Do Negative Shocks to Bank Capital Cause *Flight to Quality*?: Evidence from the Japanese Financial Crisis

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Abstract

Constructing a strong instrument for bank capital from the empirical observation of Japanese banks' past behavioral changes, we identify the impact of capital adequacy on the allocation of bank lending supply across groups of industries. We find that, in FY 1997, contrary to the *flight to quality* hypothesis, the large negative shock resulted from the financial crisis and the regulator's response induced banks to rebalance their lending portfolio toward *lower quality*. Our findings also suggest that the recapitalization of large banks helped banks restructure their portfolio toward *high quality* industries in FY 1998.

Keywords: flight to quality, ever-greening, financial crisis, instrumental variable
JEL classification: C21, G21

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1. Introduction

The fiscal year 1997 marks the culmination of financial crisis in Japan. Indeed, the weaknesses of the Japanese financial sector had started in FY 1995.[1] Hoshi and Kashyap (2001) explain several undesirable events that had occurred in the financial sector in FY 1996. Japanese banks had been charged higher borrowing rates than other international banks in Eurodollar and Euroyen markets since the summer of 1995 until the end of the calendar year. The liquidation of *jusen* companies, banks' subsidiary housing loan companies, required large financial contributions by banks. Hanwa Bank, one of the relatively small regional 2 banks operating in the Kansai area was forced to liquidate by the order of the Ministry of Finance (MOF), which marked the first exercise of regulatory power to force a bank out of the market in the post-war period. These events were recognized as direct and indirect negative capital shocks by banks.

It is interesting to ask how banks react to a large negative capital shock. Effectiveness of such policy measures as easing monetary policy and recapitalization of banks by public funds in the wake of a stagnant economy hinges on it. If banks follow profit maximization and efficient investment by reorganizing lending portfolios toward quality borrowers, the bank lending channel of monetary policy still plays an important role propagating the easing effects into productive industries and firms, and recapitalization of banks prevent them from reducing credit supply to quality borrowers in case they are capital constrained. Such banking behavior is popularly described as *flight to quality*. On the other hand, if banks react unoptimally and make inefficient allocation of loanable funds toward unproductive borrowers, the policy mix of easing monetary policy and recapitalization leads to the inefficient financial support of unproductive industries and firms. If this is the case, the policymakers should instead consider direct stimulation of lending demand of productive borrower firms. Borrowers, not banks, are the source of problems.

In this paper, we attempt to measure the Japanese banks' reactions in their lending supply behavior to negative capital shocks in the period of financial crisis using the unique identification strategy that exploits the banks' structural behavioral changes in the 1980s under financial liberalization. Banks shifted their lending portfolio toward real estate lending under the bullish expectations on land prices. The land price bubble was burst and large portion of real estate lending became non-performing. Thus the higher real estate lending share in the late 1980s explains the higher non performing loans (NPLs) in the late 1990s. In practice, we use the real estate lending share of each individual bank in the end of 1980s as an instrument for bank capital. The basic empirical strategy is to examine banks' lending supply to certain types of borrowers in response to the negative capital shocks. If banks are found to cut back on lending supply to financially weaker industries and firms more than lending supply to financially stronger ones in response to negative capital shocks, it is likely that *flight to quality* is occurring. The paper is organized as following. In section 2, *flight to quality* in the context of the Japanese banking crisis

[1] The Japanese fiscal year starts on April 1st and ends on March 31st.

is defined, and the distinction of *credit crunch* and *flight to quality* is discussed. In section 3, data and econometric issues are examined. In section 4, empirical results are reported and policy implications are drawn based on empirical findings. Section 5 concludes.

2. Financial crisis and *flight to quality*

Financial crisis in Japan

The Japanese financial crisis in the mid 1990s has compound origins. A series of various adverse events had coincided. When one refers to the Japanese financial crisis, one simply summarizes such a set of negative events into the vaguely defined crisis. However, these multilayered distinct events resulted in a single negative shock to banks, a negative capital shock. Such negative events channel into reduction in bank capital through accumulation of NPLs, declining bank profits, fall in market value of banks' equity, among others. Among all, the most important negative event is, however, a regulator's change in its stance toward a tougher regime in the context of the heavily regulated Japanese banking industry. Chronologically, the fiscal year for 1997 marks the year of culminated financial crisis in Japan.[2] In this subsection, we will attempt to synthesize and interpret events as they are related to bank capital.

A signal of the financial crisis was observed when the so-called *Japan premium* emerged in August 1995. In the Eurodollar and Euroyen inter-bank markets, lenders had begun to charge Japanese banks higher rates than other international banks. Borrowers perceived higher default risks embedded in Japanese banks that had been rumored to have accumulated huge NPLs unrecognized.[3] According to Peek and Rosengren (2001), the premium reached as high as 80 basis points in fall 1997. The *Japan premium* of this magnitude must have hampered Japanese banks' profitability greatly under the low interest rate environment that shrank the borrowing rates - lending rates margin for banks and hence impacted negatively on bank capital.

It was in early 1996 that the government decided to liquidate *jusen* companies, which are the housing loan companies founded by mainly large banks and financed by banks and other lending institutions[4]. They were forced out of the consumer housing loan markets toward real estate lending in the 1980s. After the bubble burst, most of their loans were deemed non-performing. Toward the end of fiscal year 1995, early 1996, the government liquidation plan was implemented, which was unfavorable to banks that were forced to contribute 3.5 trillion yen total 6.41 trillion yen of unrecoverable assets written off. Banks appropriated large accounting losses, which hurt banks' equity capital greatly.

Onset of bank failures had started with the liquidation of a small regional 2 bank, Hanwa Bank.

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[2] Hoshi and Kashyap (2001) provide the best summary source of chronology of the Japanese financial crisis.

[3] Peek and Rosengren (2001) defines the Japan premium to be how the borrowing rate charged to the Bank of Tokyo-Mitsubishi, the most internationally credible Japanese bank of that time, less the rate charged to average US-UK banks.

[4] The size of lending to *jusens* by agricultural cooperatives is almost as large as that of bank lending.

The resolution of Hanwa Bank marked the first liquidation forced by the regulator in the post-war period.[5] Departure from implicit government guarantee granted to banks, which may be desirable from the efficiency point of view in the industry, generated the expectations among the public that the regulator would not protect troubled banks. Such changes in expectations should have lead to a fall in bank stocks, for instance. What appears to be important is not the observation that a growing number of banks had experienced financial difficulties and insolvency, but rather that such a regulatory regime change induced realizations of troubles in banks and caused their financial difficulties. The failure of Hokkaido Takushoku Bank in November of 1997, which marked the first failure of a large bank, accompanied by bankruptcies of two securities companies, spawned the financial crisis. The rumors about deep troubles of two major banks, Long-Term Credit Bank (LTCB) and Nippon Credit Bank (NCB), gave an impetus to the general perception of the approaching financial crisis.[6] Toward the end of FY 1997, the MOF required banks to carry out the more rigorous self-assessment of their assets and the adequate loan loss write offs and provisions based on them. Loan loss write offs and provisions amounted to 13.3 trillion yen in FY 1997.[7]

Flight to quality

It is said that during economic downturns, lenders choose to lend more to informationally transparent firms or firms with stronger balance sheets, and that financially more fragile or informationally opaque firms have a harder time keeping access to credit markets. Lenders reallocate loans in response to a negative shock to themselves. The literature's focus has been on an empirical examination of a lender's portfolio (re)allocation in response to tightening monetary policy. Bernanke, Gertler, and Gilchrist (1996) compare the growth rates of short term debts between bank dependent borrowers that do not issue commercial papers and the rest, as well as those between larger and smaller firms and find that short term credit to informationally opaque firms, bank dependent and small firms, declines faster than that to others in response to tightening monetary policy. [8]

Though, as Diamond and Rajan (2000) discuss, a bank as a relationship lender takes informational advantage regarding their borrower firms, and can insulate informationally opaque firms from credit supply shocks relative to other lenders, empirical works supporting banks' *flight to quality* do exist.[9] Gertler and Gilchrist (1994) and Oliner and Ridebisch (1995, 1996) find that

[5] Until then, banks faced with management crisis had been mediated by the MOF to be acquired by larger and healthier banks.
[6] LTCB and NCB were nationalized in fall 1998.
[7] These are the aggregate figures reported by the BOJ and include figures in trust accounts.
[8] For an extensive survey of the empirical literature on flight to quality, see Bernanke, Gertler, and Gilchrist (1996).
[9] *Flight to quality* is not a unique phenomenon to banks. More recently Bond (2003) shows that a bank as a special financial intermediary that does not engage in production itself emerges endogeneously only when it is substantially more efficient in transmitting information from borrower firms to depositors than non-financial firms.

bank lending to smaller firms declines more than lending to larger firms in response to a tightening policy. Lang and Nakamura (1995) find that the aggregate ratio of safe lending defined by loans with lower interest rates increases after a tightening policy. However regarding their reaction to their own financial difficulties, which happens to be a subject of our study, findings by Berger, Klapper, and Udell (2001) with Argentinean matched micro data on borrowers and banks find that banks in financial distress do not reduce lending to opaque small businesses and strongly oppose the *flight to quality* hypothesis.

RBC regulatory framework, *credit crunch*, and *flight to quality*

The RBC regulatory framework requires internationally operating banks to satisfy the minimum standard for the risk adjusted (based) capital asset ratio.[10] The principle of the regulation is that banks exposed to higher risks should hold more equity capital as a buffer.[11] In practice it requires that the ratio of capital to risk weighted assets (riskier assets are assigned to higher weight and vice versa) not be below the specified minimum threshold. Lending has been assigned to 100% irrespective of credit risks of each contract (credit worthiness of each borrower). The minimum standard for banks registered as "international" banks has been 8 percent, whereas that for banks registered as "domestic" has been 4 percent.[12]

The MOF formalized the regulatory intervention for troubled banks by switching its arbitrary regulatory regime to the rule based prompt corrective action framework (PCA). The PCA allows the regulator (then MOF, currently the FSA) to intervene into banks with a Basel RBC capital asset ratio below the regulatory threshold.[13] Philosophically, the PCA was institutionalized to serve for early detection of a troubled bank, and the resulting earlier execution of correction measures, while avoiding the costly bank failure that would trigger an industry-wide crisis. In reality, the PCA may have made banks capital constrained.

Theoretical works have shown that asymmetric information -- involving investors, a bank, and borrowers -- makes issuing the new equity costly.[14] The economically optimal way for profit

[10] The franework was agreed in the Basel Accord and took full effect for fiscal year for 1993 in Japan. All banks publicly reported ratios under the Japanese Bankers Association (*zenginkyo*) criteria

[11] A few works have theoretically justified the banks' capital constraint from the viewpoint of the informational friction between banks and borrower firms rather than assuming the regulation. Holmstrom and Tirole (1997) discuss how bank capital is used for monitoring of borrower firms. Bond (2003) shows that the joint liability arrangement among borrowers that reduces the expected costs of information disclosure of a bank leads to a capital crunch in that a failure of some of borrower firms to reduce bank capital and subsequently bank lending supply to viable borrowers.

[12] Only large banks were subject to the PCA immediately from the beginning of FY 1998. It expanded to subject all other banks one year later.

[13] 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. Several intermediate action thresholds were set up. As a bank enters the lower interval crossing a threshold, the government intervention enters the more rigorous action stage.

[14] Stein (1998) states that the informational asymmetry between investors and a bank leads to the adverse selection problems in that the equity issuing banks are considered to be under-performing. Diamond and Rajan (2000)

maximizing banking firms to recover the minimum standard along this line is to examine lending contracts individually (or at least individual borrowers), to reduce riskier lending with high default probability, and to hold healthier lending constant, if associated costs are negligible. This is banks' *flight to quality* in response to a negative capital shock. But in contrast if costs are prohibitively high, banks will cut all kinds of lending irrespective of borrowers' credit worthiness. This is *credit crunch*, or *capital crunch*. The generally associated costs that we can think of are the observable operational and system cost of rating of individual contracts and borrowers. There could be unseen informational cost as well. Suppose banks have stored publicly unavailable information through the long-term relationship with the currently financially weaker borrowers. Furthermore, if they have stronger relationships with some borrowers than others, the cost of dissolution of the relationship may result in informational disadvantage to banks in the future. In sum, banks' undesirable behavioral responses, if ever they occur, results from the nature of the RBC regulatory framework that does not take into account of the variation of credit risks within lending. Otherwise, banks would have incentive to behave more efficiently.[15]

Several works have either directly or indirectly examined the *flight to quality* hypothesis in the context of banks' responses to losses on their own capital. Bernanke and Lown (1991) with the micro bank data in New Jersey and Peek and Rosengren (1995) with the similar data in New England test the hypothesis in the US *credit crunch* period of the early 1990s. Based on the empirical tendency that smaller borrower firms depend financing almost solely on local small banks, they compare a larger banks' behavioral response to capital loss with a smaller banks' response. The former finds larger capital impact on lending by smaller banks whereas the latter does not find the significant behavioral differences in bank size. With the state level data constructed from the micro bank level data, Hancock and Wilcox (1998) directly test the effect of bank capital on lending supply to small firms, and find the positive effect. Hancock and Wilcox's direct testing method, however, has a drawback. They only find that lending to smaller firms respond to capital. What is important is the comparison of the magnitude of response of lending to smaller firms with that to larger firms. Nonetheless, the finding of the magnitude of impact of capital loss on the small borrower lending being not larger than the large borrower lending does not necessarily undermine the *flight to quality* hypothesis. Smaller borrowers have trouble finding alternative credits to bank borrowing than larger borrowers. Therefore, even if banks' lending supply cut to them in response

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argue that equity finance generates inefficient rent when a bank is a relationship lender. Van den Heuvel (2002) incorporates the adverse selection problem in issuing equity into the model of the bank's dynamic optimization behavio.

[15] Basel Committee on Banking Supervision that coordinates the international agreement on the RBC regulatory framework has proposed the amendment to the original version. The main reform is to take into account credit risks within bank lending in computing the risk-weighted asset of an individual bank. Their working paper surveys the empirical literature on the impact of the RBC framework including the capital crunch. (Furfine et al (1999)) The recognition that the old design of the regulatory framework may have resulted in the capital crunch motivated the proposed amendment.

to bank capital occurs to the same degree as banks' lending supply cut to larger borrowers, it is more damaging to smaller borrowers.

Flight to higher net worth and flight to greater transparency

Smaller firms' management and accounting are not publicly available, and non-bank creditors face greater difficulties in assessing their credit worthiness. Unlike non-bank creditors banks as relationship lenders establish their long-term relationship with borrower firms including small ones through their lending contracts.[16] Thus, small firms are not necessarily less obscure to banks than large firms.

Nonetheless, the informational asymmetries between banks and borrower firms do remain as long as they are separate entities. Therefore, as Bernanke and Gertler (1995) and Bernanke, Gertler, and Gilchrist (1998) argue, banks are more likely to charge borrower firms with less net worth a higher interest rate premium (external finance premium) than those with a higher net worth.[17] This theoretical prediction justifies our focus on varied lending pattern across varied qualities of balance sheets of borrowers than across varied sizes. Responding to the deterioration of their own balance sheet, banks may either make a price adjustment by differentiating their lending rates depending on a borrower's credit worthiness or make a quantity adjustment by changing their lending portfolio from financially weaker borrowers to financially stronger borrowers. It is only very recently that Japanese banks have started computing lending rates with models incorporating borrowers' default risks contract-by-contract. Hence we plan to test the *flight to higher net worth* hypothesis in the context of the banks' behavioral reactions to a negative capital shock.

3. Empirical methodology

Empirical model

Consider the following equation.

$$\Delta \ln L_{it}^{j} = \alpha_{0}^{j} + \alpha_{1}^{j} \Delta \ln L_{it-1}^{j} + \beta^{j} \left[\frac{K_{it}}{A_{it}} - \left(\frac{K_{i}}{A_{i}} \right)^{target} \right] + \gamma^{j} X_{it} + \varepsilon_{it}^{j} \qquad (1)$$

The dependent variable is the lending growth of an individual bank at date *t*. Explanatory variables are the lagged dependent variable and the difference between actual and desired levels of the ratio, $K/A-(K/A)^{target}$, which we call capital "surplus".[18] X is a set of control variables specific for an

[16] For the empirical evidence of banks as relationship lenders, see Berger and Udell (1995), Petersen and Rajan (1994, 2002), and Cole (1998), Degryse and Cayseele (2000) and Berger, Klapper, and Udell (2001). In their theoretical paper, Dell'Ariccia and Marquez (2001) show bank's short-term gains from higher rents by relative reorganization of their lending portfolio toward opaque borrowers in curtailed lending and refer to such a banking behavior as *flight to captivity*.

[17] Bernanke, Gertler, and Gilchrist (1998) show that the equilibrium external premium is inversely related to a borrower's net worth in a certain contract setting.

[18] In fact we subtract the regulatory minimum from the RBC ratio in the level specification until FY 1996, since

individual bank. ε_{it} is the error term. Subscripts i and j represent an individual bank and a certain group of industries (firms), respectively so that L_{it}^{j} for instance means the lending supply by a bank i to the jth group of industries at date t. β^{j}, then, can be interpreted as a reaction parameter that measures how much adjustment a bank makes in response to a surplus or a shortage of its own capital. The specification assumes that each bank has its own target for the capital asset ratio. As Hancock and Wilcox (1994) discuss, the target may vary depending on a bank's characteristics such as risk averseness, size and institutional and legal status.[19] It cuts back on its lending only when the actual capital asset ratio falls below the target ratio. The specification, unlike the standard one with the actual level of capital asset ratio, allows us to compute the portion of (negative) aggregate lending growth due to the capital constraint. More precisely, one is able to compute the average of a product of a point estimate of β and capital "surplus" (one could call it capital "shortage" if negative) measured by each bank's $K/A-(K/A)^{target}$ weighted by asset A. By doing so one can extract the component of the aggregate lending growth accounted for by capital constraint.

Nonlinearity in banks' adjustments and cross section regressions

We do not assume that banks are always capital constrained in making decisions on supplying loans. When a bank is adequately capitalized, and its management thinks that the capital position is far from the position that incurs the regulatory intervention or any other adverse effects on the management decisions, their decision is free from the constraint. A bank chooses the optimal size (growth rate) of lending supply derived from its profit maximization criteria. Its lending supply decisions are constrained only when the actual capital asset ratio is approaching the target ratio. This assumption implies that banks adjust lending supply either upwardly or downwardly in response to changes in capital only when the absolute level of capital is sufficiently low.

Such a behavioral non-linearity of banks' lending supply advocates use of econometric techniques that allow for the time variation in the coefficient on the capital asset ratio, in particular, use of year-by-year cross section regressions. It also allows us to keep the bank specific target unwashed unlike standard fixed effect estimation techniques. If a negative capital shock is aggregate, all banks move in and out of the constraint region year by year simultaneously.[20] We have seen that a series of events including the regulatory regime switches are more likely to have caused industry wide negative capital shocks rather than idiosyncratic ones.[21] The reaction

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most "international" banks stay above the 8 percent regulatory minimum whereas "domestic" banks stay around their 4 percent regulatory minimum. The distinction between both regulatory types became less obvious after many "international" banks switched their regulatory status to "domestic."

[19] In order to obtain the optimal target, one can solve, for instance, a bank's profit maximization problem when its cost function is decreasing in the capital asset ratio. Justification of such a cost structure is that the regulator not only takes an action against a bank which fails the regulatory minimum but also pressures a bank informally as well as conducts a special inspection as its capital asset ratio nears the minimum.

[20] If the shock were idiosyncratic, the non-linear specification could be used.

[21] The regulatory regime switches, such as the introduction of Prompt Corrective Action (PCA) and urging more

coefficient, β, should vary across years. More importantly, in years when banks are making a capital free optimization, the estimate of β should not be statistically significant.

Data

The main data source of bank level data is the Nikkei NEEDS bank financials data bank. It is the standard data source for any research on Japanese banks. The data represents a 27 year-long period from FY 1974 to FY 2000. It contains not only balance sheets and income statements of all domestically licensed banks, but also details of lending classified by industry, by types of collateral, by use (equipment funds/working capital), as well as the amount of lending to small and medium sized firms. The Nikkei data has become fairly standard for the analysis of Japanese banks recently.[22,23]

Sample selection

We are searching for responses to the financial crises by viable banks. Lending supply cut by non-viable banks is mostly either a process of closure, or clean up of NPLs in preparation for handover to a new management. To this end, banks affected by bank failures, failed (liquidated or nationalized) banks, as well as banks having experienced rescue mergers or acquisitions, are dropped.[24] A total of 126 banks remain in the sample.

Disaggregating lending data into healthy and troubled industries

In order to test the *flight to higher net worth* hypothesis, we must compare the banks' lending supply behavior to borrower firms with higher net worth to that to firms with lower net worth. To this end the contract-by-contract data between lending banks and borrowing firms are desirable. Matching loan data with a borrowing firm's balance sheet, we can distinguish high net worth borrowers from low net worth borrowers according to their capital asset ratios. Unfortunately no contract-based data is publicly available in Japan.[25]

Use of bank balance sheet data alone does not allow us to classify lending supply into the lending supply of varied balance sheet strengths. We need the individual level micro bank data that disaggregate lending data according to the proxy of net worth across firms. One possibility is the use of lending data disaggregated by industry. If the distribution of net worth of firms is not uniform across different industries, the net worth of one industry is significantly lower than that of

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stringent assessment of assets are aimed at the entire banking industry rather than particular individual banks.

[22] Ogawa and Kitasaka (2000), Hoshi and Kashyap (2000), Ueda (2000), and Hoshi (2001)

[23] Missing items on recent balance sheets of a few banks are supplemented by their annual reports.

[24] Banks having experienced non-rescue mergers are treated as single banks in pre-merger dates by adding values of variables for banks involved in the deals. One long-term credit bank was dropped since detailed lending data for the 1980s are missing. One regional 2 bank founded in the 1990s is also dropped.

[25] Several kinds of micro borrower balance sheet data are available, but they only identify their larger lenders.

the other, and vice versa. The book value of equity of the balance sheet does not necessarily reflect the net worth of a firm. The net worth is the present value of a firm's future profit flows. The alternative to the book value is the market value of equity capital of a firm, its stock value. However, the stock value is for instance swung by irrational expectations of investors, and it may not be the best proxy for the fundamental value of the firm's net worth. The ordering of industries varies greatly year-by-year. The relative stock value of an industry is not robust against the timing of measurement.

Larger non-performing loans to a certain firm imply that the priority of the allocation of a firm's liquidity is assigned to debt services and that the firm is prevented from sizable investment. They also signal a firm's poor ability regarding investment decisions that is a stationary characteristic persistent to a firm. In either justification, a firm with larger non-performing loans is less profitable and consequently must have lower net worth than a firm with smaller non-performing loans. Figure 1 shows the distribution of NPLs and loans across industries[26]. We designate an industry whose share of NPLs to the industry exceeds the share of total lending to a "troubled" industry. Such industries include real estate, construction, wholesale and retail, and service. The share of NPLs to "troubled" industries accounts for three-fourths of total NPLs whereas the share of entire loans is just 46 percent. "Troubled" industries keep a significantly higher ratio of NPLs to total loans than the rest. Further decomposition uncovers that the amount of NPLs to "troubled" industries is split almost evenly between real estate related lending (real estate and construction) and others. The fact that a significantly larger portion of NPLs, is not directly related to the real estate industry is the essence of identification strategy. [27]

Insert Figure 1 here.

Capital measures

Three different measures of capital asset ratio, the ratio of book capital to total asset, the BIS risk based capital asset ratio, and the market based capital asset ratio that includes unrealized gains (or losses) on holding assets as capital, are examined as *K/A*, in equation (1).[28] Book capital roughly corresponds to the core capital in the BIS regulatory framework. Accounting losses and profits are most clearly reflected in this measure. The BIS capital includes not only core capital elements but also supplemental instruments such as subordinate debts that are debts rather than

[26] The data are taken from BOJ (2001)

[27] The distribution of NPLs across industries remains qualitatively unchanged over time. The distribution of net worth across firms in the same industry is not necessarily uniform. A financially stronger firm in the "troubled" industry may have a higher net worth than a financially weaker firm in the "healthy" industry. Disaggregation by industry is the best way possible with the available data.

[28] The Basel RBC ratios and unrealized gains on assets are taken from the Japanese Bankers Association's Analysis of Financial Statements of All Banks.

capital in nature.[29] Such characteristics of BIS capital may have resulted in a banks' accounting manipulation, which may cause covering up *true* capital shocks.[30] The market based ratio is examined from the view that the regulator may have become more market oriented after the establishment of the FSA as a new bank oversight regulatory body.

Control of institutional characteristics

Dummy variables indicating banks' institutional characteristics are included as a set of control variables *X*. Japanese banks have been traditionally classified into city banks, trust banks, long-term credit banks, regional banks, and regional 2 banks. The first three are nationally operating large banks. Trust banks are allowed to conduct in trust business in addition to the standard banking business. Long-term credit banks have been specializing on the longer term lending. Regional banks are medium-sized local banks operating prefecture wide. Regional 2 banks are small banks operating in a region smaller than a prefecture. Such dummy variables included are CITY, TRUST, and REGIONAL, which represent city banks, trust banks, and regional banks respectively.[31] They control for the structural behavioral characteristics of banks' lending practice. Since each class of banks has had the fairly distinct customer base, it also controls the lending demand.

Estimating target

One needs to estimate the target capital asset ratio, K/A^{target}. As we see in Figure 2, the aggregate capital asset ratio of domestically licensed banks steadily soars at the beginning of the 1990s up until around the end of FY 1992, then, stays at a high plateau of around 5 percent until FY 1994. Our interpretation that banks set their capital target to move toward the full implementation of the BIS risk based capital regulation framework, leads to the idea of estimating the target from this early period rather than estimating it from the entire sample period. We estimate the target by the data from FY 1992 through FY 1994. This is not only the period when the capital asset ratio is stably high but also the post Basel pre- "credit crunch" period. We should not include the "credit crunch" period because it is quite likely that banks were running shy of the target at that time. We should not include the pre- Basel period because banks may have been short of capital and in the process of achieving their goals as the end of the fiscal year for 1992 approached. Of course, we should not include the data before FY 1988 when the Basel capital regulatory framework had not manifested itself and capital ratios to banks were insignificant.

[29] Banks must satisfy both the core book capital requirement and the RBC requirement. The Basel Accord requires that 50 percent of capital included in the calculation of the RBC ratio be core capital elements.
[30] Ito and Sasaki (1998) find that Japanese banks increased subordinate debts in response to their losses on core capital in the early 1990s.
[31] No long-term bank remains in the sample.

Insert Figure 2 here.

In estimating, we apply a relatively simple method: we compute the time-series average of each capital asset ratio measure for each bank over the fiscal years of 1992-1994 and use it as a target. Thus the target variable constructed this way varies across banks but is time invariant. A bank's target should be bank specific. It may vary depending on a bank's characteristics such as risk averseness, size and institutional and legal status. The actual internal capital target may vary across fiscal years. For example, banks facing the tougher regulator in certain fiscal years may harden their targets as Hancock and Wilcox (1994) discuss. The FSA/MOF does not explicitly change actual regulatory minimum requirements over time, although it began to base its formal regulatory actions on the BIS capital ratio as the intervention criteria in FY 1997, and we can say that the regulator got tougher that year. Unfortunately it is impossible to measure to what extent banks responded to the regulatory action of raising their capital targets, since it is solely an internal response and is not reported anywhere. Furthermore, such changes in regulatory toughness are likely to accompany changes in the banks' balance sheets reflecting increases or decreases in NPLs, and therefore should be treated as secular changes of the banks' capital positions rather than changes in targets. On the other hand, in an economic downturn when it is harder to reach the initial capital targets, banks may lower their targets. Under such a circumstance, at the micro level, each bank may reach its internal goal, but from the macroeconomic point of view, we should assume that negative aggregate shocks lowered their capital rather than that the banks lowered their targets in response to negative shocks. In other words, the relative capital position of an individual bank among other banks may not change, but its absolute capital position does.

As a conclusion, it is safer to extract the information regarding the banks' capital targets from publicly observed data in the pre- "credit crunch" years than to make targets vary across time using both past and contemporaneous data.[32] Such a way of constructing the target implicitly assumes the backward looking behavior of banks. This is more appropriate since the banks' constrained behavior has resulted from the legacy of the past and the banks' relatively short-term objective itself is to overcome this legacy, which is regressed by nature. In order to construct the target capital asset ratios of individual banks, we need to make an assumption about the Japanese banks' behavior regarding their own capital positions. As we saw in Figure 2, the aggregate capital asset ratio of

[32] Alternatively one may estimate the relationship between the banks' capital ratio and their characteristics (size, regulatory and institutional dummy variables from pre- crisis and post Basel years (1992-1994) and then compute fitted values for out of sample crisis years (1995-2000). This would accommodate the banks' switch in regulatory status from higher to lower minimum capital requirement if they actually do so over FY 1995- FY 2000. In principle, the target would not vary much over the time horizon unless their size or regulatory status changes dramatically. Yet, each individual bank has its own target each year according to its size and institutional characteristics. I estimated the target this way as an experiment. The relationship over 1992-1994 is very inaccurately estimated, and quite a number of banks have negative values for their targets during FY 1997- FY 1999.

domestically licensed banks steadily soars at the beginning of the 1990s up until around the end of FY 1992, then, stays at a high plateau of around 5 percent until FY 1994. Our interpretation that banks set their capital target to move toward the full implementation of the BIS risk based capital regulation framework leads to the idea of estimating the target from this early period rather than estimating it from the entire sample period. More specifically, we estimate the target by the data from FY 1992 through FY 1994. This is not only the period when the capital asset ratio is stably high but also the post Basel pre- "credit crunch" period. We should not include the "credit crunch" period because it is quite likely that banks were running shy of the target at that time. We should not include the pre- Basel period because banks may have been short of capital and in the process of achieving their goals as the end of the fiscal year for 1992 approached. Of course, we should not include the data before FY 1988 when the Basel capital regulatory framework had not manifested itself and capital ratios to banks were insignificant.

Simultaneity and identification

Estimation of equation (1) requires caution. Our objective is to find banks' behavioral reactions to changes in their own bank capital. However, the OLS estimator of the coefficient on the distance between target and actual capital asset ratios, β, may not reflect solely banks' behavioral responses. One may observe the positive correlation between two variables through the borrowers' financial performance and the borrowing behavior along with business cycles. For instance, if the aggregate economic (regional) environment worsens, firms adjust their investments on plant and equipment downward, which in turn results in delaying borrowing. Simultaneously, the firms' sluggish sales performances in their product markets may prevent them from gaining returns high enough to service the repayments to their lender banks on time. Thus, their existing loans become non-performing, which hurts the lender bank's capital position through the provisions taken for loan losses and/or charge offs against their equity capital. In an economic upturn, borrowing demand soars, while the higher profits of the banks are added to their equity capital.

In overcoming the identification problem, one needs a valid instrument. Such instruments should be independent of the supply shock, ε_{it}, and strongly and consistently correlated to the capital asset ratio, K_{it}/A_{it} in equation (2). Almost all contemporaneous variables are endogenous and are not very effective to this end. The commonly used approach is employment of lagged "predetermined" variables as instruments (Peek and Rosengren [1995 a], Ogawa and Kitasaka [2000]).[33] The drawback to this approach is that such predetermined variables lack an economic account of the bank capital and that the strong correlation with capital asset ratios is not guaranteed.

Ueda (2000) and Hoshi (2001) discuss that the regulatory driven "structural" change of the

[33] Peek and Rosengren (1995 a) adds the current change in equity capital as one of instruments to lagged variables. The point estimate of the coefficient on the capital asset ratio in the instrumental variable regression (2SLS) and that in the OLS surprisingly coincide. One may wonder whether such instrumental variables are not exogenous to the contemporaneous supply-demand system.

financial markets in the 1980s forced banks to reorganize their business. The deregulation of corporate bond markets that followed the liberalization of the secondary markets of government bonds made large *keiretsu* firms less dependent on bank lending. While large firms benefited from raising funds in the credit markets, regulations governing the banks' activities confined them to their traditional lending business.[34] In response to the loss of long-standing core borrowers, the banks needed to drum up some new customers. As the asset price bubble developed, banks rapidly increased lending to the real estate industry with the strong and illusory expectations that land prices would never fall. The cross-sectional data of individual banks in the late 1990s show that the banks' portfolios tilt toward real estate lending most strongly explains the accumulation of the NPLs more than a decade later. "Riskier" banks piled up more NPLs while less "riskier" banks avoided the deterioration of their balance sheets as the land price bubble busted. Such empirical evidence provides us with the ideal instrument. Such behavioral responses in the mid-1980s are an exogenous factor to the demand-supply system of bank lending in the 1990s, yet, they best explain the development of NPLs in the late 1990s. Consequently, banks with higher NPLs write off more assets against their equity capital, and incur severer capital shortages than banks with lower NPLs. Hence there should be a negative correlation between the banks' portfolio changes toward real estate lending and their capital asset ratio.[35, 36]

The intuition behind the instrumental variable regression is the following two-step estimation. The first step runs the regression of the capital asset ratio on the banks' lending portfolio shift toward real estate lending. The fitted value of the capital asset ratio represents the structural component of the capital asset ratio that is independent of current borrowers, whereas the demand side influenced by the business cycle fluctuations is absorbed in the residual. Then, the fitted value is used as an explanatory variable in running the capital-lending regression. This way, one is able to estimate the response of bank lending to the structural component of capital asset ratio attributable to the banks' structural behavioral change in the 1980s.

In practice, we construct both the level of and the change in real estate lending over the 1980s

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[34] For more on the Japanese financial deregulation process since the 1970s, see Hoshi and Kashyap (2000)

[35] One may argue that the share of real estate lending in the late 1980s and the lending supply in the late 1990s could be endogenously determined. If banks ex-ante had known that real estate lending was a very bad investment and foresaw that they would lose money, the ex-ante correlation of two variables would occur. However, this argument may arise from confusion between ex-ante and ex-post banking behavior. It is true that banks ended up with huge losses from real estate lending due to the burst bubble in land prices. We, however, need to keep in mind that land prices had never significantly fallen before the bubble burst and that the public, including the banks' managements, believed in the "myth of land speculation". (They're not making any more of it.) Banks must have regarded real estate lending as a lucrative, low risk, high return alternative to *keiretsu* lending.

[36] Suppose, rather, that banks anticipated ex-ante that real estate lending was very risky. Such banks' prescience does not lead to an ex-ante correlation between the real estate lending share in the late 1980s and the lending supply shock in the late 1990s. The expectation of a lending supply shock conditional on the real estate lending share is still zero because riskier investment does not mean a negative expected return but merely a positive variance.

and use them as instruments for the capital asset ratio. For the "level" instrument we use REAL89: each bank's share of lending to the real estate industry in FY 1989, when land prices recorded a historical peak. For the "change" instrument we use PORT: each bank's 10-year growth of lending share to the real estate industry since FY 1980.[37]

REAL89 and PORT are highly likely to be correlated with the real estate related lending supply in the late 1990s. For instance, a bank having made loans available to the real estate industry realizes that such loans are non-performing after the bubble burst and reduce such lending later. Alternatively, a bank may be continuing lending to the real estate industry by making rescue lending. In order to ensure validity of an instrument, lending to the real estate and construction industries are dropped from the *troubled* industries.

4. Results

Regression results

A table 1 ensures the strength of a set of employed instrumental variables for capital asset ratio. Correlation coefficients between REAL89 and three measures of capital "surplus" are substantially negative for all but the book ratio in FY 1994 since FY 1994.[38] Table 2 shows the 2SLS cross sectional regression results of equation (1) from FY 1995 to FY 2000. The results of the regressions using the book capital, the BIS risk based capital and the market based capital are reported in order. To illustrate the advantage of our instrumental variable approach, the OLS results are reported for the regressions with the book capital. Numbers shown in cells are estimates of β. The first two columns labeled "Troubled" displays the results on the bank lending supplied to the troubled industries not closely related to the real estate industry: industries included are wholesale and retail, and service. The third and the fourth columns labeled "Non-troubled", on the other hand, show the results on lending to the non-manufacturing industries little burdened with NPLs: industries included are agriculture, mining, financial and insurance, transportation and communications, and utility. The first column, "Lag", of two columns of each lending category reports the results of regressions with capital asset ratio taken one year lagged, whereas the second column, "Cont.", shows the results of regressions with the contemporaneous ratio.

Insert Table 1 and Table 2 here.

[37] In addition, constant, predetermined variables including lagged and twice lagged loan growths, lagged and twice lagged interest rate differentials, and other lagged variables including twice, three times, and four times lagged deposit growth rates, and lagged and twice lagged land price growths, are included as a set of instrument variables. 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).

[38] We are primarily interested in a banks' behavior during the period throughout the second half of the 1990s and the early 2000s, the period since the *financial crisis* emerged. However, the testing results for FY 1994 are included since we examine both one year lagged and contemporaneous capital ratios as the explanatory variable in the regressions.

The OLS estimator provides statistically significant but substantially smaller point estimates of coefficients than does the 2SLS estimator in fiscal years 1996 and 1997. All of the OLS estimates are statistically significant in FY 1999, whereas none of the 2SLS estimates is. Our main findings from the 2SLS results with book capital are twofold. First, in FY 1996 the estimated coefficient on the lagged capital is positive and significant for "troubled" lending, whereas, in contrast, none of the coefficients are for "non-troubled" lending.[39] In FY 1997 and 1998 the estimated coefficient on the contemporaneous capital "surplus" is significant for both types of lending, though the point estimate is substantially larger for "non-troubled" lending than for "troubled" lending. Indeed, the larger coefficient occurs to "non-troubled" lending in these two years regardless of the measure of capital employed.

Aggregate impact of bank capital

Table 3 compares the aggregate growth rates of lending to "troubled" industries and "non-troubled" industries. The data on all banks, which are our main focus, as well as subgroups comprising smaller and domestic regional banks, and regional 2 banks, are reported. The data are constructed from the micro data of banks included in the sample of the cross sectional regressions, thereby make them comparable to the aggregate supply side effects of bank capital on lending that are computed from the estimation of equation (1). The aggregate data on all banks are not in favor of the *flight to quality* hypothesis. In all fiscal years since 1995, except FY 1999 when lending to "non-troubled" industries exhibited negative growth, lending to "troubled" industries grows faster than that to "non-troubled" industries (that is, the absolute value of the negative growth rate to the former is greater than the latter). The resulting 15.3 percent decline of bank loans to "non-troubled" industries from FY 1995 to FY 2000 falls behind the 11.6 percent decline of loans to "troubled" industries in the same six year period. We admit that some heterogeneity across bank size remains. Lending by regional banks largely follows the trend of aggregate lending, whereas lending by regional banks is opposite to it. Indeed, non-troubled lending by regional 2 banks always grows faster than troubled lending.

Insert Table 3 here.

[39] A caveat in interpreting the results follows. The fact that both a coefficient on the lagged capital "surplus" and a coefficient on the contemporaneous capital "surplus" are significantly positive does not necessarily imply both lagged and contemporaneous capital structurally effects lending. Since capital "surplus" constructed this way keeps the property of the level of capital asset ratio, it is highly serially correlated. Such a serially correlation results in the statistical correlation between lending and the capital "surplus" at a certain date which is not deduced from the structural causal relationship. Indeed regressions with both lagged and contemporaneous ratios erase both a statistical significance of coefficients on the lagged ratio. Besides an overidentification test rejects the null hypothesis at 10 % level for the lag specification for troubled lending in fiscal years 1997.

Table 4 shows how much either a capital "shortage" or a capital "surplus" of banks in the sample contributes to the growth rate of the aggregate lending supply to a certain group of industries. The correct sign of the estimated capital "surplus" is crucial for a legitimate comparison between two groups of borrowers. The interpretation of the results flips over as the sign of a capital "surplus" changes. In order to avoid confusion resulting from this, we report only the results with the book capital, which provides the best yardstick by far.[40] A number in each cell is the product of the point estimate of the reaction parameter, β, and is specific to a subject group of industries, and the aggregate capital surplus obtained by averaging a bank specific $K/A-(K/A)^{target}$ over all 126 banks in the sample. The aggregate book capital is in "shortage" in fiscal years for 1995, 1996, and 1997, and is in "surplus" in fiscal years for 1998, 1999, and 2000.[41] The greater number for "non-troubled" lending than for "troubled" lending suggests the *flight to quality* in response to a capital shock. Banks reallocate their lending from "troubled" industries to "non-troubled" industries. The reverse implies the *flight to less quality* or the *evergreening*.

Insert Table 4 here.

A capital shortage in FY 1995 reduces lending supply to "troubled" industries in FY 1996 by 2.74 percent, but its effect on lending supply to "non-troubled" industries is statistically negligible. A capital shortage in FY 1997 has the contemporaneous impacts on lending supply to both "troubled" and "non-troubled" industries, though the 4.65 percent fall in lending supply to "troubled" lending is almost doubled by the 8.54 percent fall in lending supply to "non-troubled" lending. In FY 1998, in turn, a positive capital shock raised the lending supply to the "non-troubled" sector by 3.82 percent, whereas it did not cause any substantial change in lending supply to the "troubled" sector.

Testing reallocation of lending portfolio

We attempt the rather formal statistical test to compare "troubled" lending supply with "non-troubled" lending supply. Subtracting the equation (1) for "non-troubled" lending from that for "troubled" lending, we obtain,

[40] The BIS capital tends to underestimate and the market based capital overestimate a capital loss of a bank. The BIS ratio does not reflect banks' capital losses entirely because banks are allowed to make up for losses on core capital elements by supplemental instruments. Indeed almost all banks satisfy the minimum RBC requirement. On the other hand, banks had had large capital gains on their holding assets that had been the legacy of the bubble economy in the late 1980s. A capital shortage estimated with market based capital is negative in FY 1998 at the time of large capital infusion by the government into banks.

[41] A sign of the aggregated capital "surplus" coincides with the sign of the number in the second column of Table 5. This is because as shown in the second column of Table 2, the coefficient on the contemporaneous book capital asset ratio is positive in all fiscal years since FY 1995.

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

A positive coefficient β^{tr}-β^{nt} and an aggregate capital "shortage" imply the banks' reallocation of loans to the underperforming sector in the wake of a negative shock, that is, the *flight to quality*. A negative coefficient and an aggregate capital "shortage" imply the *flight to less quality* or *evergreening*. We run the 2SLS regression of equation (2) year by year. Employed instruments are a union of sets of instruments used in running regressions of equation (1) for both "troubled" and "non-troubled" sectors. REAL89 remains to play a key role as an identifier.

Table 5-1 reports the results estimated with three measures of bank capital examined. In FY 1996 the coefficients on the contemporaneous capital "surplus" measured by the BIS ratio and the market based ratio are positive and statistically significant, whereas the coefficient on the contemporaneous capital "surplus" for book ratio is also positive but statistically not significant at the 10 percent level. In FY 1998 the coefficients on contemporaneous capital "surplus" are in turn all negative and those estimated with the book ratio and the market-based ratio are statistically significant.

Since these regressions are the most important for our hypothesis testing, we attempt a further test of validity of instruments. Table 5-2 shows the "partial squared correlation coefficient" proposed by Shea (1997) to serve as a goodness of fit test for a capital asset ratio with a set of instruments employed. 22 out of 36 partial squared correlation coefficients are greater than 0.1.[42] Table 5-3 displays the complete estimation results of equation (2). As it turns out, the overidentification test for FY 1999 fails so that the estimated results for this year are not reliable.

Insert Tables 5-1, 5-2, and 5-3 here.

Robustness check by sub sampling

In order to check on the robustness of our position, we replicate the regressions of equation (1) (Table 6-1) with book capital, the resulting contribution of a capital "surplus" to the distribution of supply of bank loans (Table 6-2), and the regression of equation (2) for three capital measures (Table 6-3). Groups investigated are regional banks registered as "domestic" as of the end of the fiscal year for 2000, and regional 2 banks.[43] Regarding the results of equation (1), the results for regional

[42] The Shea's coefficient is, roughly speaking, an R-square taken into account the collinearity among the instrumental variables. Shea gives an example where the normal R-square is 0.1 and this statistic is 0.05, and concludes that the goodness of fit is not as good as the standard R-square test implies.

[43] 14 regional banks that register as international banks that pertain to the higher minimum capital standard are excluded from the regional bank sub-sample. It serves to test our hypotheses with the very homogeneous sub-sample. All regional 2 banks are registered as domestic banks that are subject to the lower standard.

banks are mostly consistent with our findings from estimating equation (1) with all 126 banks. Interestingly, regional banks, which remain to be undercapitalized in FY 1998, appear to continue withdrawing funds from healthier firms, whereas they stop rationing unhealthier industries. On the other hand, none of coefficients from regressions of equation (2) is statistically significant. The results for regional 2 banks are not clear, as very few coefficients are statistically significant. If we were to venture an opinion, they may have been in engaged in the *flight to less quality* in FY 1999. This is not, however, statistically confirmed.

1. Insert Tables 6-1, 6-2, and 6-3 here.

Interpretation of empirical results

The empirical findings with the book capital asset ratio consistently suggest that banks shifted their lending portfolio from the "troubled" industries to the "non-troubled" industries in response to a negative contemporaneous capital shock in FY 1996. The findings with the BIS ratio and the market-based ratio are supportive of the book capital results. We must warn, however, that the partial correlation coefficient of REAL89 with a set of explanatory variables is not high, and there is a suspicion about its validity as an instrument.

The estimated contraction of loan supply to healthy non-manufacturing industries by nearly 9 percent in FY 1997 due to undercapitalization of banks suggests that the large negative capital shock caused a *credit crunch*. Besides both findings from estimating equation (1) and equation (2) are more supportive of *flight to less quality*, though the evidence is not statistically persuasive. We interpret this to mean that banks may have changed their lending practice in response to the large negative capital shock in FY 1997 that primarily resulted from the FSA's tougher regulatory stance against banks. Indeed, if we recall that there are a greater number of write offs of NPLs in troubled industries, the disparity in *new* lending between troubled and healthy industries must be even more pronounced, because disposal of NPLs reduces both loans and capital equally. Though, *flight to quality* hurts financially weaker borrowers, it is the optimal response by banks to a negative shock. In contrast *flight to less quality*, which is the inefficient allocation of funds to unproductive borrowers, is even more harmful, and can be a serious negative phenomenon. The banks' behavioral pattern remained the same the next year, FY 1998. The sign of β^{tr}-β^{nt} remains negative and even statistically significant. However, the flow of funds supplied by banks was in turn directed to healthier firms thanks to their overcapitalization. Recovery in bank capital is attributable largely to the prudential policy actions, which were meant to prevent *credit crunch*, the possibility of which policymakers had been aware of since the year before.[44] The implications of

[44] 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 action, thereby were effective

the results in the fiscal years of 1999 and 2000 are not clear. None of the results of the estimating equation (2) indicates any direction for the banks' loanable funds.

Banks are accused of being engaged in the practice of *ever-greening* if they roll over loans to borrowers who fail to repay on time. The empirical literature on the practice of ever-greening Japanese banks has been growing recently.[45] Among relevant studies, Peek and Rosengren (2004) find that a main bank with a strong relationship with a firm is likely to extend credit to a firm in response to financial deterioration of a firm and a lender itself than a non-relationship lender. They discuss that such last minute rescue lending by a bank allows a distressed firm to repay debts to the (same) lender on time, which then benefits the lender itself by forestalling the creation of additional NPLs. Our empirical findings partially endorse their view that banks are the primary cause of ever-greening. In FY 1997, when banks had the strongest incentive to cover up the capital crunch under the unprecedented regulatory pressure, the data are indicative that banks with less capital, who had the most incentive to ever-green, rebalanced their portfolio more aggressively toward unhealthy industries. In FY 1998, however, banks intentionally cut the number of underperforming borrowers with a help of enhanced capital.

Ever-greening bias?

Neither the Hansen (1982)'s overidentification test nor the simple examination of correlation coefficients between REAL89 and the estimated residual implies the endogeneity of this key instrument in our empirical framework. However, one may still wonder if the endogeneity exists through a bank's management competency; more precisely, its tendency to make wrong predictions and resulting wrong management decisions. A bank that shifted its lending portfolio more aggressively toward real estate lending may have been more prone to lend to industries that were later found underperforming. A bank management with more bullish expectations for land prices may have been simply more incorrect in forecasting the future in general and chased a greater number of "wrong" borrowers. Alternatively, although the real estate industry itself and the construction industry are excluded from the examined "troubled" industries, the remaining "troubled" industries may be the industries where use of land as collateral was more common than in "non-troubled" industries. Then a bank whose management had a stronger belief in rising land prices may have chased these industries as well. In any case, such a bank either cleans up borrowers in "troubled" industries, or rescues them, as it becomes evident that they are poor performers.

Econometrically, one can model such endogeneity as a possible correlation between REAL89 and some bank specific fixed effect in the regression equation. Thus, one way to formally test the

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to restore the aggregate lending growth in the highly concentrated Japanese banking industry.

[45] For the extensive literature review, see Caballero, Hoshi, and Kashyap (2003) and Kobayashi, Saita, and Sekine (2003).

possible influence of such endogeneity is to remove the fixed effect by first differencing a kind of regression equation (2) allowing the time variant coefficient of the capital "surplus" and to estimate it with the panel data of some sample period. A drawback to this approach is that it not only removes the fixed effect but also washes away the bank specific target. Our attempts do not result in plausible estimates.[46] Though these failed attempts may simply be because banks react only to the estimated capital "surplus", our findings with cross section regressions cannot be overstated.

Implications on prudential policy

Public recapitalization of banks facilitates the efficient allocation of funds only when the supply of loans to healthy borrowers is structurally linked to bank capital and the link is stronger than a similar link to loans supplied to unhealthy borrowers, if it exists at all. FY 1998 was certainly the year when such conditions were met. A similar recapitalization policy, if executed now, however, would not have the desired restructuring effect since conditions are not satisfactory. Even worse, in FY 2000 capital effected the supply of loans to "non-troubled" industries, but it did not effect the supply of loans to "troubled" industries, suggesting the chance that banks would engage in the inefficient portfolio reallocation toward unhealthy industries still remains. Nevertheless the estimated banks' reaction is not large, and the banking industry holds adequate capital to satisfy their own capital target. Borrowers with decent performance records are not hurt by the cut back of banks loans supplied, either. bank loans supplied, either. The shrinking loans to healthy borrowers documented in the equilibrium data are likely to be a reflection of declining lending demand rather than a reduced supply of loans. Thus the bank-lending channel still does not lose its role as a conduit for monetary policy, and an expansionary policy would still be effective if it can successfully stimulate the lending demand of productive borrowers.

Some of the findings with respect to domestic regional banks imply the picture that would have happened to the entire banking industry without the large infusion of public funds. Banks as a whole may have not only reduced the lending supply to healthy industries, but also reduced less of it for unhealthy industries, and the potentially more harmful "flight to less quality" would have lasted. Since in reality the large public funds reversed the aggregate capital position of banks, exactly the same structure of the bank lending supply function that constrains only "troubled" lending to capital helped the bank finance directed relatively to "non-troubled" lending by increasing such lending supply, which would not have occurred without a substantial public capital infusion.

Our empirical findings are consistent with the theoretical prediction of Diamond (2001). He shows that too little public capital is not adequate to restore the lending supply function of constrained banks, but that too much public funds leads to inefficiencies due to banks' rent seeking

[46] For the detailed description of the empirical model, see the appendix. The regression estimated over the sample period from FY 1997 to FY 1999 results in coefficient estimates whose signs in fiscal years for 1997 and 1998 are consistent with cross section results. Such results, however, are not robust across different choices of a sample period.

behavior. When the adequate public funds are provided to banks so that banks are no longer constrained, additional capital will not increase the lending supply to healthy borrowers but simply be wasted.

5. Conclusion

This paper investigates bank reactions to large negative capital shocks. Starting from FY 1995, a series of negative events such as the higher borrowing rates in the European inter-bank market (Japan premium), the liquidation of *jusen* corporations, and distrust in the banking sector resulting from the failures of large banks, resulted in the financial crisis. The financial crisis and the regulator's policy reaction that required a more stringent assessment of assets in FY 1997 resulted in large negative capital shocks to the banking industry. The regulator started the Prompt Corrective Action regulatory framework in the same year, which stipulates the regulator to intervene in banks in the case of the r risk adjusted capital asset ratio.

The paper examines changes in the bank lending supply in response to the gap between actual and target capital asset ratios, a capital "surplus". The individual target is estimated by computing the three-year average of the ratio from FY 1992 to FY 1994. We estimate the bank lending supply function for both "troubled" industries with disproportionally greater NPLs and "non-troubled" industries with disproportionally smaller NPLs and watch the differentiated reactions by banks against two borrower groups. Identification of lending demand and lending supply is done by use of the unique instrument. Making use of the empirical finding that the structural component of non-performing loans are best explained by the portfolio reorganization toward real estate lending over the 1980s, we employ the within bank share of real estate lending in the late 1980s as an instrument for bank capital. It turns out that the constructed variable is very negatively correlated to capital asset ratio and can be an effective instrument. "Troubled" industries exclude real estate and construction industries to ensure validity of the instrument.

Our main empirical findings are threefold. First, a large negative capital shock in FY 1997 not only caused the contraction of credit supply (*credit crunch*), but also may have induced the banks' inefficient reallocation of loanable funds to unhealthy industries (*flight to less quality*). Second, in contrast, previously undercapitalized banks may have restructured their portfolios toward a healthier one encouraged by the positive capital shock that was largely due to the recapitalization of large banks in FY 1998. Third, banks have not been strongly capital constrained since FY 1999, suggesting that enhancing the banks' capital with public funds would not bring about a positive impact on the lending supply to productive borrowers.

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Appendix: The fixed effect estimation with the time variant coefficient

Consider the following model of the lending supply function that factors in the time variation in the coefficient on capital "surplus".

$$y_{it} = \alpha_0 + \alpha_1 y_{it-1} + \beta_t \left\{ \frac{K_{it}}{A_{it}} - \left(\frac{K_i}{A_i} \right)^{target} \right\} + \gamma X_i + \eta_i + \mu_t + u_{it}, \; t=1,...,T \quad \text{A1}$$

where $y_{it} = \ln L_{it}^{tr} - \ln L_{it}^{nt}$

This is essentially the same as equation (2) with a major modification in the time subscript attached to β. The time subscript disappears from a set of control variables X as we use the same time invariant dummy variables to indicate the bank's institutional characteristics as in estimating the cross sectional regressions. The residual is further decomposed into the bank fixed effect η_i, the time effect μ_i, and the random error u_{it}. First differencing (2)', we obtain,

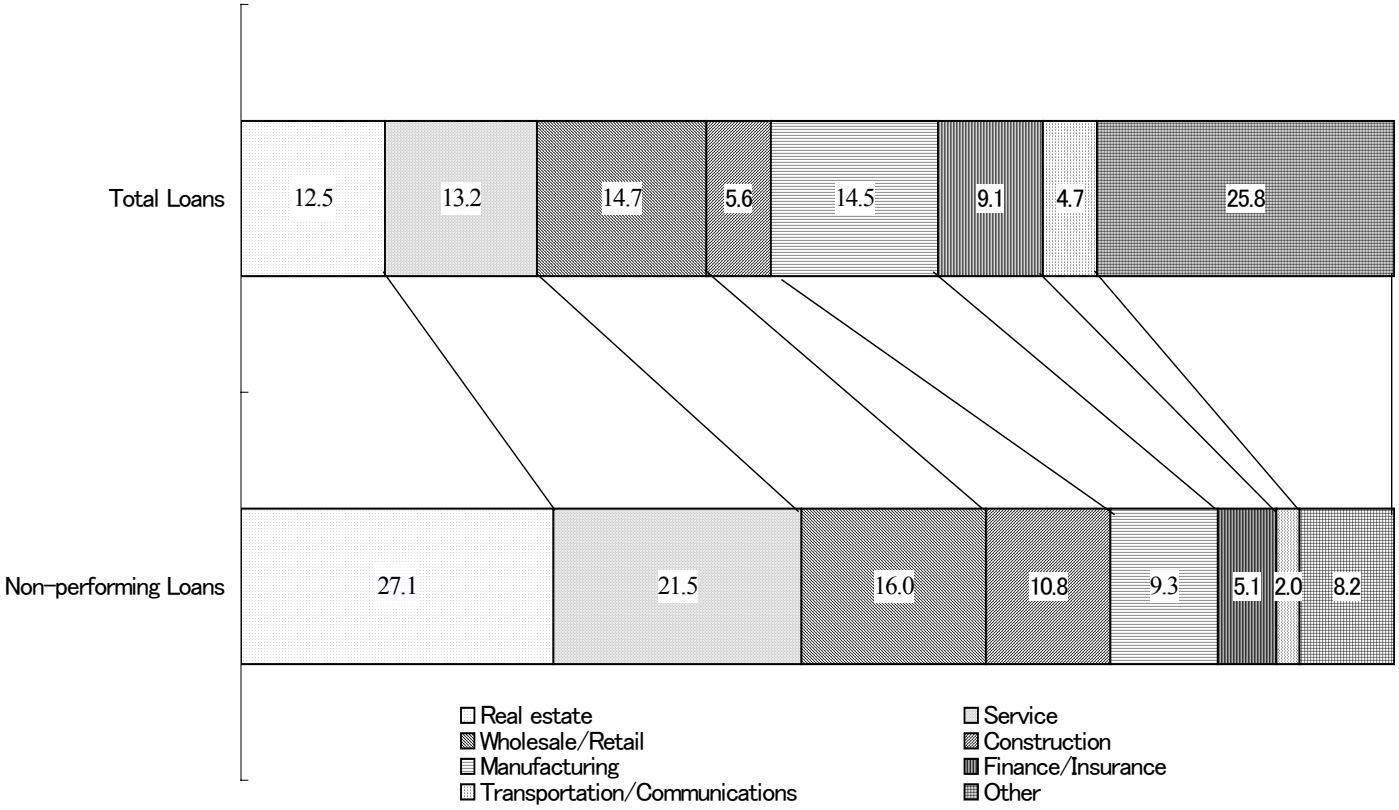
$$\Delta y_{it} = \alpha_1 \Delta y_{it-1} + \beta_t \frac{K_{it}}{A_{it}} - \beta_{t-1} \frac{K_{it-1}}{A_{it-1}} + \Delta\mu_t + \Delta u_{it} \quad , t=2,...,T \qquad \text{A2}$$

The simple matrix algebra shows that estimating (4)' is equivalent to estimating the following equation that involves interaction terms of time dummy variables D_t's with the history of capital asset ratios stretching over the entire panel.

$$\Delta y_{it} = \alpha_1 \Delta y_{it-1} + \sum_{\tau=1}^{T} \beta_\tau^* \left(D_t \frac{K_{i\tau}}{A_{i\tau}} - D_{t-1} \frac{K_{i\tau-1}}{A_{i\tau-1}} \right) + \Delta\mu_t + \Delta u_{it}, \; t=2,...,T \quad \text{A3}$$

In practice, besides the interaction terms we use time dummy variables as explanatory variables to represent the time effect $\Delta\mu_t$.

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



Taken from the BOJ (2001)

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

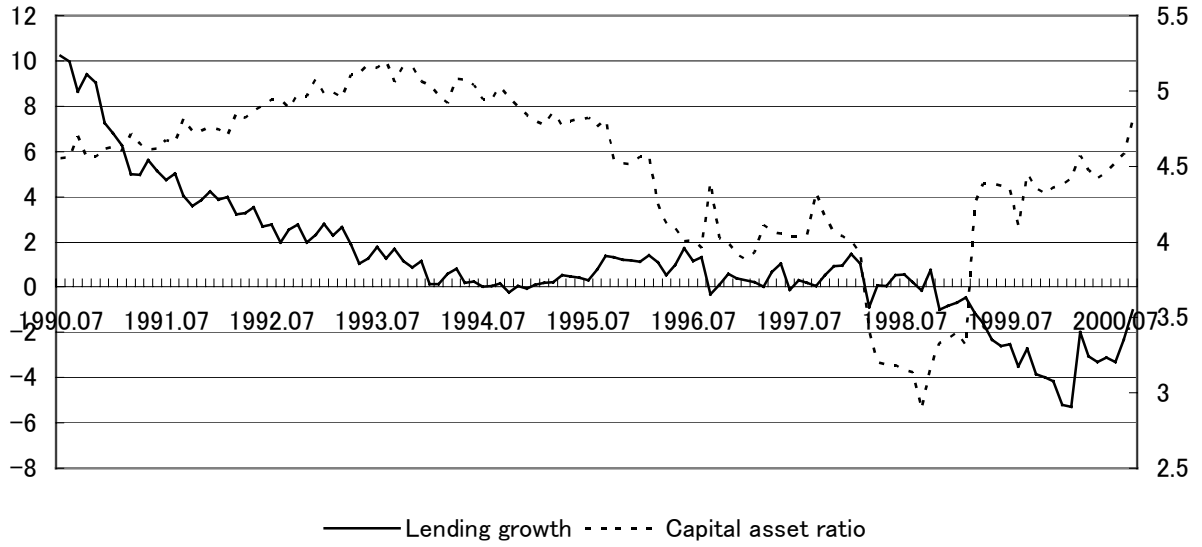


Table 1 Correlation coefficients of REAL89 and capital "surplus" measures

	1994	1995	1996	1997	1998	1999	2000
CAPR	-0.0096	-0.4607	-0.2767	-0.5345	-0.3443	-0.3214	-0.4358
BIS	-0.2551	-0.2321	-0.2139	-0.1055	-0.1568	-0.2340	-0.1933
CAPRM	-0.3940	-0.3255	-0.3740	-0.5392	-0.5105	-0.3149	-0.5102

Table 2 Year by year coefficients on capital "surplus" measures for lending to troubled and non-troubled industries, all 126 banks

Book capital								
	Troubled (OLS)		Non- troubled (OLS)		Troubled (2SLS)		Non- troubled (2SLS)	
	Lag	Cont.	Lag	Cont.	Lag	Cont.	Lag	Cont.
1995	1.3704	*0.2674*	-0.3124	0.2765	1.2136	*3.3626*	-4.0994	*3.5128*
	(0.6066)	(0.2968)	(-0.3907)	(-0.3629)	(0.1128)	*(1.2284)*	(-0.2480)	*(0.6069)*
1996	2.3252**	1.1854**	1.7939**	0.7447	*5.7893***	*2.5416**	*-3.5591*	*-2.0894*
	(2.6715)	(2.4185)	(2.0859)	(1.0707)	*(2.0323)*	*(1.6936)*	*(-0.6131)*	*(-0.5302)*
1997	2.7157***	2.1303***	2.5863*	4.5159***	*6.4836****	*4.9944****	*4.3003*	*9.1686****
	(4.5641)	(4.9453)	(2.4724)	(4.8534)	*(3.2679)*	*(4.1249)*	*(0.7476)*	*(3.2906)*
1998	0.2139	0.6913	-1.3191	-0.1037	*2.7310*	*2.5271**	*5.7499*	*9.6862***
	(0.3719)	(1.6701)	(-1.2806)	(-0.1142)	*(1.0962)*	*(1.8360)*	*(1.0688)*	*(2.3266)*
1999	1.1159**	1.3152***	2.8447***	3.2006***	*0.5055*	*1.1473*	*2.3607*	*-2.7237*
	(2.6241)	(2.9665)	(-2.7903)	(2.8519)	*(0.5174)*	*(-0.9917)*	*(0.8584)*	*(-0.7951)*
2000	0.9354	0.8535**	0.2977	0.3301	*1.2710**	*1.3214**	*1.4006*	*2.3445*
	(2.4559)	(2.6432)	(-0.2192)	(0.2814)	*(1.7610)*	*(-1.9003)*	*(0.4863)*	*(0.8027)*

	BIS				Market based capital			
	Troubled		Non- troubled		Troubled		Non- troubled	
	Lag	Cont.	Lag	Cont.	Lag	Cont.	Lag	Cont.
1995	-1.8061	*0.6698*	-23.2494	*-5.0820*	*0.9899*	*-0.3897*	*-10.1156*	*-5.9153***
	(-0.281)	*(0.5367)*	(-0.9051)	*(-1.5475)*	*(0.3045)*	*(-0.3843)*	*(-1.3233)*	*(-2.0892)*
1996	*2.0366*	*1.5432*	*-5.2090*	*-2.8174*	*-0.0246*	*1.2112*	*-3.2084*	*-3.0940*
	(1.2191)	*(1.5015)*	*(-1.3123)*	*(-1.0099)*	*(-0.0272)*	*(1.4738)*	*(-1.3994)*	*(-1.2890)*
1997	*3.6342***	*-1.3043*	*17.1556**	*9.8893*	*5.4465****	*3.5219****	*7.0660**	*5.9576****
	(2.0772)	*(-0.6671)*	*(1.7993)*	*(1.5864)*	*(3.6157)*	*(4.4332)*	*(1.9178)*	*(3.1200)*
1998	*2.9497*	*1.4297**	*0.2987*	*4.2528**	*0.8058*	*1.0319*	*2.3332*	*5.1633***
	(1.0089)	*(1.8634)*	*(0.0501)*	*(1.9868)*	*(0.6564)*	*(1.3774)*	*(0.9766)*	*(2.5024)*
1999	*0.9113*	*0.9465*	*1.1858*	*-1.8280*	*0.4298*	*0.3685*	*0.3895*	*-0.7325*
	(1.1750)	*(1.2325)*	*(0.6348)*	*(-0.8435)*	*(1.3712)*	*(1.4858)*	*(0.2166)*	*(-0.4268)*
2000	*0.8456***	*1.4792***	*2.1014*	*4.0075**	*0.9104*	*0.8809**	*2.6039*	*2.1791*
	(2.0231)	*(2.1496)*	*(1.4518)*	*(1.9191)*	*(1.5474)*	*(1.8229)*	*(1.2131)*	*(1.2319)*

Cells with italic letters indicate that differences between capital asset ratio and its desiredlevels are negatively and significantly correlated with REAL89.

*** shows 1%, **, 5%, and *, 10%, respectively.

Table 3 Aggregate lending growths to troubled and non-troubled industries

	All banks		Regional banks		Regional 2 banks	
	Troubled	Non- troubled	Troubled	Non- troubled	Troubled	Non- troubled
1995	-0.43	-1.10	1.14	-1.77	1.40	4.68
1996	-1.51	-4.65	-0.41	-4.38	0.59	2.95
1997	-2.12	-3.92	-0.77	-0.91	-0.89	-0.20
1998	-2.61	-5.41	-2.28	-2.53	-1.25	0.32
1999	-2.98	4.08	-6.55	-2.11	-4.25	-2.70
2000	-2.56	-5.00	-2.85	1.64	-1.75	-1.24

Table 4 Aggregate capital shocks to bank lending supply to troubled and non-troubled industries, all 126 banks

	Book capital			
	Troubled		Non- troubled	
	Lag	Cont.	Lag	Cont.
1995	0.07	*-1.61*	-0.24	*-1.68*
1996	*-2.74***	*-1.06**	*1.68*	*0.87*
1997	*-2.69****	*-4.65****	*-1.78*	*-8.54****
1998	*-2.48*	*1.00*	*-5.22*	*3.82***
1999	*0.20*	*0.78*	*0.96*	*-1.85*
2000	*0.84**	*0.68**	*1.63*	*2.29*

	BIS				Market based capital			
	Troubled		Non- troubled		Troubled		Non- troubled	
	Lag	Cont.	Lag	Cont.	Lag	Cont.	Lag	Cont.
1995	*0.53*	*-0.04*	*6.79*	*0.33*	-0.76	0.07	7.81	1.13**
1996	*-0.13*	*-0.34*	*0.34*	*0.62*	0.00	-1.52	0.59	3.87
1997	*-0.80***	*-0.27*	*-3.77**	*2.02****	-6.76***	-9.43***	-8.77*	-15.94***
1998	*0.64*	*2.57*	*0.07*	*7.64***	-2.13	-1.45	-6.16	-7.23**
1999	*1.65*	*2.13*	*2.14*	*-4.12*	-0.13	-0.07	-0.54	0.23
2000	*1.94***	*2.77***	*4.80*	*7.43**	-0.27	-1.39*	-0.76	-3.44

Cells with italic letters indicate that differences between capital asset ratio and its desired levels are negatively and significantly correlated with REAL89.
*'s on the upper right of the figure indicate the significance of coefficient on the corresponding difference between capital asset ratio and its desired level in the original 2SLS regression. *** shows 1%, **, 5%, and *, 10%, respectively. *'s are attached only when the sign is correct (positive) and REAL89 is a valid instrument (negatively correlated with the difference between capital asset ratio and its desired level).

Table 5-1 Year by year coefficients on capital "surplus" measures in equation (2), all 126 banks

	Book capital		BIS		Market based capital	
	Lag	Cont.	Lag	Cont.	Lag	Cont.
1995	-14.0639	*4.2215*	-10.6949	*1.9881*	11.6699	*4.0110**
	(-0.7886)	*(0.6356)*	*(-0.7482)*	*(0.7411)*	*(1.4810)*	*(1.6802)*
1996	*9.3553*	*6.4602*	*7.1803*	*5.4928**	*2.7938*	*5.0151***
	(1.4451)	*(1.6267)*	*(1.5823)*	*(1.7437)*	*(1.2206)*	*(2.0274)*
1997	*4.9334*	*-3.4935*	*-3.4452*	*-7.2823*	*0.5586*	*-2.0126*
	(0.9563)	*(-1.2160)*	*(-0.8319)*	*(-1.3378)*	*(0.1697)*	*(-1.0649)*
1998	*-12.3933*	*-7.7444**	*-3.4452*	*-7.2823*	*-5.8835*	*-5.1774***
	(-1.4307)	*(-1.9514)*	*(-0.8319)*	*(-1.3378)*	*(-1.4802)*	*(-2.2153)*
1999	*-1.9405*	*3.1321*	*0.3268*	*3.6396*	*-1.0074*	*-0.0074*
	(-0.7008)	*(0.9229)*	*(0.1562)*	*(1.4379)*	*(-0.5780)*	*(-0.0046))*
2000	*0.5697*	*-2.1843*	*-0.0889*	*-1.5291*	*-0.6353*	*-0.6810*
	(0.2068)	*(-0.8638)*	*(-0.0575)*	*(-0.7029)*	*(-0.2912)*	*(-0.3841)*

Cells with italic letters indicate that differences between capital asset ratio and its desired levels are negatively and significantly correlated with REAL89.
*** shows 1%, **, 5%, and *, 10%, respectively.
The Hansen's (1982) overidentification test does not reject the null hypothesis that instruments are uncorrelated with a set of explanatory variables for any regression at least at 10 % level. (Results are not shown.)

Table 5-2 Partial squared correlation coefficients

	Book capital		BIS		Market based capital	
	Lag	Cont.	Lag	Cont.	Lag	Cont.
1995	0.0725	0.0916	0.0422	0.1305	0.0799	0.1230
1996	0.1559	0.1305	0.0874	0.0874	0.1894	0.1523
1997	0.1154	0.1734	0.0577	0.0319	0.1042	0.1663
1998	0.0445	0.0960	0.0190	0.0861	0.0826	0.1532
1999	0.2016	0.1495	0.1291	0.0848	0.2544	0.1867
2000	0.2687	0.2403	0.2139	0.1200	0.1242	0.2256

Table 5-3 Regression results of equation (2)

FY 1995

	Book capital		BIS		Market based capital	
	Lag	Cont.	Lag	Cont.	Lag	Cont.
Constant	0.0125	0.0027	0.0110	0.0006	0.0063	-0.0076
	(0.7322)	(0.201)	(0.6578)	(0.0428)	(0.4449)	(-0.4954)
Lagged growth of "troubled" lending	-0.1806	-0.1793	-0.1568	-0.1397	-0.248	-0.1820
	(-0.8334)	(-0.781)	(-0.7193)	(-0.6742)	(-1.0397)	(-0.8339)
Lagged growth of non "troubled" lending	-0.0980	-0.0197	-0.0998	-0.0446	0.0490	0.0059
	(-1.0385)	(-0.1727)	(-0.9951)	(-0.4880)	(0.4025)	(0.0590)
Capital "surplus"	-14.0639	4.2215	-10.6949	1.9881	11.6699	4.0110
	(-0.7886)	(0.6356)	(-0.7482)	(0.7411)	(1.4810)	(1.6802
CITY	-0.0461	-0.0077	-0.1122	-0.0258	0.1243	0.0172)
	(-0.9316)	(-0.135)	(-0.9314)	(-0.5640)	(1.0839)	(0.3117)
TRUST	0.0310	0.0922	-0.0371	0.0229	0.1319	0.0540
	(0.7212)	(0.7143)	(-0.4728)	(0.5763)	(1.4729)	(1.1663)
REGIONAL	0.0094	0.0094	-0.0028	0.0056	0.0436	0.0075
	(0.5466)	(0.5144)	(-0.1374)	(0.3338)	(1.3777)	(0.4276)
J statistics	8.7528	8.3930	7.9289	8.4913	5.5402	5.3688
	(0. 2709)	(0. 2992)	(0.3389)	(0.2913)	(0.5943)	(0.6151)

FY1996

Constant	-0.0238	-0.0195	-0.0408**	-0.0304	-0.0322*	-0.0100
	(-1.4607)	(-1.1681)	(-2.0013)	(-1.6366)	(-1.8666)	(-0.5298)
Lagged growth of "troubled" lending	0.1928	0.3056	0.3585	0.4122	0.2145	0.2222
	(0.7220)	(1.1019)	(1.2045)	(1.2894)	(0.8328)	(0.7673)
Lagged growth of non "troubled" lending	-0.3005**	-0.2663**	-0.2348*	-0.2535*	-0.2136	-0.2709*
	(-2.137)	(-1.9636)	(-1.6859)	(-1.7178)	(-1.6726)	(-1.8771)
Capital "surplus"	9.3553	6.4602	7.1803	5.4928*	2.7938	5.0151**
	(1.4451)	(1.6267)	(1.5823)	(1.7437)	(1.2206)	(2.0274)
CITY	0.1545**	0.1721**	0.1474**	0.1866**	0.1401**	0.2213**
	(2.1435)	(2.2498)	(2.0540)	(2.2028)	(2.0686)	(2.4706)
TRUST	0.1633	0.0529	0.0208	-0.0006	0.0224	0.0878
	(1.3082)	(0.9002)	(0.4033)	(-0.0115)	(0.4502)	(1.2955)
REGIONAL	0.0550**	0.0307	0.0538**	0.0521**	0.0502**	0.0530**
	(2.4371)	(1.2341)	(2.2771)	(2.1062)	(2.3491)	(2.2005)
J statistics	8.1881	7.3204	6.6779	5.2116	9.5385	4.6192
	(0.3163)	(0.3963)	(0.4632)	(0.6342)	(0.2163)	(0.7063)

FY1997

	Book capital		BIS		Market based capital	
	Lag	Cont.	Lag	Cont.	Lag	Cont.
Constant	-0.0256	-0.0424**	-0.0264	0.1066	-0.0274	-0.0441*
	(-1.3874)	(-2.0760)	(-1.4817)	(1.0330)	(-1.4641)	(-1.9613)
Lagged growth of "troubled" lending	-0.8099**	-0.4863	-0.5493	-0.4535	-0.6989**	-0.5063
	(-2.3908)	(-1.5002)	(-1.6531)	(-1.1626)	(-2.1087)	(-1.5448)
Lagged growth of non "troubled" lending	0.1893	0.1519	0.1695	0.0954	0.1850	0.1648
	(1.4134)	(1.1915)	(1.2945)	(0.5672)	(1.4430)	(1.2973)
Capital "surplus"	4.9334	-3.4935	-3.4452	-7.2823	0.5586	-2.0126
	(0.9563)	(-1.2160)	(-0.8319)	(-1.3378)	(0.1697)	(-1.0649)
CITY	0.0714	-0.0149	0.0053	-0.1696	0.0437	-0.0412
	(0.8529)	(-0.1911)	(0.0682)	(-0.9842)	(0.4415)	(-0.4257)
TRUST	0.1348	0.0125	0.0513	0.0108	0.0850	-0.0255
	(1.4238)	(0.1588)	(0.7441)	(0.1211)	(0.8092)	(-0.2312)
REGIONAL	0.0022	0.0265	0.0094	-0.0954	0.0145	0.0076
	(0.0750)	(0.9729)	(0.3543)	(-1.0950)	(0.5492)	(0.2958)
J statistics	5.2471	5.6432	5.8816	2.8449	6.6928	5.8641
	(0.6298)	(0.5820)	(0.5536)	(0.8990)	(0.4615)	(0.5557)

FY 1998

Constant	-0.0895*	-0.0523**	-0.0264	0.1066	-0.0726*	-0.0540**
	(-1.8714)	(-2.1183)	(-1.4817)	(1.0330)	(-1.9956)	(-2.203)
Lagged growth of "troubled" lending	0.6838	0.2261	-0.5493	-0.4535	0.7457	0.4734
	(1.2374)	(0.7253)	(-1.6531)	(-1.1626)	(1.3166)	(1.3233)
Lagged growth of non "troubled" lending	0.2330	0.1542	0.1695	0.0954	0.1586	0.1402
	(1.1680)	(1.1501)	(1.2945)	(0.5672)	(1.0379)	(1.1143)
Capital "surplus"	-12.3933	-7.7444*	-3.4452	-7.2823	-5.8835	-5.1774**
	(-1.4307)	(-1.9514)	(-0.8319)	(-1.3378)	(-1.4802)	(-2.2153)
CITY	-0.0209	0.1603**	0.0053	-0.1696	-0.0709	0.0416
	(-0.1909)	(2.3444)	(0.0682)	(-0.9842)	(-0.5302)	(0.6064)
TRUST	-0.1371	0.0247	0.0513	0.0108	-0.1734	-0.0800
	(-0.9838)	(0.3540)	(0.7441)	(0.1211)	(-1.1150)	(-0.9257)
REGIONAL	0.0937	0.0687*	0.0094	-0.0954	0.0024	-0.0146
	(1.6270)	(1.7522)	(0.3543)	(-1.095)	(0.0642)	(-0.3777)
J statistics	6.2465	5.4240	11.7559	8.5606	7.0119	4.2314
	(0.5113)	(0.6084)	(0.1089)	(0.2858)	(0.4276)	(0.7528)

FY1999

	Book capital		BIS		Market based capital	
	Lag	Cont.	Lag	Cont.	Lag	Cont.
Constant	-0.0236	-0.0284	-0.0239	-0.1279	-0.0227	-0.0185
	(-0.9131)	(-1.0359)	(-0.5670)	(-1.5856)	(-0.8883)	(-0.7491)
Lagged growth of "troubled" lending	0.0171	-0.0402	-0.0389	-0.2894	0.0247	-0.0145
	(0.0564)	(-0.1314)	(-0.1160)	(-0.7679)	(0.0812)	(-0.0486)
Lagged growth of non "troubled" lending	0.1656	0.1145	0.1285	0.0571	0.1442	0.1375
	(1.2918)	(0.9084)	(0.9639)	(0.3995)	(1.1948)	(1.1136)
Capital "surplus"	-1.9405	3.1321	0.3268	3.6396	-1.0074	-0.0074
	(-0.7008)	(0.9229)	(0.1562)	(1.4379)	(-0.578)	(-0.0046)
CITY	-0.0712	-0.0897	-0.0801	-0.0507	-0.1074	-0.0796
	(-0.7995)	(-0.9939)	(-0.9168)	(-0.5193)	(-1.0810)	(-0.9042)
TRUST	-0.0372	-0.0290	-0.0432	0.0223	-0.0640	-0.0400
	(-0.4028)	(-0.3077)	(-0.4610)	(0.2052)	(-0.6394)	(-0.4185)
REGIONAL	0.0123	-0.0064	0.0047	0.0693	-0.0052	0.0008
	(0.3045)	(-0.167)	(0.1061)	(1.1156)	(-0.1368)	(0.0195)
J statistics	17.8332	16.9085	18.6800	13.5807	7.9289	8.4913
	(0.0127)	(0.0180)	(0.0093)	(0.0592)	(0.3389)	(0.2913)

FY2000

Constant	-0.0406	-0.0218	-0.0351	0.0153	-0.0357	-0.0385
	(-1.3556)	(-0.6479)	(-0.6100)	(0.1895)	(-1.2618)	(-1.4158)
Lagged growth of "troubled" lending	-0.3381	-0.1179	-0.2921	-0.1568	-0.2679	-0.2695
	(-1.0200)	(-0.3289)	(-0.8882)	(-0.4438)	(-0.8789)	(-0.9187)
Lagged growth of non "troubled" lending	0.1746*	0.1815*	0.1784*	0.1578	0.1936*	0.1883*
	(1.6918)	(1.7389)	(1.7484)	(1.4645)	(1.6838)	(1.7912)
Capital "surplus"	0.5697	-2.1843	-0.0889	-1.5291	-0.6353	-0.6810
	(0.2068)	(-0.8638)	(-0.0575)	(-0.7029)	(-0.2912)	(-0.3841)
CITY	0.1187*	0.1121	0.1200*	0.0990	0.1151*	0.1042
	(1.7883)	(1.6465)	(1.7934)	(1.3403)	(1.6810)	(1.3275)
TRUST	-0.0589	-0.0562	-0.0568	-0.0764	-0.0675	-0.0757
	(-0.8218)	(-0.7838)	(-0.7813)	(-0.9896)	(-0.8339)	(-0.8680)
REGIONAL	-0.0171	0.0030	-0.0162	-0.0477	-0.0178	-0.0135
	(-0.4240)	(0.0664)	(-0.3412)	(-0.7781)	(-0.4440)	(-0.3494)
J statistics	4.2263	3.3208	4.2562	3.6100	4.1740	4.1286
	(0.7534)	(0.8538)	(0.7498)	(0.8234)	(0.7595)	(0.7648)

*** shows 1%, **, 5%, and *, 10%, respectively.
Numbers shown in parentheses below J statistics are p-values.

Table 6-1 Year by year coefficients on capital "surplus" measures for lending to non real estate related troubled industries and non-troubled non-manufacturing lending, 49 regional banks and 48 regional 2 banks

Book capital

	Regional banks				Regional 2 banks			
	Troubled		Non- troubled		Troubled		Non- troubled	
	Lag	Cont.	Lag	Cont.	Lag	Cont.	Lag	Cont.
1995	*0.3799*	*2.6118*	*2.2662*	*7.4764***	*-4.9492*	*2.2091*	*24.6967*	*-0.4540*
	(0.0631)	*(1.4669)*	*(0.1647)*	*(2.1618)*	*(-0.3768)*	*(0.5666)*	*(1.0757)*	*(-0.0519)*
1996	*3.7884***	*3.2901***	*5.4119*	*0.9829*	*1.1021*	*-0.5911*	*1.6216*	*1.4291*
	(2.0306)	*(2.7191)*	*(1.4886)*	*(0.3823)*	*(0.3055)*	*(-0.4148)*	*(0.1749)*	*(0.3664)*
1997	*3.6875****	*2.6871****	*7.7449***	*6.4116****	*-0.1797*	*2.7030****	*-3.3035*	*1.8580*
	(3.5377)	*(3.6596)*	*(2.4217)*	*(3.1778)*	*(-0.0727)*	*(3.2503)*	*(-0.4264)*	*(0.5451)*
1998	*0.1923*	*0.3197*	*11.3092****	*8.4511****	*-0.7082*	*-0.7175*	*-1.1813*	*-0.5111*
	(0.1472)	*(0.3061)*	*(3.0981)*	*(3.3579)*	*(-0.5834)*	*(-0.6328)*	*(-0.4533)*	*(-0.1994)*
1999	*0.1033*	*-0.1317*	*3.5083*	*2.1911*	*-0.5388*	*-0.2468*	*-4.5208*	*-7.1490*
	(0.1594)	*(-0.1765)*	*(1.4816)*	*(0.8130)*	*(-0.4750)*	*(-0.1502)*	*(-1.5053)*	*(-1.5584)*
2000	*1.7753****	*1.1814*	*1.8227*	*3.7935*	*-0.9006*	*0.2628*	*-0.6743*	*-0.1052*
	(2.8843)	*(1.6083)*	*(0.4674)*	*(0.8397)*	*(-0.7958)*	*(0.4163)*	*(-0.2400)*	*(-0.0633)*

Cells with italic letters indicate that differences between capital asset ratio and its desired levels are negatively and significantly correlated with REAL89.
*** shows 1%, **, 5%, and *, 10%, respectively.

Table 6-2 Aggregate capital shocks to bank lending supply, 49 regional banks and 48 regional 2 banks, book capital

	Regional banks				Regional 2 banks			
	Troubled		Non- troubled		Troubled		Non- troubled	
	Lag	Cont.	Lag	Cont.	Lag	Cont.	Lag	Cont.
1995	*0.03*	*-0.62*	*0.16*	*-1.79***	*-0.17*	*-0.14*	*0.87*	*0.03*
1996	*-0.86***	*-0.50***	*-1.23*	*-0.15*	*-0.07*	*0.04*	*-0.10*	*-0.09*
1997	*-0.50****	*-1.03****	*-1.05***	*-2.45****	*0.01*	*-1.62*	*0.20*	*-1.11****
1998	*-0.07*	*-0.09*	*-4.30****	*-2.25****	*0.42*	*0.22*	*0.70*	*0.16*
1999	*-0.02*	*-0.03*	*-0.84*	*0.42*	*0.16*	*-0.07*	*1.38*	*-2.02*
2000	*0.35****	*0.93*	*0.36*	*2.97*	*-0.26*	*0.11*	*-0.20*	*-0.04*

Cells with italic letters indicate that differences between capital asset ratio and its desired levels are negatively and significantly correlated with REAL89.
*** shows 1%, **, 5%, and *, 10%, respectively.

Table 6-3 Year by year coefficients on capital "surplus" measures in equation (2),

49 regional banks

	CAPR		BIS		CAPRM	
	Lag	Cont.	Lag	Cont.	Lag	Cont.
1995	*0.1621*	*-0.6749*	-0.2922	-0.2455	*-0.8114*	-0.0337
	(0.0915)	*(-0.3031)*	(-0.9195)	(-0.8339)	*(-0.3439)*	(-0.1184)
1996	*-2.5731*	*-2.5974*	0.7310	0.7207	-0.0458	*2.1185*
	(-1.5277)	*(-1.6117)*	(0.9928)	(1.0064)	(-0.0805)	*(0.9973)*
1997	*0.0225*	*0.4083*	-1.0097	-1.2888	*1.3054*	*0.6393*
	(0.0131)	*(0.2411)*	(-1.2667)	(-1.1343)	*(0.4475)*	*(0.3245)*
1998	*-2.0769*	*-0.4420*	-0.0812	*-0.6356*	*3.1068*	*3.3247*
	(-0.8733)	*(-0.1902)*	(-0.0536)	*(-0.5107)*	*(1.0794)*	*(1.3225)*
1999	*-0.2707*	*0.2851*	*-1.4552*	*-0.9229*	*-2.0851*	*-1.8280*
	(-0.1489)	*(0.1840)*	*(-1.1961)*	*(-0.7752)*	*(-0.7870)*	*(-1.0362)*
2000	*-0.9411*	*-1.0996*	*-1.6663*	*-2.2968*	*1.4842*	*1.8562*
	(-0.7619)	*(-0.9032)*	*(-0.9661)*	*(-1.0212)*	*(0.4591)*	*(0.5975)*

48 regional2 banks

1995	*-38.5311*	*4.3710*	2.2894	*12.3331*	*21.1960*	*13.2450****
	(-1.0728)	*(0.4203)*	(0.1371)	*(1.1185)*	*(1.9583)*	*(2.8468)*
1996	*-3.0736*	*-4.0779*	*0.5869*	0.3933	*5.3946*	*-0.0331*
	(-0.2865)	*(-0.8806)*	*(0.0528)*	(0.0804)	*(0.8590)*	*(-0.0113)*
1997	*3.3991*	*1.2172*	-4.6955	*-1.9540*	*-0.4199*	*-0.5042*
	(0.4835)	*(0.3479)*	(-0.7170)	*(-0.8869)*	*(-0.1209)*	*(-0.2263)*
1998	*-5.676*	*-5.2666*	*-3.3330*	*-3.1767*	*-3.4592*	*-3.6562**
	(-1.4180)	*(-1.5670)*	*(-1.1796)*	*(-1.4327)*	*(-1.1991)*	*(-1.7296)*
1999	*4.7804*	*7.3340*	*3.7713**	*2.2327*	*2.9268*	*-1.4592*
	(1.5025)	*(1.5343)*	*(1.7037)*	*(1.0815)*	*(1.3570)*	*(-0.6344)*
2000	*0.9382*	*1.3179*	*-2.2931*	*-1.0678*	*0.2544*	*0.7344*
	(0.3245)	*(0.7664)*	*(-1.7638)*	*(-1.0986)*	*(0.1881)*	*(0.5385)*

Cells with italic letters indicate that differences between capital asset ratio and its desired levels are negatively and significantly correlated with REAL89. *** shows 1%, **, 5%, and *, 10%, respectively