

# Does a Large Loss of Bank Capital Cause *Evergreening*? Evidence from Japan

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## *Abstract*

Using the real estate lending share of the bank's loan portfolio at the peak of the land price bubble as an instrument for bank capital, we identify the impact of capital adequacy on the allocation of bank lending under the Basel regulatory framework. We find that, in Japan, a large loss of bank capital caused by the regulator's *excessively* tough stance towards banks not only induced the contraction of the bank lending supply but also the banks' reallocation of their lending portfolios to financially unhealthy industries with a higher concentration of non-performing loans.

Keywords: evergreening, bank capital, real estate lending, instrumental variable

JEL classification: C31, G21

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## 1. Introduction

The purpose of this paper is to provide an answer to the empirical questions “Do banks make adjustments not only in the quantity of the lending supply but also in the *quality* of the lending supply as a response to a large negative capital shock within the Basel risk-based capital regulatory framework? And if so, how?”

The answers to our empirical questions have interesting policy implications. If bank lending is shifted from high-quality borrowers to low-quality borrowers (*evergreening*), an *excessively* tough regulatory stance that urges banks to write off non-performing loans -- which causes a large loss of capital -- is an undesirable policy that leads to inefficient financial support of unprofitable firms at the cost of profitable investment opportunities.<sup>1</sup> If the opposite is the case (*flight to quality*), a tough regulatory stance has the effect of encouraging profitable investments.

Despite the important implications on modern-day prudential policy and the potentially enormous macroeconomic impact, little has been done to explore the influence of inadequate bank capital on the quality of bank lending supply. We now turn to the second largest economy in the world, Japan, which recently suffered from a staggering non-performing loans (NPLs) problem and a decade long economic stagnation, to discuss our agendas.

In fiscal year 1997 Japanese banks, under strong regulatory pressure, finally recognized a huge amount of non-performing loans and incurred a huge loss of capital.<sup>2</sup> Bank capital, which had already been diminished by a series of negative events during the financial crisis that surfaced in FY

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<sup>1</sup> *Evergreening* is sometimes called *forbearance lending* in the literature.

<sup>2</sup> One may argue that the Japanese regulator’s stance against banks had been too soft and referring to its tougher stance in FY 1997 as “excessively tough” is misleading. By a term “excessive,” we refer to the very fact that the regulator (Ministry of Finance, MOF) went from one extreme (an unusually soft policy) to another extreme (a sudden tough policy). The MOF’s momentum toward a tough stance against banks was undeniably “excessive”. We, however, do not deny that the MOF was mishandling the banking sector before FY 1997. The MOF should have acted earlier when land prices were still higher and the magnitude of non-performing loans was still manageable. Use of a term “excessive” also reflects our perception that the MOF did not make up for losses incurred by its tough stance by capital injection immediately. This point is discussed later.

1995, reached a level that was low enough for regulatory intervention to be a real threat. Watanabe (2007) determined that Japanese banks did reduce lending to relatively healthy industries such as the manufacturing industry but did not examine how capital-constrained banks allocated lending between high quality and low quality borrowers.<sup>3</sup>

To identify the Japanese banks' lending behavior in the late 1990s, we resort to the strategy developed by Watanabe (2007) that exploits the banks' structural behavioral changes in the 1980s in the face of financial liberalization. Japanese banks had shifted their lending portfolios toward the real estate sector based on bullish expectations concerning land prices just as American financial institutions amassed mortgages based on bullish expectations concerning housing prices during the period from 2003 to 2006. In the early 1990s, the land price bubble in Japan was burst and a large portion of real estate lending became non-performing just as the burst of the housing bubble left a large number of mortgages delinquent in the United States. Thus, in Japan, the higher share of real estate lending in the late 1980s explains the higher non-performing loans and lower bank capital in the late 1990s.

Focusing on the real estate share of lending within the banks' loan portfolios at the end of the 1980s as an instrumental variable for bank capital-- which allows us to distinguish the lending supply function from the possible demand side capital-borrowing relationship -- unveils complexity of the Japanese banks' lending practices. We find that large accounting losses of bank capital in FY 1997 induced banks not only to reduce overall lending supply but also to reallocate lending to unhealthy industries with a higher concentration of non-performing loans.

In FY 1997, under the regulator's request to carry out rigorous assessments of outstanding loans, weakly capitalized banks knew that, because of tougher standards, they would risk falling below the regulatory minimum unless distressed firms managed to repay their debts on time. Thus, banks, in

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<sup>3</sup> Woo (2003) also points out that inadequate bank capital was a cause of declining bank lending supply in FY 1997.

attempt to raise the risk based capital (RBC) to asset ratio, while cutting back on lending to healthy firms, they became less willing to cut back on lending to unhealthy firms, since without the banks' financial support, firms in trouble would have failed and the banks would have incurred even further capital losses. From a macroeconomic stand point, while quantitative deterioration of bank credit likely triggered the economic downturn, qualitative deterioration of bank credit favored the inefficient resource allocation in the real sector, and likely prolonged the slump.

We believe that our findings have two contributions to the broader audience particularly in the context of the current global financial turmoil. First, the banks' overinvestment in loans collateralized by real estates during the real estate upturn makes banks extremely vulnerable to the downward real estate price risk and causes a devastating negative impact on their balance sheet when real estate prices actually fall. Second, at a time of a severe capital crunch, banks behave inefficiently unless the regulatory framework is appropriately designed with a strong enforcement of fair accounting standards. The banks' perverse incentive of *evergreening* was created in part by the ample opportunities for the regulatory arbitrage under the Basel I framework and in part by the weak enforcement of accounting standards.

This paper is organized as follows. In Section 2, a bank's possible behavioral reactions to a loss of its own capital are discussed, and the relevant literature is reviewed. In Section 3, the data and econometric issues are examined. In Section 4, the empirical results are reported. Section 5 concludes.

## **2. Capital crunch, flight to quality, the credit crunch, and evergreening: theoretical considerations and literature survey**

Japanese banks suffered a substantial loss of capital during the mid 1990's due to such various adverse events as their contribution to the liquidation of *jusen* housing loan companies, declining

bank profitability, and distrust of the banking industry by market participants.<sup>4</sup> It was, however, the regulator's adoption of a tougher stance towards banks (i.e., its urging them to implement a more rigorous self-assessment of their assets) in FY 1997 that resulted in a loss of bank capital of unprecedented magnitude (the *capital crunch*). Up until that time, most NPLs had been left unrecognized and had not appeared on the banks' financial statements.<sup>5</sup>

The Risk Based Capital (RBC) regulatory framework requires banks to satisfy the minimum standard for the ratio of capital to risk weighted assets (riskier assets are assigned the higher weights), the so-called RBC ratio.<sup>6</sup> Corporate lending has been assigned a weight of 100% irrespective of the credit risk of each contract (credit worthiness of each borrower). Introduction of the Prompt Corrective Action framework (PCA) in April 1998, immediately after the end of FY 1997, which allows the regulator to intervene in the management of banks with an RBC capital ratio below the regulatory minimum, made failure to achieve the minimum standard particularly costly for banks.<sup>7</sup>

What can a bank do if a large loss of capital brings down its RBC ratio to a level close to the regulatory minimum? Asymmetric information -- involving investors, banks, and borrowers -- makes issuing new equity costly.<sup>8</sup> There are, however, potentially three ways for a bank to raise the RBC ratio without issuing equity. First, if associated operational costs are negligible, the bank may examine individual lending contracts (or at least individual borrowers) and reduce riskier loans while

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<sup>4</sup> Distrust of the Japanese banking industry by market participants manifested itself as the Japan premium in 1996 and 1997. In the Eurodollar and Euroyen inter-bank markets, lenders charged Japanese banks higher rates than other international banks. See Peek and Rosengren (2001).

<sup>5</sup> Hoshi and Kashyap (2001) provide the best summary source of the chronology of the Japanese financial crisis.

<sup>6</sup> The framework was agreed to in the Basel Accord and in Japan took full effect in fiscal year 1992. All banks publicly reported ratios in accordance with the Japanese Bankers Association (*zenginkyo*) criteria.

<sup>7</sup> The regulatory minimum is the Basel standard of 8 percent for banks that conduct international businesses and 4 percent for those that operate only domestically. It was only major banks that were affected by the PCA in the introductory year of FY 1997. However, other banks must have foreseen the PCA's greater coverage of the banking industry.

<sup>8</sup> See Stein (1998) and Diamond and Rajan (2000) for discussions on the banks' cost of issuing equity.

retaining safer loans. This is the bank's *flight to quality* in response to a negative capital shock. Second, if such costs are prohibitively high, banks may cut the supply of loans irrespective of the borrowers' credit worthiness. This is the *credit crunch*. Third, the bank can engage in the so-called *evergreening* for borrowers who have difficulty in servicing their debts. The supply of additional loans to such borrowers not only allows them to fulfill their contractual obligations on previous debts but also helps the lender bank to avoid the appearance of NPLs on its financial statements. This paper sheds light on the banks' adjustment of the quality of their supply of loans in response to a large loss of their own capital; it tests the *evergreening* hypothesis against the *flight to quality* hypothesis by examining shifts in the supply of loans among borrowers of various financial strengths.<sup>9</sup>

The hypotheses have been tested by comparing small business lending with lending to larger firms with various sets of data from both the US and abroad, on the ground that creditors should reduce loans to opaque small firms in times of capital losses (Bernanke and Lown [1991], Peek and Rosengren [1995], Hancock and Wilcox [1998], Berger, Klapper, and Udell [2001]). The results are not very conclusive.<sup>10</sup> Since banks establish long-term relationships with borrowers through rounds of lending contracts, small firms are not necessarily more opaque to banks than larger firms are.<sup>11</sup> Thus, this traditional approach may be misleading.

A growing number of recent empirical studies are supportive of *evergreening* by Japanese banks. Kobayashi, Saita, and Sekine (2003) document that the growth of loans to highly leveraged firms

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<sup>9</sup> According to Bernanke and Gertler (1995) and Bernanke, Gertler, and Gilchrist (1998), credit supply to borrowers with higher net worth is greater than to those with lower net worth under the optimal contract, when there is asymmetric information between the lender and the borrower. The allocation of credit supply is accelerated in the wake of a negative shock to creditors such as tightening monetary policy and a loss of bank capital.

<sup>10</sup> Gertler and Gilchrist (1994), Oliner and Rudebusch (1995, 1996), and Lang and Nakamura (1995) support the banks' *flight to quality* in response to tightening monetary policy.

<sup>11</sup> For empirical evidence of banks as relationship lenders, see Berger and Udell (1995), Petersen and Rajan (1994, 2002), Cole (1998), Degryse and Cayseele (2000) and Berger, Klapper, and Udell (2001).

accelerated. Peek and Rosengren (2005) find that a financially weaker bank, whose risk-based capital to asset ratio was closer to the regulatory minimum, was likely to extend credit to the firm in response to the financial deterioration of the firm. Caballero, Hoshi and Kashyap (2008) has gone one step further in showing how zombies congest the industries in which they operate, depressing overall restructuring and decreasing the investment of healthy peers in their industries.<sup>12</sup>

### 3. Empirical methodology

#### Empirical model

Consider the following equation. The specification follows Watanabe (2007).

$$\Delta \ln L_{it}^j = \alpha_0^j + \alpha_1^j \Delta \ln L_{it-1}^j + \beta_t^j \left\{ \frac{K_{it}}{A_{it}} - \left( \frac{K_i}{A_i} \right)^* \right\} + \gamma^j X_i + \varepsilon_{it}^j \quad (1)$$

The special emphasis is placed on the superscript  $j$ , which indicates a group of industries. Here, comparisons of the estimation results for a group of “unhealthy” industries with the results for a group of “healthy” industries are our central interest, unlike Watanabe (2007) who investigates lending to “healthy” industries only.

The dependent variable  $L_{it}^j$  is the lending growth of an individual bank  $i$  to the  $j$ 'th group of industries at date  $t$ .<sup>13</sup> Explanatory variables are the lagged dependent variable and the difference between actual and target levels of the capital to asset ratio,  $K_{it}/A_{it} - (K_i/A_i)^*$ , which we call the capital “surplus” (“shortage” if it is negative).<sup>14</sup>  $X_i$  is a set of dummy variables (CITY, TRUST, and

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<sup>12</sup> For an extensive literature review, see Kobayashi, Saita, and Sekine (2002), Caballero, Hoshi, and Kashyap (2008) and Hosono and Sakuragawa (2005).

<sup>13</sup> The use of loan growth as the dependent variable is intended to capture the bank's adjustment of new lending in response to a change in capital. Bernanke and Lown (1991), Berger and Udell (1994), Ogawa and Kitasaka (2000) and Ito and Sasaki (2002) use loan growth in the same spirit. Peek and Rosengren (1997) use the change in loans divided by beginning-of-period assets. Woo (2003) calculates new loans by adding write-offs of non-performing loans to the change in loans. Though Woo's dependent variable is the most preferred, and one should calculate new loans as Woo (2003) does, data on write-offs of NPLs by industry are not available.

<sup>14</sup> Ogawa and Kitasaka (2000) derive a similar specification including a lagged dependent variable as one of the

REGIONAL) that control for an individual bank's institutional characteristics and indicate a city bank, a trust bank, or a regional bank, respectively. These dummy variables are meant to control for lending demand as each group of banks has a distinctive customer base.<sup>15</sup>  $\varepsilon_{it}^j$  is the error term.

As Van den Heuvel (2002) shows, when a bank maximizes the expected sum of future dividend payouts under the Basel regulatory framework, it starts to cut back on its lending supply only when its capital to asset ratio is sufficiently close to but above the regulatory minimum. How much earlier the bank acts in response to a loss of capital, which serves as a buffer to the regulatory minimum for a forward-looking bank, depends on the bank's characteristics such as risk averseness, size, and institutional and legal status.<sup>16</sup> The bank's specific target for the capital to asset ratio  $(K_i/A_i)^*$  is the level that triggers the bank to act.<sup>17, 18</sup>

### Data and sample selection

The main data source of bank level data is the Nikkei NEEDS bank financial data bank, which has become standard for recent empirical works on Japanese banks.<sup>19</sup> The data represents a 27 year-long period from FY 1974 to FY 2000. It contains not only the balance sheets and income

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independent variables from the optimization problem of a forward-looking bank. Excluding the lagged dependent variable did not alter the results in the following empirical analysis (the results are not shown.)

<sup>15</sup> Dummy variables are based on the conventional classification of Japanese banks. Regional 2 banks are used as a base group. Long-term credit banks do not survive in the construction of the analyzed sample, which will be discussed later.

<sup>16</sup> See Hancock and Wilcox (1994) for a discussion

<sup>17</sup> Testing on the non-linear effect of bank capital on the lending rate, Hubbard, Kuttner and Palia (2002) find that the price effect is more likely to be linear than to be non-linear. As a bank level interest rate on the flow of loans is unable to extract from the financial statements and the only estimable interest rate is the average rate on the present balance of total loans, the price term is not included in our model. The price effect is negligible since bank lending rates remain mostly unchanged under the Bank of Japan's unusually low interest rate policy.

<sup>18</sup> Using data on Italian banks, Gambacorta and Mistrulli (2003) conduct their empirical tests that are based on the view of Van den Heuvel (2002), which is that the reaction of the banks' lending supply to capital adequacy is non-linear.

<sup>19</sup> Ogawa and Kitasaka (2000), Hoshi and Kashyap (2000), Ueda (2000), Hoshi (2001) and Watanabe (2007)



statements of all domestically licensed banks but also information on bank loans classified by industry, allowing us to compare loans supplied to various sectors.<sup>20</sup>

In order to distinguish the banks' reactions to the loss of their own capital from simultaneous falls in loans and capital by failed banks during the process of liquidation (or during the clean up of NPLs in preparation for a handover to new management), banks affected by bank failures, liquidated or nationalized banks and those experiencing rescue mergers or acquisitions of failed banks, were dropped from the sample.<sup>21</sup> A total of 126 banks remained in the sample.

#### Disaggregating lending data into healthy and troubled industries

Non-performing loans (NPLs) reduce a firm's net worth. Large NPLs suggest that priority for the allocation of a firm's resources is being given to servicing debts and that the firm is being deprived of the opportunity to grow by investing in profitable projects. An industry is considered a "troubled" industry if the share of NPLs to that industry in total NPLs exceeds the share of loans to that industry in total loans as of the end of fiscal year 2000. "Troubled" industries are defined as real estate, construction, wholesale and retail, and service industries. As displayed in Figure 1, they account for three-fourths of the total NPLs, even though only 46 percent of total loans are directed to them.

[Insert Figure 1 about here.]

The "flight to quality" hypothesis is tested against the "evergreening" hypothesis by comparing

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<sup>20</sup> Missing items on recent balance sheets of a few banks are supplemented by their annual reports.

<sup>21</sup> Banks that had experienced non-rescue mergers are treated as single banks in pre-merger dates by adding values of variables for the banks involved in the deals as do Peek and Rosengren (1995) and Kishan and Opiela (2000). One long-term credit bank was dropped because detailed lending data for the 1980s are missing, and one regional 2 bank founded in the 1990s was also dropped.

the estimation results of the bank lending supply function for “troubled” industries and that for “non-troubled” industries.

### The capital measure

The ratio of book capital to total assets (book-based ratio) is used as the capital measure when estimating equation (1) rather than the Basel risk based capital to asset ratio. The book-based ratio is a preferred measure since it captures an exogenous variation in core capital (Tier 1 elements), which is required to be at least 50 percent of capital to meet the minimum standard under the Basel framework.<sup>22, 23</sup>

### Estimation methodology

Following Watanabe (2007), we use as the target the average of each capital to asset ratio measure for each bank for the fiscal year 1992-1994. It seems reasonable to assume that banks had achieved their targets during this period as the aggregate capital to asset ratio stayed high at around 5 percent (Figure 2). The periods before and after the sample period were excluded because (1) the Basel regulatory framework did not take full effect until FY 1992 and (2) banks experienced large losses of bank capital in FY 1995 and in FY 1997.<sup>24</sup>

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<sup>22</sup> The Basel risk based ratio is endogenous for two reasons. First, since it is normalized by risk weighted assets, a feedback effect from the growth of the supply of loans (the dependent variable) to the Basel ratio through the denominator of the ratio likely results. Second, as authors such as Ito and Sasaki (1999) points out, banks can issue supplemental quasi-capital instruments such as subordinate debts to affiliate firms and can raise the Basel ratio in the wake of the loss of core capital. See Watanabe (2007) for more discussion on supporting a choice of the book based ratio.

<sup>23</sup> Tier I capital is not available in the electronic format. One needs to hand collect the data from banks’ annual reports. Tier I capital and book capital are almost identical by definition.

<sup>24</sup> The Basel Accord agreed in 1988 encouraged banks to accumulate adequate capital by the time of its full implementation.

[Insert Figure 2 about here.]

The target constructed in this way varies across banks but is time invariant. Figure 3 shows that capital shocks are aggregate rather than idiosyncratic in nature and influence an individual bank's capital position in a synchronized manner. In FY 1997 all banks were either short of or just achieved their targets. In FY 1998, by contrast, many banks had drummed up their capital and achieved their targets. By FY 1999, most banks had achieved their targets. The time variant but cross-sectionally invariant reaction coefficient  $\beta_t^j$  is meant to capture the banks' reactions to such aggregate shocks.<sup>25</sup>

[Insert Figure 3 about here.]

We estimate equation (1) using yearly bank panel data and interacting time dummies with the explanatory variables to leave the coefficients including the one on capital "surplus"  $K_{it}/A_{it}$  -  $(K_{it}/A_{it})^*$  time-variant.<sup>26, 27, 28</sup>

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<sup>25</sup> The target may change over time as the regulatory and economic environments change. However, arguably the most important economic influence on the banks' targets, interest rates, stayed low and barely changed in the late 1990s. Watanabe (2007) discusses a potential for an alternative regression based estimation of targets.

<sup>26</sup> Resulting point estimates are numerically equivalent to those from separate cross sectional regressions. Watanabe (2007) run year by year cross sectional regressions.

<sup>27</sup> We could restrict some of the coefficients to be time invariant if they seemed to be stable over time.

<sup>28</sup> It is possible to interpret  $\beta_t^j (K_{it}/A_{it})^*$  obtained by expanding the expression in brackets on the right hand side of equation (1) as the time-variant response of bank lending to the *observed* bank specific fixed effect. Theoretically, one could model the time-variant response of bank lending supply to a standard unobservable fixed effect, which is incorporated in the regression equation as a time dummy, and identify the time-variant response and the fixed effect. One could then test whether the "restricted" model with the estimated target outperforms the "unrestricted" model with the unobserved fixed effect by using, say, the log likelihood principle. In order for us to be able to use standard test statistics to compare the two sets of regression results, instruments have to be shared between the two. Since bank dummies have to be included in the "unrestricted" model to ensure the high dimension of the set of instruments, they have to be in the original model as well, but the inclusion of bank dummies as instruments in the "restricted" model resulted in implausible estimates. Developing a new testing strategy will be an interesting topic for future research.

### Simultaneity and identification

The OLS estimator of the coefficient of the capital “surplus” measure  $\beta_t^j$  in equation (1) may capture not only the banks’ behavioral responses but also the potential demand-side relationship. If economic conditions worsen, firms adjust their investments downward, which in turn results in declining borrowing demand. On the other hand, firms’ sluggish sales performance may prevent them from earning enough revenues to service their debts on time. Thus, their existing loans become non-performing, which reduces the lender bank’s capital. Similarly, in an economic upturn, borrowing demand soars, and the higher bank profits are added to their equity capital.

In order to identify the bank lending supply function from the balance sheet data, we need a valid instrument that is independent of the error term  $\varepsilon_{it}^j$  and strongly correlated with the capital to asset ratio,  $K_{it}/A_{it}$ . Following Watanabe (2007), we use the share of real estate lending in the bank’s lending portfolio in FY 1989, which we call REAL89 as a key instrumental variable for bank capital.<sup>29</sup>

Ueda (2000) and Hoshi (2001) find that the tilt in a bank’s portfolio toward the real estate industry in the 1980s best accounts for the size of the NPLs of that bank in the late 1990s. In response to the loss as customers of long-standing large *keiretsu* firms -- which were beneficiaries of the financial liberalization (deregulation) and turned to financial markets to raise needed funds -- banks implemented a structural reorganization of their customers giving more weight to real estate companies in the expectation that land prices would keep rising.<sup>30</sup> When the land-price bubble

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<sup>29</sup> It effectively overcomes the drawback of the classical approach in the literature of using lagged “predetermined” variables that cannot provide an economic explanation of bank capital and whose correlation with bank capital is not guaranteed. See Peek and Rosengren (1995) and Ogawa and Kitasaka (2000). Peek and Rosengren (1995) adds a current change in equity capital to lagged variables, as instruments.

<sup>30</sup> For more on the Japanese financial liberalization, see Hoshi and Kashyap (1999)

burst, a considerable portion of real estate lending became bad loans and were recognized as NPLs on the bank's financial statements in the late 1990s, thereby reducing their capital.

The banks' behavioral responses to the deregulation of the mid-1980s are exogenous to the demand-supply system of bank lending in the 1990s, and thus REAL89 is independent of the error term in the lending supply function (1). The instrumental variable regression with REAL89, therefore, picks up the banks' responses to the loss of bank capital arising from their structural behavioral change in the 1980s and nets out the effect of concurrent business cycle (demand side) factors.<sup>31</sup> REAL89 is strongly negatively correlated with capital "surpluses" since FY 1995 (Table 1).

[Insert Table 1 about here.]

To REAL89, we also add as an instrument the 10-year growth of each bank's lending share to the real estate industry from FY 1980 to REAL89.<sup>32</sup>

#### 4. Results

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<sup>31</sup> REAL89 is meant to capture large drops in land prices due to the burst of the bubble that preceded the large loss of bank capital in the late 1990s. A large loss of capital stemming from falls in land prices had occurred in FY 1997 when regulators urged banks to write off NPLs. Changes in land prices in the late 1990s were minor relative to the burst of the land price bubble that had occurred earlier. For instance, land prices in Tokyo fell by 38 percent over the five-year period FY 1991-1995, whereas it fell by only 9 percent over the three-year period FY 1997-1999. Thus, changes in land prices do not cause serious problems when interpreting the results of instrumental variable regressions in different years. One way to take account of changes in land prices in the late 1990s is to use the product of REAL89 and a contemporaneous land price as an instrument. However, REAL89 multiplied by land price, has less explanatory power as an instrument for bank capital.

<sup>32</sup> In addition, the following are included as a set of instrumental variables; constant, predetermined variables including lagged and twice lagged loan growths, lagged and twice lagged interest rate differentials constructed as earned interest rates less the prime rate divided by loans, and other lagged variables including twice, three times, and four times lagged deposit growth rates, and lagged and twice lagged growths of the land price of the prefecture in which the headquarters of a bank is located. The (one period) lagged deposit growth is excluded from instruments due to a concern about the possible behavioral endogeneity between lending and deposits as described by Diamond and Rajan (2000).

## Descriptive statistics

Table 2 shows descriptive statistics of dependent variables, independent variables and instrumental variables used for regressions of equation (1) over the sample of 756 observations (126 banks for six years from FY 1995 to FY 2000).

On average, “troubled” lending, that is, lending to “troubled” industries not closely related to the real estate industry (wholesale and retail and service industries) grew more slowly than “non-troubled” lending, that is, lending to healthy non-manufacturing industries that were little burdened by NPLs, regardless of whether such healthy industries included the financial and insurance industry (agriculture, mining, financial and insurance, transportation and communications, and utilities) or not (agriculture, mining, transportation and communications, and utilities).<sup>33</sup> The capital “surplus” is on average marginally positive. As for our most important instrumental variable, REAL89, it is on average a little less than 10 percent and varies substantially across observations.

[Insert Table 2 about here]

## Regression results

Table 3 shows the estimates of the coefficient of the contemporaneous capital “surplus”,  $\beta_i^j$ , from the 2SLS regression of equation (1) based on panel data on banks for the FY 1995-2000 period. The first row presents the results for bank lending to “troubled” industries not closely related to the real estate industry; the industries included are wholesale and retail and service. The second row labeled “non-troubled (2)” presents the results for bank lending to healthy non-manufacturing

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<sup>33</sup> Some non-banks are said to have engaged in intensive real estate related lending. Though presence of NPLs to the financial and insurance industry is not outstanding in the data, we present the results on the healthy non-manufacturing industries excluding the industry to check the robustness of the results.

industries (agriculture, mining, financial and insurance, transportation and communications, and utilities). The third row labeled “non-troubled (3)” presents the results for bank lending to healthy non-manufacturing industries excluding the financial and insurance industry (agriculture, mining, transportation and communications, and utilities).

[Insert Table 3 about here.]

In FY 1996, estimated coefficients of the contemporaneous capital “surplus” are positive for both “troubled” and “non-troubled” industries, but neither is statistically significant in the case of “troubled” industries. In FY 1997 the estimated coefficient is positive and statistically significant for the lending supply to both groups of industries, though the point estimate is substantially larger for “non-troubled” industries than for “troubled” industries.<sup>34</sup> The coefficient is estimated to be larger for “non-troubled” industries than for “troubled” industries in FY 1998, although it is not significant in the case of “non-troubled” industries when the financial and insurance industry (FII) is excluded.<sup>35</sup>

#### The issue of the timing of events

The regulator’s official announcement of the rigorous assessment framework of bank assets was published on March 5th, 1997, about a year before the end of fiscal year 1997. Banks knew a year in advance that a large loss of capital was inevitable at the end of fiscal year 1997. Regression equations with a lagged capital to asset ratio were also examined (the results are not shown). Just

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<sup>34</sup> The OLS estimator provides statistically significant but substantially smaller point estimates of coefficients than does the 2SLS estimator in fiscal years 1996 and 1997 and insignificant estimates in FY 1998. (Results are not shown.)

<sup>35</sup> Regressions that include time effects (time-variant constant) and the time-variant coefficient of the capital “surplus” but that leave other coefficients time invariant result in qualitatively similar results. The LR tests do not reject such restrictions on coefficients. (Results are not shown.)

as the coefficient of the contemporaneous ratio is significant and positive, so generally is the coefficient of the lagged ratio. As the constructed capital “surplus” is a stock of capital less a time invariant target, it is strongly serially correlated. Besides, an overidentification test rejects the null hypothesis at the 10 percent level for the lag specification for troubled lending in fiscal year 1997.

In fact, in regressions with both lagged and contemporaneous ratios, the coefficients of the lagged ratios are not statistically significant in any fiscal year (the results are not shown). It is a common regulatory practice to announce actions before the close of the fiscal year so that banks act accordingly toward the fiscal year end. Furthermore, every announcement generally is followed by lengthy parliamentary discussions. Thus, our finding that contemporaneous capital rather than lagged capital influences the supply of loans does not contradict the timing of events.

#### Aggregate impact of bank capital

Table 4 compares *actual* aggregate growth rates of loans to “troubled” industries and to “non-troubled” industries over a six year period from FY 1995.<sup>36</sup> Loans to “non-troubled” industries excluding the financial and insurance industry kept rising whereas loans to “troubled” industries kept falling until FY 1996.<sup>37</sup> In FY 1997, however, bank loans began to gravitate toward “troubled” industries. In fact, though both loans to “non-troubled” industries excluding the financial and insurance industry and loans to “troubled” industries fell two years in a row in FY 1997 and FY 1998, the percentage drop in the former was slightly larger than the percentage drop in the latter.

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<sup>36</sup> The data are constructed from the micro data of banks included in the sample of the panel data estimation; thereby making them comparable to the aggregate supply side effects of bank capital on lending that are computed based on the estimation of equation (1).

<sup>37</sup> The clean up of loans to *jusen* companies is the most likely cause of a positive growth of loans to “non-troubled” industries *excluding* the financial and insurance industry and a negative growth of loans to “non-troubled” industries *including* it in FY 1995 and FY 1996.



[Insert Table 4 about here.]

Table 5 compares the *estimated* aggregate growth rates of the lending supply to “troubled” industries and to “non-troubled” industries induced by the banks’ capital positions. Each entry aggregates the third term in (1)  $\beta_t^i \{K_{it}/A_{it} - (K_i/A_i)^*\}$ . The corresponding point estimate from Table 3 is used for  $\beta_t^i$  and asset size is used as a weight. The number measures the aggregate impact of the banks’ capital positions on the bank lending supply in each year.

The actual capital to asset ratio fell short of the target on average (aggregate capital “shortage”) in fiscal years for 1995, 1996, and 1997, and the actual ratio exceeded the target (aggregate capital “surplus”) thereafter.<sup>38</sup> Therefore, the greater value for “troubled” industries (-4.7 percent) than for “non-troubled” industries (-8.5 percent if they *include* FII, and -7.4 percent if they *exclude* it) in FY 1997 strongly suggests that the banking industry as a whole engaged in *evergreening* in response to a large loss of capital. Larger values for “non-troubled” industries in FY 1998 could be evidence of a positive allocative effect of the large public capital injection. Compared with Table 4, it is only in FY 1997 that the distribution of loan growth across “troubled” and “non-troubled” industries is strongly attributable to the banks’ capital positions.

[Insert Table 5 about here.]

### Testing reallocation of lending portfolio

We attempt a formal statistical test to compare the lending supply to “troubled” industries with that to “non-troubled” industries. The regression equation used is obtained by subtracting equation

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<sup>38</sup> A sign of the aggregated capital “surplus” coincides with the sign of the value in the first row of Table 5 because as shown in the first row of Table 3, the coefficient of the contemporaneous book-based capital asset ratio for lending to “troubled” industries is positive in all fiscal years since FY 1995.

(1) for “non-troubled” industries ( $i=nt$ ) from that for “troubled” industries ( $i=tr$ ) (equation [2]) and is estimated by 2SLS with the set of instrumental variables employed being the union of the instruments used when estimating equation (1) for both “troubled” and “non-troubled” sectors. REAL89 remains to play a key role as an identifier.

$$\Delta \ln L_{it}^{tr} - \Delta \ln L_{it}^{nt} = (\alpha_0^{tr} - \alpha_0^{nt}) + \alpha_1^{tr} \Delta \ln L_{it-1}^{tr} - \alpha_1^{nt} \Delta \ln L_{it-1}^{nt} + (\beta^{tr} - \beta^{nt}) \left[ \frac{K_{it}}{A_{it}} - \left( \frac{K_i}{A_i} \right)^{target} \right] + (\gamma^{tr} - \gamma^{nt}) X_i + (\varepsilon_{it}^{tr} - \varepsilon_{it}^{nt}) \quad (2)$$

The estimation results are presented in Table 6-1. Our interests are in estimates of  $\beta^{tr} - \beta^{nt}$  in FY 1996 and FY 1997 when banks failed to achieve their targets as an industry. Though statistically insignificant, the point estimate of  $\beta^{tr} - \beta^{nt}$  is positive ( $\beta^{tr} > \beta^{nt}$ ) in FY 1996. This may imply the presence of portfolio reorganization toward “non-troubled industries” (*flight to quality*). In FY 1997, in sharp contrast to the result of one year earlier,  $\beta^{tr} - \beta^{nt}$  is estimated to be negative ( $\beta^{tr} < \beta^{nt}$ ). The estimate is statistically significant at the 5 percent significance level when “non-troubled” industries *exclude* FII. Banks reorganized their lending portfolios from (unquestionably) healthy industries to unhealthy industries. In FY 1998, a year of capital recovery, the coefficient is negative and significant only at the 10 percent level when “non-troubled” industries *include* FII and is insignificant when “non-troubled” industries *exclude* FII.<sup>39, 40</sup> The complete estimation results of equation (2) are presented in Tables 6-2 (“non-troubled” industries *including* FII) and 6-3 (“non-troubled” industries *excluding* FII).<sup>41</sup>

<sup>39</sup> In FY 1999, in turn, the coefficient is significant and positive when “non-troubled” industries *exclude* FII. This results from the negative and insignificant coefficient for “non-troubled” industries and the positive and insignificant coefficient for “troubled” industries in FY 1999 on Table 2.

<sup>40</sup> “Partial squared correlation coefficients,” developed by Shea (1997) to test the strength of the set of instruments employed to explain a capital “surplus”, were high, which build further confidence in the employed instrumental variables.

<sup>41</sup> Regressions are estimated using panel data on banks for the FY 1995-2000 period. Regressions that include

[Insert Tables 6-1, 6-2, and 6-3 about here.]

### Only poorly capitalized banks practiced *evergreening*

The theory predicts that undercapitalized banks whose actual capital to asset ratio does not meet their target have a strong incentive to *evergreen* firms in “troubled” industries. Adequately capitalized banks, on the other hand, are less likely to have such a perverse incentive.<sup>42</sup> Table 6 presents the results of the cross section regressions of equation (2) for banks that are adequately capitalized relative to their target and for banks that are poorly capitalized relative to their target in FY 1997. The obtained results strongly support the assertion that *evergreening* was practiced by undercapitalized banks in FY 1997. The estimate of  $\beta^{tr}-\beta^{nt}$  is negative and statistically significant at the 1 percent level when “non-troubled” industries exclude FII for poorly capitalized banks. This significant and positive estimate is much larger than the significant and positive estimate for the entire sample presented in Table 5-1, which makes sense, as the estimate of  $\beta^{tr}-\beta^{nt}$  is not statistically significant for adequately capitalized banks. These findings strongly support our hypothesis that only poorly capitalized banks *evergreened* firms in “troubled” industries in FY 1997.

[Insert Table 6 about here.]

### The choice of the instrumental variable is crucial

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time effects (time-variant constant) and the time-variant coefficient of the capital “surplus” but that leave other coefficients time invariant result in very high standard errors for coefficients. None of them is statistically significant at the 10 percent level although the LR tests do not reject such restrictions on coefficients. (Results are not shown.)

<sup>42</sup> According to the credit crunch and ever-greening hypotheses we have considered, banks that meet their capital target are not constrained to their capital in supplying loans. If the bank specific target is observed (precisely estimated without an error) and the hypotheses are correct,  $\beta^{tr}-\beta^{nt}$  would be significant only for banks that are undercapitalized relative to their target.

Table 8 presents year by year OLS estimates of coefficients  $\beta^{lr}-\beta^{nt}$  in equation (2) along with 2SLS estimates from Table 5-1 when “non-troubled” industries exclude FII. The OLS estimate for FY 1997 is statistically significant only at the 10 percent level. This suggests that our use of the share of real estate lending in the bank’s lending portfolio in FY 1989 as an instrumental variable for bank capital is crucial in obtaining the strong results that point to the banks’ *evergreening* in FY 1997. This is in contrast to Watanabe (2007) who presents that both OLS and 2SLS estimates indicate the strong positive relationship between bank capital and the growth of bank lending to healthy industries. It is our choice of the instrument that allowed us to unveil the complexity of the Japanese banks’ lending practices.

[Insert Table 8 about here.]

#### Controlling for the region that the bank is headquartered in

Controlling for bank type does control for loan demand variation but may not be sufficient. Table 9 demonstrates the cross section regression results of equation (2) for FY 1997 when seven region dummies indicating the region in which a bank is headquartered are included as additional control variables. Regressions are estimated for three different samples; the sample of all 126 banks, that of 69 banks that are poorly capitalized relative to their target and 57 banks that are adequately capitalized. The results of regressions with region dummies are qualitatively consistent with results of regressions without region dummies. The coefficient  $\beta^{lr}-\beta^{nt}$  is negative and statistically significant at the 10 percent significance level for all banks, negative and significant at the 1 percent level for poorly capitalized banks and not significant for adequately capitalized banks.

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<sup>43</sup> The eight regions are Hokkaido and Tohoku, Kanto, Koshinetsu, Tokai, Kinki, Chugoku, Shikoku, and Kyushu.

[Insert Table 9 about here.]

### Interpretation of empirical results

To our surprise, the banks did not reduce their lending supply to unhealthy industries as much as they did to healthy industries in FY 1997 when the regulator's tougher stance (i.e. their request for a more rigorous assessment of the banks' assets) towards banks resulted in a large loss of bank capital and the banks' lending decisions were constrained to inadequate capital positions.<sup>46</sup> According to our estimates, while the supply of loans to healthy non-manufacturing industries induced by the undercapitalization of banks contracted by 7 to 9 percent, the supply of loans to unhealthy non-manufacturing industries declined by less than 5 percent.<sup>47</sup> The extent that a fall in lending supply to unhealthy industries exceeded a fall in lending supply to healthy industries is statistically significant for banks that failed to achieve their individual target but is insignificant for banks that are adequately capitalized. This is the evidence that not only strengthens the *evergreening* hypothesis but also justifies our method of estimating targets.

Knowing that they would fail to meet their capital targets at the end of the fiscal year, the banks had to depress loans on their balance sheets during the course of FY 1997. In doing so, banks were

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<sup>44</sup> For these analyses, "non-troubled" industries *exclude* the finance and insurance industry. Region dummies are added to the set of instrumental variables so that 2SLS estimators are well defined.

<sup>45</sup> Since none of the banks headquartered in Shikoku is poorly capitalized relative to its target, only six region dummies are included in the regression for the sample of poorly capitalized banks.

<sup>46</sup> Using the contract based data on loans to Japanese borrowers, Smith (2003) reports that the median loan maturity suddenly fell from 6 years in (calendar year) 1997 to 1 year in (calendar year) 1998. He explains that a sudden fall in loan maturity is in part caused by the Japanese banks' acceleration of *evergreening* toward the end of FY 1997 under the regulatory pressure. According to Smith (2003), Japanese banks made short new loans to help firms repay outstanding loans that they had been in trouble repaying on time.

<sup>47</sup> Since there are a greater number of write offs of NPLs in "troubled" industries and disposal of NPLs reduces both loans and capital equally, the disparity in *new* lending between "troubled" and "healthy" industries must be even more pronounced.

not as keen on cutting lending to healthy borrowers as they were on unhealthy borrowers, as cutting back on lending to distressed firms would result in more recognized non-performing loans and then further deteriorate the banks' capital positions.<sup>48</sup> Banks responded to the *capital crunch* by continuing to lend to questionable firms at the expense of the financial needs of healthy firms.

In contrast, the results for FY 1996 seem to suggest the opposite of those for FY 1997-- a portfolio shift toward healthy industries in response to a minor capital loss, or a *flight to quality*. It is only when banks lose a large amount of capital and a fall below the regulatory minimum is a real threat does a perverse incentive to *evergreen* unhealthy firms arise. The *positive* capital shock resulting from the infusion of large amounts of public capital into large banks in FY 1998 seems to have assisted these banks in redirecting their lending portfolios toward healthy industries and seems to have had some effect on improving the quality of the lending supply.<sup>49</sup>

Our empirical evidence suggests that poorly capitalized banks intentionally *evergreened* unhealthy firms only in FY 1997. Admittedly, one of the disadvantages of our analysis originates from our advantage, use of REAL89 as an instrumental variable, which does not allow us to analyze the industry with the highest share of non-performing loans, the real estate industry itself. Were real estate lending to be included in our empirical framework, our evidence of *evergreening* in FY 1997 would be strengthened.

Our finding is not necessarily inconsistent with the evidence by such authors as Peek and

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<sup>48</sup> Since loans from Japanese banks matured mostly in less than one year, banks could manage to reduce loans by simply deciding not rolling over outstanding loans and rejecting new loan applications rather than demanding that current borrowers make repayments before contractually agreed dates. Moreover, this alternative interpretation is not necessarily inconsistent with the banks' perverse incentive induced by a severe capital crunch. If a bank did not have a perverse incentive, it would have forced unhealthy firms that had had trouble servicing debts to default on outstanding loans and finalized loan losses. If a bank did not aggressively collect loans from unhealthy firms in order to avoid losses, the bank was intentionally rebalancing its loan portfolio toward unhealthy firms, which is evidence of a bank's perverse incentive.

<sup>49</sup> Public funds injected into the banking system amounted to 58,090 million yen. Funds were selectively supplied to larger banks, most of which were severely undercapitalized at the time of this action, and were effective in restoring the aggregate lending growth in the highly concentrated Japanese banking industry.

Rosengren (2005) and Caballero, Hoshi and Kashyap (2008) that misallocation of bank credit was a persistent problem during the post bubble period. Real estate loans grew steadily until FY 1997 when “non-troubled” non-manufacturing loans continued to fall. After FY 1997, this trend appears to have been persistent.<sup>50</sup> Banks, however, must have had less incentive to assist firms with difficulties servicing their bank loans since bank capital was not seriously inadequate before and after FY 1997. Our guess is that banks kept up their real estate lending based on the ex-post false expectation that land prices would recover sooner or later. Though the abovementioned authors’ claim that the banks were practicing *evergreening* in years other than FY 1997 is probably correct, our results emphasize that understanding the motivations behind the banks’ decision making is crucial in drawing prudential policy implications.

Indeed, Peek and Rosengren (2005) presents the evidence that is more consistent with our finding. They show that, in terms of stock returns, the performances of the firms whose loans increased during the later period from FY 1995 to FY 1997 “when a larger proportion of the banks were under severe pressure to improve the quality of their loan portfolios” were worse than those of the firms whose loans increased during the earlier period from FY 1993 to FY 1994 “when banks were under relatively less pressure to evergreen loans.” Peek and Rosengren (2005) do not conduct the analogous comparisons of the earlier period and the later period in their formal probit regression exercises for the probability of increased bank loans. Our findings can be interpreted as the formal evidence of Peek and Rosengren (2005)’s simple tabulation results, though admittedly the bank data used in our analyses are rather limited compared to their bank-firm matched data. We specified that the period “when a larger proportion of the banks were under severe pressure to improve the quality of their loan portfolios” a la Peek and Rosengren was rather short. Banks were capital constrained

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<sup>50</sup> Real estate loans from 126 banks in our sample grew or shrank 1.30 percent, 2.32 percent, and 3.12 percent, -1.44 percent, -0.25 percent and -1.71 percent in FY 1995, FY 1996, FY 1997, FY 1998, FY 1999 and FY 2000, respectively. It is only in FY 1999 that real estate loans grew at a lower rate or shrank at a higher rate than “non-troubled” non-manufacturing loan regardless of its definition (including or excluding financial and insurance).

only in FY 1997.

Banks likely practiced *evergreening* before and after FY 1997 as demonstrated by the banks' tilt toward real estate lending. "*Evergreening* as a phenomenon", misallocation of credit across sectors had taken place before FY 1997 and did not end in FY 1997. The capital shortage in FY 1997, however, undoubtedly created the banks' perverse "*evergreening* incentive" and worsened misallocation of credit.

#### Did the run on banks cause a reallocation of bank portfolios?

We can think of an alternative interpretation of our results. As shown in Peek and Rosengren (2001), during November 1997, in interbank markets, borrowing rates charged to Japanese banks abruptly increased, thus the differential between the Japanese banks' average borrowing rate and the American and British banks' borrowing rate rose sharply. This differential came to be known as the "Japan premium." The presence of the "Japan premium" indicates that there was a nationwide run on the banks as part of a chain reaction following large bankruptcies and defaults.<sup>51</sup> Depositors and other creditors ran on their banks. In particular, those banks with insufficient capital suffered from severe bank runs. Therefore, in order to meet their creditors' liquidity needs, the banks aggressively collected on existing outstanding loans. When the banks demanded the collection of loans, banks were able to collect loans from healthy firms but were less successful in collecting loans from unhealthy firms that themselves were short of cash or liquid assets. Thus, in this case, poorly capitalized banks had no perverse incentive to intentionally favor borrowers with an unhealthy balance sheet.

As discussed by Peek and Rosengren (2001), banks dramatically reduced foreign loans in response, but were unlikely to respond to the "Japan premium" by demanding loan repayments to

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<sup>51</sup> Yamaichi Securities, then the third largest brokerage house in Japan, closed its business.



domestic borrowers before contractually agreed dates. The *tankan* “lending attitudes of financial institutions’ diffusion indices that are based on the views of Japanese firms regarding their creditors’ attitudes, did not fall sharply at the time of the “Japan premium.” They did fall sharply months later toward the end of FY 1997.<sup>52</sup> Large deposit outflows from the banking sector were not observed, either. The balance of deposits in Japanese banks increased two months in a row during November and December of 1997. During this two month period, deposits grew positively year on year as well.<sup>53, 54</sup> These facts suggest that the banks were not in an urgent hurry to liquidate existing loans.

#### The regulatory architecture and enforcement of accounting standards

Our findings imply that under the older regulatory framework known as Basel I, banks that fail to meet their individual capital target had a strong incentive to rebalance their lending portfolio toward unhealthy industries so that they are not forced to recognize and write off non-performing loans, which would further deteriorate their capital position. This banks’ perverse incentive arose in part because regulatory risk weights were the same across corporate loans of varying credit risk so that reducing safer corporate loans relaxed banks’ *regulatory* capital pressures equally as reducing riskier corporate loans did so that there were ample opportunities for banks to engage in a so called regulatory arbitrage.<sup>55</sup> Under the revised regulatory framework known as Basel II, which came into

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<sup>52</sup> See Watanabe (2007) for trends of *tankan* (lending attitudes of financial institutions) indices for various types of firms.

<sup>53</sup> During November and December of 1997, deposits at Japanese banks grew by 2% and by 1.5%, respectively. Year on year growth rates of deposits relative to the same months of 1996 were 0.8% and 0.9% in November and December, respectively.

<sup>54</sup> Deposits were fully insured in FY 1997 by the deposit insurance system. We do not deny though, that there may have been sufficient public incredulity in the system that it would collapse when the systemic risk materialized as an industry wide bank run.

<sup>55</sup> The regulatory arbitrage is a term to describe a bank’s practice to make its portfolio riskier without increasing its risk weighed assets.

full effect at the end of fiscal year 2006, not only do risk weights of corporate loans depend positively on their credit risk but also non-performing loans with a higher coverage of loan loss provisions are assigned lower risk weights than under the Basel I in order to encourage banks to (indirectly) write off NPLs.

Therefore, under the Basel II, banks are awarded with lower risk assets if they rebalance their loan portfolio from riskier loans to safer loans. In addition, greater loan loss provisions for recognized NPLs are compensated for by a reduction in the risk weighted assets. Thus, the negative effects of a tough regulatory stance to urge banks to conduct strict assessment of their assets on banks' regulatory capital adequacy are mitigated under the Basel II framework. Under the Basel II, risk weights are calculated based on either external or internal credit rating. We already see that, in the case of mortgage backed securities issued in the recent United States, credit rating is not flawless. Thus, under the Basel II, there is still a likelihood that banks call in highly rated loans which are viable and extend loans which are rated highly *by mistake* and are virtually defaulted.

Therefore, though the inefficiency stemming from the regulatory architecture is greatly mitigated, a bank's incentive to *evergreen* underperforming firms in response to a large capital loss will to some degree remain. What should regulators do to prevent banks from engaging in such perverse behavior? Based on our finding that an injection of public capital in FY 1998 had a favorable effect of redirecting the loan portfolio from unhealthy to healthy industries, the regulator had better offset capital losses resulting from its tougher prudential stance against banks by injecting public capital into the system. The tougher regulatory stance aimed at removing bad loans from a bank's book is desirable. However, if a loss on bank capital is left unattended, a bank could engage in inefficient lending.<sup>56</sup> In sum, a tougher policy should be accompanied by a simultaneous

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<sup>56</sup> The consolidated based risk based capital adequacy of the Long Term Credit Bank, one of two large banks that failed and was nationalized in October 1998, fell from 10.32% in FY 1997 to 0.12% in FY 1998. When it was liquidated, the LTCB was discovered to have covered up non-performing loans by *evergreening* its subsidiary real

accommodating policy that would infuse public capital into banks. If large amounts of public capital infusion and tougher assessment of bank assets had been executed simultaneously during FY 1997, banks would not have engaged in *evergreening* and non-performing loans would have been removed much earlier from banks' balance sheets.

Strong enforcement of accounting standards is also a crucial issue. If the commercial code was appropriately enforced, banks would not have been allowed to engage in *evergreening*.<sup>57</sup> In a slightly different context, we see in the modern day United States that banks' risky activities such as bank guaranteed special purpose companies (structured investment vehicles and conduits) and credit default swaps were kept off balance though they were on balance in practice, which covered up banks' losses.

### Macroeconomic implications

The banks' reorganizing of their portfolios so that they favor unhealthy industries over healthy industries was observed only in FY 1997. This does not mean that this perverse bank behavior had

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estate firms. Not only the LTCB but also most of the other banks were said to have been engaged in the so called practice of *tobashi*. A bank sold a non-performing loan to another firm (often but not always the bank's subsidiary) at a value higher than the loan's market value while the bank financed the firm's purchase of the non-performing loan with a new loan. This way, a bank was not *evergreening* its original defaulting borrower, which made the regulator to accuse the bank difficult. If *tobashi* of a non-performing loan was practiced by one firm to another firm within the same industry, which it mostly was especially in the case of the real estate industry, loans outstanding to this industry are shown as a net increase. Yanai (2007) gives a detailed account of the LTCB's *tobashi* practice.

<sup>57</sup> As far as the Japanese commercial code is concerned, *evergreening* is inappropriate behavior. If the regulator had enforced the code more rigorously, banks would have incurred more capital losses. If capital losses were immediately financed by public capital, neither a credit crunch nor *evergreening* would have happened. The current Financial Services Agency (FSA) is known as a tough regulator. It was only after the severe crisis and its economy wide negative impact (such as reduced lending to small and medium enterprises) that policymakers finally allowed the FSA to not only get even tougher with the banks than the MOF had in FY 1997 but also to inject taxpayers' money into the system to bail out banks under a legally defined plan of action. In FY 1997, the massive recapitalization of private banks with taxpayers' money would have been unacceptable to policymakers because there was the public's resentment against banks due to the widely held belief that the public already subsidized banks through extremely low deposit rates. The fact that the MOF conducted the smaller scale public recapitalization in FY 1997, (which was in no way to offset the capital crunch induced by the tougher regulatory stance) supports this view. The MOF was aware of the need for full-scale public recapitalization, but its implementation was probably politically prohibitive.

a macroeconomic impact only in that year. “Unprofitable” firms are likely to be “unproductive.” If such “unproductive” firms that should have exited the market survived by the banks’ perverse incentive, the aggregate production would have been less efficient than if they had gone out of business and more “profitable” entrants had replaced them. Caballero, Hoshi and Kashyap (2008) empirically show that such a negative effect of banks’ *evergreening* on the real sector was at work.

## 5. Conclusion

In this paper, we estimated a bank lending supply function that is consistent with the dynamic optimization behavior regulated by the Basel framework using a valid instrument constructed by Watanabe (2007). We found that a large loss of bank capital caused by the regulator’s tougher policy towards banks in FY 1997 not only induced the contraction of the bank lending supply but, more importantly, caused the banks’ reallocation of their lending supply to unhealthy industries with a higher concentration of non-performing loans (*evergreening*). Our empirical findings show that without simultaneous public capital injection into impaired banks, an *excessively* tough policy that causes a large loss of bank capital leads to inefficient financial support of unprofitable firms and is apparently very harmful to the real sector as a whole. The Japanese evidence should not be studied in isolation but in a more general global context. The international Basel regulatory framework was reformed to become the Basel II in part because regulators not only in Japan but also in other parts of the world, agreed that the Japanese banks’ perverse behavior was not an isolated event but a warning that banks could abuse deficiencies in the regulatory framework and that such a behavior could happen anywhere in the world.

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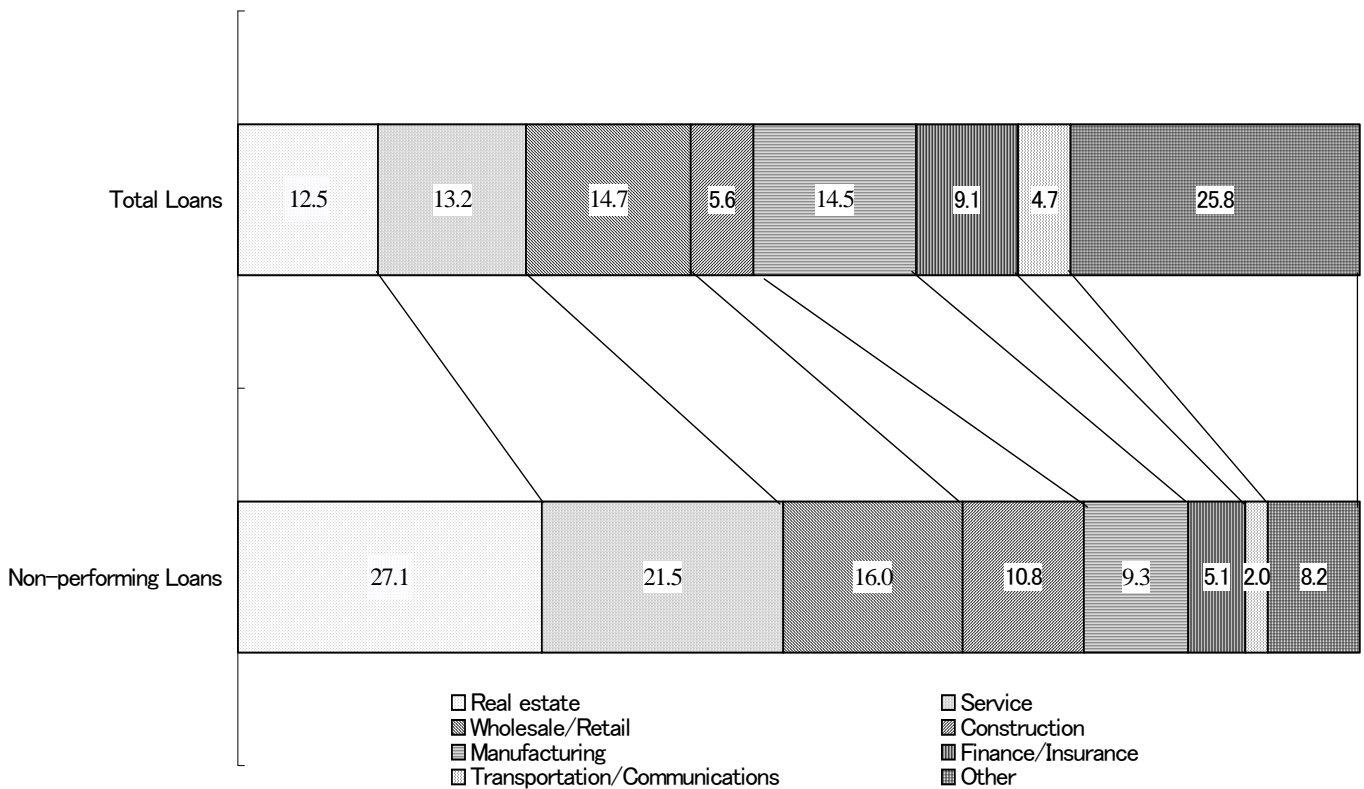
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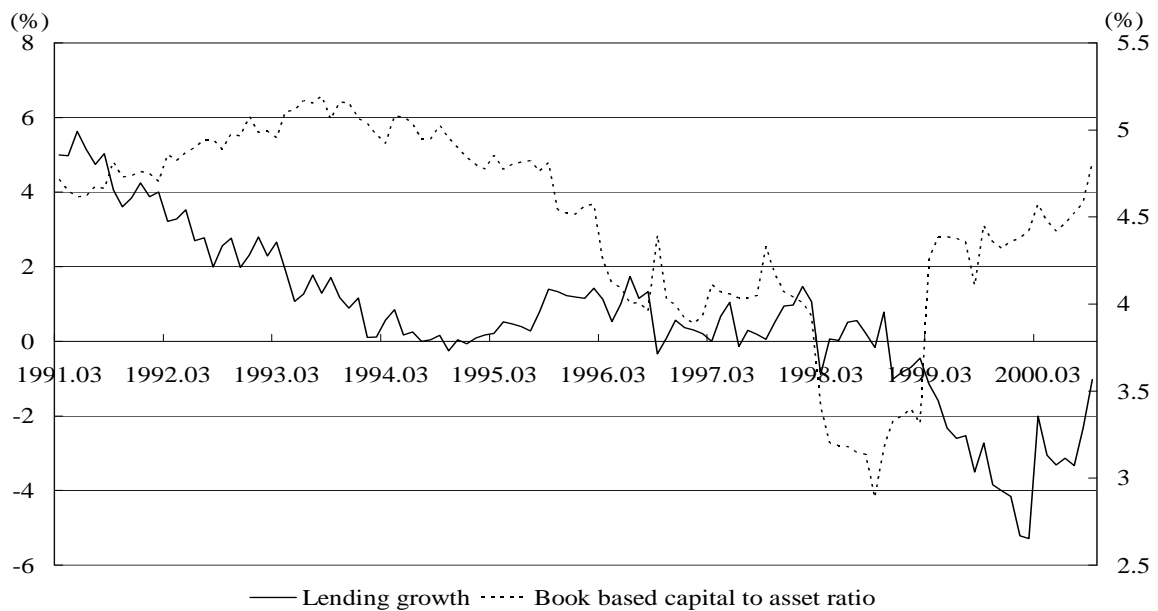
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Figure 1. Non-performing loans and total loans by industry



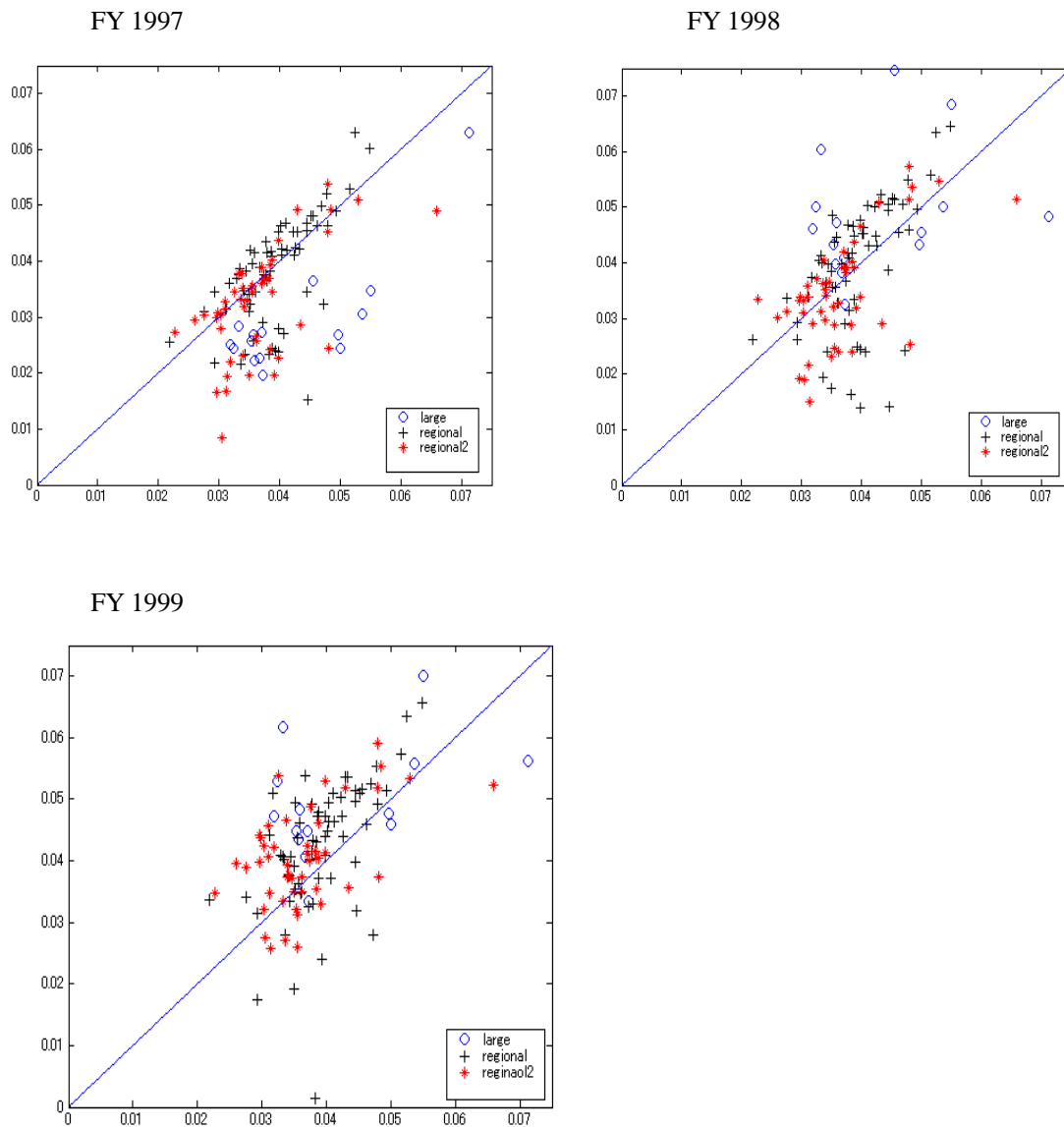
Source: Bank of Japan (2001)

Figure 2. Domestic loan growth and capital asset ratio of domestically licensed banks



Note: The left scale and the right scale measure lending growth and the book based capital to asset ratio respectively. The data frequency is monthly.

Figure 3 Target and actual capital to asset ratios



Note: The vertical axis represents the actual capital to asset ratio, and the horizontal axis represents the target ratio. Thus, banks above the 45-degree line are in shortage of actual capital relative to its target, whereas those below the 45-degree line are in surplus of actual capital relative to its target. Circles, crosses, and double crosses are large banks, regional banks, and regional 2 banks, respectively.

Table 1 Correlation coefficients of REAL89 and the capital “surplus”

	1995	1996	1997	1998	1999	2000
	-0.4607	-0.2767	-0.5345	-0.3443	-0.3214	-0.4358

Table 2 Descriptive statistics of dependent variables, independent variables and instrumental variables for equation (1).  
Continue to the next page

Variable type	Variable name	mean	median	standard deviation	min	max
Dependent variables	Growth of "troubled" lending	-0.0144	-0.0097	0.0476	-0.3250	0.1107
	Growth of "non-troubled" lending (including financial and insurance)	-0.0026	-0.0077	0.1085	-0.4967	0.7594
	Growth of "non-troubled" lending (excluding financial and insurance)	0.0042	0.0079	0.1330	-2.6527	0.4035
Independent variables	Lagged growth of "troubled" lending	-0.0074	-0.0019	0.0465	-0.3250	0.1107
	Lagged growth of "non-troubled" lending (including financial and insurance)	-0.0006	-0.0011	0.0957	-0.4132	0.4567
	Lagged growth of "non-troubled" lending (excluding financial and insurance)	0.0120	0.0137	0.0890	-0.4914	0.4035
	Capital "surplus"	0.0009	0.0012	0.0093	-0.0369	0.0382
	CITY	0.0714			0	1
	TRUST	0.0476			0	1
	REGIONAL	0.5000			0	1
REGIONAL2	0.3810			0	1	

Table 2 Descriptive statistics of dependent variables, independent variables and instrumental variables for equation (1).  
Continued from the previous page

Variable type	Variable name	mean	median	standard deviation	min	max
Instrumental variables	Twice lagged growth of "troubled" lending	0.0036	0.0060	0.0447	-0.2541	0.5337
	Twice lagged growth of "non-troubled" lending (including financial and insurance)	0.0031	0.0015	0.0874	-0.3274	0.4543
	Twice lagged growth of "non-troubled" lending (excluding financial and insurance)	0.0212	0.0229	0.0822	-0.4739	0.4035
	Twice lagged deposit growth rate	0.0127	0.0162	0.0468	-0.2915	0.4690
	Three times lagged deposit growth rate	0.0135	0.0184	0.0579	-0.3635	0.6445
	Four times lagged deposit growth rate	0.0171	0.0219	0.0608	-0.3635	0.6445
	Lagged interest rate differential	0.0246	0.0242	0.0043	0.0048	0.0405
	Twice lagged interest rate differential	0.0238	0.0236	0.0047	0.0048	0.0405
	Lagged growth of the land price of the prefecture in which the headquarters of a bank is located	-0.0163	-0.0114	0.0267	-0.1210	0.0222
	Twice lagged growth of the land price of the prefecture in which the headquarters of a bank is located	-0.0205	-0.0104	0.0427	-0.2046	0.0260
	The 10 year growth of a bank's lending share to the real estate industry from FY 1980)	0.5441	0.5410	0.3046	-0.2621	1.4925
	REAL89 (the share of real estate lending in a bank's lending portfolio in FY 1989)	0.0991	0.0863	0.0470	0.0307	0.2882

Table 3 Year by year coefficients on the capital “surplus” for loan supply to “troubled” and “non-troubled” industries, all 126 banks

Group of industries	1995	1996	1997	1998	1999	2000	Number of observations	J statistic
Troubled (1)	3.3626 (1.3375)	2.5416 (1.6331)	4.9944*** (3.0530)	2.5271* (1.8663)	1.1473 (0.6810)	1.3214 (1.3082)	756	32.0547 (0.6568)
Non- troubled (2)	3.5128 (0.4978)	-2.0894 (-0.4231)	9.1686*** (3.2830)	9.6862** (2.3555)	-2.7237 (-0.7116)	4.4350 (1.6671)	756	37.6673 (0.3928)
Non- troubled (3)	3.6581 (0.5396)	2.1016 (0.5103)	7.9786*** (3.1913)	4.0622 (0.9252)	-4.9156 (-1.4343)	0.9873 (0.6455)	756	26.0731 (0.8884)

Note: \*\*\* shows 1%, \*\*, 5%, and \*, 10%, respectively, and t statistics computed with a robust standard error are in parentheses and the number shown in parentheses below J statistics is a p-value

The financial and insurance industry is included in the “non-troubled” industries in the second row and is excluded in the third row.

Table 4 Aggregate lending growths to “troubled” and “non-troubled” industries, all 126 banks

Group of industries	1995	1996	1997	1998	1999	2000
Troubled (1)	-0.43	-1.51	-2.12	-2.61	-2.98	-2.56
Non- troubled (2)	-1.10	-4.65	-3.92	-5.41	4.08	-5.00
Non- troubled (3)	3.24	0.79	-2.56	-3.95	2.13	-3.57

Note: The financial and insurance industry is included in the “non-troubled” industries in the second row and is excluded in the third row.

Table 5 Estimated aggregate lending growths to “troubled” and “non-troubled” industries induced by the bank’s capital positions, all 126 banks

Group of industries	1995	1996	1997	1998	1999	2000
Troubled (1)	-1.61	-1.06	-4.65***	1.00*	0.78	0.68
Non- troubled (2)	-1.68	0.87	-8.54***	3.82**	-1.85	2.29
Non- troubled (3)	-1.75	-0.88	-7.43**	1.60	-3.34	0.51

Note: \*\*\* shows 1%, \*\*, 5%, and \*, 10%, respectively. The financial and insurance industry is included in the “non-troubled” industries in the second row and is excluded in the third row.

Table 6-1 Year by year coefficients on the capital “surplus” in equation (2)

“Non-troubled”	1995	1996	1997	1998	1999	2000
Includes financial and insurance	4.2215 (0.5536)	6.4602 (1.0336)	-4.3578 (-1.5255)	-7.7444* (-1.7897)	3.1321 (0.8845)	-2.1843 (-0.8180)
Excludes financial and insurance	0.6162 (0.0873)	4.1433 (1.1704)	-5.7656** (-2.1631)	-1.4617 (-0.3676)	6.9203* (1.8522)	2.5125 (1.0903)

Note: The financial and insurance industry is included in the “non-troubled” industries in the first row and is excluded in the second row.

\*\*\* shows 1%, \*\*, 5%, and \*, 10%, respectively, and t statistics computed with a robust standard error are in parentheses.

Table 6-2 Regression results of equation (2), “non-troubled” industries include the financial and insurance industry

	1995	1996	1997	1998	1999	2000
Constant	0.0027 (0.2097)	-0.0195 (-1.3691)	-0.0366 (-1.4946)	-0.0523** (-2.0529)	-0.0284 (-1.1254)	-0.0218 (-0.8123)
Lagged growth of “troubled” lending	-0.1793 (-0.6590)	0.3056 (1.0215)	-0.4372 (-1.2020)	0.2261 (0.5514)	-0.0402 (-0.1269)	-0.1179 (-0.3454)
Lagged growth of “non-troubled” lending	-0.0197 (-0.1466)	-0.2663*** (-2.1136)	-0.0791 (-0.5696)	0.1542 (0.9934)	0.1145 (0.7083)	0.1815 (1.5539)
Capital “surplus”	4.2215 (0.5536)	6.4602 (1.0336)	-4.3578 (-1.5255)	-7.7444* (-1.7897)	3.1321 (0.8845)	-2.1843 (-0.8180)
CITY	-0.0077 (-0.1484)	0.1721* (1.8732)	-0.0536 (-0.8778)	0.1603** (1.9972)	-0.0897 (-0.9925)	0.1121 (1.6738)
TRUST	0.0922 (0.6402)	0.0529 (0.5541)	-0.0226 (-0.2582)	0.0247 (0.3891)	-0.0290 (-0.3707)	-0.0562 (-1.0030)
REGIONAL	0.0094 (0.5109)	0.0307 (1.1062)	0.0171 (0.6640)	0.0687* (1.6331)	-0.0064 (-0.1968)	0.0030 (0.0810)
J statistics	48.3256 (0.2326)	Number of observations		756		

Note: \*\*\* shows 1%, \*\*, 5%, and \*, 10%, respectively, and t statistics computed with a robust standard error are in parentheses.

The number shown in parentheses below J statistics is a p-value



Table 6-3 Regression results of equation (2), “non-troubled” industries exclude the financial and insurance industry

Independent variable	1995	1996	1997	1998	1999	2000
Constant	-0.0004 (-0.0248)	-0.0043 (-0.2744)	-0.0297 (-1.4925)	-0.0295 (-1.3663)	-0.0373* (-1.6910)	-0.0370 (-1.6122)
Lagged growth of “troubled” lending	0.1982 (0.7567)	0.6163** (2.4682)	-0.0130 (-0.0488)	0.2369 (0.7412)	-0.3788 (-1.6655)	-0.7806 (-1.0565)
Lagged growth of “non-troubled” lending	-0.1152 (-0.8724)	-0.3039** (-2.5468)	0.1441 (1.4241)	0.0220 (0.1414)	0.3836*** (3.0214)	0.4366* (1.7249)
Capital “surplus”	0.6162 (0.0873)	4.1433 (1.1704)	-5.7656** (-2.1631)	-1.4617 (-0.3676)	6.9203* (1.8522)	2.5125 (1.0903)
CITY	-0.0697 (-1.2851)	0.0822 (1.1196)	-0.0246 (-0.4328)	0.0877 (1.3150)	-0.0193 (-0.2439)	0.1470** (0.5870)
TRUST	0.0534 (0.3649)	-0.0294 (-0.6540)	-0.1272* (-1.9050)	0.0084 (0.1351)	-0.0162 (-0.3040)	-0.0665 (-1.2221)
REGIONAL	-0.0416** (-1.9922)	-0.0568** (-2.6011)	-0.0325 (-1.4452)	0.0173 (0.4724)	-0.0192 (-0.6985)	-0.0191 (-0.3633)
J statistics	38.1291 (0.6416)		Number of observations	756		

Note: \*\*\* shows 1%, \*\*, 5%, and \*, 10%, respectively, and t statistics computed with a robust standard error are in parentheses.

The number shown in parentheses below J statistics is a p-value

Table 7 Regression results of equation (2) for adequately capitalized and poorly capitalized banks in FY 1997

“Non-troubled”	Includes financial and insurance		Excludes financial and insurance	
	Above the target	Below the target	Above the target	Below the target
Capital position				
Constant	-0.0085 (-0.1644)	-0.0577 (-1.0098)	0.0415 (1.0755)	-0.0825*** (-2.8399)
Lagged growth of “troubled” lending	-0.4217 (-0.7253)	-0.4358 (-1.0036)	-0.5815 (-1.5349)	0.1738 (0.4402)
Lagged growth of “non- troubled” lending	0.0941 (0.4484)	0.2389 (1.1853)	0.6044*** (4.0666)	0.1706* (1.8227)
Capital “surplus”	-9.8230 (-0.5738)	-3.9658 (-0.6886)	-12.3342 (-0.8836)	-9.3051** (-2.4681)
CITY		0.0378 (-0.5613)		0.0149 (0.3229)
TRUST		0.0804 (0.8760)		-0.1021* (-1.8084)
REGIONAL	0.0017 (0.0420)	0.0505* (1.7423)	-0.0986*** (-2.8237)	-0.0421* (-1.7593)
J statistics	5.8910 (0.7508)	5.6419 (0.5821)	9.6132 (0.3827)	4.1440 (0.7631)
Number of observations		57	69	57

Note: \*\*\* shows 1%, \*\*, 5%, and \*, 10%, respectively, and t statistics computed with a robust standard error are in parentheses.

The number shown in parentheses below J statistics is a p-value

CITY and TRUST are dropped for banks whose capital to asset ratio is above their target since all such adequately capitalized banks are regional banks or regional 2 banks.

Table 8. Year by year OLS and 2SLS coefficients on the capital “surplus” in equation (2)

“Non-troubled”	1995	1996	1997	1998	1999	2000
OLS estimates	-1.8164 (-0.4872)	-0.0077 (-0.0036)	-2.7123* (-1.7227)	-1.0599 (-0.8430)	1.3274 (1.0525)	3.5102*** (3.1806)
2SLS estimates (from Table 5-1)	0.6162 (0.0873)	4.1433 (1.1704)	-5.7656** (-2.1631)	-1.4617 (-0.3676)	6.9203* (1.8522)	2.5125 (1.0903)

Note: The financial and insurance industry is excluded from the “non-troubled” industries.

\*\*\* shows 1%, \*\*, 5%, and \*, 10%, respectively, and t statistics computed with a robust standard error are in parentheses.

Table 9 Regression results of equation (2) for all banks, adequately capitalized banks and poorly capitalized banks in FY 1997

	All banks	Above the target	Below the target
Constant	-0.0452** (-1.9979)	0.0064 (0.1437)	-0.0619** (-2.3337)
Lagged growth of “troubled” lending	0.1281 (-0.4651)	-0.6467* (-1.8359)	0.2199 (0.5825)
Lagged growth of “non-troubled” lending	0.3759*** (3.2281)	0.5838*** (3.7656)	0.1069 (1.2322)
Capital “surplus”	-4.4415* (-1.7900)	-20.7810 (-1.6249)	-7.9188*** (-3.0193)
CITY	0.0354 (0.7641)		0.0020 (0.0549)
TRUST	-0.1221** (-2.4678)		-0.0999** (-2.1810)
REGIONAL	-0.0591*** (-3.1113)	-0.0666** (-2.4085)	-0.0319 (-1.2583)
Hokkaido and Tohoku	-0.0182 (-0.6794)	0.0092 (0.1799)	-0.0455 (-1.4600)
Kanto	0.0329 (1.3104)	0.1205*** (3.0396)	0.0108 (0.5052)
Koshinetsu	0.0524* (1.9135)	0.0794* (1.7875)	0.0258 (0.4669)
Tokai	0.0209 (0.7767)	0.0437 (1.1387)	-0.0313 (-1.0591)
Kansai	0.0090 (0.3310)	0.0390 (0.7067)	-0.0292 (-0.9511)
Chugoku	0.0661** (2.3691)	0.0426 (1.0330)	0.0147 (0.4158)
Shikoku	0.0703** (2.4812)	0.0786* (1.8634)	
Number of observations	126	57	69
J statistics	8.4182 (0.2972)	8.6858 (0.4668)	7.5719 (0.3719)

Note: The financial and insurance industry is excluded from the “non-troubled” industries.

\*\*\* shows 1%, \*\*, 5%, and \*, 10%, respectively, and t statistics computed with a robust standard error are in parentheses.

CITY and TRUST are dropped for banks whose capital to asset ratio is above their target since all such adequately capitalized banks are regional banks or regional 2 banks

Shikoku is dropped for banks whose capital to asset ratio is below their target since none of banks headquartered in Shikoku is below their target.