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**In Search of “Capital Crunch”:  
Supply Factors Behind the Credit Slowdown in Japan**

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**Abstract**

The seeming failure of loose monetary policy to reactivate Japan's economy has led some observers to suggest that the usual credit channels through which monetary policy affects the real economy are blocked, and this because of a pervasive shortage of bank capital that has induced a leftward shift in the supply of bank credit: the so called credit crunch hypothesis. This paper finds support for the hypothesis in the 1997 bank data—a year during which the landscape of the Japanese financial system was changed fundamentally—but finds no, or even contrary, evidence, for most of the 1990's.

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## I. INTRODUCTION

While the continuing stagnation of Japan's economy has for a number of years been at the center of public policy debate, it has recently become, with the emergence of the Asian crisis, an issue of even more urgent concern. Although no consensus has yet been reached as to the means by which the Japanese economy may best be revived, it is generally agreed that standard macroeconomic policies have so far failed in turning the tide by effecting a sustained response. While fiscal stimulus in 1995 created a brief spell of growth in 1996 and in the first quarter of 1997, the economy slumped back sharply soon after the reversal of the stimulus in 1997. Monetary policy likewise appears to have had little impact on the stagnant economy, even with the already near zero nominal short-term interest rates.

The seeming ineffectuality of macroeconomic policies has led some observers to conclude that Japan's economic slump is more structural than cyclical in character, manifested in such structural weaknesses as financial distress of the banking system, aging of the population, rigidity in the labor market and overregulation of the service sector (Roubini, 1996). Recently, the view that problems in the banking system are chiefly responsible for Japan's economic malaise has received widespread support in both policy circles (Bayoumi, 1998) and in the press. The proponents of this view argue that a sharp deterioration of loan quality and a substantial loss of banks' securities holdings (the result of the dramatic decline in the Japanese stock market) have eroded the capital positions of the banks. At the same time facing closer scrutiny by the market and regulators alike, and unable to raise new capital, banks have responded to the erosion of their capital base by reducing their loans (in order to meet the capital adequacy requirement). The argument goes on to suggest that the contraction in bank lending pushes marginal borrowers into bankruptcy, lifting the stock of nonperforming loans and further increasing the pressure on the banks' capital positions. Thus Japan is said to be caught in a vicious cycle, which is even further exacerbated by a sharp increase in the default rate of loans extended by Japanese banks to South East Asian countries. This is the so called "credit crunch", or, to borrow the expression coined by Richard Syron (1991)<sup>2</sup>, the "capital crunch" theory of Japan's economic crisis. Its conclusion is that the "clogged" credit channels have neutralized the effects of loose monetary policy.

Although the above hypothesis has yet to be tested formally, the credit crunch view of the Japanese economic crisis has recently gained support within the Japanese government which announced a 60 trillion yen bank restructuring package<sup>3</sup> in late October this year. The first round of capital injection into 21 banks, amounting to 1.8 trillion yen, already took place in

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<sup>2</sup>Mr. Syron, the President of the Federal Reserve Bank of Boston, used the expression to characterize the observation that a shortage of equity capital limited banks' ability to make loans during the 1990-91 recession in the United States.

<sup>3</sup>25 trillion yen will be allocated for the recapitalization of banks that are viable but still require assistance. 18 trillion will be allocated for the nationalization of insolvent banks.

March 1998 and will now soon be followed by others<sup>4</sup>. Moreover, in another move calculated to lessen the pressure on banks' capital positions, the government took steps to relax the regulatory framework<sup>5</sup> by introducing accounting changes<sup>6</sup> which artificially raise the capital ratios of all banks. At the same time, banks have also been encouraged to withdraw from their international operations so as to face a less stringent capital adequacy requirement<sup>7</sup>. Meanwhile, to compensate for the lapse in bank credit, the Bank of Japan (BOJ), which in November this year announced that it would relax conditions on its commercial paper (CP) purchase by moving the maturity limit from 3 months to 1 year, has been aggressively buying commercial paper on a repurchase basis, in the process becoming a major provider of lending, albeit an indirect one, to the non-financial sector of the economy.

This study is an attempt to test the hypothesis that the shortage of bank capital has constrained the ability of Japanese banks to lend in the 1990's. With a sample of banks representing 90 percent of Japan's banking assets, this paper examines the dynamics between the evolution of bank balance sheet items and bank capital. To address the usual concern that reported BIS risk-weighted capital ratios do not fully capture the capital strength of Japanese banks, two additional capital ratios, reflecting, respectively, the unrealized capital gains and the market capitalization of each bank, are introduced. It will be shown that until 1995, no evidence is found to support the credit crunch hypothesis. In fact, for most of the first half of the decade, it would appear that weakly capitalized banks tended to increase their lending more rapidly than the more strongly capitalized banks. This surprising finding is the case even for the first years of the decade, during which period the BIS risk-based capital requirement was first introduced in Japan. The paper, however, does find strong support for the credit crunch hypothesis in the 1997 data from which a positive and statistically significant correlation between beginning-of-period capital ratio and lending growth emerges. It will be argued that the uniqueness of 1997 was due in large part to a series of fundamental changes in the financial system, which included the abatement of the moral hazard problem when the

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<sup>4</sup>Some observers have pointed out that weak but solvent banks may be reluctant to apply for capital injection as the move of itself may signal their weakness to the market.

<sup>5</sup>Cardona, Ferri and Cobein (1998) recently argued that regulatory forbearance during a crisis may help avert a systemic credit crunch.

<sup>6</sup> These comprise allowing banks to include 45 percent of their revalued real estate holdings in their tier 2 capital, and an optional change from the lower of cost or market accounting of unrealized equity securities holdings to cost basis accounting (many banks' securities holdings value has become considerably lower than their cost).

<sup>7</sup> In Japan, banks which do not have foreign operations have an option to choose to be subject to the 8 percent BIS capital adequacy requirement or to the 4 percent capital requirement under the domestic standard (which is different from the BIS standard in the calculation of capital ratio).

government allowed a string of failures of high-profile financial institutions to take place, as well as a substantial strengthening of the supervisory and regulatory framework and heightened scrutiny of the banks by the market.

The structure of the paper is as follows. Section II briefly reviews the U.S. experience during the 1990-91 recession and the empirical methodology. Section III presents a descriptive account of the financial conditions of Japanese banks in the 1990's; section IV presents the findings of the paper; section V traces the major developments of the Japanese financial system in 1997 and conclusions are presented in the final section.

## II. CREDIT CRUNCH IN THE U.S. (1990-91) AN EMPIRICAL METHODOLOGY

Before beginning the analysis of the Japanese credit crunch, it is useful to briefly review the experience of the United States during the 1990-91 recession. The purpose of this is, on the one hand, to infer some similarities between Japan's situation in 1997 and that of the U.S. in the late 1980's and early 1990's, and, on the other, to present the empirical methodology of this paper.

The paper draws upon the methodology of a literature focusing on the role of bank capital in what has been described as the "unprecedentedly sharp" credit slowdown in the United States before and during the 1990-91 recession. This literature arose in response to the speculation that *demand factors* alone could not explain the magnitude of the credit slowdown experienced during this period. A large body of work, in search of *supply factors*, has generally singled out losses of bank capital, tightened bank regulatory standards and heightened market scrutiny of bank capital (Sharpe, 1995) as the major factors behind the curtailment of bank lending.

The 1990-91 recession coincided with a period of considerable strengthening of the banking regulatory framework in the United States. The BIS (Bank of International Settlement) risk-based capital standards, which received formal approval in 1989, began to be phased in from the end of 1990 and went into full effect in 1992. The new requirements set equity, or "tier 1" capital at 4 percent and the sum of tier 1 and "tier 2"<sup>8</sup> at 8 percent of a bank's risk-weighted assets. In 1990, U.S. regulators also implemented a leverage rule, requiring banks to hold minimum capital equivalent to 3 percent of their unweighted balance sheet assets. Observers have also pointed out that the early 1990's were characterized by a tightening of examination criteria and loan loss reserve policies, as well as by increased administration of corrective

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<sup>8</sup>Subordinated debt and some types of preferred shares (for example, those with accumulative interest payments) are the largest component of tier 2 capital.

actions. Finally, the passage of FDICIA in 1991 codified some of the more rigorous regulatory practices, such as possible forced closure when a bank's capital ratio falls below 2 percent<sup>9</sup>.

The adoption of the risk-based capital standards increased the number of banks below the minimum regulatory capital threshold by one fifth (Berger and Udell, 1994). Moreover, given the relatively lower capital ratios of larger banks, banks representing 25 percent of total banking assets fell short of the new capital requirement (Avery and Berger, 1991). The credit crunch hypothesis postulates that these pressures on bank capital positions induced a significant leftward shift in the supply curve for bank loans, holding constant both the real interest rates and the quality of potential borrowers (Bernanke and Lown, 1991).

The findings in the credit crunch literature are summarized below. Several studies focusing on the direct link between explicit regulatory enforcement actions and the shrinkage of bank loans have revealed that banks which were subject to prompt corrective action reduced their loans at a significantly faster rate than those which were not (Peek and Rosengren, 1995)<sup>10</sup>. Other papers have used bank capital as a measure of the impact of regulatory capital constraints on banks' balance sheet expansion. Bernanke and Lown have found, for the period of 1990:Q2-1991:Q1, positive correlations between loan growth and the beginning-of-period capital ratio, in regressions using bank balance sheets aggregated to the state level and in regressions using individual bank data for New Jersey banks. For the same period, Peek and Rosengren (1992) have found a positive relationship between a bank's capital ratio and the subsequent growth of its deposits, of large CDs in particular. Jacklin (1993) and Haubrich and Wachtel (1993) have focused on the impact of initial capital on a bank's portfolio mix, finding that banks with low capital ratios are "more prone to shift from assets with high risk-weights (loans) towards assets with lower risk-weights (such as U.S. Treasury securities)."

Critics of these studies point to the fact that capital ratios are endogenous (Passmore and Sharpe, 1994); that "more rapidly growing banks are likely to face riskier and less predictable cash flows, and thus may have a greater need for financial cushions" (Sharpe). If this is true, a correlation between asset growth and capital will capture both this endogeneity and any constraining effect of internal capital on expansion. To address this problem, several studies have tried to compare the correlation between capital and credit growth in the sample period against a benchmark period, under the assumption that a change in the correlation implies a change in the regulatory standards. Berger and Udell used the 1979-1989 years as the control period, on the assumption that "if banks with low capital ratios always tend to lend less, then there may be ..... no credit crunch." They found that the effects of the risk-based capital ratio on lending did not grow consistently stronger in the early 1990's. In contrast, Lown and

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<sup>9</sup> Receivership is ordered when a bank's capital ratio falls below 2 percent for 4 quarters.

<sup>10</sup> Their analysis of New England banks' loan growth shows that banks that were targets of formal regulatory actions -- nearly one third of all banks in that region-- substantially reduced their lending following such actions.

Wenniger (1994) have found that the correlations between capital and bank lending were more significant during the 1990-91 recession than for the earlier benchmark periods. In their regressions, the significance of capital weakened, however, when loan losses were included. These contrasting findings have prevented researchers from drawing any definite conclusions regarding the credit crunch hypothesis.

### III. FINANCIAL CONDITIONS AND BEHAVIOR OF JAPANESE BANKS IN THE 1990'S

This section presents a brief descriptive account of the evolution of the financial conditions of Japanese banks in the 1990's<sup>11</sup>, followed by a discussion of the likely effects of this evolution on bank lending.

It is widely acknowledged today that the balance sheets of Japanese banks (which only a decade ago were considered to be among the strongest in the world) have, in the 1990's, deteriorated to an extent "unseen in the post-World War II period" (Taniuchi, 1997). In the late 1980's, towards the end of the bubble boom, bank lending to property developers - either directly or indirectly through non-bank finance companies (i.e., housing loan companies, also known as *jusen*) - rose sharply. Bank loans to both the real estate industry and non-banks rose from 19 percent of total lending in 1985 to 27 percent in 1989 (Taniuchi). The decline in land prices beginning in 1992 started to raise serious concerns over the quality of these loans, which were often made under lax credit conditions and which were mostly collateralized by what transpired to be over-priced land. Consequently, the volume of non-performing loans rose.

Despite substantial charge-offs and sales of bad loans, the share of nonperforming loans (defined as the sum of loans to bankrupt companies and loans at least six months overdue) over banks' total loans remained steady for the most part of the 1990's, increasing sharply in 1997 (Figure 1). In response, banks significantly accelerated their loan loss provisioning, resulting in substantial net operating losses, notwithstanding the realization of the previously hidden capital gains in their equity portfolios and stable gross operating profits (Figure 2). The combination of these sustained losses and the decision of most banks to continue paying dividends (it is said banks were concerned about the impact of suspension of dividend payments on their stock prices)<sup>12</sup> sharply eroded the capital base of the banks. At the same time, most banks were unable to raise new capital in the market. In fact, the erosion of bank

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<sup>11</sup>See also Levy (1998) for a summary of recent developments.

<sup>12</sup> While it is possible for loss making banks to pay dividend out of what is called "profit reserves", i.e. accumulated undistributed profits, banks often have to resort to selling their stock holdings or real estate holdings in order to pay dividend.

capital was so severe that between 1990 and 1996 total actual capital base<sup>13</sup> of the major banks declined by close to 30 percent (Figure 3).

Banks are often said to have responded to these circumstances by shrinking their risk-weighted assets, mainly to boost their capital adequacy ratios which were increasingly falling under the scrutiny of regulators and the market alike. A reduction in risk-weighted assets can be achieved, with the least effect on total bank assets, by curtailing those assets with the highest risk weightings. Of the assets with the highest risk weighting (100 percent), bank lending is the largest component. It is perhaps not surprising, therefore, that bank lending for much of the 1990's has been lackluster (Figure 4).

Although it is difficult to determine, in the presence of obvious demand factors (the stagnation of the economy, over-investment in the 1980's), the extent to which the credit slowdown can be attributed to credit supply factors, some preliminary descriptive evidence shows that the supply factors are important. The Tankan survey indicates that in 1997 the willingness of financial institutions to lend dropped significantly as reported by enterprises (Figure 5). The reluctance of banks to extend loans is also reflected by a noticeable increase in overdraft as a percentage of total bank loans (Figure 6).

A small number of studies have applied the empirical methodology of the studies of the U.S. credit crunch on Japanese bank data<sup>14</sup>. These papers generally focus on the period between 1990 and 1993<sup>15</sup>. These studies all found that while the risk-based capital requirement had a definite impact on the lending behavior of city banks, no such impact was observed for other banks, and especially for the regional banks (Ueda, 1993; Ito and Sasaki, 1998). More recently, Peek and Rosengren (1997) showed that binding risk-based capital requirements associated with the Japanese market decline resulted in a decline in lending by Japanese banks in the U.S.. Several studies also examined the impact of non-performing loans on bank lending, but the results were mixed. While Yoskikawa, Eto and Ike (1994) found that increase in bank lending was negatively correlated with non-performing loans, Ito and Sasaki found that the correlation was positive. One shortcoming of this approach is that data on non-

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<sup>13</sup>In Japan, banks are allowed to add 45 percent of their unrealized capital gains to their tier 2 capital. To derive the actual capital base we subtract 45 percent of the unrealized capital gains from tier 2 capital, while adding 100 percent of the unrealized capital gains to tier 1 capital. For the banks whose capital gains were negative, we subtract the amount of the loss from their tier 1 capital. The result is a measure of the actual capital strength of the banks.

<sup>14</sup>This summary of the literature, which was mostly written in Japanese, is based on Ito and Sasaki.

<sup>15</sup>Japanese banks had to meet the capital requirement under the Basle Accord by March 1993.



performing loans in these early years were very limited<sup>16</sup>. Another is the difficulty in interpreting the results. For example, if a negative correlation between lending and non-performing loans is found, it could be due to backward looking behavior of banks (to the extent that banks may assess future credit risk based on past loan performance) and have nothing to do with the credit crunch hypothesis (that is, bank capital shortage constrains lending).

As will be shown in the next section, the present paper extends the Japanese credit crunch literature in several ways. First, the paper uses data which extend up to March 1998. The lengthening of the sample period turned out to have a very meaningful effect on the findings. Second, in view of the not unreasonable assumption that reported capital adequacy ratios do not fully capture the underlying capital strength of the banks, this paper uses several proxies for bank capital. It will be shown that the data appear to strongly support the rationale behind the use of these proxies. Finally, the paper will show how the endogeneity problem which might be manifested in some of the earlier studies is not a problem here.

#### IV. FINDINGS

##### A. Sample and Model Specification

This section investigates the relationships between banks' capital ratios and changes in their balance sheet items. The sample chosen comprises all private banks continuously active between March 1990 and March 1998, excluding those banks not subject to the 8 percent capital adequacy requirement<sup>17</sup>. The sample includes 79 banks (all 10 city banks, the 3 long term credit banks, the 6 trust banks and 60 regional banks), representing about 90 percent of the banking assets in 1997. The sample years are fiscal year 1990 to fiscal year 1997 (in Japan the bank fiscal year terminates at end-March, therefore fiscal year 1997 covers up to end of March 1998). Except for the market capitalization data which are taken from Bloomberg, the rest of the bank specific data are from BankScope, compiled by FitchIBCA, a private credit rating agency.

The following are the specifications of the panel regression models:

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<sup>16</sup>Up to 1993, most banks only published loans to bankrupt companies.

<sup>17</sup>The sample includes those regional banks which do not have international operations but which have elected to be subject to the 8 percent BIS capital adequacy requirement. Between March 1997 and March 1998, more than 30 banks chose to face the less stringent domestic 4 percent requirement rather than the 8 percent BIS capital adequacy requirement. Because dropping these banks from the sample will significantly reduce the degrees of freedom of the regression analysis below, they will be included. It can be shown that their exclusion does not alter the basic results of the regressions.

$$(1) \quad ((A_{i,t+1} - A_{i,t})/A_{i,t}) * 100 = a_1 + b_1 CR_{i,t}$$

$$(2) \quad (NL_{i,t+1}/L_{i,t}) * 100 = a_2 + b_2 CR_{i,t}$$

where  $A_{i,t}$ ,  $NL_{i,t+1}$ ,  $L_{i,t}$  and  $CR_{i,t}$  denote, respectively, total bank assets at the end of fiscal year  $t$ , total new loans made during fiscal year  $t+1$ , total outstanding loan and total zero risk weight assets, and capital ratio at the end of fiscal year  $t$ . New loans are defined as

$$NL_{i,t+1} = (L_{i,t+1} - L_{i,t}) + \text{Loan Charge-off}_{i,t+1} + \text{Loss from Sales of Loans to CCPC}_{i,t+1}$$

When a loan is charged off or sold to CCPC (Cooperative Credit Purchase Company), outstanding loans decline by the amount of the charge-off or by the loss from sales of loans to CCPC<sup>18</sup>, even though no change in actual current lending has actually occurred. As pointed out by Peek and Rosengren (1992), failure to make these adjustments can lead to the erroneous conclusion that the lending of a troubled bank has been curtailed, when, in fact, the decline in its outstanding loans is due to charge-offs or loan sales<sup>19</sup>. Finally, total loans are defined as the sum of domestic and foreign loans, and no attempt will be made to distinguish between them, since banks do not differentiate between these two types of loans in their reports on loan charge-off and loan sales to CCPC. Trust loans will be excluded from the loan figures because banks do not have to include some of them in the calculation of risk-weighted assets<sup>20</sup>.

Three different sets of capital ratios (CR) will be used for the regression. One, the reported risk-weighted capital adequacy ratio (CAR), defined by Basle capital rules. Two, capital ratio adjusted for the unrealized capital gains of each bank (ADCAR). Three, capital ratio calculated using market capitalization of each banks (MCR). The reason for the use of the first capital ratio definition is straightforward. This is the ratio which is most scrutinized by the regulators and subject to the capital adequacy requirement. The reason for the use of the second capital ratio is that historically Japanese banks carried sizable unrealized capital gains of securities holdings on their books. It was agreed under the Basle accord that banks would be allowed to use only 45 percent of their unrealized capital gains towards their tier 2 capital.

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<sup>18</sup>This is because a bank selling a loan to CCPC has to extend a loan of the same amount of the loan sale to CCPC to finance the CCPC's loan purchase. The transactions of CCPC are basically designed to enable banks to take advantage of the loan loss tax deductibility.

<sup>19</sup>Due to lack of data, adjustment for the sale of loans to non-CCPC buyers (which is small) will not be made.

<sup>20</sup>Also, those loans for which banks are required to include in the calculation of risk-weighted assets, such as loans guaranteed by the banks and by the deposit insurance, carry only a 10 percent risk weighting, as opposed to the 100 percent risk weighting if these loans were made from the banking account.

The other 55 percent of the gains thus can be seen as a sort of hidden reserve for the banks<sup>21</sup>. And indeed, in recent years, banks experiencing pressure on their capital have sold off their securities holdings, realizing the capital gains and thus adding to their tier 1 capital. Therefore, in order to assess the underlying capital strength of the banks, it is important to capture the relative size of the unrealized capital gains of each banks. To do so, ADCAR will be derived by subtracting 45 percent of banks' unrealized capital gains from their tier 2 capital and by adding 100 percent of the realized gains to their tier 1 capital. This procedure would tend to bolster the banks' capital positions. For those banks whose previous usable tier 2 capital is lower than their total tier 2 capital (the Basle rule stipulates that tier 2 capital cannot exceed tier 1 capital), the transfer of the capital gains from tier 2 to tier 1 represents an additional capital boost<sup>22</sup>.

The reason for the use of the third definition of capital ratio, which is based on the market capitalization of each bank, is the likely deficiency of the first and second definitions in capturing the true capital strength of the banks. The usefulness of the first and second definitions, for example, depends on realistic assessment of non-performing loans and their appropriate provisioning, both of which can be easily manipulated by the banks. The third definition can potentially overcome these problems, assuming that the market can see through the veil of each bank. The third ratio is derived by multiplying the total outstanding shares of each bank at the end of each fiscal year by the average daily share price of each bank during the month of March (to smooth out the volatility of share prices). It will be assumed that the market capitalization of each bank approximates its real tier 1 capital (equity capital)<sup>23</sup>. The capital ratio (MCR) is derived by dividing the sum of market capitalization and tier 2 capital by risk-weighted assets.

## **B. Panel Regressions Results**

Panel regressions of equation (1) and (2) are run for the entire sample period, from fiscal year 1990 to fiscal year 1997 (end-March 1991 to end-March 1998). For these regressions, three credit demand variables are appended as additional explanatory variables: annualized nominal

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<sup>21</sup> Stock price movement has been found to have a positive impact on bank lending (Kim and Moreno, 1995).

<sup>22</sup>As pointed out to me by Akira Ariyoshi, while the realization of hidden capital gains is not taxed when a bank is losing money, it is taxed at an effective rate of about 50 percent when a bank is profitable. Thus caution should be applied in the interpretation of ADCAR.

<sup>23</sup>There will be obvious discrepancies between the market capitalization and tier 1 capital, such as the franchise value and future earnings of the bank. Market capitalization also misses out some of the converting bond issues which are used in the calculation of tier 1 capital.

GDP growth, nominal interest rates on new loan contracts<sup>24</sup> and corporate cash flow (total corporate profits divided by corporate liabilities). Dummy variables for city banks, trust banks and long-term credit banks are also added to the regressions.

Tables 1 and 2 present the results for the simple OLS regressions as well as for regressions controlling for fixed and random effects<sup>25</sup>. Table 1 shows that in the regressions of total asset growth, the estimates for the coefficients on the capital ratio variables are consistently positive and statistically significant. These results strongly suggest that banks with weaker capital positions tend to increase their assets more slowly than more strongly capitalized banks and that banks whose capital positions become weaker over time reduce the growth of their total assets. The regressions using banks' reported BIS capital ratios as the explanatory variable turn out to produce both higher t-ratios for the estimates of the coefficient on that variable as well as higher adjusted R-square than regressions using the other two definitions of capital ratios. The three demand variables are generally statistically significant and produce the right signs (the fact that the estimated cash flow coefficients turn out to be mostly negative shows that internally generated funds are probably substitutes for bank borrowing). The estimates of the coefficients on the three bank specific dummies are significant. It would appear that as a group trust banks grew more slowly than the city banks and the long-term credit banks, once other factors have been controlled for. The Hausman specification tests indicate that the fixed effect specification is the appropriate one.

Table 2 shows, however, that the relationship between new loan growth rate and bank capital ratio is not robust. The statistical significance of the estimates on the capital ratio variables is very low. This result implies that when a weakly capitalized bank reduces its asset growth, it tends to reduce the growth of its non-loan assets. This may be because it is more cumbersome to make adjustments in lending than in other types of assets. Nonetheless, the relative weakness of the results in the new loan growth regressions does not rule out the possibility that a credit crunch may still be evident in some periods of the sample. In fact, there could be structural breaks in the data which renders the pooled results less robust. Supporting this, the F test shows that the null hypothesis, whereby the underlying coefficients for the capital ratio variables are identical across different time periods, can easily be rejected. To explore this possibility, the next section will break down the sample into different time periods for which cross-sectional regressions will be run.

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<sup>24</sup> Regarding interest rates, which are also credit supply variables, it can be shown that interest rate spreads are not correlated with capital positions in Japan as was in the U.S. of the early 1990's (Lown and Wenniger).

<sup>25</sup>The results for the regressions of zero risk-weighted assets fail to produce robust results.

### C. Cross Sectional Regressions

Tables 3 and 4 present the cross sectional regressions of equation (1) and (2) for every bank fiscal year between 1990 and 1997. The main results of regressions based on the three different capital ratio definitions are similar, but the regressions using the adjusted capital ratio (ADCAR) produce more statistically significant estimates as well as higher adjusted R-squares<sup>26</sup>. The analysis below will thus only concern itself with the results of the regressions based on the adjusted capital ratios.

Surprisingly, the regressions of asset growth on capital ratios from 1991 to 1994, and the regressions of credit growth on capital ratios from 1991 to 1993 all produce negative (and for the most part, significant) estimates for the coefficients of the explanatory variable. These results would suggest that instead of growing more slowly, banks with weak capital positions actually tended to grow more rapidly than more strongly recapitalized banks, as weak banks evidently tried to grow their way out of their problem. This striking finding is particularly surprising for the beginning of the decade when the BIS capital standard was first introduced in Japan. As was pointed out in section II, American banks, similarly facing the introduction of the BIS capital standard in this period, were found to curtail their lending in response. This peculiar finding for Japanese banks could be possibly attributed to the relative laxity of the regulatory environment (there is no explicit penalties for not achieving the BIS capital requirement, Ito and Sasaki) during this period and to a risky behavior pattern among weak banks, a pattern which probably tended to further weaken them. In sum, this finding contradicts the hypothesis that a credit crunch was at work during these years.

The same tables show that in 1995, however, a clear break with the pattern of the previous years emerged. The same regressions began to produce positive estimates of the coefficients on the capital ratio variables. With the exception of 1996, all estimates are statistically significant. These results suggest that banks with lower beginning-of-period capital ratios tended to grow their assets and their lending more slowly, thus providing strong support for the credit crunch hypothesis for these years. It should also be noted that both the explanatory power of these regressions as well as the magnitude of the estimates of the coefficient of the explanatory variable rose sharply from 1995 to 1997: the estimate for the coefficient in the new loan growth regression more than tripled in 1997 from 1995 while the adjusted R-square rose from mere 2 percent in 1995 to 17 percent in 1997. One interesting observation for 1997 is the fact that the estimate for  $b_1$  is smaller than for that of  $b_2$ , implying that capital weakness tended to constrain lending growth more than asset growth. It would suggest that the slowdown in bank lending was not entirely due to funding capacity. If this had been the case, weak banks would be expected to grow their assets more slowly than their lending, as it is often more difficult to adjust lending than other bank assets. More importantly, the reversal of

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<sup>26</sup>It can be shown that the inclusion of bank specific dummies do not alter the regression results.

the sign of the estimated coefficient on the capital ratio variables indicates that the probability of an endogeneity problem is low.

#### **D. Cross-Sectional Regression with Loan Loss Reserve Cover**

Although the explanatory power of the capital/loan growth and capital/asset growth regressions for 1997 is not low, it is not as high as for some of the similar regressions produced for the U.S. banks between 1990 and 1991. One possible reason for this may lie in the different provisioning practices of the two countries, with the result of rendering the Japanese capital adequacy ratios less indicative of the banks' actual underlying capital strength.

Prior to 1997, Japanese banks' provisioning for non-performing loans was subject to less rigorous supervision, leaving room for discretion to the banks themselves. In addition, the Tax Bureau of the Ministry of Finance is very conservative in its approach to approving banks' applications for deduction of estimated loan losses from their taxable income. (Approval is often predicated on borrowers' applications for formal bankruptcy. This gives a strong disincentive for banks to provision against loans in the substandard category.) For these reasons, one would surmise that weak banks, when already faced with capital shortage, would tend to under-provision for their problem loans. In this case, the extent by which non-performing loans are covered by loan loss reserves should reflect the underlying capital strength of a bank. To account for this possibility, a new variable will be derived - the ratio of loan loss reserve to non-performing loans (LLR/NPL). Non-performing loans will be defined as the sum of loans overdue for six months or more, loans to customers receiving support, loans to bankrupt companies and restructured loans (loans on which interest reduction has been applied by banks). It would be assumed that loan loss reserve cover would be positively correlated with lending and asset growth.

Indeed, Table 5 and 6 show that loan loss reserve cover has both a positive and a significant effect on the new loan growth as well as on the total asset growth of the banks in 1997<sup>27</sup>. The adjusted R-squares of the regressions also rise substantially, with that of the regression of new loan growth climbing to almost 30 percent. The results of the weighted OLS<sup>28</sup> are even more striking. Besides the fact that both the statistical significance of the estimates and the explanatory power of the regressions increase substantially, the fact that the magnitude of the estimates is larger for the weighted regression shows that credit crunch is even more pronounced among larger banks. The weighted regression (Table 5) indicates that a difference of one percentage point in the capital ratios of two banks would lead to a difference of 1.2 percentage point in their lending growth rate.

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<sup>27</sup>Regressions for other years cannot be run because of lack of data on comparable nonperforming loan figures.

<sup>28</sup>Total assets of each year are used as weights.

## V. WHAT HAPPENED IN 1997?

As emerges from the findings of the previous section, 1997 proved to be a benchmark year for Japan's financial system. Clearly something happened that year. It will be argued that a combination of factors prompted a change in the attitude of bank supervisors and in the market's perception of the banks and that in the wake of these developments banks significantly altered their lending behavior. These developments may be usefully broken down into three parts: A) increase in distress of the financial system; B) increase in regulatory pressure and C) increase in market scrutiny. In addition it should be noted that parallels may be drawn between the U.S. experience in 1990-1991 and that of Japan in 1997.

### A. Increase in Distress of the Financial System

A stream of closures and disclosures of distress of a number of high profile financial institutions set a very disruptive tone for 1997, focusing the attention of the market on the viability and the integrity of the entire system. The following summarizes some of the most important of these developments.

- In April 1997, Hokkaido Takushoku Bank (Takugin), one of the 20 largest banks at the time, and Hokkaido Bank, a regional bank, announced a merger plan, scheduled to take place in April 1998. Over the following months, however, concern rose over the magnitude of Tokugin's bad assets, leading to a postponement of the planned merger on September 12th.
- On April 25, Nissan Mutual Life Insurance was ordered to suspend operations, on account of its insolvency. Its net liabilities were found to exceed 250 billion yen. The closure of Nissan Mutual Life Insurance was the first closure of a life insurance company in Japan and raised questions as to the viability of the entire industry.
- On October 14, Kyoto Kyohei Bank, found to be in financial distress, announced its merger plan with Kofuku Bank.
- On November 3, Sanyo Securities decided to close. While raising serious questions as to the ability of weak institutions to honor their interbank obligations, its failure has also led to a significant decline in the liquidity of the domestic interbank market.
- On November 17, Takugin, which had seen a sharp decline in its stock price, a continuing withdrawal in deposits since the merger announcement, and unable to borrow in the interbank market, collapsed. Its non-performing loans were transferred to the Deposit Insurance Corporation (DIC) and its business to North Pacific Bank (Hokuyo Bank) and Chuo Trust Bank. The closure of Tokugin was the first closure of a major bank in Japanese history.

- On November 24, Yamaichi Securities, burdened by large off balance sheet liabilities, took the first step towards closing its business by suspending its operations.
- On November 26, Tokuyo City Bank, which experienced withdrawal of deposits and unable to raise funds in the market, collapsed, with its business transferred to Sendai Bank and its nonperforming assets and other assets to the DIC and to Seventy-Seven Bank.
- On December 18, the Bank of Japan requested from Daiwa Securities and Nikko Securities a submission of concrete measures to restore financial soundness.
- To avert a systemic crisis, that is, to ensure the integrity of the payment system as well as the smooth repayment of deposits, the BOJ extended special emergency loans to several failed financial institutions, including Hokkaido Takushoku Bank and Yamaichi Securities, without requiring collateral. The BOJ also stepped up its open market operations to avoid a sharp contraction in market liquidity and to support a stable formation of market interest rates (Matsushita, 1997).

There are at least two reasons why the above developments might have changed the lending behavior of the banks. One, increased failures among financial institutions would have lowered the liquidation value (Shleifer and Vishny, 1992) of all institutions and thus increased their bankruptcy cost. This probably would have caused the surviving institutions to behave more conservatively. Two, the failures of these institutions, to the extent that they reflected a decision by the government to allow them to fail, substantially abated the moral hazard problem in the system, by signaling a fundamental shift in the strategy of the government in dealing with ailing institutions. Whether this change in strategy was prompted by the government's realization that its resources rescuing the banking system were limited or by its resolve to inject some discipline into the system, it did inject credibility into the supervisory and regulatory framework. It also led to the banks' recognizing they would suffer the same fate as the closed banks if they did not quickly restore soundness. To the extent that soundness is perceived to be linked to bank capital ratios, this may be one of the reasons why weakly capitalized banks started to cut back on their lending.

### **B. Increase in Regulatory Pressure**

In 1997, the Japanese authorities established under the "Law to Ensure Financial Institution Soundness" the "Prompt Corrective Action (PCA)" framework, loosely modeled after the American framework. The PCA, which was to take full effect in April 1998, went into preliminary implementation in 1997. The PCA has two main components. The first of these, the introduction of a self-assessment process, places on the banks themselves the responsibility for valuing their assets on a prudent and realistic basis, according to well-



defined guidelines<sup>29</sup>. The results of the self-assessment exercise show total problem loans of 71 trillion yen for banks as of end-March 1998 and 81 trillion yen for all deposit taking institutions. The self-assessment procedures also require that results of the banks' own findings (including the necessary provisioning for loan losses and capital ratios) be subject to review by external auditors and inspection and monitoring by the bank examiners. As a second component, the PCA specifies the capital ratio thresholds under which the regulators can order the banks to take remedial actions. These remedial actions range from reduction of branches to reduction of dividends and liquidation in the case of insolvency.

Also in 1997, the authorities announced the creation of the Financial Supervisory Agency (FSA) to take over the role of banking supervision from the Ministry of Finance. The FSA was granted autonomy and independence in order to allow the supervisors to operate more effectively. The FSA started its operation in 1998.

### **C. Increase in Market Scrutiny**

Bank failures prompted a wave of deposit withdrawals from banks, in spite of the deposit insurance guarantee (all deposits, bond debenture and most trust accounts are guaranteed in full until March 2001), and inflows of funds to the Postal Saving Scheme, whose liabilities are guaranteed by the government. These rose steadily throughout 1997. As downgrades of Japanese banks by credit rating agencies continued, bank stock prices fell sharply in late summer (Figure 7), after a brief surge in the beginning of the year. Except for the very strongest banks (Tokyo Mitsubishi Bank), few bank stocks were spared the dramatic fall in stock prices. At the same time, bank funding rates also rose substantially. The spread in 3 month euro dollar funding rates between major Japanese banks and foreign banks widened considerably in the third quarter of 1997. Remarkably, despite the lax disclosure rules, the market differentiation of strong and weak banks was very pronounced.

The strengthening of the regulatory and supervisory framework (especially the increased attention on the extent of non-performing loans) and the increased differentiation of the banks by the market no doubt would have pressured weakly capitalized banks to increase their capital ratios even more rapidly. And because they were even less unlikely than the stronger banks to raise capital in the market, it is probably not unreasonable to assume that they cut back more sharply their lending.

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<sup>29</sup> The banks were required to complete the implementation of this exercise by August 1997.

## VI. CONCLUSION

Two explanations have emerged in recent years for the seeming ineffectuality of monetary policy in Japan. The first of these, the **liquidity trap hypothesis**, promoted by Paul Krugman (1998a), argues that real interest rates in Japan are too high and that the already near zero nominal interest rates constrain the ability of the central bank to further loosen monetary policy.

The second explanation for the ineffectuality of monetary policy is the **credit crunch hypothesis** which suggests that the credit channels of monetary policy are blocked and that banks have not responded to the lower interest rate environment by lending more because of a shortage of bank capital. This paper tests this hypothesis by looking at bank level data and performing cross-sectional regressions between bank capital and bank lending growth. It is shown that there is no evidence supporting the credit crunch hypothesis in the early years of the 1990's, and in fact, as Krugman (1998b) recently postulated, it is found that weak banks tended to actually increase their lending more rapidly than the more strongly capitalized banks for a number of years. However, the paper does find strong evidence for the credit crunch hypothesis in 1997, a year which saw a significant strengthening of the regulatory environment and an increased scrutiny of banks by the market and an abatement of the moral hazard problem in the system. The findings of the paper can be seen as lending support to the bank recapitalization package the Japanese government has recently introduced, to the extent that it is designed to alleviate the credit crunch.

Table 1. Panel Regressions of Total Asset Growth

	OLS			Fixed Effect			Random Effect		
CAR	0.90 (4.7)			1.95 (7.3)			1.26 (5.9)		
ADCAR		0.40 (4.2)			1.01 (6.8)			0.58 (5.3)	
MCAR			0.01 (0.9)			0.27 (4.0)			0.03 (1.3)
Interest Rates	0.00 (0.0)	-0.12 (-1.0)	-0.14 (-1.2)	0.17 (1.5)	-0.08 (-0.7)	-0.20 (-1.8)	0.06 (0.5)	-0.11 (-1.0)	-0.15 (-1.3)
Cash Flow	-3.12 (-1.2)	-3.4 (-1.3)	-2.19 (-0.8)	-4.33 (-1.8)	-5.51 (-2.2)	-4.18 (-1.6)	-3.53 (-1.4)	-4.05 (-1.6)	-2.28 (-0.9)
GDP Growth	-3.12 (3.4)	0.69 (3.3)	0.68 (3.2)	0.76 (3.9)	0.72 (3.6)	0.69 (3.4)	0.73 (3.7)	0.70 (3.6)	0.68 (3.3)
City Banks	-2.78 (-5.6)	-2.99 (-6.1)	-3.15 (-6.3)				-2.65 (-4.0)	-2.93 (-4.4)	-3.16 (-4.9)
Trust Banks	-6.05 (-10.8)	-6.06 (-10.7)	-5.54 (-9.9)				-6.25 (-8.3)	-6.29 (-8.3)	-5.5 (-7.7)
L-T Credit Banks	-2.23 (-2.7)	-3.08 (-3.8)	-3.03 (-3.7)				-1.93 (-1.7)	-3.11 (-2.8)	-3.06 (-2.9)
Constant	-5.36 (-1.9)	-0.68 (-0.3)	2.50 (1.1)				-8.48 (-3.1)	-2.11 (-0.9)	2.44 (-2.9)
Adj. R. Square	0.24	0.23	0.21	0.45	0.44	0.40	0.11	0.24	0.22
Hausman test p-value							0.000	0.000	0.000

Note: Numbers in parentheses are t-ratios

Table 2. Panel Regressions of New Loan Growth

	OLS			Fixed Effect			Random Effect		
CAR	0.22 (1.1)			0.16 (0.6)			0.20 (0.9)		
ADCAR		-0.01 (-0.1)			-0.05 (-0.3)			-0.02 (-0.2)	
MCAR			-0.00 (-0.0)			0.03 (0.4)			0.00 (0.0)
Interest Rates	0.26 (2.1)	0.23 (1.9)	0.23 (1.9)	0.25 (2.1)	0.23 (2.0)	0.22 (2.0)	0.26 (2.2)	0.23 (2.0)	0.23 (2.0)
Cash Flow	-9.20 (-3.4)	-8.89 (-3.3)	-8.93 (-3.3)	-9.13 (-3.7)	-8.76 (-3.5)	-9.18 (-3.6)	-9.2 (-3.7)	-8.85 (-3.5)	-8.95 (-3.6)
GDP Growth	1.01 (4.7)	1.00 (4.6)	1.00 (4.6)	1.00 (5.0)	1.00 (5.0)	1.00 (5.0)	1.00 (5.0)	1.00 (5.0)	1.00 (5.0)
City Banks	-2.44 (-4.8)	-2.53 (-5.0)	-2.52 (-5.0)				-2.33 (-3.6)	-2.53 (-3.8)	-2.52 (-3.7)
Trust Banks	-1.20 (-2.1)	-1.05 (-1.8)	-1.01 (-1.9)				-1.19 (-1.6)	-1.04 (-1.3)	-1.07 (-1.4)
L-T Credit Banks	-5.06 (-6.0)	-5.24 (-6.3)	-5.24 (-6.3)				-5.07 (-4.5)	-5.24 (-4.7)	-5.24 (-4.7)
Constant	7.2 (2.6)	9.28 (3.9)	9.17 (4.1)				7.38 (2.6)	9.37 (4.1)	9.15 (4.4)
Adj. R. Square	0.14	0.15	0.14	0.26	0.37	0.37	0.16	0.00	0.00
Hausman test p-value							0.813	0.789	0.640

Note: Numbers in parentheses are t-ratios

Table 3a. Results of Cross-Section Regressions of Asset Growth on BIS Capital Ratios

Fiscal Year	1991	1992	1993	1994	1995	1996	1997
Constant	1.69 (0.3)	-1.03 (-0.2)	13.70 (2.5)	4.99 (1.1)	-4.14 (-0.8)	-2.32 (-0.4)	-9.58 (-1.9)
CAR <sub>t-1</sub>	0.09 (0.2)	-0.20 (-0.3)	-1.37 (-2.3)	-.43 (-0.9)	0.56 (1.0)	0.27 (0.5)	0.97 (1.8)
Adj. R <sup>2</sup>	-0.01	-0.01	0.05	-0.00	0.01	-0.01	0.03

Note: numbers in parentheses are t-ratios.

Table 3b. Cross-Section Regression of Asset Growth on Adjusted Capital Ratios

Fiscal Year	1991	1992	1993	1994	1995	1996	1997
Constant	10.84 (4.0)	1.18 (0.3)	6.26 (2.2)	4.79 (1.8)	-6.05 (-2.1)	-2.08 (-0.6)	-10.34 (-2.6)
ADCAR <sub>t-1</sub>	-0.67 (-3.1)	-0.38 (-1.1)	-0.47 (-1.9)	-0.33 (-1.5)	0.66 (2.5)	0.20 (0.7)	0.91 (2.5)
Adj. R <sup>2</sup>	0.10	0.00	0.03	0.01	0.06	-0.01	0.06

Note: numbers in parentheses are t-ratios.

Table 3c. Cross-Section Regression of Asset Growth on Market Capitalization Based Capital Ratio

Fiscal Year	1991	1992	1993	1994	1995	1996	1997
Constant	4.15 (4.6)	-2.08 (-2.9)	0.90 (1.4)	0.94 (1.4)	0.71 (1.0)	-0.14 (-0.2)	-1.56 (-1.5)
MCR <sub>t-1</sub>	-0.09 (-2.1)	-0.05 (-1.1)	0.00 (0.0)	-0.00 (-0.2)	0.03 (0.6)	0.03 (0.6)	0.09 (1.4)
Adj. R <sup>2</sup>	0.04	0.00	-0.01	-0.01	-0.00	-0.00	0.01

Note: numbers in parentheses are t-ratios.

Table 4a. Results of Cross-Section Regressions of New Loan Growth on BIS Capital Ratios

Fiscal Year	1991	1992	1993	1994	1995	1996	1997
Constant	12.32 (3.0)	-7.15 (-1.1)	7.97 (1.4)	-3.49 (-0.6)	-4.83 (-0.9)	-2.07 (-0.6)	-16.8 (-3.5)
CAR <sub>t-1</sub>	-0.96 (-2.2)	1.2 (1.6)	-0.70 (-1.2)	0.57 (0.9)	1.01 (1.7)	0.37 (1.1)	1.80 (3.6)
Adj. R <sup>2</sup>	0.04	0.02	0.00	-0.00	0.02	0.00	0.13

Note: numbers in parentheses are t-ratios.

Table 4b. Cross-Section Regressions of New Loan Growth on Adjusted Capital Ratios

Fiscal Year	1991	1992	1993	1994	1995	1996	1997
Constant	14.09 (6.4)	5.19 (1.4)	9.14 (3.3)	1.89 (0.5)	-0.84 (-0.2)	-1.04 (-0.5)	-15.17 (-4.1)
CAR <sub>t-1</sub>	-0.85 (-4.9)	-0.21 (-0.6)	-0.69 (-2.8)	0.01 (0.0)	0.50 (1.7)	0.21 (1.2)	1.41 (4.2)
Adj. R <sup>2</sup>	0.22	-0.00	0.08	-0.01	0.02	0.00	0.17

Note: numbers in parentheses are t-ratios.

Table 4c. Cross-Section Regressions of New Loan Growth on Market Capitalization Based Capital Ratio

Fiscal Year	1991	1992	1993	1994	1995	1996	1997
Constant	5.35 (6.9)	4.01 (5.5)	1.24 (2.0)	1.47 (1.8)	5.12 (6.4)	0.41 (2.5)	-1.06 (-1.0)
MCR <sub>t-1</sub>	-0.10 (-2.6)	-0.07 (-1.5)	0.01 (0.4)	0.03 (0.7)	-0.04 (-0.7)	0.00 (0.2)	0.09 (1.4)
Adj. R <sup>2</sup>	0.07	0.02	-0.01	-0.00	-0.01	-0.01	0.01

Note: numbers in parentheses are t-ratios.

Table 5. Regressions of Asset Growth on Adjusted Capital Ratios and Reserve Cover

	OLS	Weight OLS
Constant	-9.54 (-2.5)	-11.85 (-2.4)
ADCAR	0.48 (1.2)	0.76 (1.5)
Reserve Cover	0.06 (2.2)	0.05 (1.4)
Adj. R-square	0.11	0.07

Note: numbers in parentheses are t-ratios.

Table 6. Regression of New Loan Growth on Adjusted Capital Ratios and Reserve Cover

	OLS	Weight OLS
Constant	-13.89 (-4.0)	-22.61 (-6.2)
ADCAR	0.76 (2.1)	1.20 (3.1)
Reserve Cover	0.08 (3.6)	0.11 (4.2)
Adj. R-square	0.29	0.38

Note: numbers in parentheses are t-ratios.

Japan

Figure 1. Non-performing Loans as a Percentage of Total Outstanding Loans of Major Banks

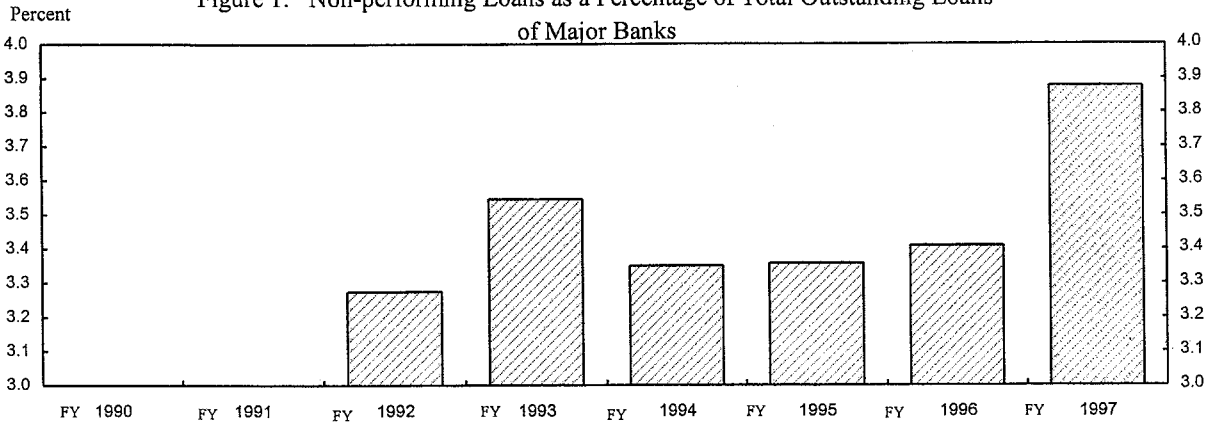


Figure 2. Trend Profitability of Major Japanese Banks

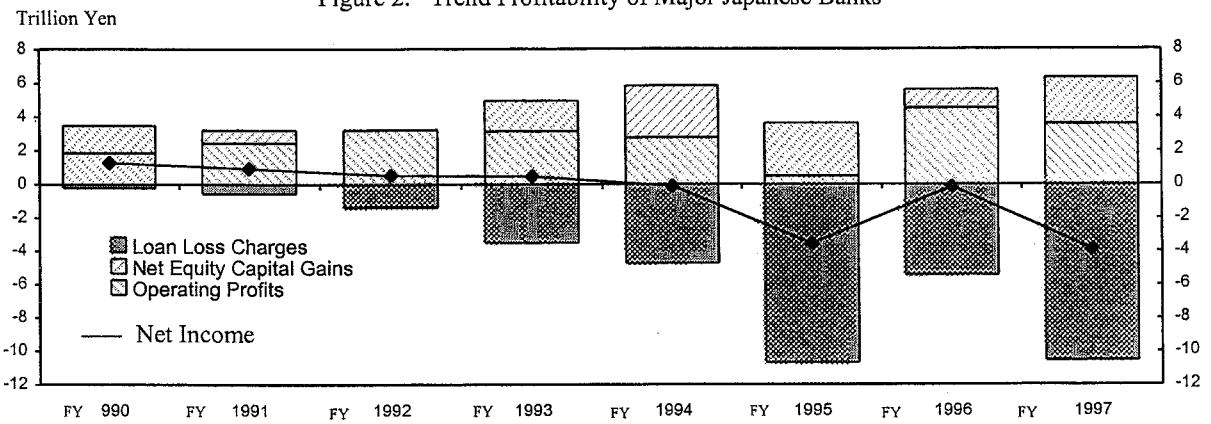
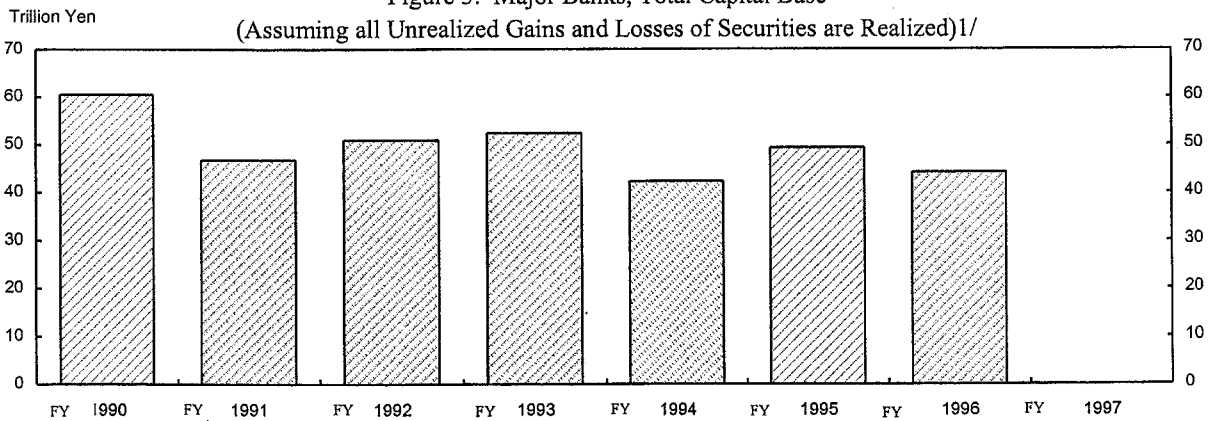


Figure 3. Major Banks, Total Capital Base (Assuming all Unrealized Gains and Losses of Securities are Realized)<sup>1/</sup>



<sup>1/</sup> 1997 is excluded because the reported capital ratios for that year are not comparable with those in previous years due to accounting changes.

Sources: Bankscope, Fitch IBCA



Japan

Figure 4. Annualized Percentage Change in Bank Credit to the Private Sector

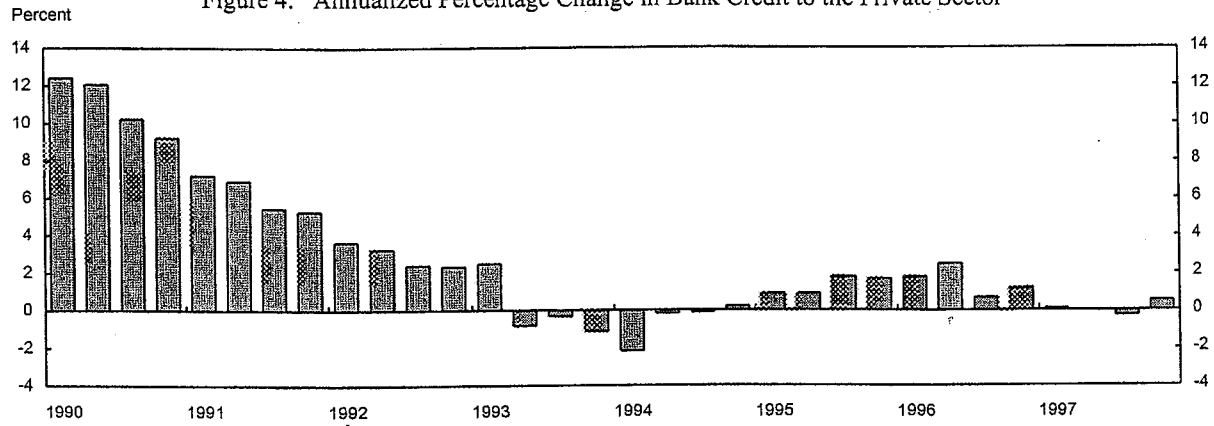


Figure 5. Financial Institutions' Willingness to Lend

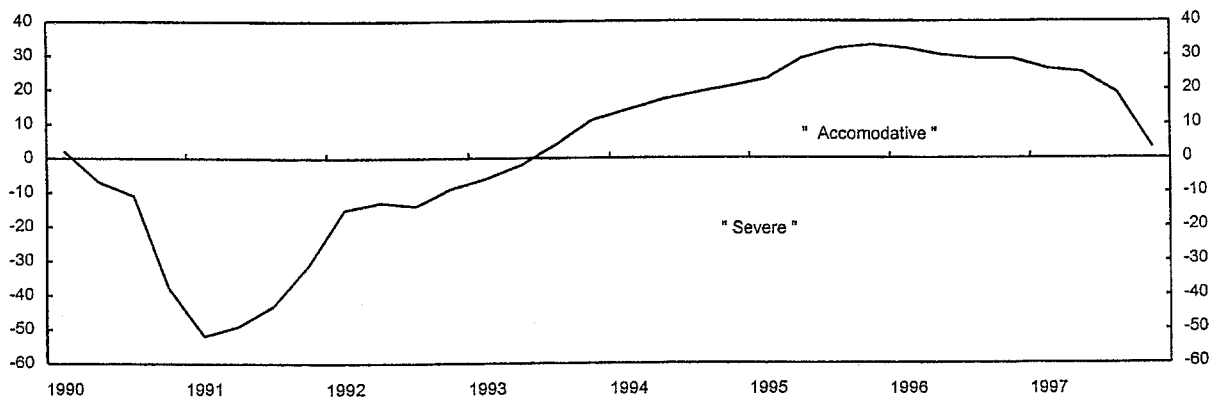
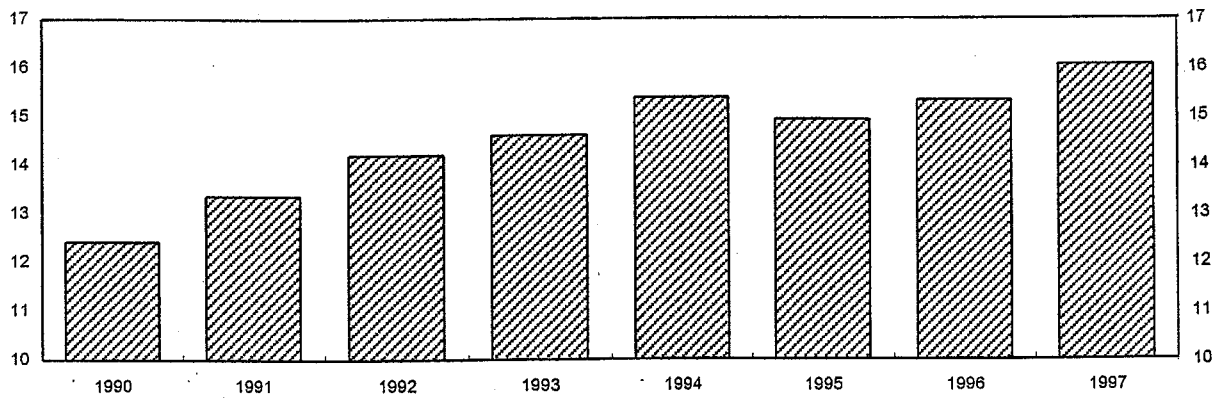
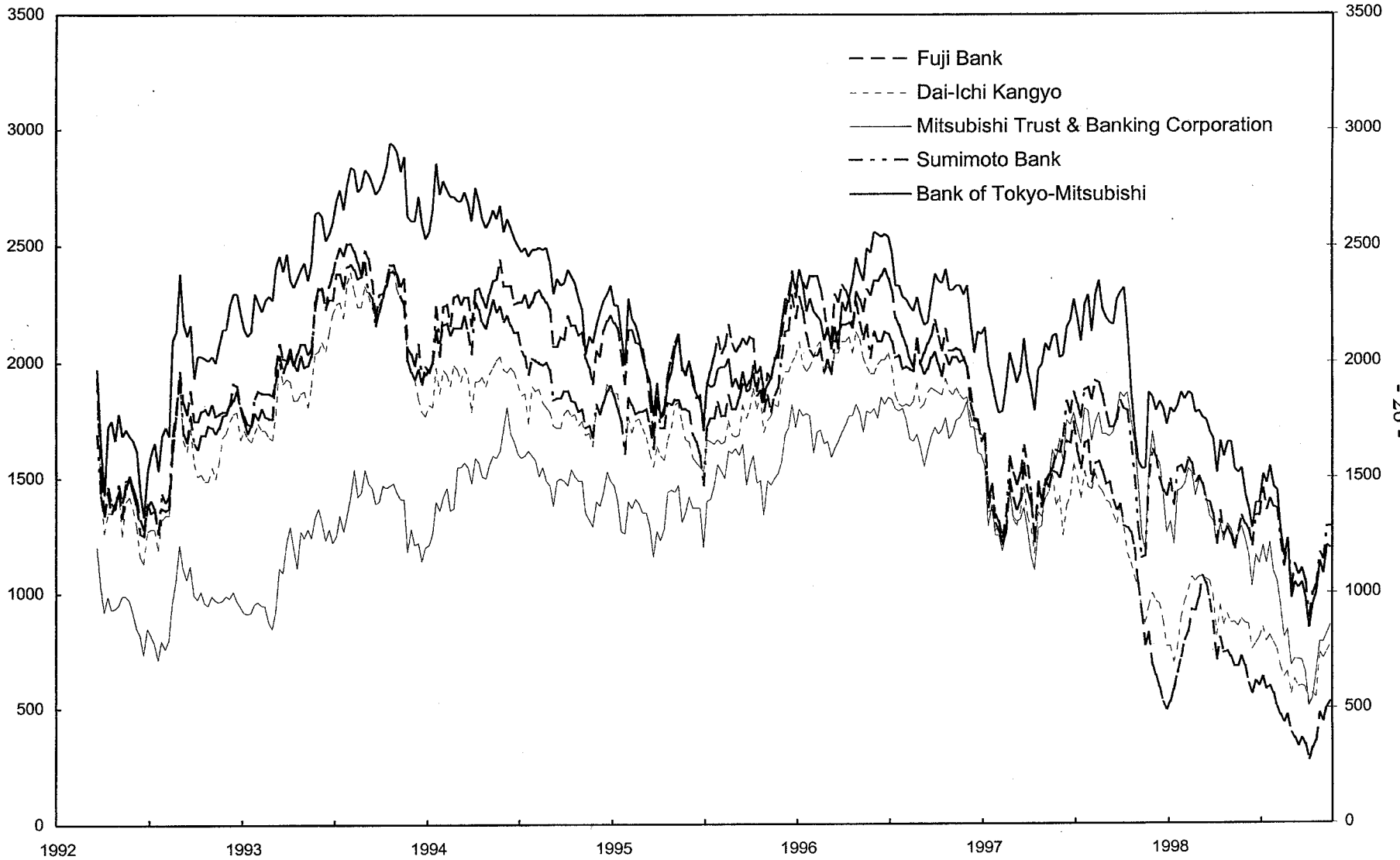


Figure 6. Overdraft as a Percentage of Total Loans



Sources: IMF IFS, Tankan Survey, Bankscope

Figure 7. Stock Prices of Major Banks  
(in Yen)



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