Structural Disposal and Cyclical Adjustment

Non-performing Loans, Structural Transition, and Regulatory Reform in Japan, 1997–2011[*]

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Abstract

Japan experienced falling asset prices, implemented financial market reforms, and was forced to reduce non-performing loans from the late 1990s to the mid-2000s. As the market reform prompted the corporate sector to replace bank borrowing with bond flotation and hence the banking business shrank, a rapid reduction of non-performing loans required a massive write-off of standing loans. We examine whether it was appropriate for the regulatory authority to guide the banking sector to aggressively write off non-performing loans in the early 2000s or to wait for cyclical recovery, along with the structural reform. We show that non-performing loans could have been cyclically reduced only by a further extension of mortgage loans, since the deregulated corporate sector scaled back its reliance on banking. Although a further deregulation of mortgage markets might have enable cyclical reduction in non-performing loans, structural non-performing loan disposal is justifiable if another housing market bubble was to be avoided.

Key words: non-performing loan; regulatory reform; mortgage loan; Japan.
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Introduction

Drastic deregulation of the financial market began in the United Kingdom and the United States in the 1980s, to be followed by Japan and continental Europe. These reforms visibly expanded and augmented the functioning of the financial industry (Abiad and Mody (2005)). Strict regulations in developed countries were largely a response to the drastic failure of the financial market in the 1930s. While these regulations were widely diverse—ranging from strengthened transparency in the United States to entry regulations in Japan—they shared the aim of containing the moral hazard of market participants and avoiding another Great Depression. Half-a-century later, as deregulation expanded and memories abated, deregulation was implemented literally as *de*-regulation, that is, with no device to curb the moral hazard of market participants, for example, through enhanced ex-post inspection, to complement the relaxed entry restrictions. In particular, the commercial banking sector continued to enjoy state protection, mainly to prevent destabilization of the real economy and to protect ordinary households in possible financial turmoils, although its businesses were widely deregulated. Naturally, countries implementing deregulation, including the United States, Japan and continental Europe,, experienced asset or housing bubbles, often worsened by the deregulated banking sector; these bubbles burst in the United States in the early 1980s, in Japan in the early 1990s, and in Europe from the late 2000s. Japan experienced a world-record in non-performing loans after the bubble burst only until being surpassed by the European financial crises from the late 2000s. Because of its own size and similarity to the European experience, the Japanese experience, of strengthened regulations and reduction in non-performing loans in particular, should have some lessons.

In 1996, the Japanese administration under premier Ryutaro Hashimoto recognized the necessity of a thorough structural reform toward an even greater deregulation of market entry with an empowered and independent monitoring authority. The structural reform planned by the Hashimoto administration included the removal of entry restrictions, separation of inspection authority from the Ministry of Finance to the newly established Financial Supervisory Agency (or FSA, later the Financial Services Agency), and allowing for the liquidation of failing banks, even if they were "too big to fail" by the pre-reform standard, under transparent and strict control by the agency. Further, the reform intended to transform Japanese corporate financing from domination by the banking sector to a tilt towards bond issuance. In other words, the major banks that were heavily regulated and protected by the government and the primary lenders to the competitive manufacturing industry were expected to have a reduced role in corporate financing.

Meanwhile, as this structural reform was being implemented, the non-performing loans of the major banks as well as regional banks kept piling up. The reforms meant to reduce the role of banks in corporate financing worsened the nation's non-performing loan ratio, that is, the number of non-performing loans as a proportion to total lending. The newly established independent authority then imposed explicit measures to reduce non-performing loans. This was largely a race between the major banks' declining role in corporate financing and the surge in non-performing loans, which reached its peak at the beginning of this century. The Financial Services Agency set a bold and ambitious target for reducing the non-performing loans of the major banks; this virtually implied the massive loan write-offs from 2002 to 2004.

The agency also recognized the critical role of regional banks in the corporate financing to small- and medium-sized companies in local economies and working of the relational banking (Uchida, Udell and Watanabe (2008) and Kano, Uchida, Udell and Watanabe (2011)). Thus, the agency set modest targets for regional banks, allowing them to continue with relational banking and lend to players in the local real economies.

This experience—the simultaneous progress in the reduction of piled-up non-performing loans and the structural reform for free and direct corporate financing, and preserving the key role of the relational banking network of regional banks in sustaining local economies and supporting small startups—is exactly the challenge that continental Europe has been facing since 2008 and probably now China is now facing in the mid-2010s. We believe that a detailed documentation and inquiry of the Japanese the experience will help enhance the performance of European and Chinese regulators. In fact, even Japanese practitioners and scholars have not yet achieved a consensus on their own experience. For instance, the current commissioner of the Financial Services Agency, Nobuchika Mori, appointed in July, 2015, casts reflective and skeptical eyes on the side effects of strengthened regulations and non-performing loan reduction implemented by the Financial Services Agency in the past two decades. He even warns European regulators not to be too much stringent when addressing the European banking system.[1]

It is rash to evaluate overall regulatory reforms in Japan from the late 1900s. Thus, we focus on a more narrowly defined issue. The most stringent policy implemented by the Financial Services Agency was on reduction in non-performing loans in the early 2000s. For policy implications, we ask whether the Financial Services Agency was too much stringent to force the major banks to write off non-performing loans or not. In other words, we examine whether non-performing loans could have been cyclically reduced or the stringent implementation of writing-off was inevitable during the structural reforms of the entire financial sector. Our conclusion is against Mr. Mori for this issue. The first option was not feasible as long as Japan should avoid another housing market bubble. Stringent implementation of non-performing reduction by the Financial Services Agency was correct and was unavoidable. A shrink of the banking sector in the last two decades was due to transformation of corporate finance along with deregulation of bond markets, not because of too much stringent policy by the Financial Services Agency.

Before going into detail, we briefly summarize the history of the Japanese financial sector.[2] In the late nineteenth century, modern firms of the growing industrial sectors had high demand for capital in the new financial markets, for this they directly relied on share and bond issuance. The banking sector played an important role in share and bond investment. Investors borrowed from banks by collateralizing the shares and bonds they held, and the borrowed money was further invested in securities. These securities were then again collateralized by the investors for their next round of investment. Thus, the banking sector performed a large role for a highly leveraged investment. With its role in the reverse side of buoyant corporate financing in the securities markets, corporate financing heavily depended on the securities markets in

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[1]Nobuchika Mori, "Too much 'medicine' could make the finance system sicker," *Financial Times*, December 14, 2015.

[2]For details of the wartime origin of the regulated banking sector, see Okazaki (1999) and Hoshi and Kashyap (2001), pp. 1–14.

the obverse side. Meanwhile, large conglomerates such as Mitsubishi and Mitusi maintained closed internal capital markets until the 1920s and most of the important companies were not listed. In the 1930s, these conglomerates switched to switch to public markets, thus allowing the securities markets to grow further. The expansion of the securities markets and the financial sector supporting the expansion were largely based on the nineteenth-century-style permissive regulations.

The transition to heavy regulations took place in two steps, one following the financial crisis of 1927, and the other following the Great Depression from 1929. The Bank Act, Act No. 21 of 1927, gave greater authority to the Ministry of Finance to affect prompt consolidation of unstable local banks (Okazaki and Sawada (2007)). In this phase, corporate financing was not severely affected. The stock and bond markets were largely free. Bond issuance regulations that required bonds to be collateralized were introduced in 1933 in order to protect investors. Direct corporate financing was still buoyant, and, with the support of the consolidated banking sector, the Japanese stock market recovered as early as in 1932. Capitalization of the Tokyo Stock Exchange reached more than 120 percent of the nation's gross national product, a record high.[3]

The full-fledged invasion of China in 1937 totally changed Japan's regulatory framework. The Cabinet Planning Agency, a version of planning agency of the Soviet Union, was put into place. The National General Mobilization Act, Act No. 55 of 1938, copied from an established Nazi equivalent, gave the state the authority to mobilize all necessary physical and human assets for war effort. By this act, property rights were severely curtailed and the stock and bond markets ceased to work, and, consequently, a heavily regulated banking sector took the central role in corporate financing. While the government intended to follow the command economy of the Soviet Union, the manufacturing sector remained private. The administration imposed an artificially low savings account interest rate for all banks. Banks that collected savings at this nationally regulated interest rate channelized them to the manufacturing industries designated strategically important by the planning agency. Since direct financing was suppressed, the manufacturing sector had no other choice but to follow the orders of the government that controlled the banking sector. Furthermore, a specific bank was assigned to each firm as primary channel. The allocation of savings to each bank was coordinated by the Financial Control Association composed of all banks and led by the Industrial Bank of Japan. Thus, war effort strengthened the system of relational banking between major banks and the manufacturing companies.[4]

This system continued as an important part of the Japanese economy even after the war ended. Indirect financing became the most effective finance system in the growth decades of the 1950s and 1960s, as it attracted public money and supplied funds to the nation's capital-starved sectors. This process was accompanied by strict state regulation of the capital market. Bond issuance was restricted and bank deposit interest rates were still regulated and kept low. The legacy of this heavy regulation and protection was not negligible. Data from even the 1970s indicate significant herd behavior of Japanese bank lending (Uchida and Nakagawa (2007)). Regulated herd behavior, rather than arbitrage, became the business norm of the

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[3]See Hoshi and Kashyap (2001), p.39.
[4]See Okazaki (1999).

Japanese banking sector under heavy regulation after 1938.

However, the expansion of government debt from the 1970s affected this regulated capital market, because the government itself wanted resumption of the bond market and absorption of its own sovereign bonds. Thus, the government began deregulation by the end of the 1970s, and restrictions on corporate bond issuance were slowly relaxed and international capital flows liberalized in the 1980s.[5] The deregulation of Japan's bond issuance allowed major corporations to change their financial strategy from bank borrowing to bond issuance, thus severely affecting the banking sector. Banking regulations were also loosened in the early 1980s, forcing banks to find new saving outlets, such as financing investment in assets, which finally led to the asset price bubble in the late 1980s. The burst of this bubble in the early 1990s created a large pile of non-performing loans. It was in this context that the Financial Supervisory Agency was born in 1998.

The first section of this paper briefly gives the history of the Financial Supervisory Agency and Financial Services Agency, FSA, showing that the Program for Financial Revival helped reduce the non-performing loans of major banks between 2002 and 2005. In section 2, we review how the non-performing loans of Japanese banks evolved and how domestic corporations shifted to issuance of offshore securities. In section 3, we attempt a quantitative analysis of the Japanese banking sector's activities in 1997–2011 based on the panel dataset we originally created. We first show benchmark results following Louzis, Vouldis and Metaxas (2012), and then investigate factors that affected growth in non-performing loans in the sample period. Losing lending to the non-financial corporate sector to the bond market, there were two possible destinations of huge savings with the banking sector; purchasing the Japanese Government Bonds or increasing housing mortgage loans. Our results show that the former did not help banks reduce non-performing loans while the latter helped. In the final section, we discuss the estimation results in a broader context, such as shift of corporate financing, and suggest some policy implications based on our analysis. A natural focus based on our results in section 3 is whether the Japanese regulatory authority should have encouraged expansion of mortgage loans or not. To discuss this point, Tajik, Aliakbari, Ghalia and Kaffash (2015) gives us a reasonable focal point. Time-series estimatios by our dataset warns that a further deregulation of the Japanese housing loan market could have resulted in another bubble of the housing market, collapse, and another pile of non-performing loans.

1 Fifteen years of the Financial Services Agency: a descriptive retrospect

1.1 The transformation of regulations, 1998–2000

As concise accounts of Japan's financial deregulations in the 1990s have been given by Hoshi and Kashyap (2001), we now discuss only the regulatory transitions that occurred from the 1990s to the 2000s. In 1998, the Financial Supervisory Agency, which later became the Financial Services Agency in 2000, was formed under the Prime Minister's Office, which was

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[5]See Hoshi and Kashyap (2001), pp. 219–220, 229.

later expanded to the Cabinet Office.[6]

The establishment of a supervisory and inspectorial agency independent from the Ministry of Finance was an essential outcome of two reforms designed by the Hashimoto administration, the regulatory reform for financial markets, and administrative reform of the central government, both planned to be completed in 2001.

The regulatory reform of the financial markets, dubbed "Japan's Big Bang," aimed at a transparent financial market, where entry is free and securities issuance play a greater role in corporate financing. The deregulation on market entry is to be accompanied by stringent post-entry implementation of transparent rules.

Initially, the FSA's primary role was inspection and supervision of financial institutions operating in Japan—banks, securities corporations, and insurance corporations—inherited largely from the Ministry of Finance and partly from the Bank of Japan.[7] After the FSA was formed, a related superior organization, the Financial Reconstruction Commission, was founded in December 1998. This commission was practically meant to prevent a possible systemic crisis from the large number of non-performing loans left after the bubble burst through prompt corrective action such as ensuring soundness of the inspected institutions' financial positions and, if considered necessary, capital injection into institutions.[8]

One of the tasks assigned to the FSA in 1998 was inspection of major banks, 18 at that time. In early 1999, the major banks and the Financial Reconstruction Commission planned for a capital injection into banks, whereby the banks had to submit a plan for improving their business performance to the Commission.[9]

Two related acts came into force in October 1998. One was the Act on Emergency Measures for Revitalizing the Financial Functions, Act No. 132 of 1998, or the 1998 Financial Reconstruction Act, defining the procedures of handling poor-performing financial institutions including liquidation and containing the potentially destructive spillover effects on the financial system, such as how financial authorities should manage bankrupt institutions, how to establish bridge banks for clearing and follow-up financing, and how to temporarily nationalize failed banks. The other one was the Act on Emergency Measures for Early Strengthening of Financial Functions, Act 143 of 1998, or the 1998 Early Strengthening Act, aiming to solve the non-performing loan problem. Based on this act, the Resolution and Collection Corporation was established, designed to purchase the stocks of failed banks and to help in their reconstruction. As soon as these two acts came into force, two of Japan's long-term credit banks, partially state-owned and the vehicles of industrial policies, were temporarily nationalized and liquidated in 1998 under the scheme.[10]

In 1999, 18 banks, including some major banks, requested for injection of public funds and this was accepted by the Financial Reconstruction Commission. These banks had to submit "follow-up" documents describing how they would reconstruct their business pursuant to the scheme of the 1998 Financial Reconstruction Act. The Financial Inspections Manual, giving

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[6]See Financial Supervisory Agency (2000), p. 1.

[7]A consolidated regulatory agency to take over supervision from the central bank was proposed in the United Kingdom from 1997 as well as in other countries. See Ferran (2011).

[8]See www.fsa.go.jp/frc/newse/ne001.html: last accessed on February 24, 2014

[9]See Financial Supervisory Agency (1999), pp. 63–66, 131–135.

[10]See Financial Supervisory Agency (1999), pp. 70–74.

the measure that the FSA inspectors must take, was also publicly announced.

In July 2000, the Financial Supervisory Agency merged with the Financial Planning Bureau of the Ministry of Finance, to become the Financial Services Agency. The FSA operated under the Financial Reconstruction Commission until the beginning of 2001, when the administrative reform was completed and the FSA came directly under the Cabinet Office.[11]

The policy packages issued by the administration in 2001 showed that the piled up non-performing loans continued to be their biggest concern, and the FSA was supposed to take up its responsibility. Under the reform-oriented administration of Junichiro Koizumi, the FSA was to take up the "integrated resolution of the problems of the non-performing loans of banks and excessive debt of corporations" through "drastic removal of non-performing loans from the banks' balance sheets,"[12] prompting the removal of non-performing loans from balance sheets through write-offs through debt forgiveness, bankruptcies or debt liquidation.[13] In practice, "the major banks" were supposed to "take measures to remove the non-performing loans already classified as 'in danger of bankruptcy' and below from the banks' balance sheets within the next two fiscal years. They will also take measures to remove non-performing loans newly classified as such within the next three fiscal years."[14]

1.2 Structural reform and program for non-performing loan reduction

In 2001, the Cabinet Office released the first annual basic policies for economic and fiscal management and structural reform. The 2001 version declared that the problem of non-performing loans must be solved "within two or three years."[15] The basic policy was elaborated into detailed procedures in October 2001, which stated that the financial institutions' loan evaluation and allowances were to keep up with the rapidly deteriorating conditions in the financial market: this implied that the FSA was going to carry out special inspections of major Japanese banks.[16] In addition to the 2001 basic policies, the administration published its "structural reform and medium-term economic and fiscal perspectives" in January 2002. According to the plan for fiscal years 2002 to 2006, which described the first two years 2002 and 2003 as an "intensive adjustment period," the non-performing loan problem had to be drastically solved through "strong and comprehensive measures."[17]

The FSA published its "measures for developing a stronger financial system" in April 2002, but by then the FSA had already started its special inspection of major banks. While

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[11]The Financial Reconstruction Commission folded in 2001. See Financial Services Agency (2001), pp. 1, 213

[12]See www5.cao.go.jp/keizai1/2001/0406taisaku-e.html: last accessed on February 24, 2014.

[13]This process is called, in Japanese, "off-balance-sheet treatment" (or literally, "measures that 'lead to' the off-balance-sheet"), because non-performing loans are "removed" from the balance sheets of institutions. In a sense, this is an enhanced usage of the idiom "off-balance-sheet exchange"—usually used in the context of strategic asset management. The administration's English documents usually avoid this misleading expression and instead use words such as "removal from the balance sheets."

[14]Financial Services Agency (2001), p. 321.

[15]See Financial Services Agency (2002), p. 75.

[16]See www.fsa.go.jp/news/newsj/13/kinyu/f-20011026-3.pdf: last accessed on February 24, 2014 and Financial Services Agency (2002), p. 77.

[17]See www.kantei.go.jp/foreign/policy/2002/0118tenbou_e.html: last accessed on February 24, 2014

the results were published, the financial institutions were "further requested to take specific measures to dispose, in principle, one half of such loans within a year and a major part (approximately 80 percent) of them within two years as concrete targets." Furthermore, it was also explicitly mentioned that the FSA was to particularly consider the importance of relational banking in the local economies sustained by the regional banks when prompting the regional banks to reduce their non-performing loans. The intensity of policy implementation was intended to be more modest for the regional banks.

In 2001, 56 financial institutions went bankrupt.[18] While most of them were small regional institutions, the series of bankruptcies convinced the administration to move more urgently. Meanwhile, major banks began to merge as part of consolidation of the entire sector. About a dozen major banks operated by the end of the last century, but they consolidated into three. The Mizuho Bank consisted of Dai-ichi Kangyo Bank, Fuji Bank, and the Industrial Bank of Japan; the Sumitomo Mitsui Banking Corporation consisted of Sakura Bank and Sumitomo Bank, later to become Sumitomo Mitsui Financial Group; the UFJ Bank consisted of Sanwa Bank, Tokai Bank, and Toyo Trust and Banking; and Mitsubishi Tokyo Financial Group consisted of the Bank of Tokyo-Mitsubishi, Mitsubishi Trust and Banking, Nippon Trust Bank and Tokyo Trust Bank.[19] The UFJ and the Mitsubishi Tokyo Financial Group later merged into the Bank of Tokyo-Mitsubishi UFJ.

In October 2002, the FSA announced its "program for financial revival,[20] stating that (a) The FSA would set up a task force on financial issues and take the initiative to resolve the problem of non-performing loans with appropriate measures, the last resort being financing from the Bank of Japan; (b) the FSA would also require financial institutions facing serious problems to undergo "managerial reform," and its task force will "strictly check [their] business plan"; (c) they would establish a new public funding scheme; and (d) the loan problems of small- and medium-sized enterprises would be dealt with through special measures. Thee Act on Special Measures for Strengthening Financial Functions, Act No. 128 of 2004, defined a new scheme for the inspection of public capital to financial institutions: this was to induce them to conduct business more efficiently and support regional banks to maintain relational banking in local economies. Under this scheme, financial institutions could obtain capital injection through the Deposit Insurance Corporation of Japan, which would purchase shares from banks if the business reconstruction plan they submitted to the FSA was considered feasible. In the business reconstruction plan, banks were required to describe their business efficiency improvement commitment, how they intended to achieve it, and how they would contribute to revamp the local economy.[21] Thus, while the numerical target of reducing non-performing loans was planned to be strictly applied for the major banks, the regional banks were differently handled to avoid thje possible destruction of relational banking in local economies.

In November 2002, the FSA released a work schedule with more details and deadlines, and

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[18]See www.fsa.go.jp/frtc/kenkyu/event/20080404-1/05e.pdf: last accessed on February 24, 2014.

[19]Financial Services Agency (2001), p. 109.

[20]See www.fsa.go.jp/news/newse/e20021030.pdf: last accessed on February 24, 2014; www.fsa.go.jp/kouhou/kouhou_03/026_1410_1.pdf: last accessed on February 24, 2014; and www.fsa.go.jp/gaiyou/gaiyouj/daijin004/20021101-1.html: last accessed on February 24, 2014.

[21]See Financial Services Agency (2004), pp. 24, 268.

by the end of 2002 issued its supervision guidelines. Thereafter, the FSA periodically reported the achievements of the program for financial revival until the end of fiscal year 2004, when the program was planned to be completed.

The non-performing loan ratio based on the 1998 Financial Reconstruction Act classification of major banks evolved as follows: 8.4 percent (March 2002), 8.1 percent (September 2002), 7.2 percent (March 2003), 6.5 percent (September 2003), 5.2 percent (March 2004), 4.7 percent (September 2004), and 2.9 percent (March 2005).[22] The FSA and the major banks achieved the target of reducing the major banks' non-performing loan ratio by about half, indicating that they rapidly and successfully improved their asset structure in less than three years. The "Structural reform and medium-term economic and fiscal perspectives: Fiscal Year 2004 revised version," a document issued at the end of January 2005, stated as follows: "With regard to structural reform, there has been a steady progress toward normalizing the problem of non-performing loans as exemplified by the steady decline in the major banks' non-performing loans ratio in accordance with the target of halving the ratio as set by the program for financial revival.[23]

Following the achievement the goal of reducing non-performing loans as planned in its 2002 program by 2005, the FSA changed its priority from emergency response to refinement of regulation measures.[24]

The 2008–2009 financial crisis was a major event for the FSA. The immense shock of the crisis to capital markets severely affected the macroeconomic situation, which was already affected by a slight increase in the non-performing loan ratio of banks in 2009. However, the level of non-performing loans never exceeded that of, for example, 2006,[25] suggesting that the FSA's regulatory reforms in the early 2000s provided banks with business discipline during the drastic changes in the world economy following by the financial crisis of the late 2000s. It was, nevertheless, reasonable to assume that some financial institutions should have difficulty in supplying capital to local industries and might require public financial support. In December 2008, the administration therefore decided to extend the Act on act Special Measures for Strengthening Financial Functions, which was planned to expire in 2008, revising it to enable more banks to use the scheme. The administration also prepared a supplementary budget to implement the program. Several financial institutions applied for this extended injection scheme.[26]

In this section, we first review the evolution of non-performing loans, where different categories of banks took different steps to reduce non-performing loans.[27]

[INSERT Figure 1 and Figure 2 HERE]

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[22]See Financial Services Agency (2005), p. 431 and Figure 1 below.

[23]See Financial Services Agency (2005), pp. 4-5, 83; www5.cao.go.jp/keizai2/2005/0121reform_and_perspectives.pdf: last accessed on February 24, 2014; and www.fsa.go.jp/newse/e2004/20041224.pdf: last accessed on February 24, 2014

[24]See www.fsa.go.jp/news/newse/e20041224.pdf: last accessed on February, 2004.

[25]See Financial Services Agency (2012), p. 667.

[26]See Financial Services Agency (2009), pp. 77, 112, 381, 600.

[27]See www.fsa.go.jp/en/regulated/npl/ for annualized summary information on non-performing loans: last accessed on February 24, 2014.

The transition in non-performing loans measured by the 1998 Financial Reconstruction Act classification is shown in Figures 1 and 2. The non-performing loans ratio in all bank categories increased in 2001 and early 2002, and then fell dramatically from mid-2002 to 2005; since then, it has been lower than the level at the end of the 1990s, except for in March 2009, following the late-2008 financial crisis shock to the Japanese economy. The increase in non-performing loans at the beginning of the 2000s reflects the (1) worsening macroeconomic condition and (2) stricter self-assessment pursuant to FSA inspection.[28] The sharp increase in non-performing loan ratio of long-term credit banks in September 2002 could be due to calculation technicality when counting non-performing loans of Mizuho Bank, newly created when the Industrial Bank of Japan, a long-term credit bank, merged with two city banks in April 2002. The downward slope corresponds to the program for financial revival. The regional banks reduced their non-performing loans in this period as well, although more slowly than the major banks did.

In the early 2000s, the banking sector as a whole was shrinking (See Figure 3), representing the nation's total credit excluding government bond purchases and non-performing loans. The reduction in non-performing loans was barely catching up with this trend. Then, the business cycle hit a trough, and thereafter Japanese economy enjoyed a modest but long upturn until 2007. However, the situation of major banks and regional banks were strikingly different. Figure 4 gives the same results as in Figure 3, but only for major banks, and Figure 5 deals with regional banks only.

[INSERT Figure 3, Figure 4, and Figure 5 HERE]

During the long expansion of the economy, regional banks increased their total credit, except for the purchase of government bonds as in Figure 5, indicating that relational banking networks were still in demand during the same period, as shown by Uchida et al. (2008). Meanwhile, the major banks' total credit rapidly decreased, except for the purchase of government bonds, and has not recovered since then as shown in Figure 4. The reason for this shrinkage includes the short-term effect of regulatory reforms, which were asymmetrically stringent on major banks, resulting in an asymmetric reduction in major bank lending (Imai and Takarabe (2011)). However, this short-term effect cannot explain any long-term tendency. The corporate sector in Japan's expanding economy in the 2000s did not rely on the major banks to finance their businesses, thus forcing the major banks to purchase government bonds as seen in Figure 6.

[INSERT Figure 6 HERE]

1.3 Transformation of corporate financing

The backdrop of the shrinking activities of major banks was the changes in corporate financing during the two decades. Anderson and Makhija (1999) and Hoshi and Kashyap (2001) showed that bank lending was largely replaced by bond issuance, particularly off-shore, from

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[28]Such was also the Cabinet Office's interpretation. See footnote 6 of www5.cao.go.jp/j-j/wp/wp-je01/wp-je01-00201.html.

the 1980s to the 1990s. This tendency never ceased, even after the 2000s. Although hit by the global financial crisis in 2007 and 2008, the corporate sector increased its off-shore stock and bond issuance as seen in Figure 7. In fact, making corporate financing dominated by direct financing and open to international markets was exactly the goal of the reforms pursued by the Hashimoto and Koizumi administrations. The corporate sector did not fail to take advantage of the reforms and to structurally transform itself. Following deregulation, businesses have left the banking sector that had been heavily regulated and protected by the state as a policy instrument since 1938—when the National Total Mobilization Act was enacted following the invasion of China and the preparations to attack the United States—until the deregulation of the 1990s.

[INSERT Figure 7 HERE]

2   Data, estimation strategy, and benchmark results

2.1   Data

We next examine the evolution and possible determinants of the evolution of non-performing loans (NPL) observed on the balance sheets of Japanese banks, such as return on equity (ROE), loan–deposit ratio (LON/DPS) and mortgage–loan ratio (MRG/LON), with controlling for the regionally and cyclically varied macroeconomic conditions, such as gross prefectural productand regional land prices, which potentially affect banking performance.

We created a panel dataset consisting of bank-specific variables, macroeconomic indices, and semi-macroeconomic indices spanning fiscal years 1997 to 2011, denoted by t. Most of the bank-specific annual series are taken from the dataset of Japanese Bankers Association (each year), adding a few other annual series from that of Japan Financial News (each year). The dataset of Japanese Bankers Association (each year) consists of the balance sheet data of city banks, (former) long-term credit banks, trust banks, regional banks I, regional banks II, and other banks.[29] For the cross-section ID number i, we used the Financial Institution Common Code defined by the Japan Bankers Association. In this ID system, when a merger or acquisition takes place, the new bank retains the number used by the surviving bank.[30] We thus assume that banks do not change their individual patterns of behavior after a merger or acquisition.

We now describe the bank classifications as mentioned above. City banks are major banks providing nation-wide services, although they have different patterns of regional branch networks. Long-term credit banks functioned under the direction of the government and issued bonds to supply long-term loans to various industries from the 1950s to the 1970s, but they ceased in the late 1990s. While regional banks I are members of the Regional Banks Association of Japan, regional banks II belong to the Second Association of Regional Banks.[31]

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[29]The other banks included in our panel data are Citibank Japan, Norinchukin Bank, and Seven Bank.

[30]Mizuho Bank, for example, inherited the Common Code 0001 from Dai-Ichi Kangyo Bank.

[31]Some of the former banks have their origins in the 1870s and were among Japan's first modern banks, while some of the latter have their origins in ROSCA-style local financial meetings. Most of the latter banks are usually smaller than the former ones, but not always.

As of April 2013, there are 5 city banks, 16 trust banks, 2 former long-term credit banks, 64 regional banks I, and 41 regional banks II.[32] For the macroeconomic indices to controll for regional and cyclical effects, we insert the gross prefectural product (GPP) reported by the Cabinet Office (each year), and residential land prices (LP)cited from the announcement of the Ministry of Land, Infrastructure, Transport and Tourism, Land Economy and Construction and Engineering Industry Bureau, (each year). The panel data include 1996 bank-year observations.[33]

We use the definition of "non-performing loans," following the 1998 Financial Reconstruction Act. Loans are classified into four categories under this system: (1) bankrupt or de facto bankrupt loans, (2) doubtful loans, (3) loans requiring special attention, and (4) normal loans. Bankrupt or de facto bankrupt loans are loams of "debtors who are legally and formally bankrupt, i.e., in the process of liquidation, reorganization, and rehabilitation, or virtually bankrupt with no prospects of resuscitation." Doubtful loans are loans of "debtors who have not gone bankrupt but are in financial difficulties, and thus whose lenders are unlikely to receive the principal and interest concerned on due dates." Loans requiring special attention are loans "whose interest and/or principal payments are in arrears by 3 months or more, and restructured assets with changes in terms and conditions." Normal loans are "all loans to debtors who have no particular problems with their financial conditions" and that are not classifiable under the first three non-performing loans.[34]

Besides the above classification, Japan has two other asset categorization systems in Japan, one is used for the risk management of loans, and the other for the banks' self-assessment of assets. The former is almost the same as the 1998 Financial Reconstruction Act classification but is based on a different law. Banks use the latter for the purpose of write-offs or provisions.[35]

2.2 Estimation strategy

Louzis et al. (2012) discussed the possible determinants of non-performing loans as issued by Greece's 9 largest banks in the 2000s, largely categorizing the determinants into two, the macroeconomic conditions and bank-specific elements. Louzis et al. (2012) used both categories of variables as regressors and estimated their impacts on changes in the non-performing loan ratio.[36] Louzis et al. (2012) suggested several arguments on the coefficient signs of esti-

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[32]Data on only four of the trust banks are used in the calculation of **Figures 1** and **2**.

[33]Land price series of residential district is LP1 in the dataset for on-line publication. See legend in the dataset file.

[34]See www.fsa.go.jp/news/newse/e20030207-1/r02.pdf: last accessed on February 24, 2014. In our dataset for on-line publication, individual series of all four categories of non-performing loans are included. We use series of summing up all four items as the series of non-performing loans, NPL. See legend of the dataset file.

[35]Depending on authors, different English words may be used to refer to the same non-performing loan classifications. One official translation (although provisional) can be found at: www.fsa.go.jp/news/newse/e20030207-1/r01.pdf: last accessed on February 24, 2014; www.fsa.go.jp/news/newse/e20030207-1/r02.pdf: last accessed on February 24, 2014; www.fsa.go.jp/news/newse/e20030207-1/r03.pdf: last accessed on February 24, 2014; and www.fsa.go.jp/news/newse/e20030207-1/r04.pdf.

[36]They also estimated the different types of non-performing loans, that is, consumer loans, mortgage loans, and business loans. Such detailed information is not available for Japanese banks, and so we had to use the data

mation models. According to them, we can reasonably assume that GDP growth has a negative impact on the non-performing loan ratio, because "excessive" lending in boom periods, even to low-quality debtors, tends to prove to be excessive and result in increase of non-performing loans after a recession. Meanwhile, ROEs may affect the non-performing loans negatively, since ROE, as an index of past performance, may be negatively associated with increases in future non-performing loans. Their view suggests baseline controls.

Our dependent variable is the non-performing loan ratio, $\mathrm{NPL}_{i,t}$ of bank i at the end of fiscal year t, as a percentage, based on the definition of "non-performing loan" as per the 1998 Financial Restoration Act classification.[37] By dividing this sum by the total loan amount, we obtain our dependent variable. For estimation, we use the first difference of the non-performing loan ratio ($\Delta\mathrm{NPL}_{i,t}$) because we cannot reject the hypothesis of the level series having individual unit roots.[38]

We control for two series of semi-macroeconomic determinants as proxies of cyclical and regional effects: gross prefectural product, $\mathrm{GPP}_{i,j,t}$, and land prices in residential areas, $\mathrm{LP}_{i,j,t}$, if the central branch of bank i is located at prefecture j in year t. These are assumed to be proxies of regional economic conditions cyclically changing. For bank-specific variables, besides the lagged values of the dependent variable, we also control for the ROE of the banks, $\mathrm{ROE}_{i,t}$, which is assumed to indicate bank performance and thus affect $\mathrm{NPL}_{i,t}$ negatively, as high performance leads to a rapid reduction of non-performing loans.

As we have seen, the progress of non-performing loan reduction in Japan is seen to move with the overall decrease in lending to the non-financial business sectors. If the banks did not reduce their own business volumes overall, theyhad in practice two possibilities of channelizing this country's vast savings; financing the government through purchasing the Japanese government bonds (JGB), or investing in the housing market through housing mortgage lending. This shift in banking size and portfolios can be decomposed into the loan–deposit ratio ($\mathrm{LON}_{i,t}/\mathrm{DPS}_{i,t}$), Japanese government bond holding–deposit ratio ($\mathrm{JGB}_{i,t}/\mathrm{DPS}_{i,t}$), and the mortgage–loan ratio ($\mathrm{MRG}_{i,t}/\mathrm{LON}_{i,t}$), where $\mathrm{LON}_{i,t}$ denotes the total loan, $\mathrm{DPS}_{i,t}$ total deposit, $\mathrm{JGB}_{i,t}$ total Japanese government bond holding, and $\mathrm{MRG}_{i,t}$ total housing mortgage of bank i in year t.

The other possible determinants are as follows. (a) Management inefficiency, $\mathrm{INEF}_{i,t}$, is defined as the ratio of operating costs over operating income; its increase may raise the non-performing loan ratio. (b) Equity ratio, $\mathrm{EQR}_{i,t}$, is the ratio of owned capital over total assets, that is., the overall size of the balance sheet. Louzis et al. (2012) suggested that a decrease in equity ratio may lead to the moral hazard problem of bank managers, because thinly capitalized banks tend to make more-than-optimal risky investment to maximize man-

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of non-performing loans for all types of debtors.

[37]We sum up the loans categorized as "bankrupt or de facto bankrupt ("bankrupt or quasi-bankrupt" in the other translation), "doubtful," and "requiring special attention" (or "needs attention" or "substandard"), of which "bankrupt or de facto bankrupt" is the most risky category.

[38]The results of the unit root test (individual intercept) are as follows. For $\mathrm{NPL}_{i,t}$, the augmented Dickey–Fuller Fisher χ^2 statistic is 348.105 with $p = 0.0035$, and the Phillips–Perron Fisher χ^2 statistic is 289.308 with $p = 0.3383$ (the optimal lag length based on Schwarz Information Criteria is 0 to 2). For $\Delta\mathrm{NPL}_{i,t}$, the augmented Dickey–Fuller Fisher χ^2 statistic is 801.567 and the Phillips–Perron Fisher χ^2 statistic is 863.036, both with $p = 0.0000$ (the optimal lag length based on Schwarz Information Criteria is 0 to 1).

agers salaries that are lower bounded, as originally suggested by Jensen and Meckling (1978), thus increasing non-performing loans. In addition, we introduce dummy variables for time or cross-section fixed effects. We thus define the basic form of our model as follows:

(1)
$$\begin{aligned} \Delta \mathrm{NPL}_{i,t} = {} & \alpha_0 + \alpha_1 \Delta \mathrm{NPL}_{i,t-1} + \alpha_2 \Delta \mathrm{ROE}_{i,t} + \alpha_3 \Delta \mathrm{ROE}_{i,t-1} \\ & + \alpha_4 \mathrm{GPP}_{i,j,t} + \alpha_5 \mathrm{LP}_{i,j,t} + \boldsymbol{\beta} \Delta \boldsymbol{x}_{i,t} \\ & + \sum_{\tau=1}^{T} \gamma_{1,\tau} \mathrm{FIX}_{t,\tau} + \sum_{i=1}^{N} \gamma_{2,i} \mathrm{FIX}_i + \varepsilon_{i,t}, \\ & i = 1, \dots, N;\, j = 1, \cdots, 47;\, t = 1, \dots, T, \end{aligned}$$

where $\boldsymbol{x}_{i,t}$ denotes the bank-specific variable vector whose elements are $(\mathrm{LON/DPS})_{i,t}$, $(\mathrm{JGB/DPS})_{i,t}$, $(\mathrm{MRG/LON})_{i,t}$, $\mathrm{INEF}_{i,t}$, and $\mathrm{EQR}_{i,t}$; $\mathrm{FIX}_{t,\tau}$ $(t = 1, \dots, T)$ stands for the time fixed-effect dummy variables equal to 1 if $t = \tau$ and 0 otherwise; and FIX_i $(i = 1, \dots, N)$ are the cross-section fixed-effect dummy variables.

2.3 Benchmark results

As a benchmark, specifications 1–1 and 1–2 in Table 1 regress the growth in non-performing loans ($\Delta \mathrm{NPL}_{i,t}$) to its own first-order lag, the growth in ROE ($\Delta \mathrm{ROE}_{i,t}$), and the first-order lag in the growth in ROE. To control for regional and cyclical shocks, the gross prefectural product ($\mathrm{GPP}_{i,j,t}$) and land prices ($\mathrm{LP}_{i,j,t}$) of prefecture j where the central branch of bank i is located in year t are inserted as regressors. With period-fixed effect, specification 1–1 shows that variances in profitability affected the reduction in non-performing loans. With fixed cross-sectional effect, specification 1–2 shows that this tendency robust.[39]

Cyclical effects might be captured by stock price indices as well as the gross prefectural product. Specification 1-3 includes the average stock price indices of all companies listed on the Tokyo Stock Exchange in December each year as a regressor (TPX_t).[40] Specification 1-3 also includes the yield spread of Japanese government bonds over the US treasury bonds, which was then called "Japan premium" (JPN_t). Note that in the early 2000s, Japanese banks were recognized as riskier destinations, rather than safer ones. Then we see that the gross

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[39]We compared the fixed effect and Wu–Hausman random effect estimates in specification 1–2. In the former, the cross-sectional F statistic is 1.7405, with degrees of freedom $143, 1208$ and $p = 0.0000$, indicating that we can reject the hypothesis that the fixed effect specification is inappropriate. The latter, on the other hand, yields a cross-sectional random χ^2 statistic of 131.185521, with degrees of freedom of 5 and $p = 0.0000$, implying that we can reject the hypothesis that the random effect is appropriate. These results justify our cross-section fixed-effect specifications. We tried other definitions of the cross-section identification number i to test the effect of bank mergers and acquisitions. In Tables 1 and 2, banks established through mergers or acquisitions retain the number used by the surviving banks. In our trial definitions, we assigned new IDs to the banks created after mergers and acquisitions. We created two trial versions, one reflecting only major mergers, and the other giving information on minor mergers. We tested the same estimation specifications with these two ID systems. Neither version yielded significant results, suggesting that banks may not have changed their individual business policies after mergers.

[40]The series are calculated by the Tokyo Stock Exchange and called TOPIX, available at http://www.tse.or. jp/market/topix/data/index.html: last accessed on March 24, 2014.

prefectural product ($\text{GPP}_{i,j,t}$) is insignificant, indicating that the gross prefectural product ($\text{GPP}_{i,j,t}$) and the stock prices (TPX_t) are cyclically correlated.

Hereafter, we use the gross prefectural product ($\text{GPP}_{i,j,t}$) to control for business cycles instead of stock prices, because the former can control for regional differences in business cycles. A positive coefficient of "Japan premium" (JPN_t) indicates that an increase in international borrowing costs might have increased non-performing loans. However, because the causality between number of non-performing loans and "Japan premium" is not obvious, we do not consider this variable in the following estimations.

[INSERT Table 1 HERE]

Fixed effect specifications 1–4, 1–5, and 1–6 in Table 1 include the banks' equity ratio over total asset ($\text{EQR}_{i,t}$) and the operating costs ratio over revenue ($\text{INEF}_{i,t}$), which captures degree of management inefficiency. As asserted in Louzis et al. (2012), the equity ratio is sometimes linked to the "moral hazard hypothesis," which predicts that the lower the equity ratio, the weaker is the shareholders' monitoring of managements, resulting in a more-than-optimal leverage and, eventually, larger non-performing loans.

However, this link may not be relevant for the major commercial banks operating under the strict requirement of certain equity ratios by national agencies following the Bank of International Settlement. Higher equity ratios were often the target of monitoring agencies trying to prevent insolvencies. Moreover, Japan's major banks were strictly required to meet the equity ratio targets set by the FSA. If these could not be met, state capital injection, and hence direct intervention by the authority, including replacement of the current management, was always an option. Thus, $\text{EQR}_{i,t}$ should be taken as a measure of banks' ability to meet the higher equity ratios required by the FSA, instead of the likelihood of the principal agent problem between shareholders and bank managers. Meanwhile, the running cost ratio over revenue ($\text{INEF}_{i,t}$) can be interpreted as a proxy for degree of management inefficiency. Since we ran fixed effect estimations, the degree of management inefficiency ($\text{INEF}_{i,t}$) is expected to capture the additionally increased inefficiency of the sample banks during the sample period, with time-invariant efficiency through the period being controlled for by fixed effect.

While an increase in bank equity ratio ($\text{EQR}_{i,t}$) significantly decreases the non-performing loan ratio in specifications 1–3 and 1–5, the degree of management inefficiency ($\text{INEF}_{i,t}$) does not have any significant impact when controlling for equity ratio ($\text{EQR}_{i,t}$). The banks' defensive efforts to cut their operating costs did not significantly reduce the level of non-performing loans. The issue was thus much larger than what improvement in daily routine could manage.

3 Alternative source of cyclical reduction

3.1 Mortgage loans matter

The benchmark results show that profit effectively reduced non-performing loans. Next, we decompose source of profit. Table 2 breaks down the growth of non-performing loans ($\varDelta\text{NPL}_{i,t}$) into several factors using cross-section fixed-effect specifications.

[INSERT Table 2 HERE]

Specification 2–1 shows that the growth in ratio of loans over deposits ($\Delta(\text{LON}_{i,t}/\text{DPS}_{i,t})$) increased the level of non-performing loans. From recent research, Japan's post-deregulation banking sector shows that depositors have disciplined the banks such that higher deposits imply stronger discipline, although this is not necessarily accompanied by higher profits (Uchida and Satake (2009)). Meanwhile, as established non-financial corporations have relied more on the bond market instead of the banking sector, an increase in loan-deposit ratio did not decrease, but increased, the level of non-performing loans.

Specifications 2–2 and 2–3 show that the ratio of mortgage loans over total loans ($\Delta(\text{MRG}_{i,t}/\text{LON}_{i,t})$) had a negative impact; that is, it reduced non-performing loans. As a robustness check, we inserted the equity ratio ($\text{EQR}_{i,t}$) and degree of management inefficiency ($\text{INEF}_{i,t}$) into specifications 2–4 and 2–5. The ratio of mortgage loans over total loans ($\Delta(\text{MRG}_{i,t}/\text{LON}_{i,t})$) still shows negative coefficients when controlling for equity ratio $\text{EQR}_{i,t}$, and the degree of management inefficiency $\text{INEF}_{i,t}$ does not show a significant impact when controlling for other factors. In short, the requirement of higher equity ratio might reduce non-performing loans, but the impact is dominated by the effect of increased mortgage loans. Furthermore, operational efficiency is not relevant to reduction in accumulated non-performing loans.

From Table 2, we know that a further extension of mortgage loans might have further reduced non-performing loans. Then, where was and is the frontier? Before the financial deregulation introduced in the 1980s, mortgage loans to households were almost monopolized by the Government Housing Loan Corporation, a state-owned institution. In that period, a custom was formed. In Japan, unlike in the United States, the income tax of employed workers are withheld at the source by employers, and and employers make the income tax payments to the National Tax Agency on behalf of their employees. Under this procedure, the employers issue a certificate of income and deducted income tax through the previous year in January to every employee. Thus, financial institutions can confirm an applicant's employment income just by checking the certificate of income and deducted income tax. The Government Housing Loan Corporation used the certificate of income and deducted income tax as the primary screening device when lending against mortgages. This custom was taken up by banks after they entered the mortgage loan markets. Even now, in the mid-2010s, a difference exists between employed applicants and self-employed applicants with regard to access to mortgage loans.

Thus, if there is a frontier in the mortgage loan market, it is for self-employed applicants. Table 3 shows the ratio of employed workers over self-employed workers ($\text{EMP}_{i,k,t}$) in region k where the central branch of bank i is located in year t and the interaction term between the mortgage loan ratio and ratio of self-employed workers over employed workers ($\Delta(\text{MRG}_{i,t}/\text{LON}_{i,t}) \times \Delta(1/\text{EMP}_{i,k,t})$) as regressors of the growth in non-performing loans ($\Delta\text{NPL}_{i,t}$); the ratio of employed workers over self-employed workers ($\text{EMP}_{i,k,t}$) is calculated per region as a unit.[41]

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[41]The data are available from the Statistics Bureau, Ministry of Internal Affairs and Communications, http://www.stat.go.jp/data/roudou/longtime/03roudou.htm: last accessed on March 27, 2014. The 47 prefectures are bundled into 9 regions. The Hokkaido region includes the Hokkaido prefecture; the Tohoku region includes the Aomori, Iwate, Akita, Miyagi, Yamagata, and Fukushima prefectures; the Minami Kanto region

[INSERT Table 3 HERE]

Not surprisingly, the employed worker ratio ($\mathrm{EMP}_{i,k,t}$) shows a significantly positive impact on the growth in non-performing loans in all specifications from 3–1 to 3–6. The ratio is higher in metropolitan regions where the major firms and government offices are located; note that the metropolitan regions were the most severely affected by the collapse of real estate markets. Now, we focus on the interaction term between the mortgage loan ratio and the self-employed worker ratio ($\Delta(\mathrm{MRG}_{i,t}/\mathrm{LON}_{i,t}) \times \Delta(1/\mathrm{EMP}_{i,k,t})$), which has a negative coefficient of a large absolute value in specifications from 3–3 to 3–6. Thus, if a bank could increase its mortgage loan in a region where self-employed people relatively increased, it could contribute much to the reduction of non-performing loans. Roughly, an extension of mortgage loans in rural markets was a frontier that led to non-performing loan reduction.

3.2 Robustness check

With regard to the results in Tables 2 and 3, we might not be able to exclude the possibility of endogeneity when a bank determines its volume of mortgage loans. Specifications 4–1 and 4–2 in Table 4 show a robustness check for specifications 2–3 and 2–4 by panel generalized method of moments. Specification 4–1 appears to indicate that the negative impact of an increase in mortgage loan on non-performing loans might not be robust. However, once we control for the ratio of employed/self-employed ratio ($\mathrm{EMP}_{i,k,t}$), which captures the long-lasting structure of each regional economy and hence whose error term seems to be hardly correlated with the first difference of banks' annual performance every year, as instrument variables in specifications 4–3 and 4–4, the negative impact of mortgage loan on the volume of non-performing loans is quite significant. Therefore, we may conclude that an increase in mortgage loan effectively reduced non-performing loans after controlling for the different structures of regional economies.

[INSERT Table 4 HERE]

3.3 Cyclical effects on mortgage markets, housing markets, and non-performing loans

Estimates in Table 3 sample period 2000 to 2011, which includes both expansionary phase up to 2007 and contractionary phase from 2008 due to the financial crisis. In Table 5, we separate the sample period before and after the financial crisis. Specifications 5–1 and 5–2 apply specification 3–5 in Table 3 to period 2000–2007 and to period 2008–2011, respectively.

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includes the Chiba, Siatama, Tokyo, and Kanagawa prefectures; the Kita Kanto and Koshin region includes the Ibaraki, Tochigi, Gunma, Yamanashi and Nagano prefectures; the Hokuriku region includes the Niigata, Toyama, Ishikawa, and Fukui prefectures; the Tokai region includes Shizuoka, Aichi, Gifu and Mie prefectures; the Kinki region includes Shiga, Kyoto, Wakayama, Osaka and Hyogo prefectures; the Chugoku and Shikoku region includes Shimane, Tottori, Yamaguchi, Okayama, Hiroshima, Kagawa, Ehime, Tokushima and Kochi prefectures; and the Kyushu and Okinawa region includes the Fukuoka, Saga, Nagasaki, Oita, Kumamoto, Miyazaki, Kagoshima and Okinawa prefectures.

Specifications 5–3 and 5–4 apply specification 3–6 to period 2000–2007 and to 2008–2011, respectively.

[INSERT Table 5 HERE]

Then we see that the reduction in non-performing loans driven by increase in mortgage loans is observed only in the expansionary period up to 2007 as shown in specifications 5–1 and 5–3. This result reminds us a caveat. In general, the banking sector with state's backdrop tends to take risk more than optimal. This conventional wisdom is theoretically supported (Kato and Tsuruga (2016)). Further, in case of the United States, where the deregulated banking sector did funnel funds to the housing market from the late 1990s, a striking observation is reported. In the early stage until the mid-2000s, the rise in housing price was accompanied by the reduction in non-performing loans, as we showed for the Japanese case. However, from the mid-2000s, the hike in the housing price was accompanied by piling non-performing loans (Tajik et al. (2015)).

Table 6 shows impact of increasing ratio of residential land price of the prefecture where the central branch of sample bank is located on growth in non-performing loans of the bank,

$$
(2) \quad \begin{aligned} \Delta\mathrm{NPL}_{i,t} = \beta_0 &+\beta_1\Delta\log(\mathrm{LP}_{i,j,t}) + \beta_2\Delta\log(\mathrm{LP}_{i,j,t-1}) + \beta_3\Delta\log(\mathrm{LP}_{i,j,t-2}) \\ &+\beta_4\Delta\log(\mathrm{LP}_{i,j,t-3}) + \beta_5\Delta\log(\mathrm{LP}_{i,j,t-4}) + \beta_6\Delta\log(\mathrm{LP}_{i,j,t-5}). \end{aligned}
$$

Since we do not control for potential impacts of other factors, these results are tentative. However, specification 6–2 cannot reject a possibility that a hike in real estate prices led to an increase, not decrease, in non-performing loans, as documented by Tajik et al. (2015) for the United States. While expansion of mortgage loans contributed to reduction in non-performing loans, overheat of the housing markets might have increased non-performing loans, we tentatively conclude. In reality, Japan did not have a credit boom up to 2007, as seen in Figure 4, and hence the latter concern did not materialize.

[INSERT Table 6 HERE]

Discussion

The question of whether the growth in non-performing loans is primarily due to cyclical factors or structural factors is always nontrivial. This question will decide whether financial regulatory policies should contain structural elements or not. The ratio of non-performing loans over total outstanding loans and the other stress-resilience indicators must be standardized, consistent, and transparent, and must not be discretionary in any manner. However, the exact threshold of "unhealthiness" depends on the somehow discretionary decisions of asset treatment made by the relevant authorities and its stringency inevitably depends on what factors the authorities believe have caused the accumulation of non-performing loans, that is, whether the factors are structural or cyclical.[42] If cyclical factors seem dominant, considering the diseconomy of

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[42]Here our discussion assumes that asset treatment by the authorities may be discretionary in one dimension regarding the degree of risk. In practice, evaluation of asset treatment is often multidimensional, and hence standardization of asset treatment between the authorities beyond national borders emerges as another critical issue. See Bholat, Lastra, Markose, Miglionico and Sen (2016).

financial distress, the authorities need to be as cautious as possible and set the threshold of the non-performing loan ratio higher; that is, they need to make it more relaxed. If structural factors such as past vested rent or drastic changes in the economy's driving-force industry seem dominant, the sooner the authorities intervene the better, even if the banks that had made structural mistakes have to be consolidated; that is, the authorities need to set the threshold of non-performing loans lower, making it, more stringent.

The accumulation of Japan's non-performing loans in the 1990s was more or less due to structural factors. The Japanese bond market deregulation prompted the manufacturing sector, the source of country's productivity growth, to move from indirect financing to direct financing, that is, typically bond flotation in the international market. The deregulation of the banking sector and enhanced competition eliminated the vested rents enjoyed by the banking sector.

The question that arises is whether these structural downward pressures could have been offset by structural upward pressures. Given its historical path, the Japanese banking sector essentially had two choices. First, it could return to the corporate financing of small- and medium-sized companies. The heavy regulations of wartime and postwar corporate financing enabled major banks to retain the business of their major manufacturing firm clients, which could have gone to the bond market. When they were released through bond market deregulation, the major banks could have found new business opportunities from firms that were earlier classified as less prioritized. While the major banks' total credit except for JGB purchases remained stagnant or even declined slightly over the last decade, the regional banks' credit gradually increased. Although financing smaller firms is indeed good business, the loan–deposit ratio of regional banks did not increase during in this period. Thus, the corporate financing market for smaller firms became saturated, and the entry of major banks, which had to pay higher salaries and had limited experience with smaller firms, was not be feasible.

Second, banks could find new business. If the banking sector could find another upward structural momentum, it could compensate for the downward momentum. As shown in Table 2, mortgage loans reduce non-performing loans, whereas non-mortgage loans increase non-performing loans. The redistribution of risky corporate financing to risky consumer financing, probably contributes to profits, but it does not imply the reduction of non-performing loans. Meanwhile, consumer mortgage loans serve as a powerful tool to reduce non-performing loans. In fact, the housing market was suggested as the last frontier after deregulation to "emulate" the British experience (Lomax (1994)). The estimation results shown in Tables 2 and 3 suggest that increases in personal housing mortgage loans could have helped to reduce non-performing loans by improving the profitability of the banking sector.

Although it was intensified in Japan as a result of its own historical path, the structural reduction of indirect corporate financing is not unique to Japan. The development of information and communication technologies has produced capital markets that are far more transparent and resilient than those of the 1920s, that is, before the Great Depression. Deregulation after the 1980s prompted the banking sector to find new profit sources as the non-financial corporate sector went back to the capital markets. The two greatest post-deregulation financial crises in the United States in the early 1980s and mid-2000s had their roots in mortgage loans. As long as they are carefully handled by the banking sector and the regulation authorities, mortgage loans will likely continue to be a profitable business alternative in matured indus-

trial economies with well-established and transparent capital markets. Japan was and is not an exception to this rule.

This does not mean that the mortgage loans can be a panacea for an excessively large banking sector. As shown in results in Tables 3 and 4, increase in housing mortgage loans were virtually the only one possibility to reduce non-performing loans in Japan's case. At the same time, the effect was observed only in the period up to 2007 as shown in Table 5, and in the period, growth in land price actually led an increase in non-performing loans as shown in Table 6. Occasions from 2000 to 200y are consistent with the view suggested by Tajik et al. (2015).

In reality, from 2002 to 2004, the Japanese regulatory authority implemented the stringent non-preforming loan reduction program for major banks. The implementation might be a factor that repressed credit growth in the 2000s observed particularly for major banks as shown in Figure 4. However, if the implementation made major banks less aggressive in lending, especially for housing mortgage, it likely contain another bubble and its burst, and hence was highly likely a correct decision, provided the experience in the United States.

After all, the structural reduction in corporate financing by banks to the manufacturing sector could not have been compensated by a structural increase in financing to another channel. Moreover, the estimation results in Table 2 show that holding government bonds did not help reduce non-performing loans. Thus, the 2002–2004 implementation of the structural non-performing loan disposal of the major banks was bound to happen at sometime during the last decade.

Massive bank consolidation was and may still be inevitable. If so, a lower threshold of non-performing loan ratio in a stricter investigation and evaluation of non-performing loans is justified even at the risk of structural reorganization of the banking sector. The strict measures taken by the FSA in 2002 to 2004, forcing banks to write off their non-performing loans as quickly as possible, was the best and wisest option.

The United States, Spain, and Ireland, whose financial markets had been structurally reformed, saw a rapid expansion of their deregulated mortgage loan markets, a boost in housing prices, and improved banking sector profitability in the mid-2000s. However, the result was another pile of non-performing loans. Unless a novel and innovative way to regulate the mortgage loan market is found, stringent mortgage loan regulation is advisable. Our tentative evaluation of the rapid 2002–2004 non-performing loan disposal is thus justified. Our view is more pessimistic than that put forward by Hoshi (2011), who argues that a more properly tailored regulatory reform could have avoided the stagnation in the major banks. We admit that our result is rather tentative and that further inquiry into the feasibility of such an optimistic alternative, with rigorous linkage with the real economy, is required.

We summarize our lessons from the Japanese experience as follows. First, the predominance of corporate finance by a heavily regulated and protected banking sector, like during the period of the Great Depression and the Second World War, inevitably would dissolve, and corporate financing for listed companies would naturally become overwhelmed by direct financing. Second, relational banking for small- and medium-sized companies, many of which are not listed and hence cannot access the bond market, is feasible even in a matured economy. Third, stringent monitoring and guidance during the down-sizing of major banks is appropriate, as was decisively implemented in Japan from 2002 and 2004, while the asym-

metrical treatment of regional banks providing relational banking to startups and small- and medium-sized companies is reasonable.

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Table 1 Trends of non-performing loan reduction.

	1–1		1–2		1–3		1–4		1–5		1–6	
Estimation method	panel least squares											
Dependent variable	$\Delta NPL_{i,t}$		$\Delta NPL_{i,t}$		$\Delta NPL_{i,t}$		$\Delta NPL_{i,t}$		$\Delta NPL_{i,t}$		$\Delta NPL_{i,t}$	
Cross-section	pooled		fixed		fixed		fixed		fixed		fixed	
Period (year)	fixed		pooled		pooled		pooled		pooled		pooled	
Independent variables	coefficient	t statistic	coefficient	t statistic	coefficient	t statistic	coefficient	t statistic	coefficient	t statistic	coefficient	t statistic
CONSTANT	-0.2310	-2.7382 ***	-2.4751	-3.3124 ***	-2.2754	-3.0590 ***	-1.8645	-2.8817 ***	-2.5810	-3.4505 ***	-2.0181	-3.1390 ***
$\Delta NPL_{i,t-1}$	-0.0529	-2.2743 **	-0.1071	-4.2174 ***	-0.1295	-5.1013 ***	-0.0622	-2.8183 ***	-0.1182	-4.6087 ***	-0.0720	-3.2518 ***
$\Delta ROE_{i,t}$	-0.0024	-2.8624 ***	-0.0032	-3.5310 ***	-0.0032	-3.4875 ***	-0.0011	-1.4115	-0.0031	-3.4394 ***	-0.0005	-0.6365
$\Delta ROE_{i,t-1}$	-0.0013	-1.9380 *	-0.0015	-2.2493 **	-0.0015	-2.2224 **	-0.0010	-1.6611 *	-0.0014	-2.1179 **	-0.0006	-1.0391
$GPP_{i,j,t}$	0.0000	-2.0316 **	0.0000	-2.1397 **	0.0000	-1.5828	0.0000	-2.1475 **	0.0000	-1.3906	0.0000	-1.3123
$LP_{i,j,t}$	0.0000	1.0394	0.0000	7.7005 ***	0.0000	4.2857 ***	0.0000	6.9096 ***	0.0000	6.5872 ***	0.0000	5.9389 ***
ΔTPX_t					-0.0009	-4.5935 ***						
JPN_t					0.2379	2.6693 ***						
$\Delta EQR_{i,t}$							-0.5862	-20.1895 ***			-0.6093	-20.0836 ***
$\Delta INEF_{i,t}$									0.0262	2.2298 **	0.0132	1.3006
cross-sections included	144		144		144		144		144		144	
periods included (years)	11 (2000–2010)		11 (2000–2010)		11 (2000–2010)		11 (2000–2010)		11 (2000–2010)		11 (2000–2010)	
included observations	1,357		1,357		1,357		1,357		1,357		1,357	
adjusted R^2	0.1209		0.0899		0.1125		0.3191		0.0402		0.2924	
Log likelihood	-2,808.4302		-2,761.0478		-2,742.9053		-2,563.6317		-2,558.4779		-2,363.2866	
F statistic	13.4309 ***		1.9053 ***		2.1455 ***		5.2652 ***		1.3638 ***		4.5626 ***	

Notes :   ***, **, and * respectively denote significance at 1, 5, and 10 percent levels.

Table 2 Factors of non-performing loan reduction.

Independent variables	2–1 coefficient	t statistic	2–2 coefficient	t statistic	2–3 coefficient	t statistic	2–4 coefficient	t statistic	2–5 coefficient	t statistic	2–6 coefficient	t statistic
Estimation method	panel least squares		panel least squares									
Dependent variable	$\Delta\,\mathrm{NPL}_{i,t}$		$\Delta\,\mathrm{NPL}_{i,t}$		$\Delta\,\mathrm{NPL}_{i,t}$		$\Delta\,\mathrm{NPL}_{i,t}$		$\Delta\,\mathrm{NPL}_{i,t}$		$\Delta\,\mathrm{NPL}_{i,t}$	
Cross-section	fixed		fixed		fixed		fixed		fixed		fixed	
Period (year)	pooled		pooled		pooled		pooled		pooled		pooled	
CONSTANT	-1.3851	-1.9637 **	-2.4421	-3.9042 ***	-2.2518	-3.6780 ***	-2.1487	-3.4376 ***	-1.9272	-3.1719 ***	-2.0344	-3.3757 ***
$\Delta\mathrm{NPL}_{i,t-1}$	-0.0796	-3.3552 ***	-0.0161	-0.7225	-0.0202	-0.9144	-0.0192	-0.8663	-0.0282	-1.3042	-0.0377	-1.7409 *
$\Delta\mathrm{ROE}_{i,t}$	-0.0038	-4.4731 ***	-0.0034	-4.3311 ***	-0.0036	-4.5635 ***	-0.0036	-4.5999 ***	-0.0021	-2.6713 ***	-0.0018	-2.2036 **
$\Delta\mathrm{ROE}_{i,t-1}$	-0.0018	-2.8048 ***	-0.0016	-2.6956 ***	-0.0016	-2.7872 ***	-0.0016	-2.8396 ***	-0.0013	-2.2804 **	-0.0010	-1.8903 *
$\mathrm{GPP}_{i,j,t}$	0.0000	-4.0771 ***	0.0000	-2.0108 **	0.0000	-2.4769 **	0.0000	-2.6248 ***	0.0000	-2.4245 **	0.0000	-1.6515 *
$\mathrm{LP}_{i,j,t}$	0.0000	8.8464 ***	0.0000	8.4418 ***	0.0000	8.7123 ***	0.0000	8.7710 ***	0.0000	7.9009 ***	0.0000	6.8594 ***
$\Delta(\mathrm{JGB}_{i,t}/\mathrm{DPS}_{i,t})$	-4.1033	-4.1792 ***	-1.3861	-0.8908			-1.4305	-0.9258	-1.4382	-0.9585	-2.2710	-1.4943
$\Delta(\mathrm{LON}_{i,t}/\mathrm{DPS}_{i,t})$	10.9751	13.2431 ***			4.4629	4.2151 ***	4.4412	4.1914 ***	4.0021	3.8844 ***	3.9538	3.5270 ***
$\Delta(\mathrm{MRG}_{i,t}/\mathrm{LON}_{i,t})$			-3.2725	-2.1592 **	-3.2197	-2.1404 **	-3.1779	-2.1113 **	-2.9926	-2.0471 **	-2.4864	-1.7518 *
$\Delta\mathrm{EQR}_{i,t}$									-0.4390	-8.4850 ***	-0.4319	-6.3699 ***
$\Delta\mathrm{INEF}_{i,t}$											0.0077	0.7985
cross-sections included	140		140		140		140		140		140	
periods included (years)	11 (2000–2010)		11 (2000–2010)		11 (2000–2010)		11 (2000–2010)		11 (2000–2010)		11 (2000–2010)	
included observations	1,355		1,324		1,326		1,324		1,324		1,247	
adjusted R^2	0.2128		0.1139		0.1256		0.1262		0.1760		0.0842	
Log likelihood	-2,658.4845		-2,478.4664		-2,472.5180		-2,468.6501		-2,429.2821		-2,236.1762	
F statistic	3.4395 ***		2.1650 ***		2.3041 ***		2.3000 ***		2.9089 ***		1.7739 ***	

Notes: ***, **, and * respectively denote significance at 1, 5, and 10 percent levels.

Table 3 Impact of mortgage loan with controlling for self-employed households.

	3–1		3–2		3–3		3–4		3–5	
Estimation method	panel least squares									
Dependent variable	$\Delta\,\text{NPL}_{i,t}$		$\Delta\,\text{NPL}_{i,t}$		$\Delta\,\text{NPL}_{i,t}$		$\Delta\,\text{NPL}_{i,t}$		$\Delta\,\text{NPL}_{i,t}$	
Cross-section	fixed		fixed		fixed		fixed		fixed	
Period (year)	pooled		pooled		pooled		pooled		pooled	
Independent variables	coefficient	t statistic	coefficient	t statistic	coefficient	t statistic	coefficient	t statistic	coefficient	t statistic
CONSTANT	-2.1784	-3.5311 ***	-1.9236	-3.1823 ***	-2.1316	-3.4717 ***	-1.8897	-3.1386 ***	-1.8623	-3.0336 ***
$\Delta\text{NPL}_{i,t-1}$	-0.0224	-1.0191	-0.0257	-1.1775	-0.0242	-1.1043	-0.0269	-1.2403	-0.0269	-1.2355
$\Delta\text{ROE}_{i,t}$	-0.0034	-4.3517 ***	-0.0035	-4.5966 ***	-0.0035	-4.5039 ***	-0.0036	-4.7191 ***	-0.0036	-4.7481 ***
$\Delta\text{ROE}_{i,t-1}$	-0.0015	-2.7143 ***	-0.0016	-2.8247 ***	-0.0016	-2.7973 ***	-0.0016	-2.8932 ***	-0.0016	-2.9281 ***
$\text{GPP}_{i,j,t}$	0.0000	-2.5469 **	0.0000	-3.1552 ***	0.0000	-2.4573 **	0.0000	-3.0502 ***	0.0000	-3.0433 ***
$\text{LP}_{i,j,t}$	0.0000	8.0186 ***	0.0000	8.3345 ***	0.0000	7.9632 ***	0.0000	8.2677 ***	0.0000	8.2781 ***
$\Delta\text{EMP}_{i,k,t}$	1.2213	6.2839 ***	1.2201	6.3554 ***	0.8168	3.6477 ***	0.8513	3.8335 ***	0.8492	3.8135 ***
$\Delta(\text{JGB}_{i,t}/\text{DPS}_{i,t})$	-0.5412	-0.3521			-0.4176	-0.2730			-0.4718	-0.3103
$\Delta(\text{LON}_{i,t}/\text{DPS}_{i,t})$			4.4433	4.2661 ***			4.1781	4.0156 ***	4.1490	3.9840 ***
$\Delta(\text{MRG}_{i,t}/\text{LON}_{i,t})$	-3.7428	-2.5064 **	-3.6779	-2.4825 **	-10.0590	-4.3625 ***	-9.4086	-4.1020 ***	-9.4204	-4.1013 ***
$\Delta(\text{MRG}_{i,t}/\text{LON}_{i,t})/\Delta(1/\text{EMP}_{i,k,t})$					-1,850.0182	-3.5821 ***	-1,677.3799	-3.2634 ***	-1,689.1921	-3.2812 ***
cross-sections included	140		140		140		140		140	
periods included (years)	11 (2000–2010)		11 (2000–2010)		11 (2000–2010)		11 (2000–2010)		11 (2000–2010)	
included observations	1,324		1,326		1,324		1,326		1,324	
adjusted R^2	0.1420		0.1539		0.1505		0.1608		0.1611	
Log likelihood	-2,456.6031		-2,450.1664		-2,449.4129		-2,444.1944		-2,440.5228	
F statistic	2.4892 ***		2.6396 ***		2.5839 ***		2.7152 ***		2.7056 ***	

Notes : ***, **, and * respectively denote significance at 1, 5, and 10 percent levels.

Table 4 Robustness check for possible edogeneity of morgage loan.

	4–1		4–2		4–3		4–4	
Estimation method	panel generalized method of moments							
Dependent variable	$\Delta\,\text{NPL}_{i,t}$		$\Delta\,\text{NPL}_{i,t}$		$\Delta\,\text{NPL}_{i,t}$		$\Delta\,\text{NPL}_{i,t}$	
Cross-section	fixed		fixed		fixed		fixed	
Period (year)	pooled		pooled		pooled		pooled	
Independent variables	coefficient	t statistic	coefficient	t statistic	coefficient	t statistic	coefficient	t statistic
CONSTANT	0.3058	0.8097	-2.5826	-3.2199 ***	-2.2617	-3.6889 ***	-2.2702	-3.6967 ***
$\Delta\text{ROE}_{i,t}$	-0.0019	-2.3556 **	-0.0019	-2.5286 **	-0.0022	-3.6129 ***	-0.0022	-3.6161 ***
$\text{GPP}_{i,j,t}$	0.0000	-1.4763	0.0000	-2.1016 **	0.0000	-2.3907 **	0.0000	-2.3895 **
$\text{LP}_{i,j,t}$	0.0000	1.2979	0.0001	5.6181 ***	0.0000	8.7641 ***	0.0000	8.7747 ***
$\Delta(\text{LON}_{i,t}/\text{DPS}_{i,t})$	6.4980	6.4538 ***	3.9858	2.9348 ***	4.3456	4.0971 ***	4.3179	4.0679 ***
$\Delta(\text{MRG}_{i,t}/\text{LON}_{i,t})$	-58.3490	-1.4602	-43.2764	-1.6809 *	-4.0104	-2.6147 ***	-3.9902	-2.6004 ***
Instrument varialbes								
CONSTANT	Yes		Yes		Yes		Yes	
$\Delta\text{NPL}_{i,t-1}$	Yes		Yes		Yes		Yes	
$\Delta\text{ROE}_{i,t}$	Yes		Yes		Yes		Yes	
$\Delta\text{ROE}_{i,t-1}$	Yes		Yes		Yes		Yes	
$\text{GPP}_{i,j,t}$	Yes		Yes		Yes		Yes	
$\text{LP}_{i,j,t}$	Yes		Yes		Yes		Yes	
$\Delta\text{EMP}_{i,k,t}$	No		No		Yes		Yes	
$\Delta(\text{JGB}_{i,t}/\text{DPS}_{i,t})$	No		Yes		No		Yes	
$\Delta(\text{LON}_{i,t}/\text{DPS}_{i,t})$	Yes		Yes		Yes		Yes	
$\Delta(\text{MRG}_{i,t}/\text{LON}_{i,t})/\Delta(1/\text{EMP}_{i,k,t})$	No		No		Yes		Yes	
cross-sections included	140		140		140		140	
periods included (years)	11 (2000–2010)		11 (2000–2010)		11 (2000–2010)		11 (2000–2010)	
included observations	1,326		1,324		1,326		1,324	
Standard Error of Regression	2.2913		0.1608		1.6606		1.6612	
Instrument rank	17		147		148		149	
J statistic	2.6664		3.3302		8.1145		9.0818	

Notes :   ***, **, and * respectively denote significance at 1, 5, and 10 percent levels.

Table 5 Impact of mortgage loan before and after the financial crisis.

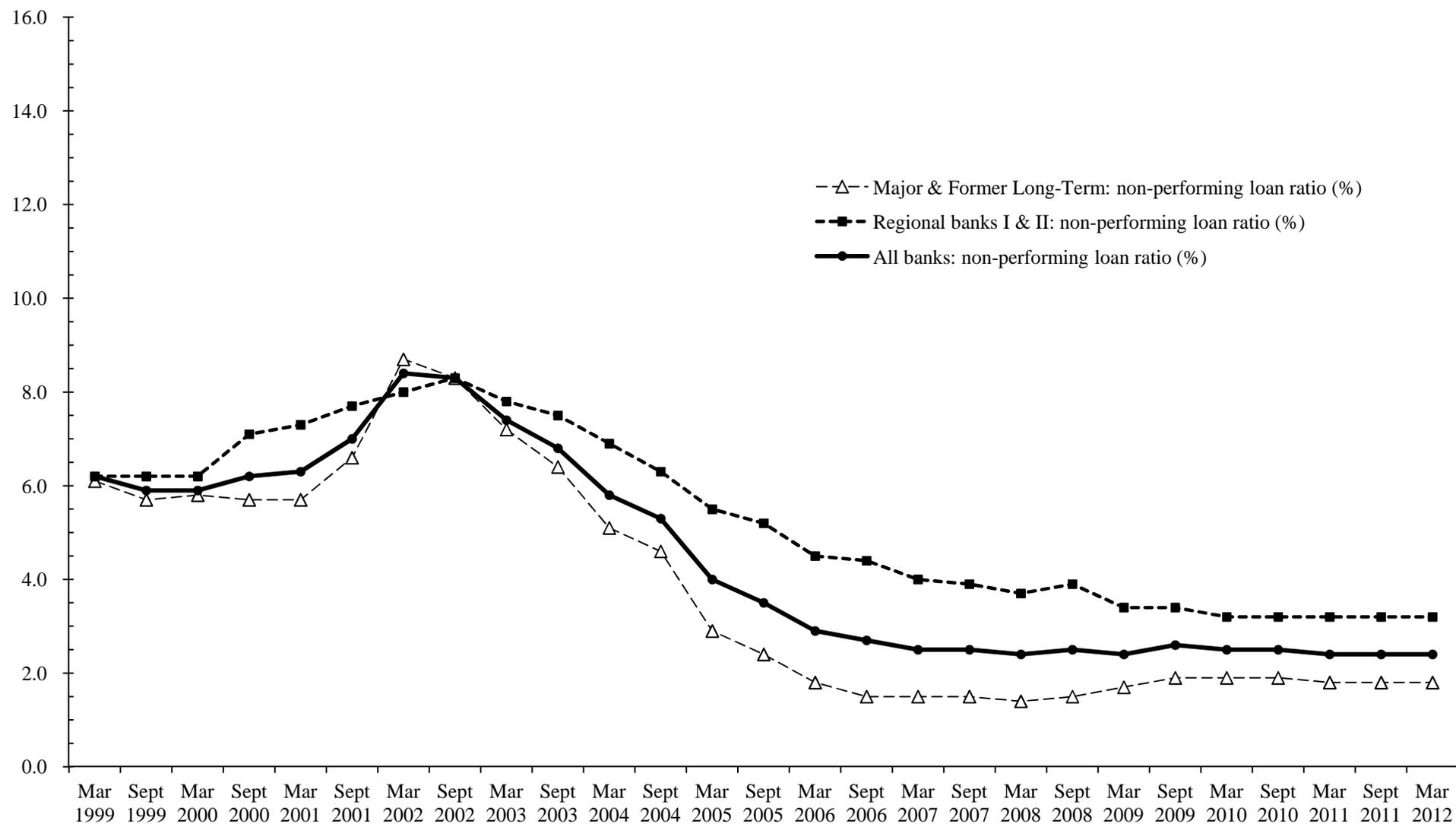|	5–1		5–2		5–3		5–4	
Estimation method								
Dependent variable	$\Delta \text{NPL}_{i,t}$		$\Delta \text{NPL}_{i,t}$		$\Delta \text{NPL}_{i,t}$		$\Delta \text{NPL}_{i,t}$	
Cross-section	fixed		fixed		fixed		fixed	
Period (year)	pooled		pooled		pooled		pooled	
Independent variables	coefficient	t statistic	coefficient	t statistic	coefficient	t statistic	coefficient	t statistic
CONSTANT	-2.7285	-3.7712 ***	1.1579	0.8237	-2.3389	-3.1663 ***	1.1227	0.8066
$\Delta \text{NPL}_{i,t-1}$	-0.0512	-2.0436 **	-0.4240	-7.2619 ***	-0.0474	-1.8940 *	-0.4458	-7.4714 ***
$\Delta \text{ROE}_{i,t}$	-0.0033	-3.6720 ***	-0.0094	-4.3796 ***	-0.0034	-3.7781 ***	-0.0099	-4.6770 ***
$\Delta \text{ROE}_{i,t-1}$	-0.0015	-2.3667 **	-0.0041	-1.9315 *	-0.0016	-2.4822 **	-0.0043	-1.9948 **
$\text{GPP}_{i,j,t}$	0.0000	-1.9613 *	0.0000	-1.6739 *	0.0000	-2.5532 **	0.0000	-1.7077 *
$\text{LP}_{i,j,t}$	0.0000	6.7693 ***	0.0000	0.9043	0.0000	7.0059 ***	0.0000	0.8779
$\Delta \text{EMP}_{i,k,t}$	1.1407	4.1754 ***	-0.0820	-0.2128	1.0983	4.0241 **	-0.0166	-0.0435
$\Delta(\text{JGB}_{i,t}/\text{DPS}_{i,t})$					-5.0277	-2.4488 ***	4.9955	2.5618 **
$\Delta(\text{LON}_{i,t}/\text{DPS}_{i,t})$	5.1191	4.0596 ***	-1.0382	-0.5701	5.1967	4.1323 ***	-0.0482	-0.0260
$\Delta(\text{MRG}_{i,t}/\text{LON}_{i,t})$	-9.2420	-3.4553 ***	-10.2162	-1.2877	-8.9975	-3.3717 ***	-8.9658	-1.1261
$\Delta(\text{MRG}_{i,t}/\text{LON}_{i,t})/\Delta(1/\text{EMP}_{i,k,t})$	-1,745.6497	-2.8059 ***	-1,319.1701	-0.8882	-1,717.8240	-2.7691 ***	-1,175.3463	-0.7848
cross-sections included	140		118		140		118	
periods included (years)	8 (2000–2007)		3 (2008–2010)		8 (2000–2007)		3 (2008–2010)	
included observations	977		347		977		347	
adjusted R^2	0.1919		0.2814		0.1967		0.3067	
Log likelihood	-1,852.8675		-403.1867		-1,849.3381		-394.2596	
F statistic	2.5660 ***		2.0815 ***		2.6044 ***		2.2050 ***	

Notes : ***, **, and * respectively denote significance at 1, 5, and 10 percent levels.

Table 6 Effects of growth in land price on non-performing loans.

	6–1		6–2		6–3	
Estimation method						
Dependent variable	$\Delta \mathrm{NPL}_{i,t}$		$\Delta \mathrm{NPL}_{i,t}$		$\Delta \mathrm{NPL}_{i,t}$	
Cross-section	fixed		fixed		fixed	
Period (year)	pooled		pooled		pooled	
Independent variables	coefficient	t statistic	coefficient	t statistic	coefficient	t statistic
CONSTANT	0.0672	0.8291	-0.3021	-1.4446	0.1914	1.1224
$\Delta\log(\mathrm{LP}_{i,j,t})$	4.5667	3.8114 ***	8.5336	4.3114 ***	3.8683	1.7022 *
$\Delta\log(\mathrm{LP}_{i,j,t-1})$	5.6606	4.5622 ***	5.3430	1.9819	4.2349	2.2826 **
$\Delta\log(\mathrm{LP}_{i,j,t-2})$	0.1029	0.0970	-2.7579	-1.4581	1.4514	0.7368
$\Delta\log(\mathrm{LP}_{i,j,t-3})$	6.1751	5.3160 ***	3.6772	1.8684 *	4.0077	1.6946 *
$\Delta\log(\mathrm{LP}_{i,j,t-4})$	3.0172	2.4211 **	0.2020	0.0960	3.0070	1.2599
$\Delta\log(\mathrm{LP}_{i,j,t-5})$	0.9626	0.6837	1.0550	0.5348	1.9204	0.7475
cross-sections included	131		127		123	
periods included (years)	9 (2003–2011)		5 (2003–2007)		8 (2008–2011)	
included observations	1,092		612		480	
adjusted R^2	0.1214		0.2025		-0.0293	
Log likelihood	-1,626.7533		-886.1873		0.8934	
F statistic	2.1087 ***		2.1756 ***		0.7709	

Notes : ***, **, and * respectively denote significance at 1, 5, and 10 percent levels.

Figure 1 Aggregate non-performing loans defined by the Financial Reconstruction Act, 1999–2012.

Figure 2 Sectoral non-perfoming loan defined by the Financial Reconstruction Act, 1999–2012.
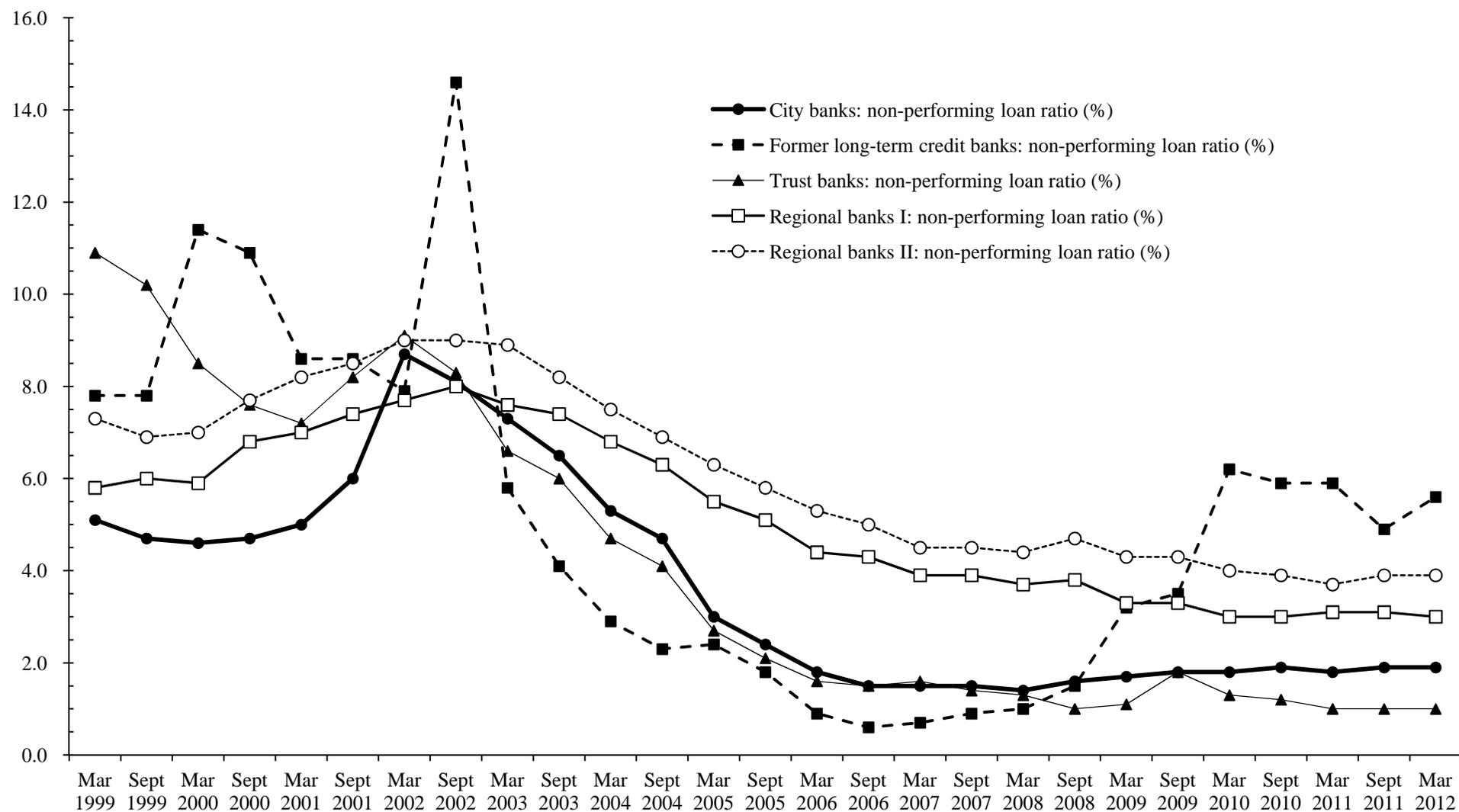
Figure 3 Total credit and non-perfoming loan, 1999–2012

Figure 4 Total credit and non-perfoming loan of major banks, 1999–2012.
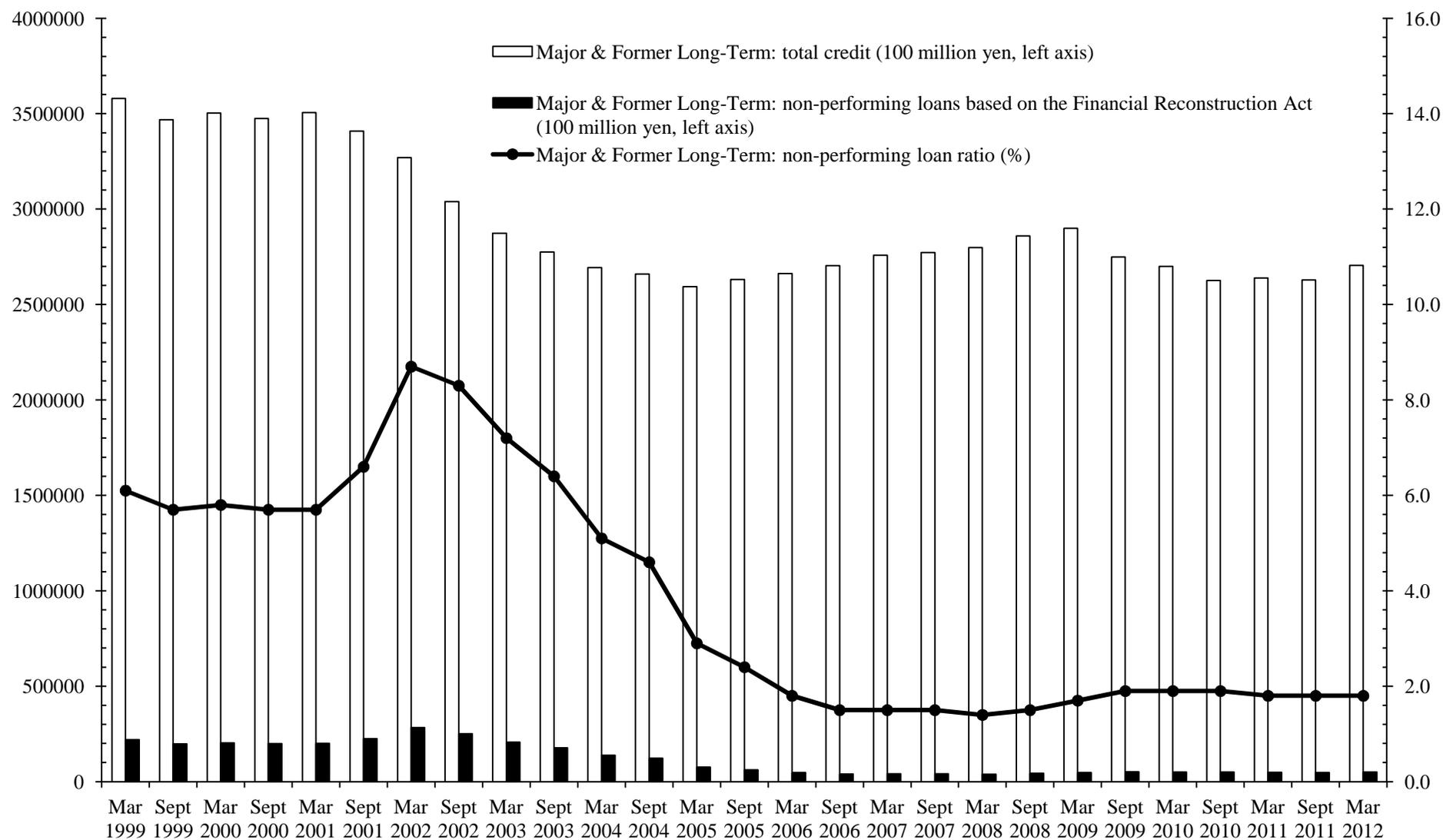
Figure 5 Total credit and non-perfoming loan of regional banks, 1999–2012

Regional banks I & II: total credit (100 million yen, left axis)

Regional banks I & II: non-performing loans based on the Financial Reconstruction Act (100 million yen, left axis)

Regional banks I & II: non-performing loan ratio (%)

Figure 6 JGB holding over total credit ratio, 1998–2011
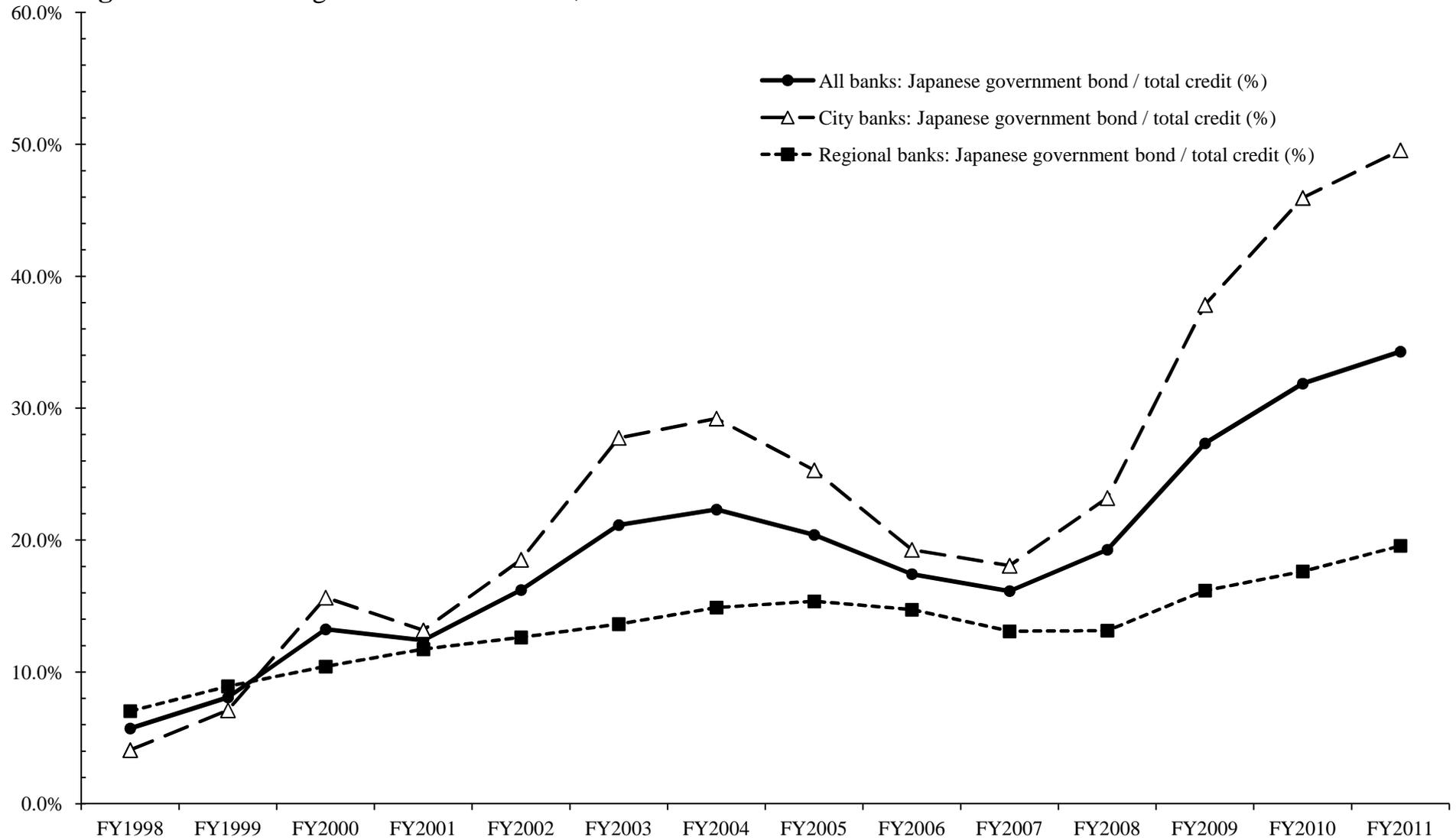
Figure 7 Foreign securities issuance, 1997–2012.

100 million yen

■ Foreign issuance: stock
□ Foreign issuance: convertible bond
▨ Foreign issuance: straight bond

Source: Ministry of Finance; the Tokyo Stock Exchange, *Tosho Yoran (Fact Book of the Tokyo Stock Exchange)*; The Japan Securities Dealers Association, *Shokengyo Ho (Security Dealers Report)*.