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The choice of lending patterns by Japanese banks during the 1980s and 1990s: The causes and consequences of a real estate lending boom

Kotaro TSURU*

Abstract

This paper presents empirical evidence on the choice of bank lending patterns by using a sample of 113 listed Japanese banks over the past two decades. In the second half of the 1980s, banks with weak capital positions, or having lost good customer bases, shifted their portfolio from loans to the manufacturing sector to those to the real estate sector, whose assets were, at the time, experiencing significant inflation. Thus, banks switched some of their operations towards collateral lending during this period. When land prices collapsed in the 1990s, Banks with a larger share of real estate lending found themselves with a higher bad loan ratio or lower profitability. Weakly capitalized banks, however, continued to refinance unprofitable real estate firms, rather than to provide new lending to the manufacturing sector in this post-bubble era. Finally, the strengthening of the regulatory and supervisory framework in 1997-98 may have weakened such soft-budget-constraints problems.

Key words: Real estate lending; Financial liberalization; Land price inflation; Non-performing loans; Soft-budget-constraints; Credit crunch

JEL classification: G21, G28, G32, G38

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1 Introduction

Some commentators have called the 1990s in Japan a “lost decade”. While there are, no doubt, numerous reasons for the country's prolonged stagnation, it cannot be denied that the non-performing loan problems of the banking sector are one of the most important. Despite the difficulties inherent in international comparisons of banking crisises, Hoshi and Kashyap (2000) argue that the magnitude of Japan's bad loan problems has been much larger than that of the US saving and loan crisis, while Corbett (2000) suggests that the worst-case estimates may even approach the scale of the problem faced by the Nordic countries. The question as to why Japanese banks accumulated such huge non-performing loans is thus crucial.

Many have argued that the aggressive lending behaviour of the late of 1980s was at the root of the non-performing loan problems of the 1990s. During the second half of 1980s, there was a large shift in bank loans to sectors such as finance/insurance (i.e. nonbanks), real estate and other services (Table 1). On the other hand, the proportion of loans to traditional industries, such as manufacturing and wholesale and retail trade fell significantly. This change had been ongoing for some firms for structural reasons, but it accelerated during the bubble period. On the other hand, and, contrary to widespread beliefs, there was little change in the proportion of loans to the construction sector during the same period. Table 2 presents the relationship between loan portfolio shifts and land price inflation rates in the main operating area of each bank in the second half of 1980s. Among loans by borrowers, only the shift to real estate loans was highly correlated with land price inflation.

Is there any economically meaningful relationship between banks' portfolios and the non-

performing loan problem? Since information on individual banks' non-performing loans by borrower is hardly available, we can only consider loans by industry. This evidence shows a correlation between shifts in the sectoral allocation of lending in the period 1985 – 1990 and the non-performing loan ratio[1] for 110 listed banks[2]. Table 3 shows that the non-performing loan ratio is correlated with portfolio shifts toward real estate (0.36) and nonbanks financial institutions (0.34). In the sample excluding long-term credit and trust banks, the correlation, however, becomes negative for the finance/insurance sector (-0.16) but rises for the real estate sector (0.52). This evidence suggests that the loan portfolio shift to real estate during the bubble period may have played a key role in generating non-performing loans later.

Interestingly, even after the burst of the bubble, loans to real estate firms continued to grow, while loans to manufacturing kept declining (Figure 1). This is somewhat puzzling since many of real estate projects turned sour due to the collapse in land prices. Thus, it is important to understand why such a lending pattern emerged during the post-bubble period.

Based on these empirical observations and motivations, Section 2 of this paper discusses the reasons why banks increased real estate loans in their loan portfolio. In particular, we test the theoretical predictions outlined in our companion paper (Tsuru (2001)). Section 3 considers the empirical relationship between the bank's portfolio shift and their ex-post performance. Section 4 focuses on the continued increase in real estate lending and fall in manufacturing lending during the 1990s, from the perspective of the coexistence of the soft-budget-constraints and credit

[1] The ratio of loans under risk management to total loans in March 1998. See Section 3.2 for the definition of loans under risk management.
[2] Throughout this paper, we use a sample of 113 listed banks (9 city banks, 3 long-term credit banks, 7 trust banks, 59 regional banks (tier I), 35 regional banks (tier II)), which is obtained from the Nikkei NEEEDS Company Data Base. As for the data during the 1980s, we use 110 listed banks (9 city banks, 2 long-term credit banks, 7 trust banks, 58 regional banks (tier I), 34 regional banks (tier II)) due to the availability of data.

crunches, as discussed in Tsuru (2001).

2 A large shift in banks' portfolios to real estate loans during the bubble era

2.1 Theoretical foundations

Review of the basic model

Here, we apply the theoretical results of Tsuru (2001). Before doing that, we review the basic model here (see Section 1 – 3 in Tsuru (2001) for more details).

There are a risk-neutral bank and a risk-neutral firm (borrower) with a project. In a two-period model, a bank can opt between collateral (i.e. secured lending with the requirement of (real estate) collateral requirement) and non-collateral lending (unsecured lending with no such requirement) at the beginning of period 1 and the bank makes this choice dependent on a number of economic conditions. For simplicity of the model, the bank is assumed to have all bargain powers to acquire all verifiable returns from the project, leaving private (non-verifiable) benefits for the firm.

There are two type of projects ("good" and "poor") and neither the firm nor the bank know the quality of his project, while they knows its distribution (the share of good projects, $0 < \alpha < 1$). Once the firm has started a project, it becomes aware of its quality. The firm with a poor project can possibly make it successful with his costly effort, which is not observed by the bank. At the end of period 1, the bank and the firm know the outcome of the project. If the project generates a successful outcome, they will end the contract. If the project becomes poor, the bank providing collateral lending has two options. One is to terminate the project, with getting a collateral value evaluated by a land price at the end of period 1. A land price is "high" or "low" and the ex ante probability of a high land price is $r\ (0 < r < 1)$. The other option is to refinance the poor project in

period 2, with engaging in monitoring activities (its efficiency, $k > 0$), which can surely increase the bank's payoffs, while reduce the firm's (private) benefits. The bank that has chosen non-collateral lending always refinances the poor project.

The merits of collateral lending lie in its option of acquiring collateral by terminating a poor project and its payoffs are larger the higher is a land price at the end of period 1. The threat of termination can potentially induce the borrower's effort. The demerits of collateral lending is that the bank incurs the set-up costs of collateral, since it has to find out the firm's assets for the use of collateral, evaluate their value, and manage them. We define the bank's efficiency in setting up collateral, $\delta > 0$ as the amount of collateral associated with a unit of the bank's marginal cost. In contrast, non-collateral lending does not incur such costs, while the bank with non-collateral lending has no alternative but to refinance a project, once it has become poor. The bank chooses lending pattern by comparing the expected payoffs from collateral and non-collateral lending.

Our main results from the basic model are summarised as follows.

(1) *When the bank's monitoring efficiency (k) is relatively high, the firm will exert effort ("the disciplinary case"). Otherwise, the firm will exert no effort (under non-collateral lending) ("the soft-budget-constraints (SBC) case"). In each case, there are corresponding threshold values of the efficiency in setting up collateral and the probability of high land prices that determine lending behaviour.*

(2) *When the efficiency in setting up collateral (δ) is relatively low (i.e. lower than the threshold values), the bank will always choose non-collateral lending.*

(3) *When the efficiency in setting up collateral (δ) is high enough, the bank will choose collateral lending if the probability of high land prices (r) is relatively high (i.e. higher than the*

threshold values) and non-collateral lending, otherwise. The bank's expected payoffs from non-collateral lending is constant in terms of r, while those from collateral lending increase with r.

(4) The expected payoffs from both lending patterns increase with the bank's monitoring efficiency (k) and the possibility of a good project (α).

Application of the basic model

We slightly modify this basic settings. In the above model, we considered the bank's decision on collateral requirement (i.e. collateral lending or non-collateral lending), given a project. Now, there are two different projects, M and R, which represent a manufacturing and a real estate's project respectively. A bank chooses one of the two projects and its lending pattern simultaneously.

Suppose that in the case of project M, a bank has a highly developed monitoring technology (high k_M) so that the firm always exerts effort ("the disciplinary case" holds). On the other hand, the efficiency in setting up real estate collateral (δ_M) is low. In this case, the bank always chooses non-collateral lending regardless of expected land price inflation[3]. The expected payoffs of project M can be defined as W_M^{DN}.

In contrast, let us assume that because of severe problems of asymmetric information, the bank's ability to monitor project R is very limited (k_R is low)[4] and the firm exerts no effort (the SBC case holds). On the other hand, it is easy for the bank to find the firm's real estate assets for the

[3] This theoretical result is important for the simplicity of the model, however, rather extreme. It is noted that manufacturing loans are often secured by real estate collateral.

[4] Allen (1996) stresses that asymmetric information and agency problems are severe in a real estate market, since lenders may not be able to distinguish between borrowers who are speculators and those who have good prospects.

collateral use and to evaluate their value (i.e. the efficiency in setting up collateral (δ_R) is high).

In such a case, the bank may choose collateral lending when expected land price inflation is high. The expected payoffs of project R can be defined $W_R^C \quad (r \geq r_S)$ under collateral lending and $W_R^{SN} \quad (r \leq r_S)$ under non-collateral lending. We also assume that project R generates lower returns than project M ($R_g^R < R_g^M$). For simplicity, the two projects have the same values for other exogenous variables in the model.

These assumptions are somewhat extreme, however, there is some supporting evidence for them. First, real estate companies, have on average a much higher proportion of land assets to total assets than other industries (26.6 per cent compared to 12.8 per cent for all industry in FY 1999, Ministry of Finance, "Hojin Kigyo Tokei"). In contrast, manufacturing firms have a relatively low ratio (9.0 per cent in FY 1999). Thus, banks can easily find out land assets for collateral when they provide loans to real estate firms.

Second, over the past three decades (even in the bubble era), return on assets (ROA, operating profits / total assets) in the real estate sector has been consistently lower that in the manufacturing sector, which has been, however, more variable due to business cycles (Figure 2). Thus, it is likely that a real estate project generates lower returns than a manufacturing project.

On the basis of these observations, it can be argued that real estate loans are more likely to involve collateral requirement, especially when expected land prices are high, and manufacturing loans are less secured by real estate collateral. Such a prediction can be supported by the evidence

from the correlation between the change in the proportion of loans backed by real estate collateral and those of loans by borrower's industry (Table 4)[5]. We find that a shift in loan portfolio to real estate industry in the second half of the 1980s has the highest correlation with that backed by real estate collateral, while a change in the proportion of manufacturing loans is negatively correlated to it[6]. This may indicate that the significant portion of increased loans to real estate was secured by real estate collateral.

Figure 3 shows the choice between the two projects and the lending pattern. Since project M generates higher returns than project R ($R_g^M > R_g^R$) and involves a more efficient monitoring technology ($k_M > k_R$) than project R, it always generates higher expected payoffs in the case of non-collateral lending ($W_M^{DN} > W_R^{SN}$). There exists a threshold value of the probability of high land prices (r_{MR}), at which the expected payoff of project M is equal to that of project R. If the ex ante probability of high land prices (r) is lower than this value, the bank chooses project M with non-collateral lending. Otherwise, the bank chooses project R with collateral lending.

Thus, an increase in the probability of high land prices (r) will lead to a shift in the bank's portfolio from manufacturing loans to real estate ones. We obtain our first hypothesis:

Hypothesis 1:

A bank expecting high land price inflation, is more likely to prefer collateral lending to the real estate industry to non-collateral lending to the manufacturing sector.

[5] The information of bank loan portfolio is available (1) by industry, (2) by the kind of collateral, and (3) by the size of borrowers (SMEs or large ones), while cross information is not available. Thus, we do not know, for example, the extent to which real estate loans are secured or not.

[6] The proportion of loans to the real estate sector is also negatively correlated with the proportion of loans secured by real estate collateral (-0.47 in March 1985).

The choice between the two forms of lending will also be influenced by changes in the financial landscape. Thus, in the 1980s, for instance, large or high-quality borrowers of the manufacturing sector have found more opportunities in raising their funds in capital markets due to the financial liberalisation that started at the end of 1970s, and thus reduced their dependence on banks. In addition, a surge in stock prices allowed large companies to issue equity-related securities more easily and cheaply during the second half of 1980s. Thus, since banks were losing good customer bases, they were forced to find new but poorer customers. If banks choose a quality-unknown project from the manufacturing sector, its expected quality will be lower.

Such a situation can be described as a fall in the share of good projects in the manufacturing sector in the model mentioned above. If the probability of project M's success (α_M) falls ($\alpha_M \rightarrow \alpha'_M (< \alpha_M)$), the expected benefits from financing project M, $W_M^{DN}(r, \alpha_M)$ will shift downward to $W_M^{DN}(r, \alpha'_M)$ (Figure 3), and the threshold value of (r_{MR}) will also fall($r_{MR} \rightarrow r'_{MR}$). Thus, when project M is less likely to be good (lower α_M), the bank is more likely to choose Project R and to demand land collateral.

It is also important to examine the liability (deposits) side of banks and to understand the full impact of financial deregulation, which is not explicitly taken into consideration in our basic model. Financial liberalisation usually increases not only firms' financing options but also savers' investment options. In such circumstances, banks might encounter not only a decline in good investment opportunities (i.e. the loss of good manufacturing customers mentioned above), but also a fall in the level of deposits, as household diversify the allocation of their financial assets. If the impact of these changes on the asset and liability sides of banks is balanced, banks can limit

any decline in the average quality of their customers by reducing the level of total loans.

In the case of Japan, however, financial liberalisation had little impact on the financial portfolios of households. Hence, the funds available for bank loans (i.e. deposits) went on growing (e.g. Hoshi and Kashyap (2000)). Thus, the average quality of potential customers declined. We obtain the following hypothesis.

Hypothesis 2:

Banks having lost good manufacturing customer bases and letting deposits grow are more likely to prefer collateral lending to the real estate industry to non-collateral lending to the manufacturing sector.

2.2 Methodology

We use a sample of 110 banks (9 city banks, 2 long-term credit banks, 7 trust banks, 58 regional banks (tier I), 34 regional banks (tier II)), which is obtained from the Nikkei NEEEDS Company Data Base. The sample is cross-section data (see Tables 5 and 6 for basic statistics and correlation matrix). To test the above two hypothesises, we estimate the following equations.

Our dependent variables are increases in (1) the proportion of real estate loans and (2) that of manufacturing loans from March 1985 to March 1990. A cross sectional difference in these dependent variables is explained by the following independent variables.

The first explanatory variable, which is associated with Hypothesis 1, is the land price inflation rate (commercial areas, from July 1986 to July 1990) of the prefecture in which the bank has its

headquarter office. Major banks (city banks, long-term credit banks, and trust banks) have their head quarters in major cities (usually, Tokyo or Osaka), while regional banks, which are the majority in our sample, have their main offices in smaller cities and operate in their regions. Thus, different banks, especially regional banks are likely to see different land price movements in their main operating areas. The data is from “Officially Published Land Price”, National Land Agency. One problem with this variable is the use of the “ex-post” rather than of the “expected” inflation rate of land prices, which is consistent with our theoretical model. Hence, we also test the variable of the land price inflation rate from July 1981 to July 1985, assuming adaptive expectations. We predict that banks with (ex-post) higher land price inflation rates in their main operating areas, will shift their loans more to real estate, and away from manufacturing.

We construct the second explanatory variable to test Hypothesis 2. In order to look at the asset and liability sides of banks, we focus on the ratio of “safe investment opportunities” calculated as the sum of the level of investment securities and that of loans to large companies divided by the level of deposits. Banks with a low level for this ratio will find themselves providing more loans to small business. Consider the case of an exogenous decline in loans to large firms. If banks are able to increase the level of investment securities or decrease the level of deposits, they can overcome such effects and keep this ratio constant. However, securities are generally an imperfect substitute for bank loans on the asset side of banks while the level of deposits is likely to be an exogenous variable for most banks.

Thus, given the financial constraint associated with a bank’s balance sheet, a fall in the ratio of safe investment opportunities should generate pressures to increase loans to small business. These are usually considered riskier than loans to large firms. The change in this ratio from

March 1980 to March 1995 is used as the second explanatory variable. We predict that this variable is negatively correlated to the change in the proportion of real estate loans and positively correlated to that of manufacturing loans.

To test our hypothesis, we control for two other factors. One variable is a capital ratio. Weakly capitalised banks, thus with higher default risk, are usually likely to shift their portfolios to safer assets to avoid insolvency[7]. We use the sum of own capital and loan loss reserves divided by total assets as an adjusted capital ratio in March 1985, since loan loss reserves can be added to bank capital that cushions default risk. We will examine the impact of adjusted capital ratios on the proportions of real estate and manufacturing loans.

The other variables are the proportion of real estate or of manufacturing loans to total loans in March 1985. These variables show a portfolio re-balancing effect. If there is such an effect in loan portfolios, banks with a higher proportion of a particular asset will reduce this. In such a case, the coefficients of these variables become negative.

2.3 Empirical results

Table 7 presents the empirical results of the regressions with the above explanatory variables[8].
In the first column of Table 7, we show the estimated regression for changes in the proportion of real estate loans by the OLS procedure. First, the estimated coefficient on land price inflation

[7] On the other hand, as we will see later (Section 4), very poorly capitalised banks operating under a deposit insurance system may have an incentive to engage in risk-taking behaviour, with choosing riskier projects, since the downside risk of banks is perfectly insured by the government. Thus, the effect of the capital strength on banks' portfolios is theoretically ambiguous. In the 1980s, when the financial health of Japanese banks was much better than in the 1990s, the former mechanism (the negative relationship between capital strength and the choice of safer assets) may have dominated.
[8] We also estimated the regression with the constant term, which was found to be insignificant. Thus, we omitted the constant term from the explanatory variables.

(1986-90) is positive, as predicted, and statistically significant at the 1 per cent level. A one percent difference in land price inflation rates between two banks leads to a 0.015 per cent difference in the share of their real estate loans. Second, the estimated coefficient on a change in the ratio of "safe investment opportunities" is also consistent with our theoretical prediction, negative and statistically significant at the 5 per cent level[9]. Third, the adjusted capital-asset-ratio has a negative and significant effect[10]. Weakly capitalised banks shifted their portfolios to real estate loans. This may suggest that banks considered real estate loans as "safer" assets in the late 1980s. Fourth, the proportion of real estate loans is also statistically significant, but has a positive coefficient. This implies that banks with a higher share of real estate loans in 1985 expanded these loans more aggressively than other banks.

In the fourth column, we present the estimated regression for a change in the proportion of manufacturing loans. The results are totally symmetrical to those for real estate loans. Thus, the coefficients on all these explanatory variables have signs opposite to those for real estate loans and are theoretically consistent and statistically significant. Banks with (ex-post) higher land price inflation rates, lower capital ratios and under greater pressure to shift their portfolio towards small business lending, not only increased the proportion of real estate loans but also reduced the weight of manufacturing loans.

Except for the land price inflation variable, all the other variables are based on data for March 1985 and March 1980. Given that the dependent variable covers the period 1985 – 90, these explanatory variables would seem to be exogenous. However, endogeneity between the dependent

[9] We also tested a simpler variable of "safe investment opportunities" that included only loans to large companies. The estimated coefficient (for real estate loans) was, however, less significant.
[10] We also tested a simpler variable of capital-asset-ratio (own capital / total assets), which became slightly less significant.

variables and land price inflation is possible, since such inflation in any operating area can be generated by the loans provided by banks to the real estate industry in that area.

We present the regressions with the lagged variable of land inflation rate from July 1981 to July 1985 in the second and fifth columns in Table 7. The land price inflation rate in the first half of the 1980s has a statistically significant impact on both real estate and manufacturing loans, while some of other explanatory variables becomes insignificant and the adjusted R-squared is lower in the regression for real estate loans (in the second column). This implies that the land price inflation variable in the second half of the 1980s contains important information on banks' portfolios, which cannot be captured by that variable in early 1980s. The process of asset price bubbles might be, thus, somewhat self-fulfilling in late 1980s.

We also use two-stage least squares (2SLS) estimates to deal with the endogeneity problem. Our (additional) instrumental variables are (1) the inflation rate of the land price index from July 1981 to July 1985 and (2) the adjusted capital ratio in March 1980. The results are shown in the third and sixth columns in Table 7. Like the OLS estimates, the estimated coefficients on land price inflation, change in the ratio of "safe investment opportunities" (only for real estate loans), and the adjusted capital ratio are all statistically significant and have the right signs. One of the important differences between the OLS and 2SLS estimates is that the absolute size of the estimated coefficients on the land prices is much larger (almost double) in the 2SLS estimates than in the OLS estimates[11].

2.4 Related empirical literature

[11] Another difference is that the proportion of lending to real estate becomes statistically insignificant in the 2SLS

Ueda (2000), using a sample of 147 banks, examine the determinants of the share of bank loans in 1990 to real estate related industries (real estate, construction and nonbanks). He finds that (1) land price inflation rate (1986-90), (2) the share of loans backed by real estate collateral in 1986, and (3) total loans divided by the number of branches in March 1980, are positively and significantly correlated, while (4) the ratio of current costs to current profits in 1986 is negatively correlated to the proportion of real estate loans. The effect of the adjusted capital-asset ratio in 1986 is not significant.

An interesting point emerging from this study is the effect of the third explanatory variable, which can be considered as the inverse of bank's monitoring resources devoted to a unit of loans. Given the number of customers (i.e. total loans), banks with a larger number of branches may have larger resources for credit analysis and closer access to the information of their customers. The finding that banks with the lower level of monitoring had a higher proportion of real estate loans is consistent with our theoretical model. One shortcoming of his analysis is that he did not present a particular theoretical model supporting his analysis. Nor did he explicitly consider the effects of financial liberalisation.

To overcome some of the shortcomings of the work, Hoshi (2000 a), using a sample of panel data for 150 banks during the period March 1984 – March 1990, examines the effect of financial deregulation as well as land price inflation on the rapid portfolio shift to the real estate industry. He selects several variables (measured as changes from the previous year) to proxy this deregulation effect, such as (1) loans to "Keiretsu" member firms, (2) loans to listed (presumably established) firms, (3) loans to small business, (4) the proportion of government bonds to total

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regression.

assets, (5) the ratio of overseas branches (as a proxy for the share of foreign loans and investments). Among these, only changes in loans to Keiretsu firms or to listed firms have a significant negative impact on the change in the proportion of real estate loans. This implies that the loss of a good customer base following financial deregulation led to a rapid shift to real estate lending in the bubble era.

Hoshi's empirical study covers a number of important issues related to financial deregulation. However, his selection of explanatory variables is somewhat ad-hoc. For example, government bonds are only part of the investment securities that banks hold as assets. In addition, he did not consider the liability side of banks, although he stressed its importance elsewhere.

In contrast, our empirical analysis presents a theoretical model that examines the shift to real estate loans. Second, it stresses the substitution mechanism between real estate and manufacturing loans. Third, it also considers the asset and liability sides of banks through the ratio of "safe investment opportunities". As alternative investment opportunities, we choose a broad category of investment securities, which covers different type of assets (e.g. equities) in addition to government bonds.

2.5 Summary

In this subsection, we have considered the driving forces behind the banks' rush to real estate lending in the late 1980s. As consistent with our theoretical considerations, banks (1) experiencing higher land price inflation in their main operating areas during the bubble period, (2) with lower capital ratios before the bubble started, (3) having lost more "safe investment opportunities" more in the first half of the 1980s due to the progress of financial deregulation,

shifted their loan portfolios more aggressively from the manufacturing to the real estate sector.

3 A rapid shift in banks' portfolios to real estate loans and its ex-post influence on banking performance.

3.1 Introduction and related work

After the burst of the bubble, real-estate-related projects collapsed and loans to them became non-performing. Thus, the rush toward real estate lending in the bubble era has often been blamed for the accumulation of non-performing loans in the Japanese banking sector.

As we have seen earlier, the non-performing loan ratio in March 1998 was highly correlated with the change in the proportion of real estate loans during March 1985 – March 1990. To examine this issue further, we investigate more closely the factors affecting the ex-post performance of Japanese banking in the 1990s. As for existing empirical analysis, Ueda (2000) finds that the large swing in land price inflation (rising between 1986 and 1990 and falling between 1990 and 1996) had a significant positive impact on the bad loan ratio in 1996. In addition, Hoshi (2000 a) shows that the change in the proportion of real estate loans during the period March 1983 – March 1990, also had a statistically significant and positive impact on the bad loan ratio in March 1998, while the effect of loans to nonbanks was negative and statistically insignificant.

3.2 Empirical specification and results

Using a sample of 110 banks, we re-examine the relationship between the non-performing loan ratio and the changes in banks' loan portfolios during the bubble era. Our dependent variable is

the non-performing loan ratio measured as the ratio of risk management loans to total loans in March 1998.

Risk management loans for individual banks consist of (1) loans to failed corporations, (2) past due loans (i.e. loans on which payments are suspended for more than three months), and (3) restructured loans (i.e. loans with reduced interest rates or loans to corporations under reorganisation). This definition of non-performing loans is the broadest among those published and its information is available for individual banks from March 1998. Until early 1990s, Japanese banks were not required to systematically disclose detailed information on their non-performing loans, but disclosure requirements have gradually expanded and the definition of risk management loans has come closer to the US Securities and Exchange Commission (SEC) definition.

The following explanatory variables are chosen. The first two are increases in the proportion of loans to real estate and to finance/insurance (i.e. nonbanks) during the period March 1985 – March 1990. We predict that banks with a rapid shift in their portfolios to these industries will have a higher non-performing loan ratio. Another important variable is the change in land prices during the period July 1991 - July 1998. Our prediction is that banks facing a larger decline in land prices in their main operating areas will suffer from a higher level of the bad loan ratio.

Table 8 presents the empirical results. Equations (1) – (4) show the results of different combinations of the explanatory variables. The estimated coefficients on the variables representing real estate loans, nonbanks loans and land prices are all statistically significant and have the right signs. Thus, banks, which increased the proportion of loans more to real estate or to

nonbanks during the bubble era, or experienced a large decline in land prices in the 1990s, suffered from more severe non-performing loan problems.

Contrary to the result of Hoshi (2000, a), the loans to nonbanks variable has a statistically significant effect on the non-performing loan ratio. However, the significance of this variable might be related to our sample, since this variable becomes insignificant and produces the wrong sign when we use a different sample (101 banks), excluding long-term credit and trust banks. To examine the importance of loans to nonbanks for these banks, we add two new variables into the regressions with the original sample of 110 banks. They are

(1) The increase in the proportion of lending to nonbanks multiplied by the long-term credit bank dummy (= 1 for long-term credit banks and = 0 otherwise), and

(2) The increase in the proportion of lending to nonbanks multiplied by the trust bank dummy (= 1 for trust banks and = 0 otherwise).

The estimated coefficients on both variables are positive and statistically significant at the 1 per cent level, while the loans to finance/insurance variable becomes insignificant. This suggests that an increase in loans to finance/insurance is an important factor in explaining the level of the non-performing loan ratio for long-term credit and trust banks, while for other banks (city and regional banks), the shift to real estate loans is the only relevant portfolio factor.

To examine the robustness of the relationship between changes in loan portfolios and the performance of individual banks during the post-bubble period, we also estimate regressions looking at banks' ROA (return on asset), using the same explanatory variables. Table 9 shows the results, which are consistent with those of the non-performing ratio. Thus, the estimated

coefficients on changes in the proportion of loans to real estate during the bubble era, and changes in land prices during the post-bubble period, are statistically significant and produce the right signs. In addition, the portfolio shift to nonbanks is also an important factor determining the level of ROA, but only for long-term credit and trust banks.

How can the marked difference between long-term credit / trust banks and other banks in the role of loans to nonbanks be explained ? Long-term credit and trust banks had originally specialised in long-term lending to large companies[12]. In this sense, these banks were most severely affected by the loss of a good customer base due to financial deregulation and had a greater need for finding new customers. As Table 10 shows, long-term and trust banks increased their loans to finance/insurance (i.e. nonbanks) much more drastically than other banks during the period 1985-90. It is well known that nonbank financial institutions significantly increased their loans to the real estate industry during the same period[13]. Thus, long-term credit and trust banks used nonbanks in order to provide loans to the real estate industry indirectly. In particular, long-term credit banks expanded loans to their 100 per cent owned financial subsidiaries, through which loans to the real estate sector increased significantly. This large exposure to the real estate sector led to the collapse of two long-term credit banks in 1998 (Shimizu (2000)).

[12] City banks and regional banks traditionally engage in short-term lending. Long-term credit banks are allowed to raise funds by issuing bonds (rather than taking deposits) and trust banks use money or assets entrusted by investors.

[13] "Jusen", housing loan companies are typical nonbanks that drastically increased real estate loans. In April 1990, the Ministry of Finance introduced regulations to limit total bank exposure to the real estate sector, however, loans to nonbanks were exempted. Thus, lending to nonbanks increased rapidly during 1990 – 1991, even after the above regulation was introduced.

4 The coexistence of soft-budget-constraints and credit crunches in the 1990s

4.1 Some background

In the 1990s, given the continuing weakness of the Japanese economy, overall lending growth stagnated, and a debate arose as to whether a credit crunch had occurred. Theoretically, a deterioration in a bank's capital (net worth) due to an increase in the importance of non-performing loans, induces a bank to limit the size of its lending. This is a mechanism usually associated with a credit crunch. Most studies focusing on the first half of 1990s, however, could not find clear evidence for such a crunch in Japan (e.g. Woo (1999))[14].

Such a puzzle may be justified by the coexistence of soft-budget-constraints and credit crunches as shown by a modified version of the basic model ("the risky refinancing model") in Tsuru (2001). In that model, a bank that had provided loans to a real estate project, which turned non-performing, had two options. It could either refinance this risky project (with no returns), only hoping to obtain a higher collateral value should land prices rise or it could finance a new and safe project in the manufacturing sector.

In this model, a profit-maximising bank prefers the safe project. Regulatory and supervisory arrangement of banking industry, however, may change the bank's desirable choice of a project. The deposit insurance system is likely to encourage a weakly capitalised bank to take more risk, if the authority can not easily detect such behaviour[15]. Our theoretical results from "the risky

[14] Another interesting issue is the effect of the BIS risk-based capital requirement (introduced in March 1993) on lending behaviour. Ito and Sasaki (1998) found the positive and significant impact on the lending of city banks between 1990 and 1993 and no such significant impact was not observed for other banks (trust and regional banks). They concluded that the risk-based capital requirement was a serious hurdle only for internationally active banks.

[15] We assume that the bank managers are not dismissed even if the bank is recapitalised. Thus, the bank is willing to accept capital injections when it becomes insolvent.

financing model" leads to the following hypothesis.

Hypothesis 3:

Suppose that a deposit insurance system exists and that the monitoring (or disclosure) of banks' capital positions is limited and banks are not allowed to hide their losses from the regulatory authorities. Then, even if loans to real estate (for refinancing) are unprofitable ex ante and loans to manufacturing are more profitable and safer, weakly capitalised banks will tend to increase loans to real estate.

Whether banks choose a refinancing option or not depends crucially on the effectiveness of the government's monitoring in our model. Thus, we can obtain the following hypothesis:

Hypothesis 4:

When full information on the balance sheets of banks is available and the government's prudential policy can effectively detect the banks' risk-taking behaviour, weakly capitalised banks will refrain from refinancing poor real estate projects, thus mitigating the SBCs' problems.

It is interesting to test Hypothesis 4 on the case of Japan, since the regulatory and supervisory framework for the banking industry was subject to extensive reform in 1997 - 1998. For example, comprehensive disclosure rules were imposed from March 1998 and the Prompt Corrective Action (PCA) procedure, aimed at poorly capitalised banks, was initially planned for April 1998.

Although the PCA scheme was postponed for one year to provide banks an opportunity to improve their balance sheets, it is highly likely that banks began to hesitate in refinancing poor real estate

projects 1998 onwards, thereby strengthening the impression of a credit crunch. Woo (1999) first examined the possibility of a structural change of total lending behaviour in 1997 –1998. We will reconsider this issue by focusing on real estate loans.

Among related literature, our empirical motivation is closely related to that of Hoshi (2000 b). He points to the possibility that banks with a large size of non-performing loans may lend to poor borrowers with worse investment opportunities (e.g. real estate) rather than to good borrowers (e.g. manufacturing). As supporting evidence, he shows the continuing growth in loans to real estate and the declining trend in loans to manufacturing in the 1990s. Our analysis further develops his ideas, by setting out a theoretical model and testing it by using panel data.

4.2 Data and Methodology

Our sample includes the panel data of 113 listed banks (9 city banks, 3 long-term credit banks, 7 trust banks, 59 regional banks (tier I), 35 regional banks (tier II)) during the period March 1993 – March 1998. We choose our sample period from March 1993, since the disclosure of non-performing loans for individual bank started from that year. Our dependent variable is the year-on-year growth in real estate and manufacturing loans. We test Hypothesises 3 and 4.

First of all, we consider the capital strength of banks. Due to the limited disclosure rules on balance sheet information, there is no complete measure of this. Thus, we select three proxies to measure banks' balance sheet conditions. We use one-year lagged variables for all three measures, since banks decide on the rate of loan growth in the light of their capital strength at the end of the previous period. The first measure is an adjusted capital asset ratio. This ratio is defined as follows:

The adjusted capital ratio = (own capital + loan loss reserves + unrealised capital gains (or losses) of investment securities) / total assets.

Loan loss reserves are categorised as liability item in the banks' balance sheet, nevertheless, such reserves can be used to write off bad loans and could be treated as a part of own capital. In addition, our capital asset ratio is adjusted for unrealised capital gains. Historically, Japanese banks have carried a large amount of unrealised capital gains on securities holdings, which were not captured in their books. During the 1990s, on the other hand, the fall in stock prices had led to widespread capital losses on banks' asset holdings. We predict a positive impact of the adjusted capital asset ratio on the growth in real estate loans.

The second measure is the non-performing loan ratio. Even if two banks have the same capital-asset ratio, a bank with a higher non-performing loan ratio can be considered as having weaker capitalisation, since the quality of its own capital is lower. We use "loans to bankrupt borrowers" as the definition of non-performing loans, since this, albeit the narrowest category of bad loans, is the only one available for all banks throughout the period March 1993 – March 1998. Our prediction is that the level of the non-performing loans ratio is positively correlated to the growth in real estate loans.

These reported balance sheet data may be easily manipulated by the banks themselves. To overcome this problem, we can use the market value of banks, which directly reflects the market's assessments of individual banks' performance including their capital strength. Thus, the third measure, "market-to-book" ratio is defined as follows:

The market to book ratio = (total outstanding shares × the bank's share price + total liabilities) / total assets

We expect this variable to have a negative impact on the growth in real estate loans. We move to the effect of land price movements. Our theory predicts that banks that expect higher land price inflation are more likely to refinance real estate projects. Since there is no proxy for expected land price inflation, we assume adaptive expectations. Thus, we uses one-year, two-year and three-year lagged variables of annual changes in land prices in the banks' main operating areas. Since banks are more likely to refinance poor real estate projects when they have optimistic expectations on land prices, we predict that the coefficients on the lagged land price inflation variables will be positive.

To control for other factors affecting the growth in real estate loans, we choose two additional explanatory variables: the growth rate of prefecture-level GDP[16] in the main operating area of each bank, and the deposit growth rate. Since these variables seem to be less subject to an endogeniety problem[17], we use the data in the current period.

The prefecture-level GDP growth variable controls for demand factors influencing bank lending, since loans by individual banks can be expected to be positively affected by regional economic conditions in their main operating area.

[16] Gross Prefectual Domestic Product is obtained from *Annual Report on Prefectual Accounts 2000*, Economic Planning Agency.
[17] A causality from the loan growth to the prefecture-level GDP growth or to the deposit growth may be weak.

The deposit growth variable controls for the availability of funds to banks if capital markets are imperfect. Given a decline in bank deposits, banks can offset such a shock, and their lending behaviour will be unaffected, if they can freely obtain other sources of funds (e.g. CDs) or run down their liquid assets (i.e. investment securities). Banks are, however, financially constrained due to capital market imperfections, since deposits and other sources of funds (e.g. CDs) are usually imperfect substitutes on their liability side. In addition, banks may not have a sufficient level of liquid assets to cushion the negative shock on their deposits (loans and liquid assets are also imperfect substitutes on the banks' asset side.).

Thus, a shock to the banks' deposit base is likely to translate into "real" effects on their lending behaviour (e.g. Kashyap and Stein (1995)). Thus, loan growth may be positively correlated to deposit growth.

Since we use one-year lagged variables of capital strength, we examine panel data for five years, from March 1994 to March 1998. First, we estimate pooled OLS regression. This model assumes that each bank has the same constant term. Banks in our sample may, however, be heterogeneous. In order to control for bank-specific factors, we incorporate a dummy variable for each bank in the OLS estimations. This is the one-way fixed effect model, in which the constant terms are different among banks. If the bank-specific dummies are random disturbances, the model is called the one-way random effect model. We can add to these models a time-specific dummy for each year, which controls for a common shock to banks in each year. The two-way fixed effect model has constant bank and time dummies, while these dummy variables are random disturbances in the two-way random effect model.

We estimate five competing models and select the best one by using several tests (see, for example, Greene (2000)). First, we examine the significance of the (one-way or two-way) fixed models. We test a hypothesis that the constant terms are all equal with the F test. If we can reject the null hypothesis, the result will be in favour of the fixed effect model over the OLS one. The F test can be used to test the significance of the two-way fixed effect model over the one-way one.

Next, we examine the significance of the random effect models compared to the OLS one by the Lagrange multiplier test. Our null hypothesis is that the OLS residuals are zero on average. A Lagrange multiplier test statistic is distributed chi-squared with one degree of freedom. If the null hypothesis is rejected, we can conclude that the result is in favour of the random effect model.

Finally, we use the Hausman test for the selection of the fixed or random effect models. We test our null hypothesis that the individual-specific effects derived from the fixed effect models are not correlated with other explanatory variables. The test statistic is distributed chi-squared. If we cannot reject this hypothesis, the random effect model is the better choice.

4.3 Empirical results

Panel data analysis

Tables 11 and 12 presents the results of regressions with (1) the growth rate of real estate loans, (2) the growth rate of manufacturing loans as dependent variables for the sample of panel data during the period March 1994 – March 1998 (for basic statistics and the correlation matrix, see Tables 13 and 14).

Among competing models, several tests (see Table 15) select the one-way fixed effect model[18] as the best one for the regressions of real estate loans (these are shown in the second, third and fourth columns of Table 11). The two variables standing as proxies for the banks' balance sheet strength, have negative signs, in line with our hypothesis, which suggested that banks with relatively low capital ratios would expand their loans to the real estate sector, but the coefficients are statistically insignificant[19]. Contrary to our expectation, the coefficient on the non-performing loan ratio also has a negative effect on real estate loans, but this coefficient too is statistically insignificant.

Turning to the effect of land price inflation rates, while the one and two-year lagged variables are statistically insignificant, the three-year lagged variable has a positive and significant impact on the loan growth rate. This may indicate that the formation of land price expectations by banks involves significant inertia. Banks tend to use former information (three years before) on land prices to determine their lending behaviour. Banks that have experienced a higher land price inflation rate (or, a lower land price deflation rate), are likely to have a higher growth rate in real estate loans.

As for controlling variables, the effect of deposit growth is positive and statistically significant. This suggests that deposit growth can put a financial constraint on lending growth. Prefecture-level GDP growth, as theoretically predicted, has a positive impact on lending growth, but its effect is statistically insignificant[20].

[18] For the one-way fixed models, we present t-statistics, which were calculated by heteroskedasticity consistent estimates of standard errors by White (1980) in Table 11.
[19] When we use a simpler variable of capital-asset-ratio (own capital / total assets), its coefficient has a positive sign, being inconsistent with the theoretical prediction.
[20] It is noted that the correlation between the prefecture-level GDP growth variable and the deposit growth variable is relatively low (0.14, see Table 14).

Table 12 reports the results of regressions with the growth in manufacturing loans as the dependent variable. In this occasion, the test made suggests that the two-way fixed effect model is the best one for loans to this sector (Table 15). The banks' capital strength now has a very different impact. Loans to the manufacturing sector are positively affected by both the adjusted capital ratio and by the market-to-book ratio (though the coefficient on the latter is statistically insignificant). The estimated coefficient on the non-performing loan ratio is negative, and statistically significant. These results clearly show that banks with lower capital-asset ratios or higher non-performing loan ratios had a lower growth in manufacturing loans.

Our results thus suggest that banks with weaker capital positions increased real estate loans and reduced manufacturing loans more rapidly than strongly capitalised banks. This occurred well after the burst of the bubble, This is, therefore, evidence that a credit crunch in the manufacturing sector coexisted for some years in the 1990s with soft-budget-constraints in the real estate one.

Changes in the effect of capital positions on real estate loan growth

Next, we examine how the effect of capital positions on real estate loan growth varied during the sample period. Table 16 reports OLS regressions for each year one of FY 1994-97 (March 1995-March 1998). Explanatory variables are limited to (1) the adjusted capital ratio (one-year lag), (2) the land price inflation rate in the main operating area (three-year lag), and (3) the deposit growth rate, which are basically significant in the panel data analysis. The impact of the adjusted capital ratio on real estate loans was negative and statistically significant in FY 1994, 1995, and 1996, but became insignificant in FY 1997. The absolute size of the coefficient on the adjusted

capital ratio decreases steadily from one year to the next. To test whether the adjusted capital ratio has a statistically different impact on real estate loan growth in FY 1997, we add the variable of the adjusted capital ratio multiplied by the FY 1997 dummy in the pooled OLS regression. The coefficient on this variable was statistically insignificant, but positive. This may suggest that the soft-budget-constraint effect on real estate loans weakened through time, and particularly, in 1997-98. Such a result is also consistent with the fact that the growth in aggregate real estate loans has begun to fall sharply since early 1998 (Figure 1).

These results may tentatively indicate that the mechanism of the soft-budget-constraints became weaker in 1997-1998. In addition to several regulatory and supervisory reforms in the banking system, a series of failures of large financial institutions, including Hokkaido-Takushoku Bank, and Yamaichi Securities in the autumn of 1997, might have limited risk-taking behaviour by banks and might have put pressure on weakly capitalised banks to increase their capital ratios.

Related empirical literature

Some studies investigate the determinants of lending growth in the 1990s. Woo (1999) considers the relationship between the capital strength of banks and lending growth. He finds that for most of the first half of the 1990s, the effect of capital ratios on new lending growth was negative (thus there was no evidence to support the credit crunch hypothesis) while it was positive in subsequent years, particularly so in 1997-98. He stresses that the uniqueness of the period 1997-98 was mainly due to a series of fundamental changes in Japan's financial system. One of the shortcomings of his analysis is that he considered only the total lending. The capital strength of banks should have had different impacts on loans to real estate and to manufacturing. We re-examined this issue by focusing on loans to both these sectors.

Ogawa and Kitasaka (2000), on the basis of their own theoretical model, examine the determinants of bank lending during the first half of the 1990s as well as in the 1980s. Their explanatory variables includes interest rate margins, changes in land prices and the growth rate of deposits, while they do not consider the role of banks' capital positions, arguably one of the most important determinants of lending growth in the 1990s. They examine the impact of these variables on loans to manufacturing and to non-manufacturing, but provide no clear explanation for the difference in impacts, which we have focused on in this paper.

4.4 Summary

In this subsection, we find that weakly capitalised banks with optimistic expectations on land price developments tended to increase real estate loans and limit manufacturing loans more rapidly in the middle of the 1990s. This provides evidence for the coexistence of both a soft-budget-constraint and a credit crunch in Japan in that period. The rapid changes in the banking system in 1997 – 98, however, probably weakened the soft-budget-constraints.

5 Concluding remarks

To test some of the implications of the theoretical model of Tsuru (2001), this paper provides empirical evidence on the choice of bank lending patterns by using a sample of 113 listed Japanese banks over the past two decades. In the second half of the 1980s, banks observing higher land price inflation in their main operating areas, or those with weak capital positions, or those having lost good customer bases, shifted their portfolios more aggressively away from loans to the manufacturing sector and towards those to the real estate one, which tended to be secured by real estate assets. Thus, banks switched some of their operations towards collateral lending

during this period.

Given the burst of the bubble, banks with a larger share of real estate lending were more likely to have a higher bad loan ratio or lower profitability, in the 1990s. Weakly capitalised banks, however, went on refinancing unprofitable real estate firms rather than to providing new lending to the manufacturing sector during this post-bubble era. The strengthening of the regulatory and supervisory framework in 1997-98 may, however, have weakened such soft-budget-constraints problems. The theoretical predictions contained in Tsuru (2001) are broadly supported by the evidence for Japanese banks over the past two decades.

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Table 1 Changes in the proportion of bank loans to selected industry

(Per cent)

	1977-80	1980-85	1985-90	1990-98
Manufacturing	-4.9	-4.0	-10.1	-2.3
Construction	-0.2	0.1	-0.9	1.0
Transportation/Communication	-0.2	0.2	0.0	0.6
Wholesale/Retail	-0.6	-3.1	-5.6	-2.0
Finance/Insurance	1.4	3.5	4.1	-1.5
Real estate	0.1	1.3	4.4	1.3
Other services	1.3	3.1	4.7	0.3
Individuals	2.3	-1.9	5.0	3.2
Others	0.9	0.8	-1.6	-0.6

Source: Bank of Japan, Financial and Economic Statistics 2000

Table 2 Correlation between land price inflation rate[1] and changes in the proportion of loans to selected industries[2] for 110 listed banks

	Manufacturing	Construction	Wholsale / Retail	Finance / Insurance	Real estate	Other services
Land price inflation rate	-0.39	0.14	-0.34	-0.06	0.55	-0.10

1. In each bank's main operating prefecture (July 1986 - July 1990)
2. March 1985 - March 1990

Source: Nikkei NEEDS Company Data Base

Table 3 Correlation between the non-performing-loan ratio[1] and changes in the proportion of loans to selected industries from March 85 to March 90

	Non-performing-loan ratio (March 98)	
	(1) 110 listed banks	(2) Excluding long-term credit and trust banks (101 listed banks)
Manufacturing	-0.36	-0.22
Construction	0.03	0.03
Wholsale/Retail	0.10	-0.36
Finance/Insurance	0.34	-0.16
Real estate	0.36	0.52
Other services	0.13	-0.04

1. The ratio of loans under risk management to total loans in March 1998
Source: Nikkei NEEDS Company Data Base

Table 4 Corelation between the increase[1] in the proportion of loans secured by real estate collateral and those to selected industries for 110 listed banks

	Manufacturing	Construction	Wholsale / Retail	Finance / Insurance	Real estate	Other Services
Real estate collateral	-0.49	0.07	-0.31	-0.09	0.43	0.18

1. March 1985 - March 1990
Source: Nikkei NEEDS Company Data Base

Table 5 Descriptive statistics on bank characteristics (110 listed banks

	Mean	Median	Std. Deviation	Minimum	Maximum	Cases
Proportion of loans to real estate (March 85)	0.0709	0.0614	0.03445	0.0162	0.211	110
Proportion of loans to real estate (March 90)	0.104	0.0909	0.0507	0.0306	0.2888	110
Proportion of loans to manufacturing (March 85)	0.228	0.216	0.0715	0.0911	0.386	110
Proportion of loans to manufacturing (March 90)	0.163	0.162	0.0594	0.0604	0.338	110
Proportion of loans to finance/insurance (March 85)	0.0462	0.0378	0.0319	0.0094	0.172	110
Proportion of loans to finance/insurance (March 90)	0.081	0.0648	0.063	0.011	0.301	110
Adjusted capital ratio[1] (March 85)	0.0335	0.0326	0.00781	0.0163	0.0597	110
Land price inflation rate (July 81 - July 85)	0.734	0.603	0.467	-0.0149	1.66	110
Land price inflation rate (July 86 - July 90)	2.15	2.08	0.837	1.03	4.36	110
Land price inflation rate (July 91 - July 98)	-0.644	-0.645	0.14	-0.826	-0.244	110
Ratio of safe investment opportunities[2] (March 80)	0.455	0.419	0.389	0.163	3.15	109
Ratio of safe investment opportunities[2] (March 85)	0.457	0.431	0.302	0.142	2.41	109
Non-performing-loan ratio (risk management loans / total loans, March 98)	0.0511	0.0384	0.0419	0.00981	0.257	110
ROA (operationg profits / assets, the average value from March 94 to March 98)	0.000715	0.00173	0.00441	-0.031	0.00556	110

1. The adjusted capital ratio = (own capital and loan loss reserves) / total assets
2. The ratio of safe investment opportunities = (loans to large firms + investment securities) / deposits

Table 6 Correlation matrix for explanatory variables

	Proportion of loans to manufacturing (March 85)	Adjusted capital ratio (March 85)	Changes in the ratio of safe investment opportunities (March 80 - March 85)	Land price inflation rate (July 81 - July 85)	Land price inflation rate (July 86 - July 90)
Proportion of loans to real estate (March 85)	-0.26	-0.4	-0.081	0.46	0.33
Proportion of loans to manufacturing (March 85)		0.051	-0.13	0.14	0.13
Adjusted capital ratio (March 85)			0.15	-0.61	-0.29
Changes in the ratio of safe investment opportunities (March 80 - March 85)				-0.23	-0.053
Land price inflation rate (July 81 - July 85)					0.39

Note: Number of obsevations: 109

Table 7 Determinants of a shift in banks' loan portfolios in the second half of 1980s

	Dependent variable: changes in the proportion of lending to real estate (March 85 - March 90)			Dependent variable: changes in the proportion of lending to manufacturing (March 85 - March 90)		
	OLS	OLS	2SLS	OLS	OLS	2SLS
Independent variables:	(1)	(2)	(3)	(4)	(5)	(6)
Proportion of lending to real estate (March 85)	0.17 (3.15)***[1]	0.20 (3.03)***	0.020 (0.20)			
Proportion of lending to manufacturing (March 85)				-0.29 (-8.60)***	-0.27 (-7.73)***	-0.17 (-3.36)***
Land price inflation rate in the main operating prefecture (commercial areas: July 86- July 90)	0.015 (6.72)***		0.026 (4.59)***	-0.013 (-4.82)***		-0.029 (-5.04)***
Land price inflation rate in the main operating prefecture (commercial areas: July 81- July 85)		0.023 (4.57)***			-0.031 (-5.85)***	
Adjusted capital ratio (net worth ratio) (March 85)	-0.35 (-2.84)***	0.054 (0.48)	-0.74 (-3.49)***	0.95 (4.27)***	0.56 (2.71)***	1.04 (3.55)***
Changes in the ratio of safe investment opportunities[2] (March 80- March 85)	-0.034 (-2.12)**	-0.023 (-1.27)	-0.030 (-1.68)*	0.020 (0.88)	0.032 (0.15)	0.023 (0.90)
Adjusted R-squared	0.40	0.29	0.25	0.48	0.52	0.30
Number of observations[3]	109	109	109	109	109	109

1. t statistics in parentheses. "***", "**" and "*" indicate statistical significance at the 1 , 5, and 10 per cent level respectively.

2. The ratio of safe investment opportunities = (loans to large firms + investment securities) / deposits

3. Due to data availability, we exclude Nippon Trust Bank from our sample of 110 banks.

Table 8 The effect of a shift in banks' loan portfolios on their non-performing loan ratio

Dependent variable: Non-performing loan ratio (Mar-1998)	110 listed banks					Excluding long-term credit banks and trust banks (101 listed banks)			
Independent variables:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	0.032	-0.029	-0.019	-0.028	0.023	0.027	0.0061	0.020	0.024
	(5.25)***[1]	(-1.67)	(-1.06)	(-1.69)*	(1.69)*	(8.55)***	(0.58)	(2.01)**	(2.22)**
Increase in the proportion of loans to real estate industry (1985-90)	0.59		0.32	0.38	0.42	0.47		0.43	0.43
	(4.03)***		(1.91)*	(2.42)**	(3.59)***	(6.04)***		(4.68)***	(4.67)***
Increase in the proportion of loans to finance/insurance industry (1985-90)				0.35	-0.061				-0.059
				(4.33)***	(-0.77)				(-0.97)
Increase in the proportion of loans to finance/insurance industry (1985-90)* long-term credit bank dummy					1.84				
					(5.94)***				
Increase in the proportion of loans to finance/insurance industry (1985-90)* trust bank dummy					0.85				
					(7.80)***				
Land price inflation rate (1991-98)		-0.12	-0.092	-0.085	-0.011		-0.057	-0.013	-0.010
		(4.73)***	(-3.02)***	(-2.98)***	(-0.49)		(-3.52)***	(-0.76)	(-0.57)
Adjested R-squared	0.12	0.16	0.18	0.30	0.60	0.26	0.10	0.26	0.26
Number of observations	110	110	110	110	110	101	101	101	101

1. t statistics in parentheses. "***", "**" and "*" indicate statistical significance at the 1 , 5, and 10 per cent level respectively.

Table 9 The effect of a shift in banks' loan portfolios on their ROA

Independent variable: ROA (1994-98 average)	110 listed banks					Excluding long-term credit banks and trust banks (101 listed banks)			
Independent variables:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	0.0026	0.0091	0.0083	0.0089	0.0056	0.0032	0.0075	0.0060	0.0056
	(3.99)***[1]	(5.03)***	(4.42)***	(4.82)***	(3.05)***	(7.63)***	(5.82)***	(4.78)***	(4.13)**
Increase in the proportion of loans to real estate industry (1985-90)	-0.057		-0.026	-0.030	-0.039	-0.060		-0.045	-0.045
	(-3.66)***		(-1.49)	(-1.74)*	(-2.52)***	(-5.96)***		(-3.86)***	(-3.85)***
Increase in the proportion of loans to finance/insurance industry (1985-90)				-0.023	0.0067				0.0072
				(-2.55)***	(0.64)				(0.94)
Increase in the proportion of loans to finance/insurance industry (1985-90)* long-term credit bank dummy					0.052				
					(1.26)				
Increase in the proportion of loans to finance/insurance industry (1985-90)* trust bank dummy					-0.070				
					(-4.84)***				
Land price inflation rate (1991-98)		0.013	0.010	0.010	0.0052		0.0099	0.0053	0.0049
		(4.74)***	(3.23)***	(3.15)***	(1.69)*		(4.97)***	(2.41)***	(2.19)**
Adjested R-squared	0.10	0.16	0.17	0.21	0.37	0.26	0.19	0.29	0.29
Number of observations	110	110	110	110	110	101	101	101	101

1. t statistics in parentheses. "***", "**" and "*" indicate statistical significance at the 1 , 5, and 10 per cent level respectively.

Table 10 Changes in the proportion of loans to selected industries (by the group of banks)

(Per cent)

		1980-85	1985-90	1990-98
(1) Loans by borrower's industry				
Real estate	Long-term credit banks[1]	0.0	6.2	8.0
	City banks	1.2	5.1	2.0
	Trust banks	0.3	3.6	1.4
	Regional banks (Tier I)	0.8	3.7	0.1
	Regional banks (Tier II)	1.8	4.6	-1.4
Finance/Insurance	Long-term credit banks[1]	8.0	7.6	4.9
	City banks	2.6	0.9	1.9
	Trust banks	9.0	13.1	-7.1
	Regional banks (Tier I)	2.0	4.9	-3.9
	Regional banks (Tier II)	1.1	0.9	0.2
Other services	Long-term credit banks[1]	N.B.	3.3	1.0
	City banks	2.8	5.7	-0.5
	Trust banks	6.4	5.3	-0.7
	Regional banks (Tier I)	2.3	3.8	0.5
	Regional banks (Tier II)	2.1	1.6	2.5
(2) Loans collateralised by real estate				
	Long-term credit banks[1]	-7.4	-0.5	15.3
	City banks	-3.6	7.0	-6.9
	Trust banks	-10.6	-0.1	2.8
	Regional banks (Tier I)	-2.9	1.8	2.5
	Regional banks (Tier II)	-0.2	1.0	-4.8
	Total	-4.5	3.3	-2.7
(3) Loans to small business				
	Long-term credit banks[1]	-6.6	9.1	14.5
	City banks	3.7	20.3	-0.6
	Trust banks	4.9	12.5	-1.1
	Regional banks (Tier I)	0.1	8.5	-3.3
	Regional banks (Tier II)	2.7	-2.3	1.0
	Total	2.3	12.8	0.2

1. Due to data availability, long-term credit banks include only Nippon Credit Bank.
Source: Nikkei NEEDS Company Data Base

Table 11 Determinants of the growth in real estate loans in the period 1994 - 1998

	Dependent variable: Growth in loans to real estate						
	Pooled OLS	One-way fixed effects			One-way random effects	Two-way fixed effects	Two-way random effects
Independent variables:	(1)	(2)[2]	(3)[2]	(4)[2]	(5)	(6)	(7)
Constant	0.12 (7.85)***[1]				0.12 (6.82)***	0.11 (2.46)**	0.12 (6.23)***
Adjusted capital ratio (one-year lag)	-0.89 (-4.11)***	-0.41 (-0.90)			-0.87 (-3.57)***	-0.99 (-1.38)	-0.86 (-3.24)***
Market to book ratio (one-year lag)			-0.10 (-0.07)				
Non-performing loan ratio (one-year lag)				-1.62 (-1.34)			
Land price inflation rate in the main operating area (one-year lag)	0.037 (1.12)	-0.021 (-0.59)	-0.020 (-0.57)	-0.014 (-0.40)	0.025 (0.78)	-0.024 (-0.50)	0.040 (1.05)**
Land price inflation rate in the main operating area (two-year lag)	0.040 (1.16)	0.0014 (0.041)	0.0077 (0.22)	0.0047 (0.16)	0.032 (0.97)	0.0043 (0.10)	0.048 (1.32)
Land price inflation rate in the main operating area (three-year lag)	0.044 (2.00)**	0.036 (1.98)**	0.035 (1.68)*	0.026 (1.34)	0.041 (1.99)**	-0.0085 (-0.22)	0.050 (1.76)*
Prefecture-level GDP growth in the main operating area	0.32 (1.68)*	0.16 (0.92)	0.14 (0.76)	0.14 (0.81)	0.31 (1.66)*	-0.036 (-0.14)	0.094 (0.42)
Deposit growth	0.25 (3.91)***	0.13 (2.10)*	0.11 (1.86)*	0.11 (1.89)*	0.22 (3.55)***	0.11 (1.58)*	0.19 (3.05)***
Adjusted R-squared	0.09	0.21	0.21	0.22		0.21	
Number of observation (113 listed banks, 1994-98)	565	565	565	565	565	565	565

1. t statistics in parentheses. "***", "**" and "*" indicate statistical significance at the 1 , 5, and 10 per cent level respectively.

2. Heteroskedasticity consistent estimates of standard errors by White (1980) are used to calculate the t-statisitics for regressions (2), (3) and (4) (one-way fixed models).

Table 12 Determinants of the growth in manufacturing and total loans during the period 1994 - 1998

	Dependent variable: Growth in loans to manufacturing		
	Two-way fixed effects		
Independent variables:	(1)	(2)	(3)
Constant	-0.10 (-3.33)	-0.11 (-0.60)	-0.019 (-1.88)*
Adjusted capital ratio (one year lag)	1.16 (2.41)**[1]		
Market to book ratio (one year lag)		0.082 (0.44)	
Non-performing loan ratio (one year lag)			-1.65 (-3.07)***
Land price inflation rate in the main operating area (one-year lag)	-0.050 (-1.55)	-0.077 (-2.51)**	-0.069 (-2.27)**
Land price inflation rate in the main operating area (two-year lag)	-0.00046 (-0.02)	-0.010 (-0.35)	-0.0097 (-0.33)
Land price inflation rate in the main operating area (three-year lag)	-0.044 (-1.64)	-0.056 (-2.13)**	-0.050 (-1.93)*
Prefecture-level GDP growth in the main operating area	-0.092 (-0.53)	-0.11 (-0.63)	-0.090 (-0.52)
Deposit growth	0.12 (2.62)***	0.15 (3.06)***	0.16 (3.46)***
Adjusted R-squared	0.18	0.17	0.19
Number of observation (113 listed banks, 1994-98)	565	565	565

1. t statistics in parentheses. "***", "**" and "*" indicate statistical significance at the 1 , 5, and 10 per cent level respectively.

Table 13 Descriptive statistics on bank characteristics (113 banks, March 94 - March 98)

	Mean	Median	Std. Deviation	Minimum	Maximum	Cases
Growth rate in loans to real estate	0.0512	0.0464	0.0845	-0.416	0.578	565
Growth rate in loans to manufacturing	-0.0123	-0.0106	0.0562	-0.248	0.256	565
Adjusted capital ratio (in the previous year)	0.0676	0.0662	0.0162	0.0233	0.128	565
Market-to-book ratio (in the previous year)	1.01	1.01	0.0333	0.93	1.15	565
Non-performing loan ratio (in the previous year)	0.00722	0.00597	0.00618	0.00038	0.0811	565
Prefecture-level GDP growth rate in the main operating prefecture	0.0144	0.015	0.0193	-0.041	0.075	565
Deposits growth rate	0.0106	0.0151	0.0555	-0.25	0.47	565
Land price inflation rate in the main operating prefecture (in the previous year)	-0.176	-0.163	0.108	-0.542	0.273	565

Table 14 Correlation matrix for explanatory variables

	Market-to-book ratio (-1)	Non-performing-loan ratio (-1)	Deposit growth	Prefecture-level GDP growth rate	Land price inflation rate (-1)	Land price inflation rate (-2)	Land price inflation rate (-3)
Adjusted capital ratio (-1)	0.277	-0.049	0.121	0.132	-0.078	-0.17	-0.065
Market-to-book ratio (-1)		0.057	0.075	0.18	-0.17	-0.51	-0.54
Non-performing-loan ratio (-1)			-0.083	-0.036	-0.069	-0.21	-0.25
Deposit growth				0.14	0.12	0.099	0.14
Prefecture-level GDP growth rate					0.11	-0.18	0.16
Land price inflation rate (-1)						0.28	0.18
Land price inflation rate (-2)							0.53
Number of obsevations: 565							

Table 15 Model selections for panel data analysis[1]

1. Regression of real estate lending growth with the adjusted capital ratio as an explanatory variable

Test	Alternative hypothesis	vs.	Null hypothesis	Value of test statistic	P-value
F-test	One-way fixed effects	vs.	Pooled OLS	1.75	0.000
F-test	Two-way fixed efects	vs.	Pooled OLS	1.77	0.000
F-test	Two-way fixed efects	vs.	One-way fixed effects	1.66	0.158
LM test	One-way random effects	vs.	Pooled OLS	15.12	0.000
LM test	Two-way random efects	vs.	Pooled OLS	15.12	0.001
Hausman test	One-way fixed effects	vs.	One-way random effects	24.09	0.001
Hausman test	Two-way fixed efects	vs.	Two-way random efects	16.09	0.013

2. Regression of manufacturing lending growth with the adjusted capital ratio as an explanatory variable

Test	Alternative hypothesis	vs.	Null hypothesis	Value of test statistic	P-value
F-test	One-way fixed effects	vs.	Pooled OLS	1.10	0.260
F-test	Two-way fixed efects	vs.	Pooled OLS	1.37	0.013
F-test	Two-way fixed efects	vs.	One-way fixed effects	5.96	0.000
LM test	One-way random effects	vs.	Pooled OLS	0.37	0.541
LM test	Two-way random efects	vs.	Pooled OLS	5.87	0.053
Hausman test	One-way fixed effects	vs.	One-way random effects	29.79	0.000
Hausman test	Two-way fixed efects	vs.	Two-way random efects	57.49	0.000

1. Each test is in favor of shadowed models. The best model is in framed sells.

Table 16 Changes in the effect of capital positions on real estate loan growth in the period FY 1994 - 1997 (cross-section analysis)

	Dependent variable: growth in loans to real estate				
	FY 1994 (March 1995)	FY 1995 (March 1996)	FY 1996 (March 1997)	FY 1997 (March 1998)	FY 1994 - 97 (March 95-March 98)
Independent variables:	(1)	(2)	(3)	(4)	(5)
Constant	0.20 (5.59)***[1]	0.18 (4.50)***	0.15 (3.95)**	0.045 (1.14)	0.15 (8.53)***
Adjusted capital ratio (one-year lag)	-2.00 (-4.05)***	-1.65 (-2.72)***	-0.83 (-1.71)*	-0.64 (-1.37)	-1.26 (-5.12)***
Adjusted capital ratio (one-year lag) * FY 1997 dummy					0.047 (0.30)
Land price inflation rate in the main operating area (three-year lag)	0.16 (1.55)	0.14 (2.53)**	0.26 (3.15)***	-0.11 (-1.22)	0.13 (3.86)***
Deposit growth	0.22 (1.12)	0.11 (0.62)	0.34 (2.77)***	0.35 (2.97)***	0.32 (4.53)***
Adjusted R-squared	0.15	0.11	0.12	0.08	0.12
Number of observations	113	113	113	113	452

1. t statistics in parentheses. "***", "**" and "*" indicate statistical significance at the 1 , 5, and 10 per cent level respectively.

Figure 1 Bank loans to selletcted industries and land price movements
(1994:Q4 - 1999:Q4, year-on-year growth, per cent)

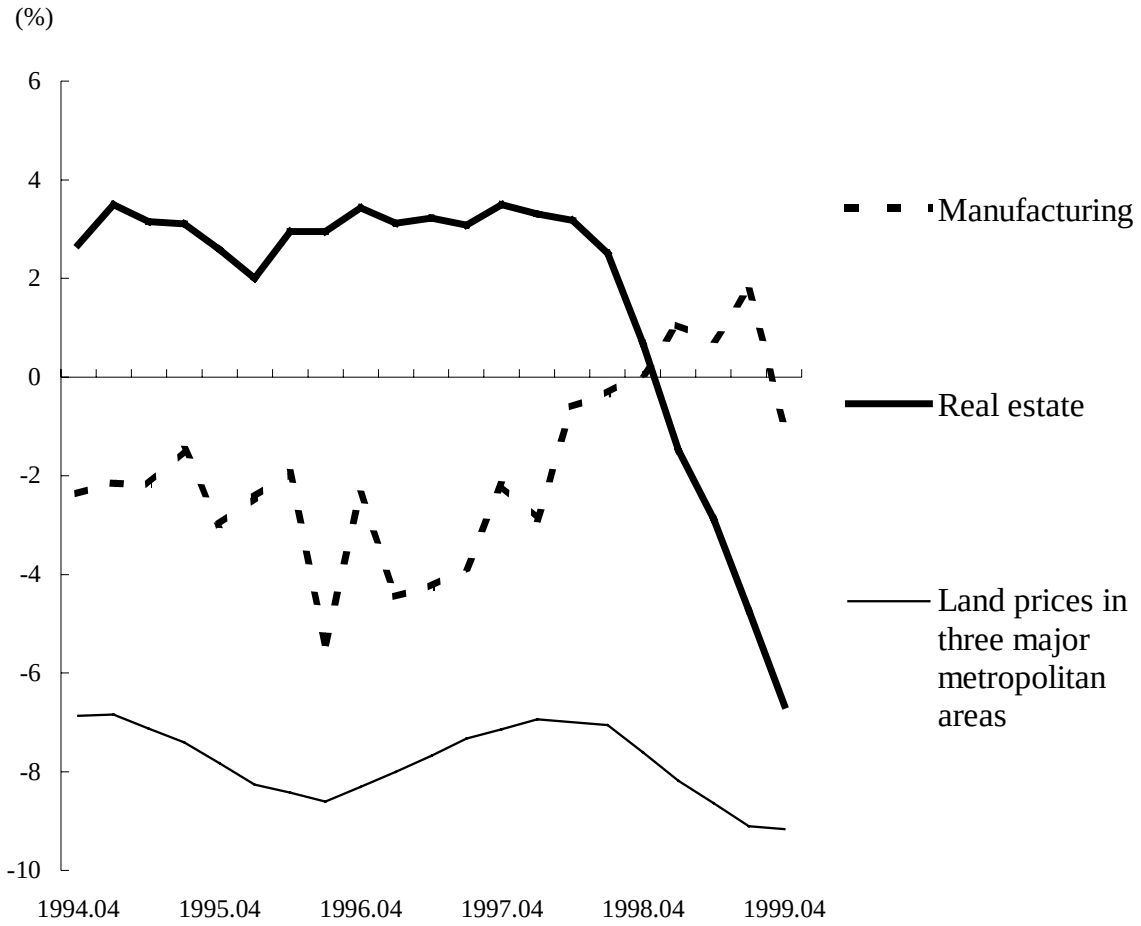

Figure 2 Return on assets (ROA) in the real estate and manufacturing sectors (per cent)

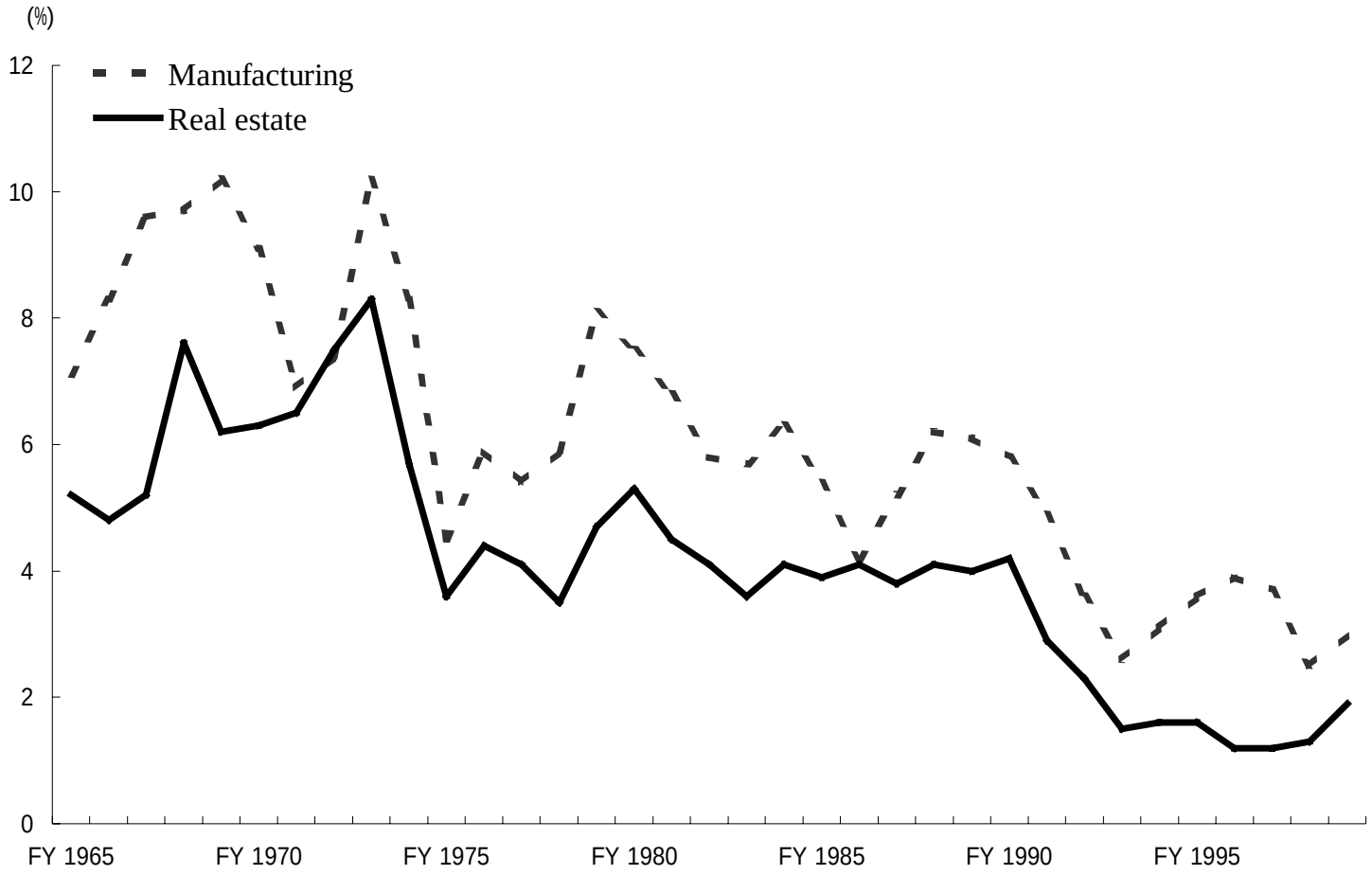

Figure 3 The bank's payoffs of project M and project R