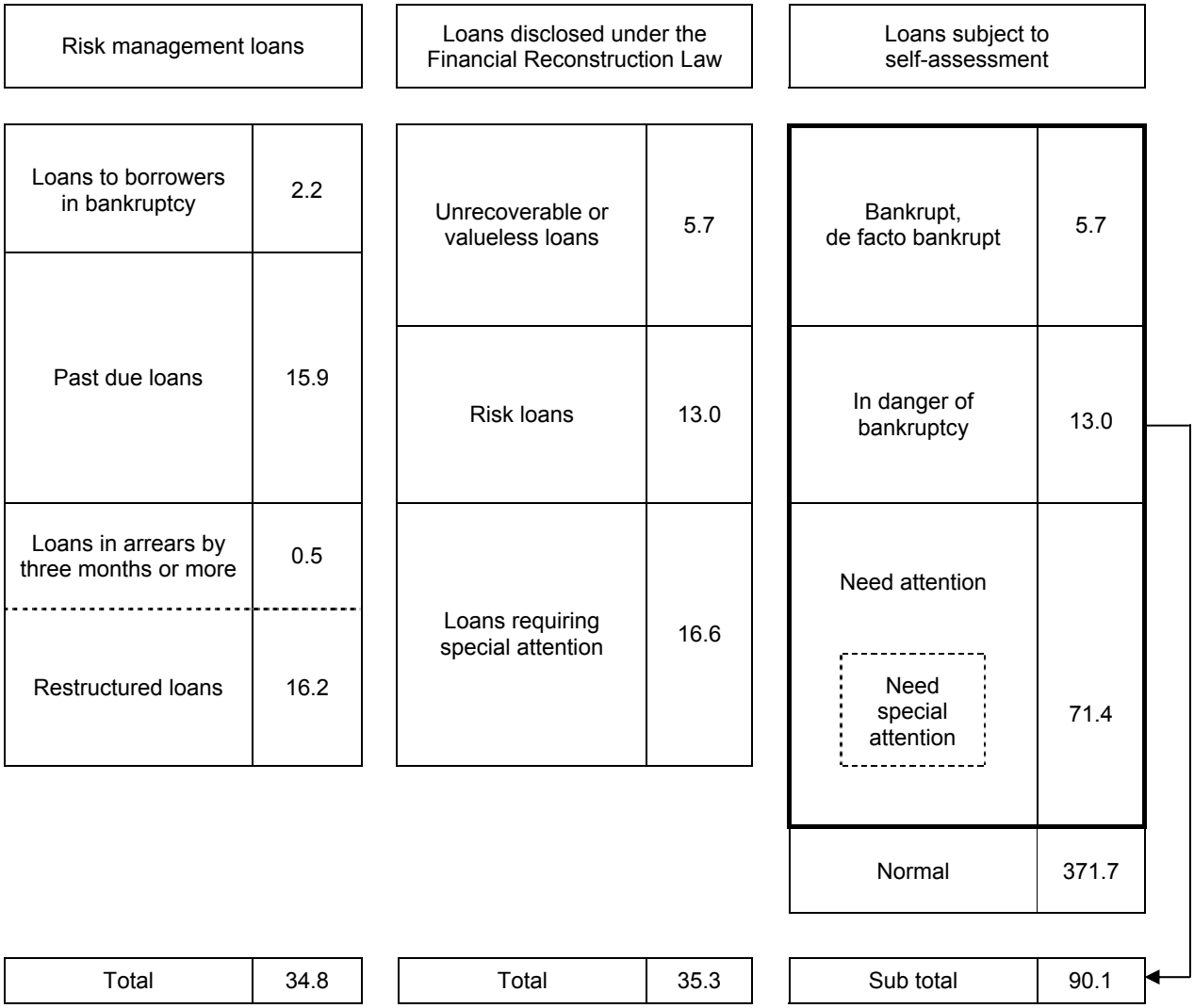


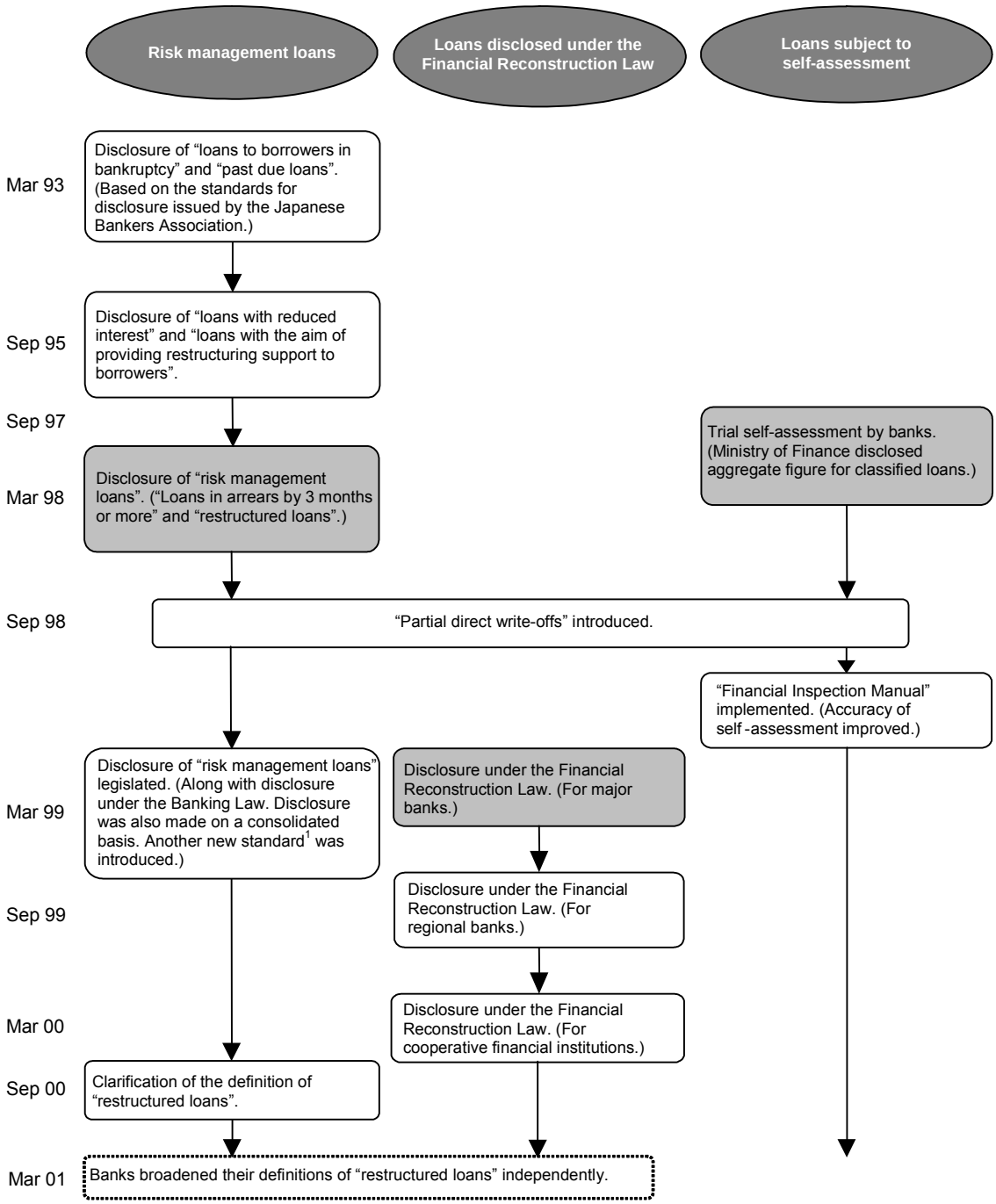
Figure 2

Definitions of non-performing loan classifications

(1) Risk management loans	
Loans to borrowers in bankruptcy	Loans where interest is not collected because borrowers are in bankruptcy.
Past due loans	Loans where interest is not collected, excluding those categorised above.
Loans in arrears by three months or more	Loans where principal or interest is in arrears by three months or more from the due date specified in the related loan agreement.
Restructured loans	Loans for which the bank has provided more favourable terms and conditions to the borrower than those in the original agreement, with the aim of providing restructuring support. These include reducing interest rates, rescheduling interest and principal payments, or waiving claims on the borrower.
(2) Loans disclosed under the Financial Reconstruction Law	
Bankrupt	Loans to borrowers who are legally or formally bankrupt, or virtually bankrupt borrowers with no prospects of resuscitation. (These correspond to loans categorised in the self-assessment as “bankrupt” and “de facto bankrupt”.)
De facto bankrupt	Loans to borrowers who have not gone bankrupt but are in financial difficulties, and thus whose lenders are unlikely to receive the principal and interest concerned on due dates. (They correspond to loans categorised in the self-assessment as “in danger of bankruptcy”.)
In danger of bankruptcy	“Loans in arrears by three months or more” and “restructured loans”. (The definitions of these are the same as under risk management loans.)
(3) Loans subject to self-assessment	
Bankrupt	Legally or formally bankrupt borrowers who are in the bankruptcy/liquidation process; who have filed for bankruptcy under the Commercial Law, the Corporation Reorganization Law or the Civil Rehabilitation Law; or whose deals are suspended at the clearing house.
De facto bankrupt	Borrowers who have serious financial difficulties with no prospect of resuscitation. Typically, they are seriously undercapitalised or have debt overdue for a long time. Although they are not legally or formally bankrupt, they are deemed bankrupt in practice.
In danger of bankruptcy	Borrowers who have financial difficulties and are likely to go bankrupt in the future. Typically, they are undercapitalised.
Need attention	Borrowers who have problems with interest payments or amortisation; or borrowers who record losses.
Need special attention	Borrowers all or part of whose debts are categorised as “loans requiring special attention” under FRL classified loans.
Normal	Borrowers who do not have particular problems.

Figure 3

Development of the NPL disclosure principles

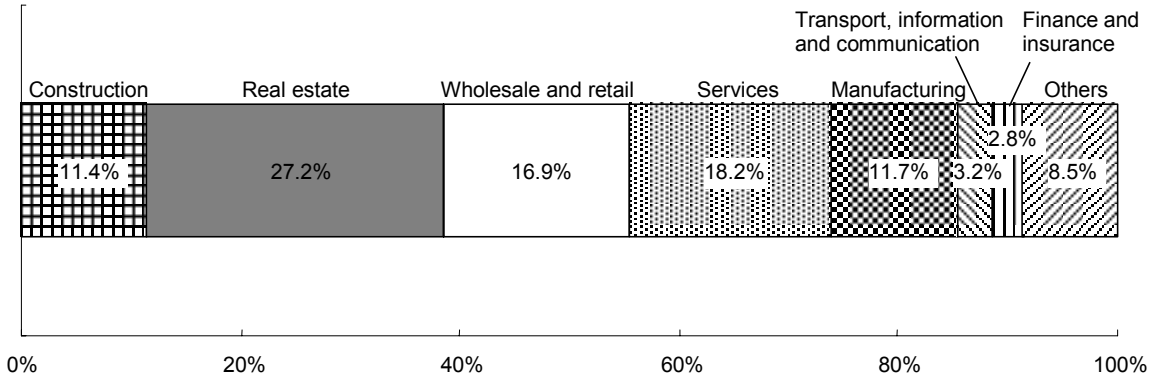


[1] Coverage of "past due loans" was extended, ie loans to borrowers "in danger of bankruptcy" must be included within "past due loans" even if they are not overdue.

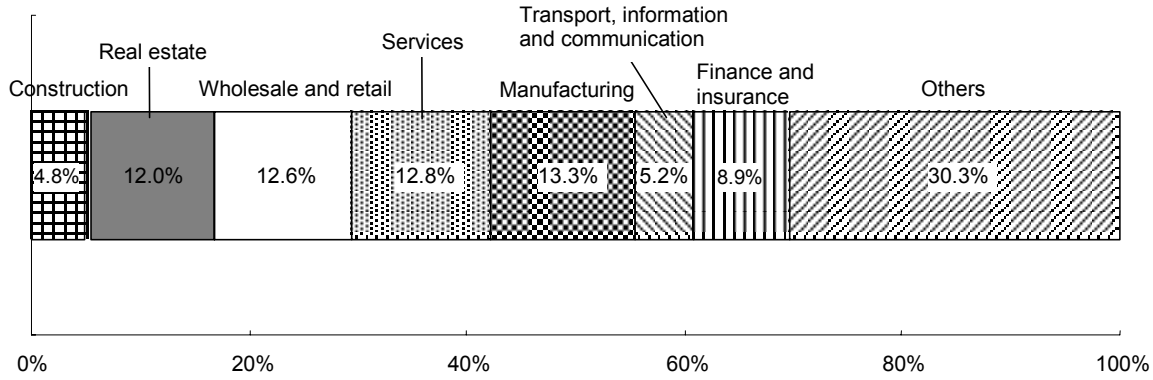
Figure 4

Breakdown of NPLs by industry

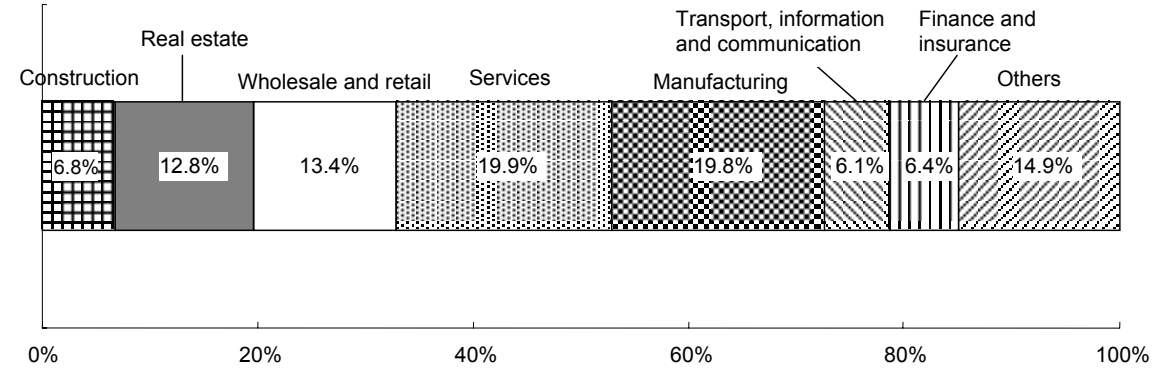
(1) Risk management loans



(2) Overall loans and discounts outstanding



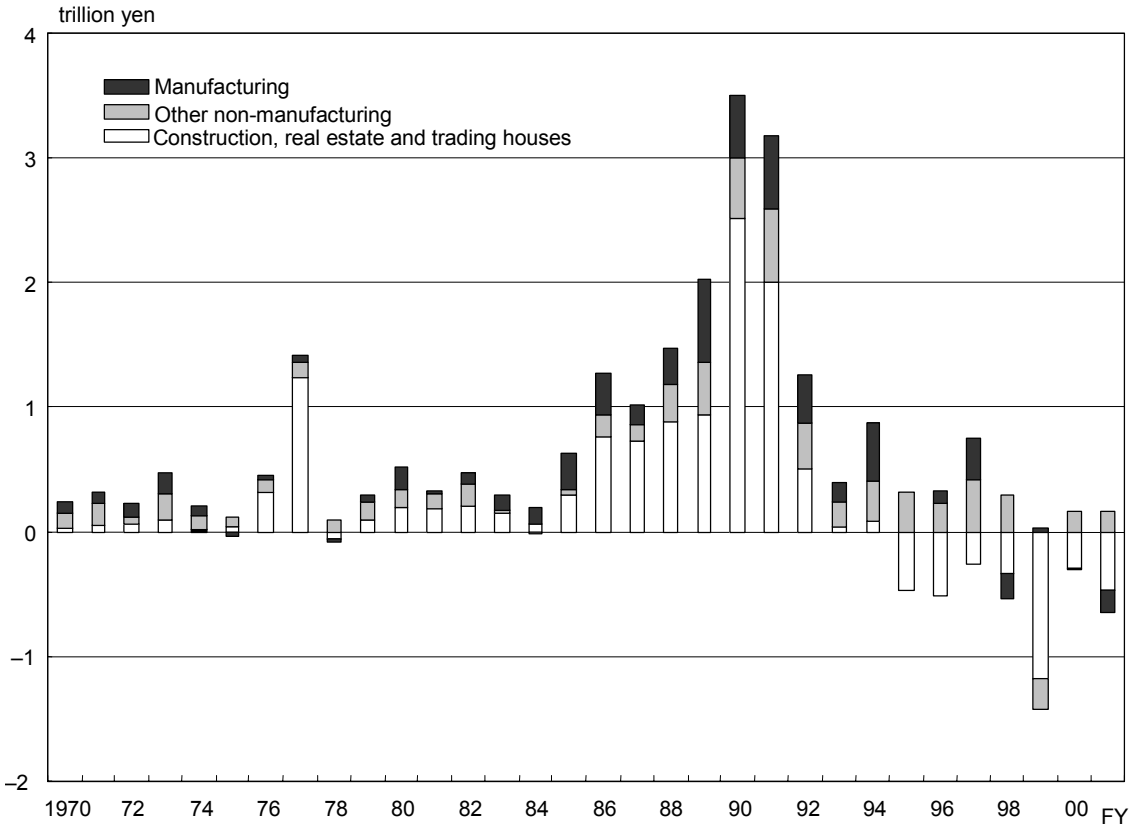
(3) Gross domestic product



Notes: 1. Risk management loans and overall loans and discounts outstanding are as of March 2003. Gross domestic product is as of FY2001. 2. Risk management loans are those disclosed by 13 major banks, ie city banks, long-term credit banks and trust banks, and 73 regional banks. They are based on banking accounts and trust accounts of domestic branches; unconsolidated data with some exceptions using consolidated data.

Figure 5

Land investment by industry



Source: Tachibana and Sekine (2003).

Figure 6

Estimation results for investment function

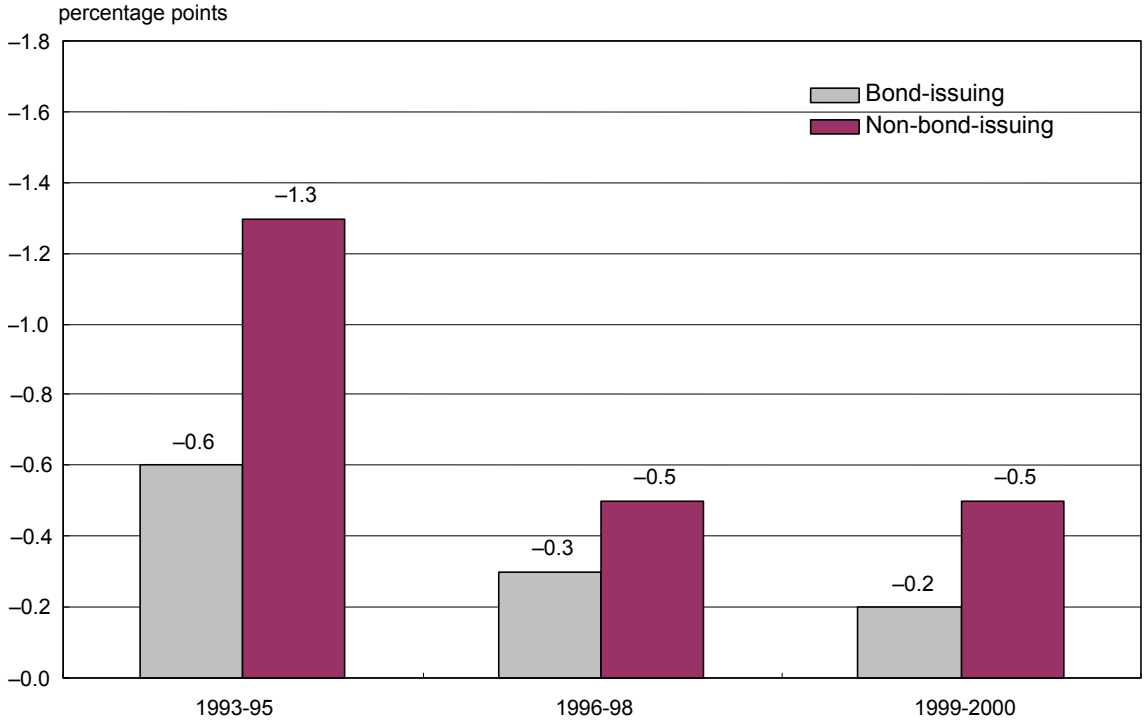
	(1)		(2)	
Dependent	***I*/*K*$_{-1}$**		***I*/*K*$_{-1}$**	
Bond issue	**Yes**		**No**	
Bank info	**Yes**		**Yes**	
I_{-1}/K_{-2}	–0.01	(0.04)	0.001	(0.04)
Δy	0.04	(0.04)	0.03	(0.05)
Δy_{-1}	0.09	(0.04)**	0.01	(0.04)
$(k - y)_{-2}$	–0.08	(0.04)**	–0.07	(0.04)*
y_{-2}	0.00	(0.01)	–0.05	(0.03)
Δj	–0.06	(0.02)***	–0.10	(0.03)***
Δj_{-1}	–0.07	(0.03)***	–0.08	(0.03)**
j_{-2}	–0.07	(0.04)*	–0.11	(0.06)
$CF/(p^k K)_{-1}$	–0.05	(0.07)	0.11	(0.07)
$(D/A)_{-1}$	–0.16	(0.05)***	–0.25	(0.09)***
Cap	0.07	(0.15)	0.56	(0.26)**
Sample period	1993-2000		1993-2000	
Observations	6,871		1,617	
Firms	856		222	
σ	0.086		0.096	
Sargan	123.9	[0.10]	141.1	[0.28]
AR(2)	–0.33	[0.74]	–0.51	[0.61]

Notes: 1. System GMM estimation (unbalanced panel). Coefficients on constants and time dummies are omitted. 2. Estimated coefficients are obtained from two-step estimators. Figures in parentheses are standard errors from two-step estimators with the Windmeijer small sample corrections. "***", "**" and "*" denote statistical significance at the 1%, 5% and 10% level, respectively. 3. AR(2) is a test for second-order residual serial correlation (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 $(I_{t-2}/K_{t-3}),\ldots, (I_{t-9}/K_{t-10}),\ldots, \Delta y_{t-2}, \Delta y_{t-3}, (D/A)_{t-1}, (D/A)_{t-2}, \Delta j_t, \Delta j_{t-1}, Cap_t, Cap_{t-1}$. Those for level equations are $\Delta(I_{t-1}/K_{t-2})$. For column (2), $\Delta y_{t-4},\ldots, _{t-9}$ are added as instruments for the first-differenced equation.

Figure 7

Contribution of balance sheet condition to I/K_{-1}

(1) Contribution of firms' balance sheet condition



(2) Contribution of banks' balance sheet condition

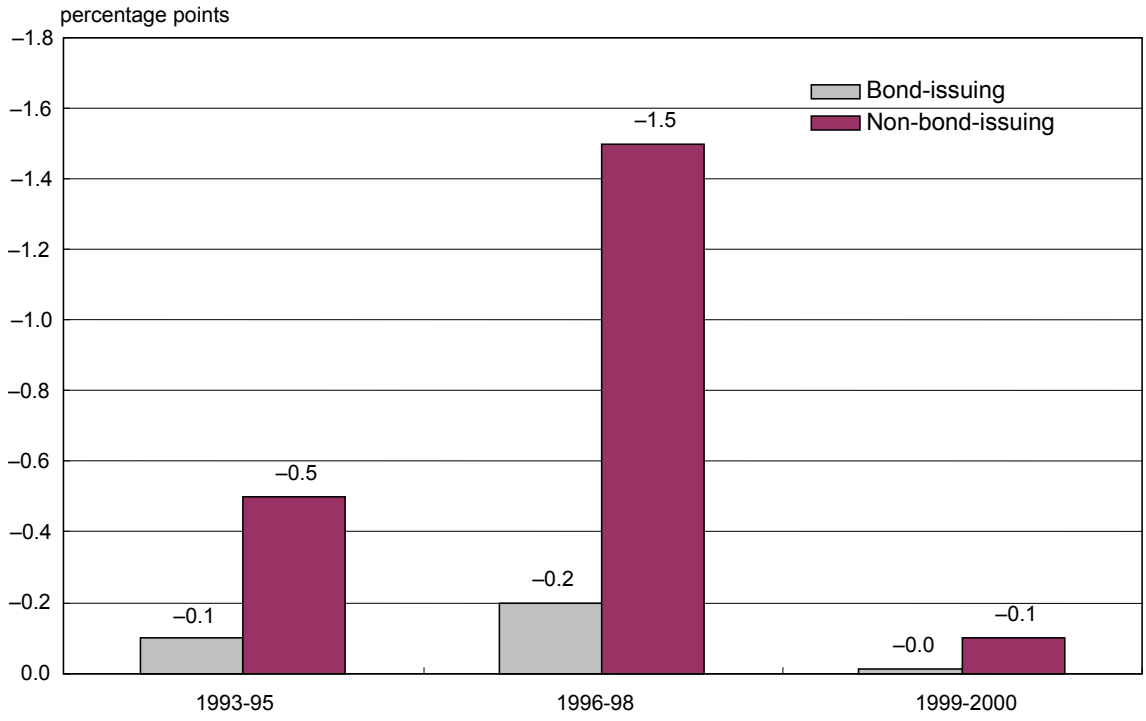


Figure 8

Correlations between loan growth and call rate

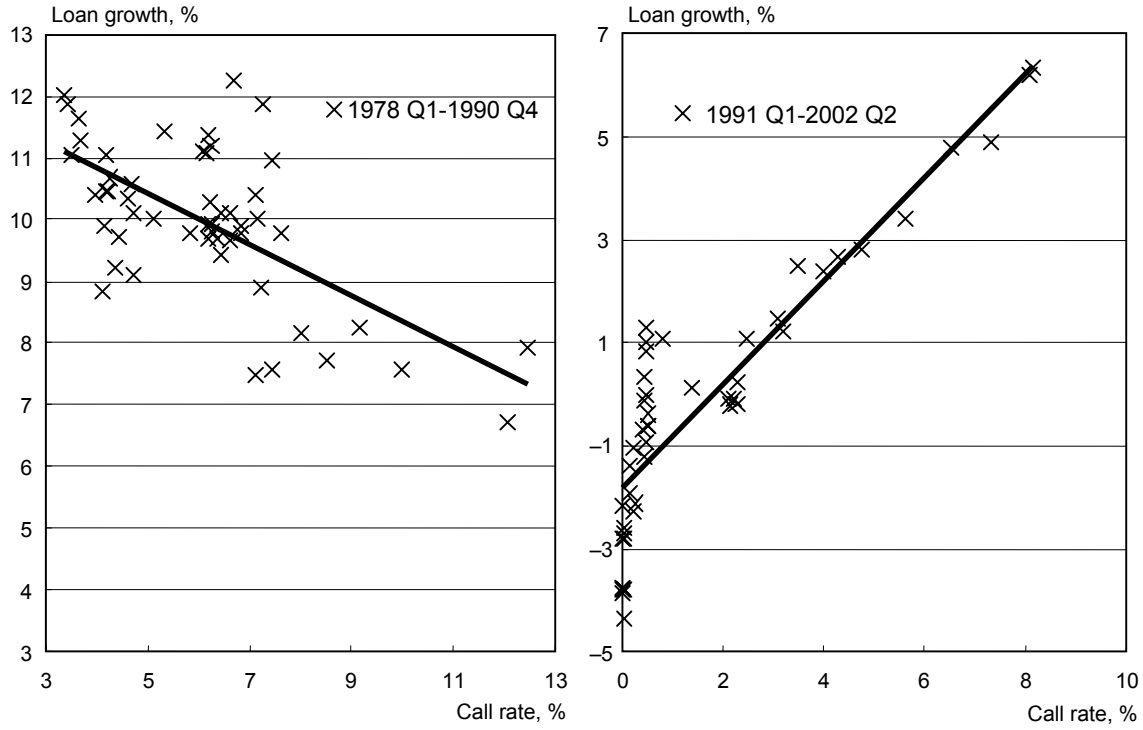


Figure 9

Estimation results for bank lending function

Industry Dependent	Manufacturing *I*		Construction and real estate *I*		Other non-manufacturing *I*	
			(A) Sample period: 1993-99			
I_{-1}	0.94	(0.02)***	0.97	(0.10)	0.97	(0.03)
r	0.12	(0.05)**	0.14	(0.08)*	0.04	(0.03)
$(D/A)_{-1}$	–0.12	(0.99)	–3.41	(1.76)*	–1.31	(1.12)
$(D/A)^2_{-1}$	–0.75	(2.11)	3.23	(1.94)*	2.02	(1.68)
ROA_{-1}	0.003	(0.01)	0.05	(0.03)	0.001	(0.02)
Observations	3,072		408		1,160	
Firms	384		51		145	
σ	0.06		0.09		0.05	
AR(2)	0.46	[0.65]	–1.37	[0.17]	–0.28	[0.78]
Sargan	112.7	[0.16]	37.4	[1.00]	116.3	[0.11]
			(B) Sample period: 1986-92			
I_{-1}	0.98	(0.02)	0.96	(0.05)***	0.98	(0.03)***
r	0.06	(0.02)	0.12	(0.03)***	0.10	(0.03)***
$(D/A)_{-1}$	–2.44	(1.49)	–3.51	(1.97)*	0.52	(1.20)
$(D/A)^2_{-1}$	4.07	(3.25)	4.40	(3.60)	–1.90	(1.82)
ROA_{-1}	–0.01	(0.01)	0.01	(0.02)	–0.01	(0.01)
Observations	3,072		408		1,160	
Firms	384		51		145	
σ	0.07		0.07		0.05	
AR(2)	0.10	[0.92]	–1.61	[0.11]	0.69	[0.49]
Sargan	125.2	[0.04]	36.64	[1.00]	111.2	[0.19]

Notes: 1. System GMM estimation (balanced panel). Coefficients on constants and time dummies are omitted. 2. Estimated coefficients are obtained from two-step estimators. Figures in parentheses are standard errors from two-step estimators with the Windmeijer small sample corrections. "***", "**", 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 $I_{t-2},\ldots,_{t-5}$, $K_t,\ldots,_{t-5}$, $(D/A)_{t-2},\ldots,_{t-5}$, and $ROA_{t-2},\ldots,_{t-5}$. Those for level equations are ΔI_{t-1}, $\Delta(D/A)_{t-1}$, and ΔROA_{t-1}.

Figure 10

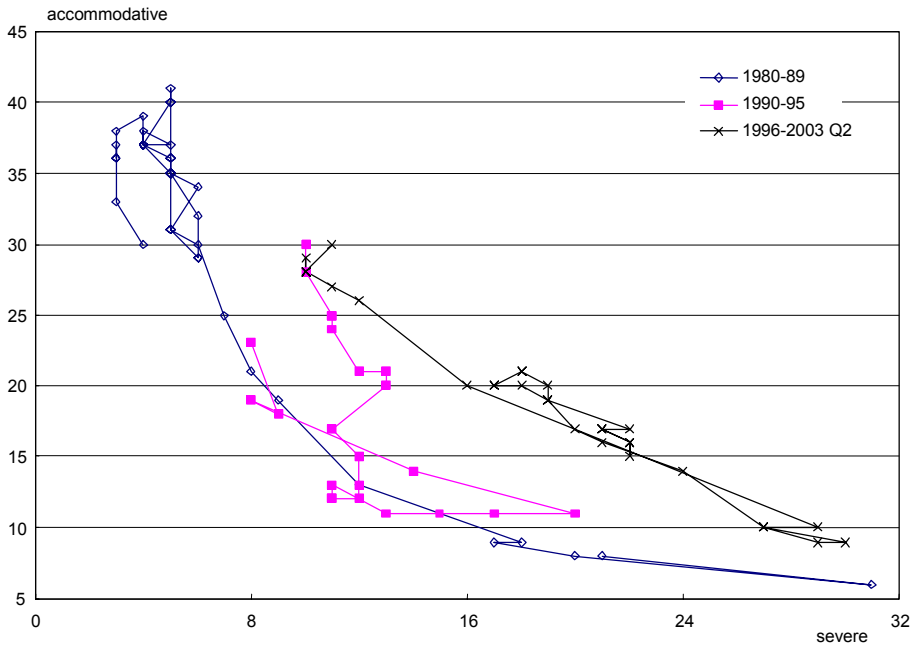
Firm profitability

Industry Dependent	Manufacturing *ROA*		Construction and real estate *ROA*		Other non-manufacturing *ROA*	
ROA_{-1}	0.54	(0.12)	0.73	(0.16)	0.83	(0.15)
$\Delta I\ (D/A)_{-1}$	–0.88	(1.23)	–2.56	(1.10)**	0.33	(0.92)
$\Delta Share$	3.49	(1.61)	–3.37	(1.91)*	0.70	(0.57)
Sample period	1993-99		1993-99		1993-99	
Observations	3,072		408		1,160	
Firms	384		51		145	
σ	4.18		1.45		1.67	
AR(2)	0.68	[0.50]	1.19	[0.23]	–0.32	[0.75]
Sargan	26.2	[0.07]	19.2	[0.32]	22.0	[0.19]

Notes: 1. System GMM estimation (balanced panel). Coefficients on constants and time dummies are omitted. 2. Estimated coefficients are obtained from two-step estimators. Figures in parentheses are standard errors from two-step estimators with the Windmeijer small sample corrections. "***", "**", and "*" denote statistical significance at the 1%, 5%, and 10%, 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 ROA_{t-2}, ROA_{t-3}, ΔI_{t-1}, ΔI_{t-2}, $(D/A)_{t-1}$, $(D/A)_{t-2}$, and $Share_t$. Those for level equations are ΔROA_{t-1}, ΔI_{t-1}, $(D/A)_{t-1}$, $(D/A)_{t-2}$, and $Share_t$.

Figure 11

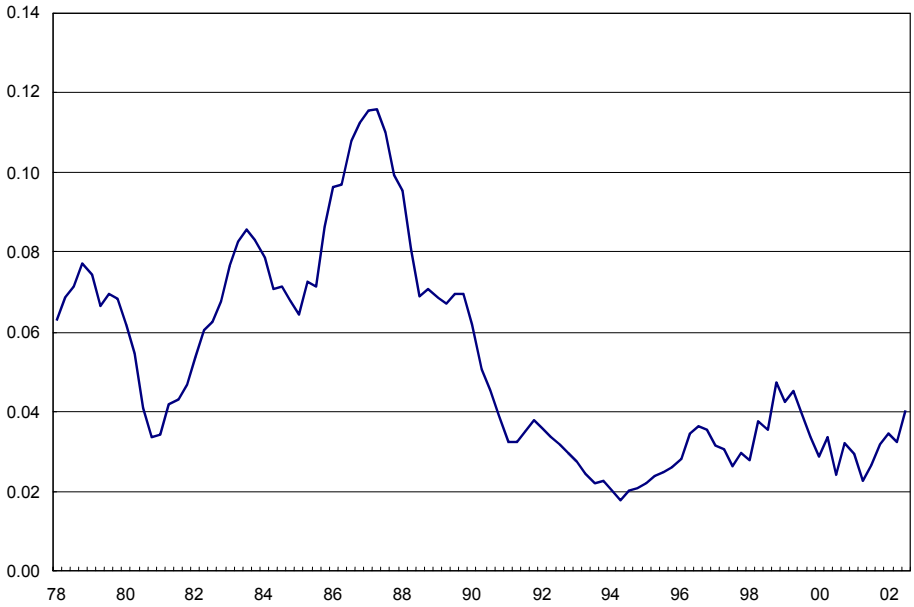
***Tankan* survey on lending attitude of financial institutions**



Source: Bank of Japan, "*Tankan* short-term economic survey of enterprises in Japan".

Figure 12

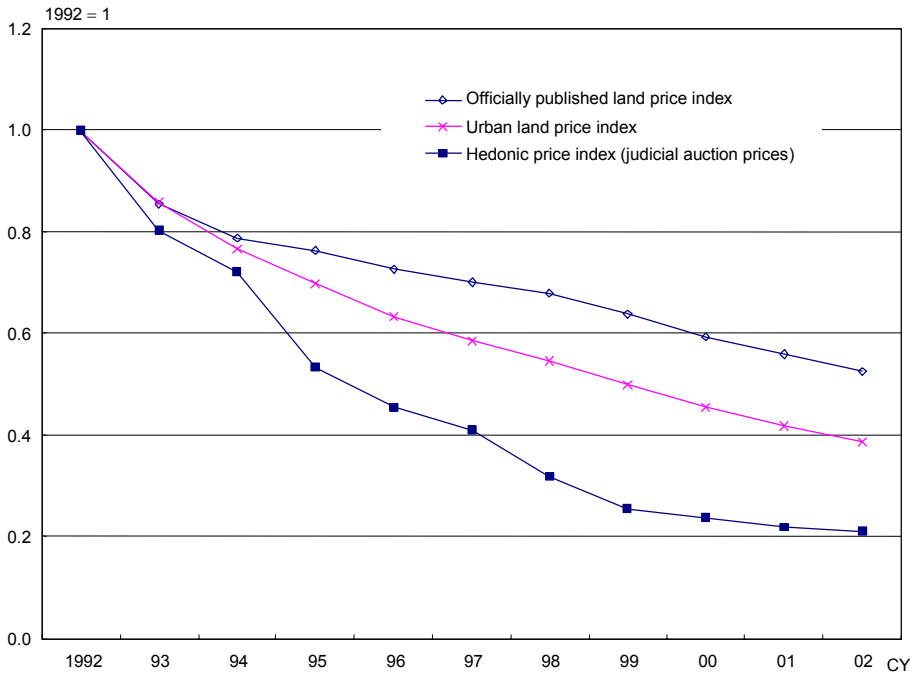
Sectoral credit shifts (σ^L)



Notes: 1. σ^L is calculated from 22 industries using data from Loans and Discounts Outstanding by Industry (Bank of Japan) from 1978 Q2 to 2002 Q4. 2. Current account overdrafts were not included in the series up to 1992 Q1, but have been included since then. 3. The figure for FY1993 is obtained from a linear interpolation of σ^L in 1992 Q1 and in 1993 Q2.

Figure 13

Land prices in Tokyo metropolitan area



Source: Saita (2003).

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