

Did the Japanese Banking Industry Really Experience “Credit Crunch” in the 1990s?

Qing-yuan SUI *
Yokohama City University, JAPAN

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Abstract

This paper focuses on the reason of slowdown of credit supply in the late 1990s, and gives some additional evidence to the simple credit crunch approach. We find that the credit supply function had totally changed from 1980s to 1990s. Our empirical results also show that both the nonperforming loans and the slowdown of credit supply in the late 1990s strongly correlated with the loan explosion in the late of 1980s and that the nonperforming loans lost the explanation power to the loan growth rate in the last few years of the 1990s when we include measures of credit explosion in 1980s as explanation variables. These results are consistent with the structural credit crunch hypothesis.

Keywords: nonperforming loan, structural credit crunch, loan explosion, Japanese financial crisis, loan portfolio correction.

JEL classification: E51, G21, G28, G33.

*Email: usui@yokohama-cu.ac.jp. Address: 22-2, Seto, Kanazawa-ku Yokohama, 236-0027, Japan

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1 Introduction

Both the real performance of the Japanese banking industry and its academic evaluations have dramatically changed in the last two decades. From the late 1980s to the early 1990s, it was believed that Japan had the largest and strongest banking system in the world. The main bank system was considered an important source in supporting the “Japanese Miracle” in the high-growth era, and it was suggested that the Japanese miracle should be learned by other developing countries. After the bubble burst, all of the following phenomena were observed in the Japanese economy: the sharp decline of the GDP growth rate, the downturn of industrial investments, the slowdown of credit supply, a huge amount of nonperforming loans and the severe erosion of capital in the banking industry. The banking problem was considered to be one of the most serious issues for the economy, with many studies trying to find evidence of the strengths of the Japanese banking industry just a few years earlier.

It seems to be quite natural to ask the question whether the banking problems triggered the over-all economic downturn in the 1990s. That is, the nonperforming loans and the erosion of capital in the banking industry, accompanied by more strict disclosure requirements and more detailed investigations by the regulators, may have weakened banks’ ability to fund intermediation and credit supply. As a result, these would trigger large-scale downturns of investment and a long-run recession. This is the so-called credit crunch.

Many studies focus on whether credit crunches happened in Japan in the 1990s.

While the evidence focused on the first half of the 1990s is mixed, there seems to be a consensus that at least for the second half, or the last few years of 1990s, a credit crunch did happen in Japan. A large part of these studies uses measures of banks' financial soundness and sees the explanation power of these measures in the growth of bank lending as evidence of a credit crunch. Because these studies do not ask the question in the first place, why banks' financial health conditions became poor, we call them "the simple credit crunch."

This paper focuses on the reason for the slowdown of credit supply in the late 1990s, and gives some additional evidence for the simple credit crunch approach. Our hypotheses are as follows. The credit supply behavior may have structurally changed along with the occurrence and the burst of the bubble. Both the financial health conditions of the banking industry and the slowdown of credit supply in the 1990s may be the results of some common factors. One of them is the bank loan explosion in the late 1980s – the bubble era. To the extent the bank loan explosion in the late 1980s was not supported by the fundamentals, both the occurrence of nonperforming loans and the need to reconstruct loan portfolios, would correlate to the loan explosion in the bubble era. We call this scenario "the structural credit crunch."

The differences between the simple and the structural credit crunch approaches are important. If the occurrence of nonperforming loans or the erosion of bank capital were exogenous, as implicitly assumed by many studies using the simple credit crunch approach, then the most urgent and stringent policy to recover from the recession is to remove the nonperforming loan and to strengthen the bank capital. On the other hand, if these phenomena were the inevitable results of the behavior of banks in the bubble era, then removing or concealing the nonperforming loans

or strengthening the bank capital by public funds, which were the policies actually executed in the 1990s, would not help, because the huge amount of nonperforming loans or the erosion of bank capital were only the accompanying results, not the original reason at all. However, as long as we simply observe the correlations between the loan supply and the level of nonperforming loans or the degree of capital erosion, there is no way to discern the differences between the above two approaches.

In this paper we use the information from banks' financial statements and try to get some evidence of the structural credit crunch. Firstly, we divide the fiscal years 1985 to 1999 into three periods and compare the structural change of credit supply functions. In the bubble era, the bank size strongly and positively correlated with the growth rate of bank lending, and the influences of loan interest and profit variables were negative, which suggest that there had been serious fund misallocation in the bubble era. For the two periods of the 1990s, the bank size negatively correlated with the growth rate of bank credit, and the loan interest rate, as well as the profit rate began to normally affect credit supply. All of the statistically significant coefficients show opposite signs for the periods before and after the 1990s. These may reflect the effects of regulation and some demand-side conditions, and it may also be true that there existed a strong need to reconstruct the exploded loans outstanding.

Secondly, we compare the explanation power of the degree of bank loan explosion and the financial soundness conditions to the growth rate of lending in the late 1990s. We find, after controlling for the influences of the loan explosion in the late 1980s, that the ratio of nonperforming loans lost their power to explain the growth rate of the credit supply.

Finally, we compare the degree of loan explosion between the banks that went

bankrupt from 1995 to 2002 and the banks that did not experience merge or bankruptcy. We find that the degree of loan explosion in the late 1980s is much higher for the bankrupt group than that of the non-bankrupt group. These results also support our hypotheses that lending behavior in the bubble era largely affected the slowdown of credit supply, the nonperforming loans, the erosion of bank capital and the crisis of the whole industry in the 1990s.

While our results do not contradict those of the simple credit crunch approach, the policy implications are different. The evidence from the simple credit crunch approach suggests that the existence of nonperforming loans and the weak position of bank capital are the source of the economic downturn. Erasing the nonperforming loans and strengthening the bank capital by public fund injection, which are the policies the government did practice, would lead to the recovery of the economy. However, our conclusion suggests that, to some extent, both the bad health condition of the banking industry and the slowdown of credit growth in the late 1990s are the results of the bank loan explosion in the late 1980s, and the restructuring of the loan portfolio was therefor necessary and inevitable.

The paper is structured as follows. Section 2 briefly surveys the related studies. In Section 3 we firstly reviews the lending behavior in the last two decades; we then describe the hypotheses and report the methods and the results of estimation. Finally, in Section 4, we conclude the paper and discuss some remaining problems.

2 An Overview of Studies on the Credit Crunch in Japan

Until the mid-1990s many studies tried to find the sources of strength of the Japanese banking system. Japanese banks were known to the famous main bank relationships

with borrowing firms. Hoshi, Kashyap and Sharfstein (1991) stress the role of the main bank in alleviating the restraint of internal funds on firms' investments. The Japanese style bank-based financial system was taken as an effective alternative to the market-based one in alleviating the asymmetric information and agency problems. There has been a large amount of such research, however, very few of this research could be used to explain the Japanese banking problems which happened in the 1990s.

The studies on the credit crunch in the 1990s in Japan can be divided based on sample, period or the methodology. The conclusions are also different depending on the sample, the period and the methods. We summarize the basic features of the related studies below.

From the studies focused on the first half of 1990s, there was no clear tendency for the banks with bad financial conditions to supply credit at a slower pace. Yoshikawa et al. (1994) is one of the earliest studies to investigate whether the slowdown of bank credit has any correlation with supply factors. They document the hearing investigation results from managers of financial institutions, firms and responsive officers of the Chamber of Commerce and Industry. They also present some regression results using banks' nonperforming loans as explanation variables, to see whether the level of nonperforming loans negatively affected the amount of loan supply in the fiscal year of 1993. They found that the link between the nonperforming loans and credit supply was not strong. The negative correlation between the nonperforming loans and the growth rate of the credit supply was only statistically significant in the case of trust banks or loans to the real estate industry. In other cases, the level of nonperforming loans did not show any significant correlations with loan growth, including loans to small- and medium-size enterprises (SME),

Honda et al. (1996) focus on the period from March 1993 to March 1995, using both the aggregate time series data and data from the financial statements of individual banks to test the credit crunch hypothesis. From the results of time series estimations, only marginally significant effects of the measures of supply factors were confirmed. In the panel estimation results, they found that significant effects of the measures of bank capital or nonperforming loans to the growth rate of credit were observed only for the major bank groups (city banks, trust banks and long-term credit banks), and the significance level is low.

Maeda (1996) corrects some measurement problems in Yoshikawa et al. (1994) and does successfully find the negative correlation between nonperforming loans and the growth rate of banks' overall credit supply or credit supply to small- and medium-size enterprises firms for the city bank, long-term credit bank group. However, Maeda does not confirm whether there was a link among other banks. After all, Maeda's results were hardly a big improvement on Yoshikawa et al. (1994), because the negative correlation between the nonperforming loans and the credit growth was already partially observed in Yoshikawa et al. (1994). Moreover, some interpretations of the nonperforming loan measure were not without controversy. For example, the amount of special provisioning for nonperforming loans (saiken tokubetsu shokyaku kanjo) was used as a measure of strength, releasing the burden of nonperforming loans. However, Ito and Sasaki (2002) use the same measure to present the burden of the nonperforming loan itself.

In contrast to many other studies in this period trying to confirm the existence of a credit crunch, Horiuchi and Shimizu (1998) identify an opposite evidence. They find a negative link between the banks' capital ratio and their credit supply. Unlike other papers, they do not explicitly take the level of nonperforming loans as the

independent variables to explain the credit supply. Instead, the amount of non-performing loans was subtracted from both the total assets and capital accounts. Although there has been no sign that the policy makers will adopt this result, their conclusions were not without reality. First, as pointed out by Ito and Sasaki (2002), the capital ratio was artificially operated. Banks with low capital ratios, issued large amounts of subordinated bonds. The published figures of the banks' financial conditions may not truly reflect the banks' soundness. Second, although some studies confirmed a negative relation between the amount of nonperforming loans and the growth rate of the credit supply, no studies successfully confirmed the positive correlation between banks' capital ratio and credit supply for the first half of the 1990s, including Yoshikawa et al. (1994) and Maeda (1996), Third, as pointed out by Hoshi and Kashyap (2004), there was a clear tendency for banks with bad financial conditions to keep a high level of "ever-greening" loan.

After controlling some demand factors from the regional economic conditions, Horie (2001) regressed credit growth rate on banks' nonperforming ratios and capital ratios. He also compared the results between fiscal years 1992 and 1997. While the estimation results for fiscal year 1997 shown a negative correlation between non-performing loans and credit growth rate and a positive correlation between capital ratio and credit growth rate, which are consistent with the simple credit crunch scenario, the same kind of correlations could not be observed for fiscal year 1992. He concludes that a credit crunch did happen in Japan but not in the first half of the 1990s.

All of these above studies used the data from the bank side. Most of them implicitly assumed that all of the banks experienced the same level of demand fluctuations. Methodologically, the empirical studies on the credit crunch and the so-called

lending-view, are quite the same things. The only difference is in the regard to the location of the hypocenter. While empirical studies on lending-view see the changes in monetary policy as the first exogenous factors, studies on the credit crunch take the soundness of a bank's balance sheet as the first cause. So, the credit crunch could also be tested using data from the firm side as long as there is a good measure showing that the supply side financial health conditions and the demand factors are well controlled. This is what was challenged by Motonishi and Yoshikawa (1999). In their study, Motonishi and Yoshikawa focus on the industrial investments in response to the bank side variables. They discovered that, after 1997, the investments of small- and medium- size firms began to be strongly affected by financial factors. They interpret these results as the evidence of a credit crunch. Ogawa (2003) renews the data, controls q in the investment equation and gets a similar conclusion. One problem with this approach is that the authors define the bank side factors based on the subjective interviews of the high ranking executives of firms that reported on the Judgement Survey of Tankan (Short-term Economic Survey of Corporations). Although the interviewing question is on the bank's lending attitude, it is hard to believe that the executives' answers purely indicate the bank side conditions. After all, almost every manager of a troubled firm would experience a more conservative lending attitude or much tougher requirement conditions from banks.

Unlike the above studies, Tsutsui (2005) uses the methods of estimation for market disequilibrium and judged whether a credit crunch happened by estimating the degree of disequilibrium. He found the degree of disequilibrium between credit demand and supply was even larger in the 1960s to 1970s. Furthermore, in his estimated loan supply function, the bank capital ratio show a negative effect. Tsutsui concluded that for most of the 1990s, the credit crunch was hardly a serious

problem in Japan and the scenario of the negative impacts from BIS regulation to loan supply is not supported by the data. However, he also found that there is a clear increasing tendency of the degree of disequilibrium and pointed out that the possibility of credit crunch after 1998 might be changed.

One more important study on the sharp decline of Japanese bank lending is Peek and Rosengren (1997). They successfully confirm the bank side factors in influencing loan supply. Controlling the demand side factors is much easier for them, because they focus on the lending fluctuation of branches of Japanese banks in the U. S. Their results can be explained by both the simple credit crunch scenario and our structural hypothesis, because they did not pay attention to the behavior of Japanese banks in the late 1980s.

Woo (2003) restricts attention to the correlation between bank capital ratio and credit growth. He compares this correlation during each fiscal year from 1991 to 1997. This correlation is positive and significant for the fiscal year 1997, but not for the earlier years. The results found by Woo seems to be consistent with most of the above studies that suggest a credit crunch did happen in Japan at least for the last few years of the 1990s.

Although the sample periods and the estimation methods are quite different in the above studies, there is one thing in common. That is, no one asked such questions in the first place as, why did the ever-strongest Japanese banking industry become so weak in the 1990s? Is it possible that both the bad financial health conditions of the banking industry and the slowdown of credit supply in the 1990s came from the same reason? These are issues we will empirically investigate in the next section.

3 Empirical Findings

In this section, we will empirically investigate three issues. First, how has the credit supply behavior of Japanese banks been changed? Second, how is the level of nonperforming loans confirmed in the late 1990s related to the loan explosion? Third, how do the measures of loan explosion in the late 1980s explain the slowdown of credit supply in the late 1990s, compared to the explanation power of the measures of the financial soundness of banks? By investigating these issues, we confirm our hypothesis: both the nonperforming loan and the slowdown of credit supply in the 1990s, to some large extent, are the results of the loan explosion in the bubble era.

Unless stated otherwise, the data we use are from the “Bank Financial Statement” (Nikkei Needs Data Bank) and “Financial and Economic Statistics Monthly” (Bank of Japan).

3.1 The Growth of Bank Credit Supply in the Last Two Decades

Before showing the estimation results, we first discuss the growth rate of bank assets and each kind of bank loans for each category of banks in the last two decades. Because many banks, especially large ones, lost their identity due to bankruptcy or merge after 2000, we constraint our focus to the periods before fiscal year 1999.

Table 1 - Table 2 present the growth rate of bank assets and the growth rate of total bank loans from fiscal year 1983 to 1999. All domestic banks are included except those that were involved in bankruptcy, merge, or branch transfer from bankrupt banks. Each figure in the table is calculated by averaging the corresponding figure of individual banks. The average value is not weighted, so it may be overly influenced by small scale banks or small scale lending. For each category of banks, bank assets

and total bank loans showed a similar movement, indicating that banks' lending behavior was the most important factor influencing bank asset formation. Almost all of the banks kept a very high level of growth rate of assets or total loans in the 1980s. This is what we call "asset explosion" or "credit explosion" in this paper. However there is a sharp decline in the growth rate of both bank assets and total bank loans in fiscal year 1990. Right before this, almost all of the categories of banks kept a two-digit growth rate level. During the remainder of the 1990s both bank assets and total loans grew slowly and even contracted in absolute value in some years of the 1990s.

There are important differences between the major bank group (city banks, trust banks, and long-term credit banks) and the small- and medium-size bank group (regional banks and second-tier regional banks). While the small- and medium-size bank group recorded the highest growth rate level from fiscal years 1986 - 1989, which was considered as the period of bubble formation, the major bank group also experienced a high level of growth in assets or bank loans in the first half of the 1980s. For example, trust banks and long-term credit banks recorded the highest growth rate of total loans and total assets in fiscal year 1984. The gaps between the major bank group and the small- and medium-size group are larger in the period of fiscal years 1983 - 1987 than in the period of fiscal years 1987 - 1989. This means that the major banks started the asset or the credit explosion before the bubble period, while the asset or the credit explosion for small- and medium-size banks roughly coincided with the of bubble period.

Table 3 shows the growth rate of SME loans. Two points are worth noting. One is that the differences between the major bankgroup and small- and medium-size group are much clearer than those in Table 1-Table 2. Large banks kept almost

the same high level of growth in SME loans before fiscal year 1990. Small- and medium-size banks raised their growth rate to over a two-digit level only in fiscal years 1988-1990. The second point is that, in Table 2, the growth rate of total loans sharply declined for all categories of banks in March 1991, while in Table 3 the growth rate of SME still recorded a very high level. This reflects changes in the definition of SME loans by newly adding up overdrafts and some other items from fiscal year 1990. If we could use a consistent definition of SME loans, a parallel movement to that of total loans could be expected to observe.

Table 4-Table 5 show the growth rate of loans to the manufacturing industry and loans to real estate industry. These industries are two extreme examples representing that credit explosions were not realized by increasing loans equally to all kinds of borrowers. Loans to manufacturing were quite stable. There were no two-digit growth rate increasing or decreasing for the whole period in any bank category, except the fiscal year 1990 and two cases of long-term credit banks, which experienced the most heavy restructuring in the last few years of the 1990s. For the same reasons we mentioned earlier, the sudden increase in loans to the manufacturing industry in fiscal year 1990 reflects the change of industrial loan definition. In contrast, loans to the real estate industry kept a very high growth rate before fiscal year 1989. Again we can observe city, trust and long-term credit banks started to increase real estate loans much earlier than regional and second-tier regional banks. One more interesting point is that, although there was an adding-up of new items to the industrial loan definition in fiscal year 1990, in contrast to what we observed in the case of loans to manufacturing industry, there is no sudden jump for real estate loan in fiscal year 1990. This is because, from April 1990 to the end of 1991, the government imposed limits on commercial bank lending to real estate related

projects (souryo-kisei). The impacts of regulation was so large that the growth rate of loans to the real estate industry still largely declined.

3.2 The Structure Changes of Credit Supply

Our basic hypotheses are as follows. The credit supply behavior may have structurally changed from the 1980s to 1990s. Both the slowdown of credit supply and the bad health condition of banks in the late 1990s, to some large extent, may be the results of the credit explosion in the late of 1980s.

In order to get the empirical evidences we divide fiscal year 1985 - 1999 into three periods and compare the changes of credit supply function. The first period is the fiscal years from 1985 to 1989. This is the period of credit explosion we sketched earlier. It is also the so-called bubble era. Both land price and stock price kept a very high increasing growth rate in this period. From the end of March 1986 to the end of March 2000, the average land prices in the six large cities¹ increased by 133% and the average stock price (Nikkei 225) by 122%. We believe the misallocation of funds was most seriously happening in this period, because so many bank loans depended for their profit basis on land collateral, and also because so many traditional high-investment sectors had stopped borrowing from banks.

The second period is fiscal years 1992 to 1996. This is the period in which all kinds of asset prices sharply declined. It is also the period in which many studies, as we mentioned in the last section, failed to confirm the occurrence of a credit crunch. Furthermore, during these years, many businessmen still did not believe the decline of asset price was the results of the bubble burst. We exclude fiscal year 1991 from our sample. There are two reasons to do so. One is, we are not clear whether or not the fiscal year 1991 should be counted as part of the bubble era. While the

¹These six cities are the urban area of Tokyo, Yokohama, Nagoya, Kyoto, Ohsaka and Kobe.

Nikkei 225 price index reached its highest level in December 1989, land price was still increasing in 1990 and 1991. The other reason is that, from in fiscal year 1991, the definition of published industrial loan data was changed by adding up overdraft lending.

The third period is fiscal years 1996 to 1999. This is the period in which many economists believed that the Japanese economy experienced a serious financial crisis. It is also the period that the government prepared the largest amount of funds in history² to deal with financial problems. As we mentioned in the last section, many studies on the Japanese credit crunch, confirmed that a credit crunch did have happened in this period. We have enough reasons to expect that there were structural changes in the banks' lending behavior among the above three period.

The reduced form of credit supply function is defined as follows:

$$GLN_{it} = a_t + b_i + cSIZ_{i,t-1} + dNET_{i,(t-1)} + ePRO_{i,(t-1)} \\ + fLRA_{i,(t-1)} + gDRA_{i,(t-1)} + \mu_{it}$$

where

i, t are the index of bank and fiscal year

GLN is defined as the annual growth rate of bank credit

SIZ represents the bank size, which is defined as the natural logarithm of total assets

NET is capital ratio, defined as the ratio of the book value of capital to the book value of assets

² In April 1999, the minister of state economic planning agency, Taichi Sakaiya, spoke at CSIS (Center for Strategic and International Studies). Using his words, "the government ... devising a ¥60 trillion financial revitalization scheme ... The ¥60 trillion package was not only the largest financial assistance package in the history of the world in absolute terms, but was also unprecedentedly large on a relative basis as the expenditures were equivalent to 12 percent of Japan's GDP."

PRO is profit ratio, defined as the percentage of current profits to total assets

LRA is loan interest rate, defined as the ratio of loan interest income to total loans

DRA is deposit interest rate, defined as the ratio of deposit interest expenditure to total deposits

We use *SIZ* and *NET* to measure some influences of the regulation or the lack of governance. The Japanese banking industry had been strictly restricted from new competitive entries. And moreover, the deposit interest rate – the price of input was also regulated. Under such kinds of regulations, the amount of rents basically proportionately changes with lending scale. So we predict *SIZ* to positively influence the credit supply in the era where bank managers believe the old regulation regime to be still effective. However, in periods like the 1990s, in which bank managers tried to reconstruct the loan portfolios this measure may negatively influence the credit supply. We also use *NET* trying to measure some influences of agency factors. “Capital” stands for the commitment of equity holders. In a relatively well disciplined bank, the credit explosion should be limited by shareholders’ commitment, so that *NET* should negatively influence the credit supply. We also expect that this measure positively influenced the credit supply in the 1990s, not only based on the reasons raised by the simple credit crunch approach, but also because of loan portfolio correction. Here both the numerator of *NET*, the amount of capital, and the denominator of the total assets are defined by book value. Because the information on the capital ratio based on BIS standards for the 1980s is not available, we use book value information to calculate *NET*. *PRO*, *LRA* is predicted to positively influence credit growth, and *DRA* is predicted to negatively influence credit growth, because these measures stand for the profitability and output and input prices. We exclude the observations of year-bank for bank that was

involved in merger, bankruptcy or branch transfer from other bankrupt banks, in the year prior to the end of March. Our regressions are estimated using unbalanced panel data with fixed effects.³ Although our specifications may omit some other demand or supply factors, time fixed or individual fixed effects allow us to account for macroeconomic shocks or any bank-specific factors that may affect credit supply.

Table 6 reports the estimation results. Model 1 shows the estimated credit supply function for the bubble era. Deposit interest rate (*DRA*) does not significantly affected credit supply in this period. Profit ratio (*PRO*), capital ratio (*NET*) and loan interest rate (*LRA*) are significantly and negatively correlated with credit supply in the next year, which is contradictory to the predictions by the standard intermediation theory. The coefficient of bank size (*SIZ*) positively affects credit supply. The magnitude and significance of the coefficient estimates are very strong. These results indicate that, other things being equal, banks with larger asset size, lower level of profit, or lower level of capital ratio increased credit supply in higher growth rates. These findings are not consistent with standard theories; however, it is not impossible to understand them if we assume that regulation rents are proportionate to the bank size and that there are strong risk-taking incentives for low capital and low profit banks because of the weak governance to discipline bank managers.

The credit supply behavior in the second period, fiscal year 1992 to 1996, shown in Model 2, is totally different. *SIZ*, *PRO* and *NET* are significant, but all of these three variables have just the opposite outcome to the results in Model 1. Bank size has very strongly but negatively affected the credit supply. Both the profit and capital ratio are positively correlated with the growth rate of the credit supply.

³The Hausman tests indicate that the fixed-effect specifications are appropriate.

The positive coefficient of profit level seems to be a natural result of intermediation, and the positive effect of capital ratio is consistent with the simple credit crunch scenario. It is not easy to explain the negative effect of bank size by the standard theory. However, in the time when the land and the stock prices suddenly began to decline, bankers would realize that the credit explosion was based on the wrong decision, or tight financial conditions could force the banks to reconstruct their loan portfolios. All these forces could be just opposite to those in the bubble era. We interpret these results as loan portfolio correction.

The estimation results of the third period are shown in Model 3. The coefficients of size, *SIZ* and profit, *PRO* have the same outcome as is found in Model 2 and both of them are statistically significant, although the magnitudes are only about one third of those in Model 2. Furthermore, in contrast to the results in Model 2, capital ratio (*NET*) does not affect credit supply and the influencing effect of loan interest rate changed to positive and significant. The lower magnitude of the effects of *SIZ* and *PRO* means loan portfolio correction was continuing but not at the same scale as that in fiscal year 1992-1996. The disappearance of the effect to capital ratio is surprising, because it contradicts to the consensus of the studies, as we mentioned in the last section, concerning the credit crunch in Japan. The difference is that here, we include other loan portfolio correction factors. This is one of our main findings, that is, after considering some loan portfolio correction factors, the correlation between credit growth and a bank's financial soundness is weak. It is true even for the period of the latter half of 1990.

While deposit interest rate still did not affect credit growth, the loan interest rate began to show a positive influence. It was believed that in the last few years of the 1990s, the Japanese banking industry experienced a serious crisis. There

are enough reasons to believe that financial institutions did not function normally. However, our results suggest that the credit supply became much more “normal” in the sense that credit supply more significantly responded to loan prices than in any other periods of our sample.

Our findings suggest that if we constrain our attention to a narrow period, we could find that loan portfolio correction may have the same evidence as the simple credit crunch scenario. But there is one thing that is different. That is, in the scenario of loan portfolio correction, what happened before the slowdown of credit supply is important; however, in the scenario of a simple credit crunch, all of the financial conditions are taken as exogenous. In the following subsection, we will try to find some evidence that the credit explosion in the 1980s heavily affected bank health conditions and loan supply in the 1990s.

3.3 The Consequences of the Loan Explosion in the Late 1980s

In this subsection, we focus on nonperforming loan ratio and see how it is correlated with credit growth in the 1980s, among other explanation variables. Before showing the estimation results, there is a need to discuss the definition of nonperforming loans in Japan after the 1990s.

Japanese banks first disclosed information about nonperforming loans in March 1993. From March 1993 to March 1995 the major banks (city banks, long-term credit banks and trust banks) reported two kinds of nonperforming loan: loans to failed firms and loans where payment had been suspended for over six months. However, in the case of regional and second-tier regional banks, only loans to failed firms were disclosed. In March 1996, the definition of a nonperforming loan was extended to include loans for which the interest rates were cut. All of the regional

and second-tier regional banks began to report the same items as those of the major banks. From March 1998, nonperforming loan was newly defined as “risk management loans.” The definition was expanded again. The minimum number of months of interest payments suspension was lowered from six to three, and loans to firms under reorganization were also included.

From March 1998, Japanese banks started self-assessment on their nonperforming loans using a classification similar to that used in the U.S. Although many banks voluntarily disclosed this information, the disclosure of self-assessment nonperforming loans is not mandated by the law.

In 1998, the government began to require each banks to disclose another kind of nonperforming loan information based on the Financial Reconstruction Law (FRL). By FRL, nonperforming loans are the sum of unrecoverable or valueless loans, risk loans, and loans in need of special attention. This information became available after March 1999 for almost all banks. Some individual banks also disclosed their information at March 1998.

The volume and quality of the disclosed information on nonperforming loans depend on when they were disclosed and whether they were voluntarily disclosed or government-mandated. Because the time-series comparison based on differently defined items is not meaningful, it is difficult to judge, by these data, how the nonperforming loan problem had evolved in the whole of the 1990s. There is a trade-off between using earlier published nonperforming data and later ones. There are enough reasons to believe that the disclosed information in the last few years of the 1990s is more reliable than that disclosed in the first half of the 1990s. However, the figures for later years would be influenced not only by the lending behavior in the earlier period but also by the decision of write-offs.

Here we use the disclosed information of nonperforming loans of individual banks and see how they correlated with the lending behavior of banks in the 1980s. Compared to studies on the credit crunch, there are fewer empirical studies concerning the economic reason for the occurrence of nonperforming loans. Ueda (2000) is an exception. The main concern of Ueda (2000) is to see how the changes in the land prices determined the scale of nonperforming loans. Here we try to find some evidence that the occurrence of nonperforming loans was correlated with the lending behavior of banks themselves.

We consider three sets of explanation variables. The first set is the loan growth rate. Although our main concern is to see how the loan explosion in the late 1980s affected the level of nonperforming loans in the 1990s, we also pay attention to loan growth in other periods. The second set of variables is on land prices⁴, which are defined as the growth rate of commercial land in prefectures where the bank's main office is located. Unlike Ueda, who sums up the increasing rate and the decreasing rate of land price before and after the bubble burst as a measure of land price swing, we define the growth rate of land price before and after the bubble burst as separate measures. The third set of variables is the profit ratio, defined as the ratio of current profits to total assets. We also separately take the profit ratio in different periods as different measures.

The estimation function is defined as follows,

$$BL_{97} = a + bGL_{i,j} + cLP_{i,j} + dPRO_{i,j} + \mu$$

where BL_{97} is the nonperforming ratio at March 1998, defined as risk management loans divided by total loans. $GL_{i,j}$ is the loan growth rate between fiscal year i and fiscal year j . $LP_{i,j}$ is average growth rate of land price of the corresponding

⁴The data of land price are taken from Chika-Kouji(Kokudo-Cho).

prefecture between fiscal year i and fiscal year j . $PRO_{i,j}$ is the bank's average rate of profit, defined as the ratio of current profits to total assets, between fiscal year i and fiscal year j .

The estimation results are shown in Table 7. Although not reported in the table, we also include dummy variables of bank type. The independent variable is the nonperforming loan ratio in March 1998, which is defined as the ratio of risk management loans to total loans. The loan growth rates before and after the bubble burst, are strongly but oppositely affected the level of nonperforming loans. The loan growth rate between fiscal years 1985 to 1989 is positively correlated with the nonperforming loan ratio and is significant at 1% confidence level. The loan growth rate between fiscal years 1992 to 1997 is negatively correlated with the nonperforming loan ratio and is also significant at the 1%. These results strongly suggest that the misallocation problem of loan supply in the late 1980s is serious, and that the move of loan supply in the 1990s can be partially explained as a correction to the above misallocation. In contrast to Ueda (2000), our land price measures do not show any significant effects. The land price measures show significant effects only when we exclude the bank type dummy as an explanation variable⁵, which means after controlling for the differences of bank types, the land price does not affect the individual bank's lending behavior.

Next we see how the loan explosion in the late 1980s correlates with the loan supply in the 1990s. We focus on the loan growth rate from fiscal year 1997 to fiscal year 1999. As mentioned earlier, the Japanese banking industry faced the most serious managerial problems in the last few years of the 1990s.

⁵This result is not shown in the table.

The estimation function is defined as follows,

$$GL_{97,99} = a + bGL_{85,89} + cBDLN_{97} + dX_{97} + \mu$$

where $GL_{97,99}$ is the growth rate of total loans during fiscal years 1997-1999, and $BDLN_{97}$ is the nonperforming loan ratio in March 1998, which is defined as the ratio of risk management loans to total loans. X_{97} stands for some other control variables including deposit interest rate, loan interest rate and profit ratio at the end of fiscal year 1997. Instead of directly using $BDLN_{97}$, we also separate the measures of nonperforming loan ratio into those that simply mirror the loan explosion and those which are independent from the loan explosion. This is done by firstly regressing $BDLN_{97}$ on $GL_{85,89}$; the independent part $BDLN_r$ is defined as the residual. The simple credit crunch scenario would suggest that the coefficient of $BDLN$ should be negative. The structural credit crunch hypothesis would see loan explosion measures to be dominant.

The results are shown in Table 8. In Model 1 and Model 2, both loan explosion measure $GL_{85,89}$ and nonperforming measure $BDLN_{97}$ are negatively and significantly correlated with loan growth rate in fiscal year 1997-1999. However, in Model 3, when both $GL_{85,89}$ and $BDLN_r$ are simultaneously considered as explanation variables, the nonperforming loan ratio, lost its explanation power.

In 1998, the Japanese government started the Special Credit Guarantee Program, in order to avoid a system meltdown. This program aimed to extend loan guarantees to ¥20 trillion. The average growth rate of guarantee acceptance from fiscal year 1997 to 1998 is 88.56%. There are enough reasons to believe that such kind of policy changed banks' lending behavior. In Model 4, we also take account of the effect of guarantee acceptance $DHOS$. This variable is weakly affected the loan growth rate from fiscal year 1997-1999, and the effects of the loan explosion in

the late 1980s and the nonperforming loan ratio in fiscal year 1997 are not different to that in Model 3. We also add loan interest rate (LRA_{97}), deposit interest rate (DRA_{97}), and profit ratio (PRO_{97}) as explanation variables. Although $GL_{85,89}$ is still significant at 10%, the significance level is much lower. This is because there is a relatively strong correlation between $GL_{85,89}$ and PRO_{97} . The correlation coefficient is 59.11%. While this multicollinearity may bias the estimation results, the strong correlation between the loan explosion in the late 1980s and the profit ratio in fiscal year 1997 supports our hypothesis from one more side: to a large extent the bad financial health conditions of the 1990s are the results of the lending behavior in the 1980s.

3.4 Some Further Robust Tests

The basic message we have argued so far is that the reason for the credit slowdown in the late 1990s should not be judged by the simple credit crunch scenario. All of these phenomena, the existence of the huge amount of nonperforming loans, the erosion of bank financial conditions and the downturn of the loan supply, are correlated with the behavior of banks in the late 1980s.

If our story were true, the financial crisis itself could be considered as an unavoidable results of the loan explosion. In order to see how the crisis in the late 1990s correlated with the loan explosion in the late 1980s, we compare the growth rate of assets and loans between banks that went bankrupt and banks that did not experience bankruptcy, branch transfers from other bankrupt banks or merge in fiscal year 1995-2002. Because very few major banks kept the same identities and the number of bankrupt banks in the case of regional banks is small, we focus only on the sample of second-tier regional banks.

There are 12 second-tier regional banks which went bankrupt during fiscal years 1995-2002, with Hyogo bank as the earliest case that failed in August 1995, and Chubu bank as the latest that went bankrupt in August 2002. There are 52 banks in the non-bankrupt group after we exclude some banks that accepted branch transfers from failed banks. We compare the growth rate of total assets, total loans, loans to manufacturing, real estate financial and insurance industries and SME during fiscal years 1984-1989 between these two groups.

The results are shown in Table 9. As predicted, the growth rate of total assets, total loans and SME loans, and loans to the financial and insurance industry⁶ for the bankrupt group are much higher than that of the non-bankrupt group. It is interesting to note that the bankrupt group reduced loans to the manufacturing industry in absolute volume during the credit explosion era. The growth rate of loans to the real estate industry is much lower for of the bankrupt group. It seems strange that the bankrupt group extended nonbank loans more conservatively than did the non-bankrupt group banks. However, because we use the volume in the end of March 1985 as the denominator in calculating the growth rate, the growth rate will be extremely high in the case of very low initial volume. For example, from the end of March 1985 to the end of March 1990, the bank that increased loans to the real estate industry at the highest growth rate (1098%!) is Shizuoka bank, which has always gotten the highest score among Japanese banks from the Moody rating agency. The loans volume at the end of March 1985 was very small, lower than 1%, to the total industrial loans.

The above comparison further confirmed our earlier finding. It is the credit explosion in the bubble era that triggered the downturn of loan supply, bad financial

⁶Financial and insurance industry here do not include banks; it is considered that most of the loans to this industry are loans to nonbanks and, finally, to the real estate related industry.

condition, and financial crisis in the 1990s.

4 Concluding Remarks

Let us answer the question we raised in the title. If we narrowly constrain the focus to some short period in the 1990s, or to the loans to certain industries, and judge the problem by seeing whether there is a positive relationship between the soundness of banks' financial conditions and their credit supply, then the answer is "yes." After all, when the disclosed information of banks' financial conditions became more accurate in the late 1990s, the bad financial conditions and the slow-down of the credit supply were observed simultaneously. On the other hand, if we consider whether we should accept the policy implications of the simple credit crunch scenario, the answer should be "no." Because the simple credit crunch scenario takes the policy of simply removing the nonperforming loans from the bank's balance sheet or strengthening bank capital by public fund as the solution. Our empirical results show that both the bad financial condition and the slowdown of credit supply strongly correlated with the loan explosion in the late 1980s.

Our results also shed some lights on the effectiveness of the Japanese banking system. From the huge number of studies after Hoshi and Kashyap (1991), the information production functions of the main bank system seem to be hardly deniable, at least for the high-growth era. The experience in the 1990s of the same banking system seems to be difficult to explain under well functioning intermediaries. What we found indicates that a well functioning intermediation system is not without conditions. The financial problems happened in 1990s may not be because the main bank system lacks the ability to produce information to overcome problems of asymmetric information and agency. However, the effects of the loan explosion

in the late of 1980s are huge and destructive. Understanding how and why did the loan explosion happen in Japan may help us to better understand the effectiveness and weakness of the bank-based Japanese financial system.

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Table 1: Growth Rate of Bank Assets

fiscal year	all banks		city banks		long-term credit banks		trust banks		regional banks		regional banks II	
	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.
1983	7.95	157	9.13	13	8.83	3	10.38	7	8.36	64	7.08	70
1984	9.35	156	15.28	13	18.05	3	32.30	7	8.16	64	6.63	69
1985	7.26	156	4.54	13	6.59	3	14.91	7	7.81	64	6.52	69
1986	9.71	155	14.23	13	12.11	3	20.72	7	8.39	64	8.86	68
1987	9.40	155	11.69	13	10.41	3	6.13	7	10.18	64	8.53	68
1988	12.39	155	15.93	13	12.87	3	15.36	7	12.84	64	10.96	68
1989	14.66	155	19.82	13	17.26	3	23.73	7	15.47	64	11.87	68
1990	3.82	153	-2.99	11	0.05	3	-7.63	7	4.97	64	5.18	68
1991	2.34	150	-3.05	10	-0.16	3	-5.52	7	3.97	63	2.53	67
1992	-1.67	149	-7.53	11	-4.49	3	-8.99	7	-1.53	63	0.10	65
1993	1.42	149	-1.79	11	-1.85	3	-0.16	7	1.81	63	1.91	65
1994	1.50	150	-1.55	11	0.77	3	2.04	7	1.71	64	1.78	65
1995	1.16	149	1.05	11	-4.30	3	-2.63	7	2.00	64	1.01	64
1996	3.45	148	5.66	10	1.36	3	-3.91	7	1.14	64	0.21	62
1997	1.26	145	0.42	9	-6.63	3	1.43	7	0.30	64	0.94	60
1998	-1.00	138	-7.82	9	-6.76	1	-9.50	6	0.81	64	1.16	56
1999	-3.64	138	-2.61	9	-9.60	1	-4.30	5	-1.32	64	-4.72	57

Note:

All domestic banks are included except those that were involved in bankruptcy, merge, or branch transfer from bankrupt banks.

Table 2: Growth Rate of Total Bank Loans

fiscal year	all banks		city banks		long-term credit banks		trust banks		regional banks		regional banks II	
	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.
1983	9.52	157	10.48	13	9.84	3	25.16	7	9.18	64	8.08	70
1984	10.34	156	14.72	13	14.94	3	27.97	7	9.76	64	8.06	69
1985	5.77	156	7.87	13	9.47	3	17.54	7	5.40	64	4.37	69
1986	8.30	155	13.46	13	11.59	3	26.79	7	7.26	64	6.24	68
1987	10.01	155	13.36	13	11.52	3	11.38	7	10.00	64	9.17	68
1988	11.37	155	13.05	13	11.95	3	11.82	7	11.69	64	10.68	68
1989	14.02	155	16.55	13	15.42	3	15.93	7	14.23	64	13.08	68
1990	6.13	153	5.58	11	5.05	3	-4.46	7	6.05	64	7.42	68
1991	3.57	150	3.04	10	1.08	3	-2.27	7	4.53	63	3.46	67
1992	3.20	149	0.10	11	-2.49	3	3.40	7	4.08	63	3.11	65
1993	1.47	149	-1.33	11	-1.85	3	0.65	7	1.90	63	1.77	65
1994	2.26	150	-1.38	11	-1.89	3	4.43	7	2.10	64	2.99	65
1995	3.84	149	3.36	11	-0.13	3	5.84	7	4.41	64	3.32	64
1996	2.15	148	5.23	10	-1.92	3	2.85	7	1.12	64	1.15	62
1997	1.19	145	-3.67	9	-12.22	3	-6.57	7	1.92	64	0.50	60
1998	-1.80	138	-6.21	9	-1.59	1	-11.28	6	0.24	64	0.20	56
1999	-3.07	138	-2.00	9	-2.80	1	2.94	5	-2.76	64	-3.21	57

Note:

All domestic banks are included except those that were involved in bankruptcy, merge, or branch transfer from bankrupt banks.

Table 3: Growth Rate of SME Loans

fiscal year	all banks		city banks		long-term credit banks		trust banks		regional banks		regional banks II	
	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.
1983	9.64	156	13.28	13	15.94	3	18.68	7	9.26	64	8.12	69
1984	9.90	155	14.02	13	9.84	3	18.12	7	9.95	64	8.23	68
1985	5.95	155	14.32	13	17.75	3	20.60	7	5.36	64	2.86	68
1986	9.57	154	23.10	13	28.23	3	25.44	7	6.61	64	7.27	67
1987	9.50	154	17.81	13	14.65	3	10.79	7	9.43	64	7.58	67
1988	9.61	154	15.95	13	11.51	3	6.63	7	11.90	64	6.41	67
1989	12.71	154	17.56	13	16.87	3	11.30	7	13.74	64	10.75	67
1990	17.71	153	23.16	11	10.88	3	11.14	7	16.98	64	18.50	68
1991	4.75	150	2.51	10	3.70	3	3.44	7	4.79	63	5.23	67
1992	3.15	149	3.23	11	2.91	3	3.16	7	3.60	63	2.72	65
1993	1.65	149	-1.01	11	2.62	3	-1.60	7	2.11	63	1.95	65
1994	2.24	150	-1.16	11	0.32	3	-1.82	7	2.44	64	3.14	65
1995	3.64	149	1.59	11	1.29	3	1.12	7	4.70	64	3.31	64
1996	1.23	147	1.09	10	0.59	3	-3.26	7	1.24	64	1.87	62
1997	-0.14	144	-1.11	9	-5.34	3	-9.40	7	0.80	64	0.41	60
1998	-1.94	138	-3.62	9	-2.89	1	-18.28	6	0.40	64	0.00	56
1999	2.00	136	6.80	9	2.03	1	2.13	5	2.54	63	0.86	57

Note:

All domestic banks are included except those that were involved in bankruptcy, merge, or branch transfer from bankrupt banks.

Table 4: Growth Rate of Loans to Manufacturing Industry

fiscal year	all banks		city banks		long-term credit banks		trust banks		regional banks		regional banks II	
	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.
1983	5.18	157	3.90	13	-1.66	3	-2.38	7	5.72	64	5.98	70
1984	7.05	156	7.53	13	-2.25	3	-4.70	7	8.96	64	6.79	69
1985	-1.68	156	1.58	13	-0.89	3	-2.70	7	-0.88	64	-2.98	69
1986	-3.07	155	-2.15	13	-4.63	3	-7.58	7	-3.10	64	-2.69	68
1987	-1.80	155	-5.29	13	-3.92	3	-11.90	7	-0.85	64	-0.90	68
1988	2.63	155	-3.24	13	-5.83	3	-11.92	7	3.98	64	4.36	68
1989	7.44	155	0.12	13	-3.14	3	-7.48	7	8.88	64	9.48	68
1990	19.93	153	31.12	11	17.29	3	35.68	7	24.47	64	12.35	68
1991	1.53	150	-2.40	10	0.09	3	4.43	7	3.54	63	0.00	67
1992	2.89	149	-2.30	11	3.26	3	6.05	7	3.54	63	2.78	65
1993	-0.09	149	-2.89	11	3.34	3	-1.10	7	0.37	63	-0.12	65
1994	-0.56	150	-4.42	11	-2.59	3	-3.52	7	-0.86	64	0.80	65
1995	0.30	149	-4.26	11	-5.74	3	-2.57	7	1.06	64	0.92	64
1996	-3.55	148	-2.45	10	-10.28	3	-4.35	7	-4.00	64	-3.30	62
1997	-1.70	145	-1.90	9	-16.16	3	-5.58	7	0.49	64	-2.95	60
1998	-2.58	137	2.65	9	9.29	1	-3.72	6	-1.51	64	-3.88	56
1999	-4.91	135	7.60	8	-2.32	1	3.56	5	-5.74	64	-5.96	56

Note:

All domestic banks are included except those that were involved in bankruptcy, merge, or branch transfer from bankrupt banks.

Table 5: Growth Rate of Loans to Real estate Industry

fiscal year	all banks		city banks		long-term credit banks		trust banks		regional banks		regional banks II	
	%	no.	%	no.	%	no.	%	no.	%	no.	%	no.
1983	14.00	155	27.87	13	11.69	1	11.67	7	14.27	64	11.44	70
1984	12.53	154	17.10	13	14.84	1	13.40	7	11.80	64	12.22	69
1985	14.40	155	32.95	13	22.80	2	31.94	7	12.67	64	10.49	69
1986	18.93	154	49.02	13	28.82	2	32.39	7	14.87	64	15.31	68
1987	14.99	154	14.04	13	15.41	2	2.62	7	14.50	64	16.90	68
1988	17.50	154	15.52	13	11.92	2	0.79	7	19.09	64	18.27	68
1989	18.19	155	16.97	13	12.69	3	6.26	7	20.26	64	17.95	68
1990	3.55	153	12.42	11	5.62	3	1.31	7	5.19	64	0.71	68
1991	2.60	150	6.69	10	3.96	3	3.22	7	5.99	63	-1.32	67
1992	5.48	149	8.10	11	4.22	3	7.38	7	7.60	63	2.85	65
1993	5.86	149	3.20	11	5.52	3	3.48	7	7.04	63	5.44	65
1994	7.05	150	1.12	11	4.26	3	-3.25	7	6.33	64	10.00	65
1995	5.18	149	1.65	11	4.09	3	2.77	7	4.69	64	6.59	64
1996	6.36	148	5.92	10	0.08	3	-1.86	7	5.31	64	5.26	62
1997	4.00	145	5.78	9	1.49	3	-8.29	7	5.16	64	3.91	60
1998	-0.30	137	0.71	9	-1.71	1	-15.67	6	0.35	64	1.60	56
1999	-0.10	135	3.00	8	-11.58	1	-5.41	5	-1.92	64	2.36	56

Note:

All domestic banks are included except those that were involved in bankruptcy, merge, or branch transfer from bankrupt banks.

Table 6: The Structural Changes of Credit Supply Function

	coeff. t-value			coeff. t-value			coeff. t-value		
	Model 1 1986/3-1990/3			Model 2 1992/3-1996/3			Model 3 1997/3-1999/3		
<i>SIZ</i>	6.6015	3.13	***	-35.1927	-10.34	***	-11.2472	-2.57	***
<i>NET</i>	-0.6239	-1.73	*	0.3528	3.27	***	0.6597	4.71	***
<i>PRO</i>	-5.4575	-2.96	***	4.4425	2.93	***	1.2815	5.76	***
<i>LRA</i>	-3.0647	-4.14	***	-0.8052	-1.10		4.1907	-4.74	***
<i>DRA</i>	-0.1756	-0.24		0.9997	1.28		-1.1600	-1.29	
<i>adj - R²</i>	0.6092			0.4285			0.5322		
no. of banks	151			139			120		
obs.	755			693			596		

Note:

The independent variable is *GLN*, the annual growth rate of bank loans. The dependent variables are as follows: *SIZ* is the logarithm of total assets, *PRO* is the ratio of current profit to total assets, *NET* is the capital ratio. Regressions are estimated using panel data with fixed effects. Significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively.

Table 7: The Nonperforming Loan and Loan Explosion in the 1980s

	coeff. t value			coeff. t value		
	Model 1			Model 2		
$GL_{85,89}$	0.0498	3.01	***			
$GL_{92,97}$	-0.0609	-4.61	***			
$LP_{85,89}$				0.0016	0.43	
$LP_{92,97}$				-0.0009	-0.03	
adj R^2	0.294			-0.029		
F value	8.84			0.473		
no. of banks	114			114		
	Model 3			Model 4		
$GL_{85,89}$	0.0532	3.14	***	-0.0064	-0.38	
$GL_{92,97}$	-0.0617	-4.63	***	-0.0362	-3.09	***
$LP_{85,89}$	-0.0003	-0.10		-0.0008	-0.33	
$LP_{92,97}$	0.0181	0.80		-0.0039	-0.21	
$PRO_{85,89}$				5.1308	2.57	**
$PRO_{92,97}$				-11.1043	-6.68	***
adj R^2	0.288			0.506		
F value	6.711			12.582		
no. of banks	114			114		

Notes

The dependent variable BL_{97} is the nonperforming ratio at March 1998, defined as risk management loans divided by total loans. $GL_{i,j}$ is the loan growth rate between fiscal year i and fiscal year j . $LP_{i,j}$ is average growth rate of land price of the corresponding prefecture between fiscal year i and fiscal year j . $PRO_{i,j}$ is the bank's average rate of profit, defined as the ratio of current profits to total assets, between fiscal year i and fiscal year j . Significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively.

Table 8: The Slowdown of Loan Growth in 1990s and Loan Explosion in 1980s

	coeff. t value	coeff. t value	coeff. t value			
	Model 1		Model 2		Model 3	
$GL_{85,89}$	-0.0299	-1.98 **			-0.0307	-2.04 **
$BDLN_r$					-0.1767	-1.62
$BDLN_{97}$			-0.2022	-1.86 *		
adj R^2	0.434		0.432		0.442	
F value	19.902		19.738		17.252	
no. of banks	124		124		124	
	Model 4		Model 5			
$GL_{85,89}$	-0.0483	-3.22 ***	-0.0298	-1.74 *		
$BDLN_r$	-0.1717	-1.43	-0.0674	-0.47		
$DHOS_{97,98}$	0.0090	1.49	0.0106	1.76 *		
DRA_{97}			-2.6601	-1.66 *		
LRA_{97}			-1.3006	-1.04		
PRO_{97}			0.6821	1.41		
adj R^2	0.288		0.319			
F value	7.7071		6.439			
no. of banks	117		117			

Notes:

The dependent variable is the loan growth rate between fiscal year 1998-1999. $GL_{85,89}$ is the loan growth rate between fiscal years 1985-1989. $BDLN$ is the nonperforming loan ratio in fiscal year 1998, defined as the percentage of risk management loans to total loans. $BDLN_r$ is residual from the regression of $BDLN$ on $GL_{85,89}$. $DHOS_{97,98}$ is the growth rate of loan guarantee acceptance from fiscal year 1997 to 1998. LRA_{97} is loan interest rate of fiscal year 1998. DRA_{97} is deposit interest rate of fiscal year 1998. PRO_{97} is the ratio of current profit to total assets of fiscal year 1998. Significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively.

Table 9: Comparisons of Loan Explosion between Bankrupt and Non-bankrupt Groups

	mean %	std dev %	obs
	bankrupt group		
total assets	65.33	33.76	12
total loans	61.61	27.29	12
loans to			
manufacturing	-3.34	28.92	12
real estate	87.23	137.54	12
financial and insurance	139.33	86.82	12
SME	55.02	31.09	12
	non-bankrupt group		
total assets	57.55	21.09	52
total loans	52.33	21.76	52
loans to			
manufacturing	10.63	15.31	52
real estate	128.97	214.25	52
financial and insurance	107.75	72.60	52
SME	38.21	28.32	51

Note:

Only second-tier regional banks are included. Each item is calculated based on the growth rate between fiscal year 1984 to 1989. The bankrupt group is defined as the banks that went bankrupt in the period from August 1995 to August 2002, and the non-bankrupt group is defined as the banks that did not experience bankruptcy or merger at the same period.