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Is macroprudential policy instrument blunt?

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Is macroprudential policy instrument blunt?*

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Abstract

Since the global financial crisis of 2008, macroprudential instruments have attracted an increasing amount of attention as potentially the best tools for stabilizing boom-and-bust cycles. This is because, in contrast to short-term interest rates, macroprudential instruments are regarded as particularly precise tools that act only on the area of concern. In this paper, we conduct an empirical examination to determine if this is the case by studying relevant areas of the Japanese economy from the 1970s to 1990s. We focus on a policy instrument called Quantitative Restriction (QR) implemented by the government. QR explicitly required banks to curb their lending to the real estate industry and related activities, and was used in the wake of the credit boom. We construct shocks to QR using narrative records of the government, and estimate their impact on the macroeconomy. We find that QR affected the aggregate economy as well as the real estate sector and land prices. In order to see why QR was a "blunt" instrument, we conduct a cross-sectional analysis using individual bank data and disaggregated industry group data. We find evidence that shocks to QR affected the aggregate economy by damaging the balance sheets of banks and non-financial firms.

JEL Classification: E20, J11

Keywords: Short-term interest rates; Macroprudential instrument; Boom-and-Bust Cycle.

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1 Introduction

Prior to the start of the 2007–08 global financial crisis, short-term interest rates set by central banks were regarded as the primary policy instrument for stabilizing the macroeconomy in developed countries. During the crisis, however, it became clear that a stabilization policy that relies solely on short-term interest rates has a number of limitations in offsetting the build-up of risks, in particular, those arising from financial activities.[1] Instead, growing attention has recently been paid to the use of macroprudential instruments to stabilize financial imbalances. In a number of jurisdictions, including the euro area and the U.K., a set of macroprudential instruments has been introduced to strengthen financial stability.

One of the arguments supporting the use of macroprudential instruments is that these instruments can target the objective, such as the specific type of borrowing sector or financial transaction. By contrast, short-term interest rates are regarded as a blunt tool that affects not only the target areas but also the rest of the economy. Along these lines, Governor Janet Yellen of the Federal Reserve stated in 2014 that, "efforts to promote financial stability through adjustments in interest rates would increase the volatility of inflation and employment. As a result, I believe a macroprudential approach to supervision and regulation needs to play the primary role," and, "macroprudential tools can, in some cases, be targeted at areas of concern." Similarly, recent work by Ajello et al. (2015) studies the optimal interest rate policy in an economy at risk of experiencing a financial crisis arising from credit conditions. They show that the optimal adjustment to interest rates that needs to be made in response to changes in credit conditions is small.[2]

In this paper, we empirically test if a macroprudential policy instrument is targeted by studying Japanese experience from the 1970s to 1990s. We focus on a policy instrument called Quantitative Restriction (QR) that was implemented at that time by the Ministry of Finance (MOF).[3] The MOF had supervisory power over financial institutions in Japan,

[1] Admittedly, there are alternative views on the role of short-term interest rates during the current crisis. See Smets (2014) for related discussions.

[2] According to Bernanke (2015), this is because "the benefit of keeping rates meaningfully higher than they otherwise would be (thereby reducing the risk of a future financial crisis and the associated damage to the economy) exceeds the cost of higher rates (lower near-term job growth and inflation below target)."

[3] QR is called *Sōryō-kisei* in Japanese. We refer to this policy instrument as Quantitative Restriction

including banks, until June 1998, and the Banking Bureau of the MOF released a series of administrative guidelines on banking activities. QR is a subset of these administrative guidelines that specifically requires banks to limit their lending to the real estate industry or for the purpose of real estate purchases. It stands out among other administrative guidelines as it explicitly sets a numerical goal for banks to achieve and was implemented in response to credit cycles.[4] QR also differs from short-term interest rates because it quantitatively controls banks' lending volume and targets only banks' lending for specific activities.

Japanese policymakers have sometimes regarded QR as an excessive powerful tool. This is because the Japanese economy has suffered a significant economic downturn on every occasion that QR was implemented. Figure 1 shows time paths of the key macroeconomic variables, including short-term interest rates, as well as the implementation period of QR, shown as the shaded area.[5] QR was implemented twice in the post-war period, once during the early 1970s, and again in the early 1990s. In both of these two periods, there was a credit boom, and policy makers leaned against the growing credit volume by raising the short-term interest rate and by implementing QR. Credit growth slowed down shortly after the rise in the interest rate and implementation of QR. In the case of the 1990s, the credit slow down was followed by a long-lasting recession known as the lost decade.[6]

We estimate the transmission channel and macroeconomic impact of the two policy instruments with the help of a factor-augmented vector autoregression (FAVAR) pioneered by Bernanke, Boivin, and Eliasz (2005), using Japanese data from the 1970s to 1990s. First, we construct a time series for a dummy variable that takes unity when QR was implemented and zero otherwise, based on official documents released by the MOF. In

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throughout this paper.

[4] As we discuss below, there is no formal agreement on how QR should be defined. In this paper, we define QR as a set of guidelines that includes a numerical goal when asking banks to limit their lending to activities related to the real estate industry.

[5] Miyao (2002) investigates the effects of a monetary policy shock in Japan from January 1975 to April 1998, and argues that the call market rate, rather than monetary aggregate, is the best monetary policy measure in Japan. Throughout this paper, we follow Miyao (2002) and use the call rate as the policy rate.

[6] Based on the observation, some argue that QR helped to cause a cause of the lost decade. See, for example, Uemura (2012).

order to ensure that our measure of QR correctly captures the effects of QR and does not capture the effects of other administrative guidelines, we examine all of the guidelines issued throughout the estimation period and show that no other administrative guideline was similar to QR and that the implementation period of QR did not coincide with the implementation period of other guidelines due to the fact that QR was implemented only in the credit boom. Next, we extract a set of latent common factors of 138 variables, including macroeconomic and bank-related variables, and use these factors to estimate the impulse response function of the variables to innovations in QR and short-term interest rate.

The key observation from our analysis of impulse responses is that shocks to QR do have an aggregate impact. An unexpected implementation of QR, which is captured by a contractionary shock to QR, has a statistically significant negative impact not only on lending volume to the real estate industry and on land prices, but also on lending volume to all industries. Its adverse effects are transmitted to the rest of the economy. For instance, GDP and stock prices fall in response to the shock. We also examine the effect on lending volume and economic activity by industry and region, as well as on the volume of financial intermediation other than bank lending. We find that a contractionary shock commonly results in an adverse impact on these variables.

Why have shocks to QR had aggregate impacts? To answer this question, we focus on the role played by the balance sheets of banks and non-financial firms. Because banks extend credit to the real estate sector and other sectors, adverse shocks to the former may result in a decline in lending to the latter by damaging banks' balance sheets. In addition, because banks held some portion of their assets in the form of land assets when contractionary shocks to QR occurred, it is possible that the decline in land prices due to the shocks damaged banks' balance sheets and dampened lending to all industries. Similarly, firms in both the real estate sector and other sectors held a large portion of assets in the form of land assets, and the land price decline due to QR could therefore lead to a devaluation of collateral and a fall in lending.

We explore empirically if this balance sheet channel has played a role in the transmission

of shocks to QR using disaggregated data for banks and non-financial firms. For banks, we employ a data set that consists of 112 individual banks and estimate the impulse response of the lending volumes of each bank to all sectors and to non-real estate sectors to a contractionary shock to QR. We then show that the decline in lending tends to be larger if that bank was extending more credit to the real-estate sector at the time when QR was implemented. For non-financial firms, we employ data that consist of 94 disaggregated industry groups including non-real estate sectors, and estimate the impulse response of their borrowing volume from banks to a contractionary shock to QR. We find that a decline in borrowing to an industry group is larger if that industry group has large land assets relative to its net worth at the time of implementation of QR.

Our paper is related to a growing number of studies on the effects of macroprudential policy instruments. For instance, Jimenez et al. (2012) use a disaggregated data set for lending contracts between Spanish banks and their customer firms and examine the effects of a dynamic provisioning policy. They show that such a policy has a significant impact on reducing variations in aggregate credit volume. Claessens, Ghosh, and Mihet (2013) use financial data from about 3,000 banks in 48 countries and show that the use of nine macroprudential instruments, including countercyclical capital buffers and loan-to-value ratios, affects banks' resilience. The analysis conducted by Elliot, Feldberg, and Lehnert (2013) is closest to ours in terms of analytical methodology. They focus on policy instruments used in the U.S. that have features in common with macroprudential policy instruments used today, including loan-to-value ratio requirements and margin requirements, and narratively construct a binary time series that accounts for the state of these macroprudential policy instruments. They show that changes in macroprudential policy instruments have a statistically significant impact on banks' lending. The analysis conducted by Kim and Mehrotra (2015) is closest to ours in terms of the study's focus. They estimate the impulse response function of the macroeconomic variables to a structural shock to a macroprudential instrument and policy rate for four inflation targeting countries in the Asia-Pacific region, Australia, Indonesia, Korea, and Thailand, and document that the former shock influences not only the credit variable but also inflation. In addition, our paper is related

to works that focus on the macroeconomic effects of policy instruments in Japan. Miyao (2002) uses vector autoregression to examine the impact of changes in short-term interest rates on the key macroeconomic variables. Uemura (2012) documents the chronology of QR implemented during the early 1990s, including its background and the intentions of policy makers.

It it also notable that in some aspects, QR is similar to the voluntary credit restraint program (VCRP) that was conducted by the Federal Reserve in 1980 as a part of the Credit Restraint Program.[7] In both QR and VCRP, banks were expected to limit specific type of lending, and the implementation was followed by a slump or worsening of the aggregate economy.[8] Compared with VCRP, however, QR was more targeted in the following two aspects. First, QR targeted lending to transaction related to real estate industry whereas VCRP targeted broader class of transaction, which was consumers' borrowing. Second, QR was not explicit about the total amount of lending to be extended whereas VCRP explicitly limited total amount of lending.[9,10]

The rest of this paper is organized as follows. The next section describes our estimation procedure, including how shocks to QR are extracted. Section 3 describes our estimation results, and Section 4 discusses candidate explanations for our estimation results. Section 5 concludes.

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[7] See Schreft (1990) for the background, the implementation process, and the economic outcome of the Credit Restraint Program.

[8] Schreft (1990) also documents that after the Credit Restraint Program was lifted, the economy recovered quickly and sharply.

[9] In VCPR, total loan growth of affected financial institutions was restricted to a range of 6 percent to 9 percent on a year-on-year basis.

[10] One other notable feature of QR is the presence of numerical goal regarding allocation of credit. In VCRP, specific type of transaction, such as making unsecured loans to consumers or financing corporate takeovers, was discouraged and other types of transaction, such as funding for small businesses or homebuyers, was encouraged. There was, however, no quantitative rule given for how financial institutions should allocate their lending (Schreft, 1990).

2 Estimation methodologies

2.1 Baseline model

We estimate the impulse response functions of macroeconomic variables and bank-related variables to shocks to two policy instruments, QR and the short-term interest rate using a factor-augmented vector autoregression (hereafter FAVAR) model proposed in Bernanke, Boivin, and Eliasz (2005). We denote a balanced panel that contains variables of interests in the economy by X_t and assume that X_t evolves according to the law of motion described by the following two equations.

$$\begin{bmatrix} F_t \\ Y_t \\ \tau_t \end{bmatrix} = \phi(L) \begin{bmatrix} F_{t-1} \\ Y_{t-1} \\ \tau_{t-1} \end{bmatrix} + \begin{bmatrix} v_t^F \\ v_t^Y \\ v_t^\tau \end{bmatrix}, \text{ and} \tag{1}$$

$$X_t^T = \Lambda^f F_t^T + \Lambda^y Y_t^T + \Lambda^\tau \tau_t^T + e_t^T, \tag{2}$$

where T stands for the transpose of a matrix. In the first equation, F_t is a $K \times 1$ vector of unobserved factors, Y_t is a time series of the short-term interest rate set by the BOJ, τ_t is a dummy variable that measures the states of QR that is constructed by the methodology described below, $\phi(L)$ is a lag polynomial of order d, and v_t^F, v_t^Y, and v_t^τ are i.i.d. error terms with zero mean and covariance matrix Q. In the second equation, X_t is an $N \times 1$ vector that consists of macroeconomic variables such as GDP and inflation rate, as well as bank-related variables such as lending volume and lending interest rates, and Λ^f, Λ^y, and Λ^τ are coefficients attached to the K number of unobservable factors and two observable factors, short-term interest rate, and QR, respectively. e_t^T is a mean-zero innovation that is orthogonal across each of the variables included in X_t.

The estimation procedure consists of four steps. We first construct a balanced panel X_t that includes a quarterly series of 138 variables from 1972Q1 to 2000Q4. The list of variables included in X_t is given in Table 1. All of the variables are transformed to stationary series by the methodology given in the table. Second, from the balanced panel

X_t, we extract the time series of a set of unobservable factors F_t. We set that the number of unobservable factor K to equal three in our baseline model. Third, we obtain the law of motion for the factors by estimating the equation (1). We set the number of lags d to equal six. Finally, we obtain the impulse response of each of the variables included in X_t to shock to a factor by estimating the equation (2) . Our estimation period is the same as what is spanned by the balanced panel X_t. We choose this starting date of the estimation period because the data for banks' lending volume by industry is only available from 1972Q1. We choose this ending date because the monetary policy instrument has changed from a short-term nominal interest rate to a monetary aggregate in 2001Q1.[11]

2.2 Construction of time series of QR

Our preferred approach is to construct a time series of a dummy variable that takes unity in quarters when QR was in effect, and zero otherwise.[12] To do this, we first define which administrative guideline belongs to QR. While an official definition of QR is absent, there is agreement among policy makers and scholars that QR includes guideline No. 555.[13] No. 555 was introduced as a response by policy makers to the land price boom which began in the late 1980s. It was effective from March 1990 to December 1991.[14] It requested banks to "keep the growth rate of lending to the real estate industry equal to or below that of total lending except for lending to public institutions committed to residential development."

In order to correctly estimate the effects of QR, we examine all of the administrative guidelines issued by the Banking Bureau of the MOF from the 1970s to 1990s from two

[11] From the late 1990s to the early 2000s, the BOJ has experienced two notable changes regarding its policy instruments. That is, it set its policy rate close to zero in January 1999 and changed its policy instrument in March 2001. Naturally, one other candidate for the ending date of our estimation period is therefore 1998Q4. We conduct an estimation using a sample period running from 1972Q1 to 1998Q4 as a part of our sensitivity analysis and obtain similar results to those in the baseline case.

[12] A similar approach is taken by Elliot, Feldberg, and Lehnert (2013). They make a comprehensive survey of policy instruments that have served to smooth the credit cycle in the U.S. They then construct binary indicators that capture the state of these policy instruments and estimate the response of macroeconomic variables to a shock to these indicators.

[13] See, for example, Matsushima and Takenaka (2011), Uemura (2012) and Nelson and Tanaka (2014).

[14] As shown in Figure 1, prior to the issuance of this guideline, the Japanese economy witnessed a dramatic increase in land prices. The widely held view of the public at that time was that control over land prices was called for so that ordinary workers would be able to buy their own houses (Matsushima and Takenaka, 2011).

points of view. First, we examine if there were other administrative guidelines that made similar requests to banks as those made in guideline No. 555. The exclusion of such guidelines from our QR measurements would result in a biased estimate of the effects of QR, since such a treatment would be equivalent to arbitrarily selecting the implementation period of QR. Second, we examine if the implementation period of QR overlaps with the implementation period of other policy instruments that could affect banks' lending behavior. If this is the case, it is difficult to separate effects arising from QR from those arising from other policy instruments.

To this end, we first select and examine in detail the administrative guidelines that request banks to change or maintain their lending volume. Table 3 includes a list of these administrative guidelines, together with the type of targeted industries, the implementation period, a summary of the requests, and whether the guideline has an explicit numerical goal.[15] Taking the first view point into consideration, we include guidelines No. 247 and No. 4279 in our list of QR. These two guidelines were issued during the credit boom at the time of the oil crisis in the early 1970s. The former requests that "Regardless of borrower's industry, banks should contain independently the growth rate of lending to real estate transactions equal to or below that of total lending except for lending to public institutions committed to residential development and housing loans to households," and the latter states that "Banks should contain the growth rate of lending to the real estate industry and hotel business equal to or below the growth rate of total lending." The two guidelines both have two features in common with No. 555. First, both guidelines target banks' lending to activities related to the real estate industry. Second, both guidelines set an explicit numerical goal.[16] There is also anecdotal evidence that shows a link between guidelines No. 247 and No. 4279 and guideline No. 555. According to a statement by Yoshimasa Nishimura, who was Assistant Vice-Minister of the MOF when guideline No.

[15] Administrative guidelines were issued to mutual banks and credit associations as well as to banks. Table 3 does not include guidelines issued to these two types of financial institution.

[16] Note that policy makers during the implementation period believed that guidelines with a numerical goal were more effective than those without such a goal. For instance, in the wake of the real estate boom starting in the mid-1980s, No. 555 was implemented after a series of guidelines without a numerical goal were set in place and proved ineffective in containing the boom.

555 was introduced, there had been concerted pressure on the MOF[17], before the issuance of guidance No. 555, to use such a policy instrument with reference to the experience of using guideline No. 247 or No. 4279 during the 1970s.[18,19]

Next, we study other administrative guidelines from the second view point. For each of the 43 guidelines listed in Table 3, we construct a dummy variable that takes unity when the guideline is effective, and zero otherwise. We then compute a contemporaneous correlation between each of the dummy variables and our measure of QR that takes unity when No. 247, No. 4279, or No. 555 is effective, and zero otherwise. The last column of Table 3 shows the correlation coefficient. A low correlation coefficient indicates that our measure of QR is less likely to capture the effects of the guideline. Guidelines other than those related to the real estate industry are not significantly correlated with our measure of QR. This reflects the fact that while guidelines included in our measure of QR were implemented cyclically, in particular in response to a credit boom, guidelines such as No. 3153 or No. 506 were implemented through the cycles.[20,21]

Some guidelines targeting the real estate industry correlate significantly with our measure of QR. This is because these instruments were implemented during the same credit boom in which No. 247, No. 4279, or No. 555 were implemented. As described in the footnote 12, in response to the credit boom, the MOF first reacted by issuing guidelines

[17] His statement was archived in Matsushima and Takenaka (2011).

[18] Admittedly, there are slight differences among the three guidelines in terms of the lending targeted. Later in this section, we conduct a sensitivity analysis in which we estimate effects of QR by splitting the sample period into the 1970s and the 1980s and beyond. The results are little changed.

[19] Note that because the guideline No. 555 was implemented from March 27 in 1990. In constructing our measure of QR, therefore, we assume that the measure takes zero at 1990Q1 and one from 1990Q2 to 1991Q4 for the guidance No. 555. The similar issue does not arise for the guidance No. 247 and No. 4279 because these two guidelines are implemented continuously. We estimate the impulse response functions of the key variables to an alternative measure of QR that takes unity instead of zero at 1990Q1 and confirm that results are little changed.

[20] It is worth noting the requirements relating to banks' balance sheet compositions stated in guideline No.901, and in the subsequent set of adjustment guidelines to No. 901. In No. 901 and its adjustment guidelines, banks were required to pay attention to the size of four variables in allocating their balance sheet compositions: loan-to-deposit ratio, capital account-to-deposit ratio, liquid asset-to-deposit ratio, and real-estate asset that serves for business-to-capital account ratio. While each variable was given a numerical goal, they were not adjusted cyclically.

[21] There were guidelines that were not binding banks even though they had a numerical goal. Ikeo (1990) discusses that the guideline on capital account-to-deposit ratio was not strictly implemented. He points out that the ratio was on average only 4.5% for all banks and 3.8% for city banks in 1987 while the ratio was required to be above 10%.

that did not have a numerical goal, such as No. 4075 or No. 2741, and then issued guidelines that did have a numerical goal, such as No. 247 and No. 555, after guidelines without a numerical goal proved ineffective in curbing the credit boom. These guidelines without a numerical goal were, however, maintained even after the ones with numerical goal were introduced. This delivers the high correlation coefficients between these guidelines and our measure of QR. We thus regard that even though implementation period of some guidelines without numerical goal overlap with that of QR, our measure of QR captures effects of those with numerical goal and not those without numerical goal.

2.3 An issue on the specification of QR in FAVAR

It is important to note that while our measure of QR is a binary variable that takes only zero or unity, the measure is treated as a continuos variable in the VAR system described in equations (1) and (2) . We choose this approach following the treatment of Elliot, Feldberg, and Lehnert (2013). The advantage of this approach is that, by estimating a VAR system, we obtain a policy function of QR measure, which enable us to disentangle predictable component and unpredictable component of QR measure. In section below, as a part of sensitivity analysis, we formulate a VAR with an alternative specification where QR measure is treated as a binary variable and show that results are little changed from the results based on the formulation described in equations (1) and (2) .

3 Estimation results

3.1 Estimated shocks

Figure 2 shows the time path of estimated shocks to QR and the short-term interest rate as well as the original series. As described above the VAR system (1), we treat residuals we obtain from the regression of our measure of QR on unobservable and observable factors as shocks to QR. Consequently, we have both expansionary shocks to QR that appear as negative values, as well as contractionary shocks to QR that appear as positive values in the figure. For instance, we see a sequence of expansionary shocks during the latter half of

the 1980s, reflecting the fact that QR was not implemented during the period, even though the fitted value in the equation of QR in the VAR system (1) indicates that QR should be implemented in these periods.

3.2 Impulse response

3.2.1 Impulse responses of the key variables

Figure 3 shows the impulse response function of the key bank-related variables to a contractionary (positive) shock to QR and short-term interest rate, with the 90% confidence interval, respectively. The two shocks result in a significant decline in lending to the real estate industry and in land prices. Total lending also falls after the two shocks. Compared with a contractionary shock short-term interest rate, however, a contractionary shock to QR delivers a persistent impact on lending.

Figure 4 shows the impulse response function of the key macroeconomic variables to the same set of shocks. Both shocks have adverse aggregate impacts. GDP, consumption, and investment, as well as stock prices, decline significantly after the shocks. It is also seen, however, that a shock to QR delivers a persistent impact than does a shock to short-term interest rate. Responses of the deflator are mixed across shocks. In response to a contractionary shock to QR, the deflator increases. In contrast, the deflator decreases in response to a contractionary shock to the short-term interest rate.

3.2.2 Impulse responses of the disaggregated variables

We examine if the impact of shocks is different across types of bank, borrower industry, and region. Figure 5 shows the impulse response function of total lending and lending to the real estate industry by bank type. There are three types of bank. City banks operate nationwide throughout Japan and have large assets. Regional banks operate primarily prefecture-wide in a specific prefecture and are relatively smaller. Shinkin banks are small-scale banks that operate within a certain city or ward in a specific prefecture. As seen in the figure, for both shocks, all variables fall after the shocks, and the difference in impulse response across bank type is minimal.

Figure 6 shows the impulse response function of borrowing volume from banks by disaggregated non-financial sector. The borrower sectors include manufacturing, service, construction, real estate, household, and local government. It is clear that the adverse effect of shocks to QR is transmitted beyond the real estate industry.[22]

Figure 7 shows the impulse response function of business condition in nine geographical regions. The regions comprise Hokkaido, Tohoku, Kanto, Chubu, Hokuriku, Kinki, Chugoku, Shikoku, and Kyusyu Okinawa. Again, while there are subtle regional differences, shocks to QR bring about qualitatively similar adverse impacts in all regions.

3.2.3 Financial intermediation other than bank lending

While macroprudential instruments are considered to be well-targeted, some studies argue that there is leakage by financial institutions that fall beyond the scope of the instrument.[23] Figure 8 shows the impulse response function of the purchase of bond and equity instruments by banks, insurance companies, securities companies, and pension funds. The figures suggest that there is no clear sign of significant leakage. Though securities purchase by insurance companies responds positively to a positive shock to QR, the proportion of funds intermediated by this specific channel throughout the sample period is limited.

3.3 Historical decomposition

We assess the importance of shocks to policy instruments by computing the quantitative contribution of these shocks to variations in the key variables.[24] Figure 9 shows the historical decomposition of the key variables into shocks to short-term interest rate, QR, unobserved factors and own shocks. Shocks to QR are shown to have a quantitatively large

[22] We repeat the exercise using sales in disaggregated non-financial sectors and obtain qualitatively similar results. For instance, the wholesale and retail industries witness a statistically significant fall in borrowing volume and sales.

[23] For instance, see Aiyar, Calomoiris, and Wielandek (2014) and Basten and Koch (2014). They conduct empirical studies to ascertain if there is leakage in time-varying capital requirements on banks in the U.K. and Switzerland, respectively. In the former case, authors report that there was leakage by banks that were out of the scope of the capital requirement. In the latter case, authors report that there was no leakage by insurance companies that were out of the scope of the requirement.

[24] Note that as shown in the equation (2), variations in the key variables are decomposed into those explained by shocks to factors v_t^F, v_t^Y, and v_t^τ, as well as shocks to the variable e_t^T.

impact on variations not only in lending to the real estate industry, but also in GDP and stock prices. In particular, during the credit boom starting in the mid-1980s, expansionary shocks to QR boosted GDP significantly during the late 1980s, and contractionary shocks to QR dampened GDP significantly during the early 1990s.

3.4 Estimations under alternative specifications

In this subsection, we perform four several sensitivity analyses using alternative estimation specifications.

3.4.1 Inclusion of Window Guidance

Throughout the bulk of the sample period, the BOJ issued a series of guidelines to banks called Window Guidance (WG) as a supplementary policy tool in monetary policy implementation.[25,26] WG was regularly issued by the BOJ. In general, it specified the total amount of lending volume that an individual bank could extend within a certain period of time by asking the bank to make adjustments to its own lending plans. See Table 3 for a comparison between QR and WG. While our baseline estimation model does not explicitly take account of the presence of WG, in this subsection, we examine if the results obtained above remain the same by explicitly including WG in our formulation of FAVAR specified in the equations (1) and (2) .

To do this, we first construct a dummy variable that captures the state of WG based on internal BOJ documents from the 1980s that are now archived in the Institute for Monetary Economic Studies of the BOJ and also studied in Itoh, Koike, and Shizume (2015).[27] Compared with QR, however, constructing such a series is not straightforward for WG. This is because the degree of requirements made to banks in each set of guidelines, and the range of banks to which WG was applied, changed over time. Table 4 describes

[25] WG is called *Madoguchi-kisei*, in Japanese. We call it Window Guidance following convention.

[26] The BOJ abolished WG in July 1991. One reason for this decision was that by that time, unlike the previous period, the interest rate channel was commonly considered to have become effective from monetary policy implementation perspective. See Itoh, Koike, and Shizume (2015) for the related discussion.

[27] Itoh, Koike, and Shizume (2015) examine the same internal BOJ documents which we use in this study and investigate how monetary policy responded to changes in economic environment during the 1980s.

a set of stages in WG and the implementation period of each stage. It can be seen that degree of requirements made in WG were often unclear, in particular when contractionary phases were gradually lifted. We construct a measure of WG by selecting periods when requirements made in WG explicitly required banks to contain their lending. Our measure of WG thus takes unity in periods when stage 1 or 2 was effective, or in a period starting from 1989Q3 to 1991Q2, and takes zero otherwise. During the last period, in principle, WG requested banks to reduce lending on a year-on-year basis. We then re-estimate a law of motion of factors and impulse responses of the key variables to shocks to factors $\phi(L)$ and Λ^f, Λ^y, and Λ^τ. The formulation of the FAVAR is unchanged from the baseline model that consists of equations (1) and (2) except that τ_t now includes two series, a dummy series for QR and that for WG.

Figure in Appendix 1 shows the impulse response of the key variables to a contractionary shock to QR, short-term interest rate, and WG based on a FAVAR that includes WG as one of the observable factors. The estimated impacts of QR are slightly affected by this change in the formulation of FAVAR. For instance, compared with the impulse response functions shown in Figure 3 and 4, the impulse response functions of some variables, such as GDP and land prices, show a limited size of decline.[28] It is, however, also seen from the figure that the total lending falls as much as does the real estate lending, indicating that QR has aggregate impacts even if effects of WG are conditioned.

3.4.2 Inclusion of a large number of unobserved factors

Following Bernanke, Boivin, and Eliasz (2005), we conduct the sensitivity analysis by changing the number of unobserved factors that is included in the VAR system described in (1) and (2). We now extract two additional factors in addition to the three factors which we use so far in the analysis from the balanced panel X_t and estimate the parameters $\phi(L)$ and Λ^f, Λ^y, and Λ^τ again.

Figure in Appendix 2 shows the impulse response of the key variables to contractionary

[28] Although we do not display in Appendix 1, the impulse response of aggregate investment falls significantly with a 90% confidence interval to a shock to QR.

shocks to QR based on the FAVAR using five unobserved factors. The estimated impacts of QR on these variables is qualitatively similar to what are obtained under our baseline specification where three unobservable factor.

3.4.3 Sub-sample analysis

Next, we estimate the response of shocks to policy instruments using two sub-sample data, one that spans from 1972Q2 to 1979Q4, and the other from 1980Q1 to 2000Q4. We first extract unobserved factors F_t from the data covering each of the subsample period and estimate impulse response function of variables to shocks to both unobserved and observed factors.[29] This sensitively analysis intends to consider the effects of long-term changes in economic environment, such as deepening of financial markets in Japan, on our estimation results. In addition, this analysis serves as a sensitivity analysis of alternative definition of QR. This is because our measure of QR contains not only No. 555, which is unquestionably classified as QR, but also two other guidelines implemented during the 1970s.

Figure in Appendix 3 shows the impulse response of the key variables to contractionary shocks to QR based on the first sub-sample period and the second sub-sample. The estimated impact of QR is qualitatively similar across the two periods, and for both periods results are also similar to the results under the baseline formulation. It is seen, however, that decline in lending, land price, and GDP are relatively sharp and significant during the latter period compared with the former period.

3.4.4 Adopting an alternative specification of QR measure in the VAR system

Last, we examine the sensitivity of our results to changes in the way that shocks to QR are extracted. Instead of estimating a law of motion of QR using the equation (1) , which implicitly treats QR measure as a continuous variable, we explicitly model it as a binary variable in the VAR system. We assume that QR and other factors obey the following law of motion instead of equations (1) and (2) .

[29] Note that in the other sensitivity analysis described in this subsection, we use the unobserved factors F_t that are the same as those used in our baseline model. In these analyses, changes are only made in terms of how law of motions of factors $\phi(L)$ and impulse response of variables are estimated Λ^f, Λ^y, and Λ^τ.

$$\begin{bmatrix} F_t \\ Y_t \end{bmatrix} = \phi(L) \begin{bmatrix} F_{t-1} \\ Y_{t-1} \\ \tau_{t-1} \end{bmatrix} + \begin{bmatrix} v_t^F \\ v_t^Y \end{bmatrix}, \text{ and} \tag{3}$$

$$\tau_t = v_t^\tau.$$

We further assume that v_t^τ is i.i.d., and its has no correlation with v_t^F and v_t^Y. Notice that under the specification described in (3) , an implementation of QR is assumed to be unpredictable, while other factors consist of predictable component and unpredictable component. Consequently, in this specification, the time series of dummy variable of QR that is shown in the panel (1) of Figure 2 are all interpreted as positive shocks to QR when it takes unity. Figure in Appendix 4 shows the impulse response of the key variables to contractionary shocks to QR based on the FAVAR setting specified in equation (3) . Notice that because there is no predictable component in QR measure, QR takes unity at the impact period and zero in the subsequent periods. The estimated impact of QR is little affected by this change in the formulation of the FAVAR.

4 Why did shocks to QR have aggregate impacts?

In this section, we explore why shocks to QR have spillover effects on the aggregate economy by shedding light on the role played by balance sheets of banks and non-financial firms.

4.1 Channels through which QR shocks impact the balance sheets of agents

4.1.1 Land asset holding

As panels (5) and (6) in Figure 9 indicate, contractionary shocks to QR contributed to a large decline in land price during the early 1970s and early 1990s. Because land is held as assets by a broad class of agents in the economy, a decline in its price damages the balance sheets of many agents and adversely affects their economic activities.[30] Figure 10 shows

[30] For instance, Iacoviello (2005) uses a dynamic general equilibrium model with collateral constraints that are tied to housing values and shows that devaluation of collateral dampens aggregate output by discouraging borrowers' expenditure.

the size of land assets as well as total assets held by financial institutions, non-financial institutions, and households from the 1970s to 1990s in Japan. It is seen that a large portion of assets were held in the form of land assets, in particular in the non-financial institutions and the household sector. For instance, in 1989, a year before the implementation of guideline No.555, 29% and 50% of assets held by the non-financial institutions and the household sector were land assets. This observation has direct implications to the spillover effect of QR on the balance sheets of these sectors. If we suppose that each sector maintains the size of its land assets as of 1989 in the subsequent years, then the loss in the balance sheet due to QR shocks over the three years after the peak period of land price, which was 1991Q2, would be 0.2%, 2%, and 7% of GNP as of 1989 in financial institutions, non-financial institutions, and the household sector, respectively.[31]

Damaged balance sheets are easily translated to a decline in lending and to an aggregate economic downturn. When the balance sheets of banks or non-financial firms are damaged, the lending extended to firms may fall, since the cost of raising external funds becomes higher.[32] When balance sheets of households are damaged, households may perceive them as negative wealth shocks and reduce their consumption expenditure.[33]

4.1.2 Collateral use of lands

It is also important to note that land has been used intensively as collateral by non-financial firms. For those firms, a land price decline is equivalent to a devaluation of their collateral, which in turn worsens their funding condition. The upper panel in Figure 11 shows the share of loan by collateral type. About 20-30% of lending by banks takes real estate and

[31] To estimate the loss in the balance sheet, we first calculate the land price decline from 1991Q2, which is the peak period of land price, to 1994Q2 due to shocks to QR using the historical decomposition of the commercial land price shown in Figure 9. We then multiply this number by the land asset holding in each sector in 1989.

[32] See Bernanke, Gertler, and Gilchrist (1999) for an explanation of why damage to the balance sheets of borrowers, in particular non-financial firms, increases the costs for them to raise the external funds. See, for example, Hirakata, Sudo, and Ueda (2011) and Aoki and Sudo (2012) for explanations of why the damaged balance sheets of banks leads them to reduce their lending to non-financial firms.

[33] See Case, Quigley, and Shiller (2003) for quantitative size of wealth effect of housing price on consumption.

floating mortgages as collateral.[34]

4.1.3 Second-round effect through banks' balance sheets

For banks, a deterioration of their borrower firms' balance sheets can cause a rise in non-performing loans and damage their own balance sheets. Damage to banks' balance sheets then brings about a second-round effect of reducing the banks' lending to non-defaulting customer firms. This second-round effect can act as an additional source of spillover effects of QR from the real estate industry to the other sectors. For instance, suppose that banks extend credit to real estate industry and economic activities in the industry is hampered due to contractionary shocks to QR. Banks' balance sheets then deteriorate, which in turn lead the banks to reduce lending to the other industries.[35,36] The lower panel in Figure 11 shows the share of lending to real estate industry. It increases over the sample period. At the time when guideline No. 555 was implemented, about 10% of total lending by banks was extended to the real estate industry.

4.2 Analysis using disaggregated banks' data

In this subsection, we explore whether damaged balance sheets of banks have played a role in the transmission of shocks to QR using the disaggregated balance sheet data of individual banks. The discussion above suggests that if a bank has a larger portion of land assets than other banks, or extends more credit to real-estate industry than other banks, then a decline of its lending will be greater in the wake of a contractionary shock to QR. We therefore examine if the impulse response function of a bank's lending to shocks to QR correlate statistically significantly with the size of land asset held or the size of lending to real-estate industry extended by the bank.

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[34] Bayoumi (2001) argues that a devaluation of collateral due to the decline in land price has played an important role in the economic downturn in Japan since the early 1990s.

[35] Along this line, Watanabe (2007), using a panel data of individual banks in Japan, reports that bank's lending to the real estate industry during the period before the bubble burst has the explanatory power of cross-sectional variations in banks' solvency during the period after the bubble burst.

[36] See Peek and Rosengren (1997) for international transmission of domestic adverse shocks to balance sheets of Japanese banks to lending of U.S. branches of these banks.

4.2.1 Summary Statistics of Data

Our bank data includes annual series of total lending and lending to the real estate industry from 1975 to 2000. It also includes two balance sheet variables as of 1989 of 112 individual banks, land asset holding and lending to real estate industry. The sampled bank includes city banks as well as regional banks in Japan. The data is taken from the annual security report of each bank. Banks for which consistent time series data is not available throughout the sample period, such as those who underwent mergers or acquisitions, are excluded from the sample. Table in Figure 12 provides summary statistics of our bank data.[37]

4.2.2 Responses of lending to shocks to QR and balance sheet of banks

We conduct a cross-bank regression analysis, focusing on the relationship between the response of a bank's lending to a contractionary shock to QR, and the balance sheet variables of the bank when the shock arrives. Because individual bank data is available only on a yearly basis, we first obtain the impulse responses of individual bank's lending to a shock to QR by estimating the following time series equation for each bank j for $j = 1, ...112$.

$$\text{Growth rate of lending}_{j,t} = \alpha + \alpha_{j,0}\hat{v}_t^{\tau} + \alpha_{j,1}\hat{v}_{t-1}^{\tau} + \alpha_{j,2}\hat{v}_{t-2}^{\tau} + \alpha_{j,3}\hat{v}_{t-3}^{\tau} + \alpha_{j,4}\hat{v}_{t-4}^{\tau} + \alpha_{j,5}\hat{v}_{t-5}^{\tau} + u_{j,t}, \tag{4}$$

where the dependent variable is the annual growth rate of lending extended by an individual bank j for $j = 1, ...112$, at year t, $\hat{v}_s^{\tau}$ for $s = t, \ ...t-5$ are estimated shocks to QR that are obtained from estimating the equation (1) , α and $\alpha_{j,h}$ for $h = 0, ...5$ are coefficients to be estimated, and $u_{j,t}$ is a bank j specific shock.[38,39] Estimated coefficients

[37] Because we prefer to use consistent time series throughout the sample period, we use entity base data instead of consolidated base data for which the data during the early period of the sample is not available.

[38] Here we regress a growth rate of lending on estimated shocks to QR to obtain impulse response function of the variable to a shock to QR. The similar approach is employed by Romer and Romer (2004). They first narratively extract time series of shocks to a monetary policy rule and regress macroeconomic variables, such as inflation rate and GDP, on these extracted time series of shocks to obtain impulse response of these variables to the monetary policy shocks.

[39] Note that because we extract shocks to QR by estimating equations (1) where all of the variables are

for $\alpha_{j,h}$ for $h = 0, ...5$ are interpreted as the impulse response function of lending extended by a bank j in h year after the shock to QR arrives. The two panels in Figure 12 show the impulse response functions of total lending and those of lending to non-real estate industry of individual banks. Here, in order to provide the comprehensive picture of how each bank reacts to the shock, we show the distribution of the impulse responses across banks. For most of the sampled individual banks, a contractionary shock to QR has a negative impact not only on total lending, but also on lending to non-real estate industry. This observation indicates that QR affects banks' lending beyond the real estate industry.[40]

Next, using the estimated impulse response function of an individual bank's lending, we conduct a cross-sectional analysis to see if there is a relationship between how an individual bank reacts to a shock to QR and the bank's balance sheet variables when the shock occurs. For balance sheet variables, we choose two variables, land asset holding relative to a bank's net worth and a proportion of lending to the real estate industry as of 1989. We intend to capture the direct effect of land price decline by including the first variable and intend to capture the second-round effect by including the second variable in our estimation equation. We choose 1989 because it is the year just before a large contractionary shock to QR occurred, as indicated in Figure 2.[41] Using these two balance variables as the explanatory variables, we test if variations across banks in terms of their impulse response functions of lending to a shock to QR are explained by the balance sheet variables of the banks.

We run the following cross-sectional regression that has the impulse response of lending extended by a bank j in h year after the shock, which is $\alpha_{j,h}$ for $h = 0, ...5$, estimated in the procedure above, as the dependent variable, and the set of balance sheet variables of

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quarterly series, the time series of shocks to QR are quarterly series as well. We convert the series to annual series by taking the sum of shocks within a year.

[40] Although we do not show in the figure, we estimate impulse response of lending to real estate industry extended by individual banks as well, using the same methodology. We find that most of the banks face a decline in lending to real estate industry in response to a contrationary shock to QR.

[41] Although a large contractionary shock has occured in 1973 as well, because we have individual banks' data only from 1975, we do not include balance sheet variables as of 1973 in our cross-sectional analysis.

the bank j as of 1989 as the explanatory variables.

$$\begin{pmatrix} \text{Impulse response of lending} \\ \text{extended by a bank } j \text{ to a shock to QR,} \\ \text{in } h \text{ year after the impact period} \end{pmatrix} = \gamma_{h,0} + \gamma_{h,1} \times \begin{pmatrix} \text{Land asset holding of bank } j \\ \text{relative to its net worth} \\ \text{as of 1989} \end{pmatrix} + \gamma_{h,2} \times \begin{pmatrix} \text{Proportion of lending} \\ \text{of bank } j \\ \text{to real estate industry} \\ \text{relative to its total lending} \\ \text{as of 1989} \end{pmatrix} + \gamma_{h,3} \times \begin{pmatrix} \text{Stock holding of bank } j \\ \text{relative to its net worth} \\ \text{as of 1989} \end{pmatrix} + \epsilon_{h,j}, \tag{5}$$

where $\gamma_{h,0}$, $\gamma_{h,1}$, $\gamma_{h,2}$, and $\gamma_{h,3}$ for $h = 0, ...5$ are coefficients to be estimated, and $\epsilon_{h,j}$ is an error term. Existing studies on Japanese banks' lending around the period of bubble burst, such as Peek and Rosengren (1997) and Bayoumi (2001), emphasize the role of stock price decline in decline in the banks' lending at that time. We include a bank j's stock holding relative to net worth as of 1989 as the third explanatory variable so as to control the effect of stock holding of bank j on its lending.

Figure 13 displays the regression coefficients of (5) . We conduct the estimation for a bank j's total lending and for its lending to non-real estate sector and show the results in the first and the second column in the figure. The horizontal axis of each panel indicates the number of years after the impact period of a contractionary shock to QR. The vertical axis indicates the correlation coefficient of the impulse response of lending extended by each bank with its land asset holding, lending to real estate industry, and stock holding, as of 1989. We plot the estimated coefficients of the three balance sheet variables $\gamma_{h,1}$, $\gamma_{h,2}$, and $\gamma_{h,3}$, with two-standard-error bands. For both total lending and lending to non-real

estate industry, the signs of estimated coefficients of land asset holding are significantly positive but only within two years after the impact periods. The coefficients then become insignificant after two years. By contrast, the signs of estimated coefficients of lending to real-estate industry are significantly negative throughout the five-year horizon.

These observations are consistent with a view that shocks to QR are transmitted to the rest of the economy through the second-round effect arising from damaged banks' balance sheets. That is, banks that have extended credit to real-estate industry when a contractionary shock to QR arrived suffered from the balance sheet problem and cut their lending volume to non-real estate industries, which results in the spillover to the aggregate economy. We check if this second round channel has been working by looking at how interest income of each bank responds to a shock to QR. To do this, we first run a regression for an equation that is similar to (4) . In this equation, we replace the dependent variable with "Growth rate of interest income$_{j,t}$." We then estimate an cross-sectional equation that is similar to the equation (5) for which the dependent variable is replaced from "Impulse response of lending extended by a bank j to a shock to QR in h year after the impact period" to "Impulse response of interest income received by a bank j to a shock to QR in h year after the impact period." The third column of Figure 13 displays the regression coefficients in this alternative estimation equation. The response of interest income is more negative for a bank with a larger amount of lending to the real-estate industry, which in turn implies that a decline in interest income played a role in damaging banks' balance sheets and generating the second round effect.

4.3 Analysis using disaggregated non-financial industry group data

Next, we turn our attention to the balance sheets of non-financial firms. In this subsection, we conduct the similar analysis as above, now using non-financial industry group data.

4.3.1 Summary Statistics of Data

We use disaggregated industry group data to see if the balance sheets of non-financial firms have played a role in the transmission of shocks to QR to the aggregate economy. Our

industry group data is the time series data of borrowing from banks of industry groups as well as balance sheet variables in these industry group based on the "Financial Statements Statistics of Corporations by Industry (quarterly surveys)" released by the MOF. Table 5 summarizes the properties of our data set. The statistics covers 25 industries, where each industry except "Electricity" has four disaggregated components that are grouped by the size of their capital, and "Electricity" has only two large disaggregated components. We therefore have 98 industry groups in total. Because we are focusing on the spillover effects of shocks to QR, however, we exclude the real estate industry from the scope of our analysis, which leaves us with 94 industry groups.

4.3.2 Responses of lending to shocks to QR and balance sheet of non-financial firms

We again conduct a cross-sectional regression analysis, now using the balance sheet variables of non-financial industry groups as of 1989. Note that since our industry group data is available only from 1975Q1, we do not include them in the balanced panel X_t that is used for extracting unobservable factors. Instead we estimate the impulse response of borrowing of disaggregated industry group j by running the following equation that is similar to the equation (2), using the time series from 1975Q1 to 2000Q4.

$$\text{Growth rate of borrowing}_{j,t} = \eta_j^f F_t^T + \eta_j^y Y_t + \eta_j^\tau \tau_t + \varepsilon_{j,t}$$

Here, η_j^f, η_j^y, and η_j^τ are coefficients to be estimated, F_t^T, Y_t, and τ_t are factors, and $\varepsilon_{j,t}$ is an industry group j specific shock. Using the estimated impulse response of borrowing of industry group j to a contractionary shock to QR, we conduct the following cross-sectional

regression.

$$\begin{pmatrix} \text{Impulse response of borrowing} \\ \text{made by a industry group } j \text{ to a shock to QR,} \\ \text{at } h \text{ quarter after the impact period} \end{pmatrix} = \beta_{h,0} + \beta_{h,1} \times \begin{pmatrix} \text{Land asset holding of} \\ \text{industry group } j \\ \text{relative to its net worth} \\ \text{as of 1989} \end{pmatrix} + \beta_{h,2} \times \begin{pmatrix} \text{Other variables of} \\ \text{industry group } j \end{pmatrix} + \varepsilon_{h,j}, \tag{6}$$

where h denotes the number of quarters after a contractionary shock to QR. "Other variables of industry group j" consists of share of stock asset holding relative to net worth in industry group j, and a dummy variable that accounts for the capital size of the industry group. $\beta_{h,0}$, $\beta_{h,1}$ and $\beta_{h,2}$ are coefficients to be estimated, and $\varepsilon_{h,j}$ is an error term. For each of $h = 0, ..., 40$, we run the regression above and obtain the coefficient between impulse response function and balance sheet variables.

Figure 14 displays the regression coefficients $\beta_{h,1}$ and coefficient for stock asset holding relative to net worth for $h = 0, ..., 40$. The horizontal axis of each panel indicates h, and the vertical axis indicates the estimated coefficients of the balance sheet variables with two-standard-error bands. The sign of the estimated coefficients of land asset holding implies that the response of borrowing volume of a industry group j is more negative when the industry group j possess a larger land asset in 1989. This observation is consistent with a view that land price decline due to a contractionary shock to QR had an adverse effect on borrower firms' balance sheets or on the value of their collateral, leading them to lower their borrowing from banks.

5 Conclusion

In this paper, we study empirically whether macroprudential policy is well-targeted by examining the impact of Quantitative Restriction on the Japanese economy. Quantitative Restriction was used to lean against the credit boom associated with lending to the real estate industry during the 1970s and the 1990s, and it stands out among policy instruments since it explicitly requested banks to limit their lending exclusively to economic activities related to the real estate industry.

Based on the empirical analysis using a factor-augmented VAR, we find that Quantitative Restriction had aggregate impacts even though its regulatory scope was limited. An unexpected tightening of Quantitative Restriction causes not only a decline in lending volume to the real estate industry and in land price, but also a decline in lending volume to all industries and in GDP. We conduct several sensitivity analyses and obtain qualitatively similar results.

In order to see why Quantitative Restriction had an aggregate impact, we conduct cross-sectional analyses using individual bank data and disaggregated non-financial industry group data. We find that for banks the adverse impact of a contractionary shock to Quantitative Restriction is greater if banks lend more to the real estate industry, and for industry groups, the adverse impact is greater if a larger amount of land assets is held relative to net worth in the industry group. These observations are consistent with the view that the effects of Quantitative Restriction are transmitted to the aggregate economy through the balance sheets of banks and non-financial firms.

Our study has demonstrated empirically the possibility that a macroprudential policy instrument that targets only a specific transaction or borrowers may have an aggregate impact. We have shown that Quantitative Restriction, a policy instrument that targets real estate transactions and land prices, has brought about a large aggregate impact. We have also shown that balance sheets of banks and non-financial firms play an important role in the transmission. Admittedly, however, our analysis is not comprehensive in a sense that it does not recover all of the potential channels through which Quantitative Restriction

influences the aggregate economy. In particular, an analysis of household behavior is not conducted in this paper due to the lack of relevant data for our purpose. It is also noteworthy that the aggregate impacts of Quantitative Restriction may change depending on a structure of financial system. In a bank-based financial system, including that in Japan, banks play the major role in the aggregate financial intermediation. During the most of our sample period, when financial deregulation was not complete, the role of banks was more pronounced, which could in principle have enhanced effects of Quantitative Restriction. In this sense, our results may be better applied to an economy with bank-based financial system rather than that with market-based financial system. Uncovering the other potential channels or exploring the implication of the financial structure are left as a topic for future research.

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Table 1: List of variables used in extracting latent factors

Descriptions appearing in the table are as follows:

'Trans' - The transformation code.
The transformation codes are: 1 - no transformation; 5 - first difference of logarithm.
'SA' - Seasonal adjustment code (1=seasonally adjusted, 0= not adjusted).
'Slow' - "Slow-moving" in the estimation (1=slow moving, 0=fast moving).
For explanation of "Slow-moving", see Bernake, Boivin and Eliasz (2005).

No	Data description	Trans	SA	Slow
	Real output and income			
1.	GDP: Real Gross domestic expenditure (GDE=GDP)	5	1	1
2.	GDP: Real Private non-residential investment	5	1	1
3.	GDP: Real Private final consumption expenditure	5	1	1
4.	GDP: Real Government final consumption expenditure	5	1	1
5.	GDP: Real exports	5	1	1
6.	GDP: Real imports	5	1	1
7.	GDP gap (estimated by author)	1	1	1
8.	Industrial production: production（2010=100）	5	1	1
9.	Industrial production: Shipments（2010=100）	5	1	1
10.	Industrial production: Index of capacity utilaization (manufacturing)	5	1	1
11.	ROA (operating profits/total asetts)	1	0	1
	Employment and hours			
12.	Monthly Labour Survey, Total hours worked （2010=100）	5	1	1
13.	Labour Force Survey, Unemployment ratio	1	1	1
14.	Labour Force Survey, Labor force population	5	0	1
15.	Labour Force Survey, Number employed	5	0	1
16.	Labour Force Survey, Number of employees	5	1	1
17.	Employment Referrals for General Workers, Active job openings-to-applicants ratio	1	1	1
18.	Financial Statements Statistics of Corporations by Industry: All industries, number of labor	5	1	1
19.	Financial Statements Statistics of Corporations by Industry: Manufacturing, number of labor force, share of total	1	1	1
20.	Financial Statements Statistics of Corporations by Industry: Construction, number of labor force, share of total	1	1	1
21.	Financial Statements Statistics of Corporations by Industry: Transport and Postal activities, number of labor force, share of total	1	1	1
22.	Financial Statements Statistics of Corporations by Industry: Electricity, Gas, Heat supply and Water, number of labor force, share of total	1	1	1
23.	Financial Statements Statistics of Corporations by Industry: Wholesale trade and Retail trade, number of labor force, share of total	1	1	1
24.	Financial Statements Statistics of Corporations by Industry: Real estate, number of labor force, share of total	1	1	1
25.	Financial Statements Statistics of Corporations by Industry: Services, number of labor force, share of total	1	1	1
	Consumption			
26.	Current Survey of Commerce, sales at retail stores (deflated by the GDP deflator）	5	1	1
27.	Sales profit ratio	1	0	1
28.	Financial Statements Statistics of Corporations by Industry: All industries, Sales (deflated by the GDP deflator）	5	1	1
29.	Financial Statements Statistics of Corporations by Industry: Manufacturing, Sales (deflated by the GDP deflator), share of total	1	1	1
30.	Financial Statements Statistics of Corporations by Industry: Construction, Sales (deflated by the GDP deflator), share of total	1	1	1
31.	Financial Statements Statistics of Corporations by Industry: Transport and Postal activities, Sales (deflated by the GDP deflator), share of total	1	1	1
32.	Financial Statements Statistics of Corporations by Industry: Electricity, Gas, Heat supply and Water, Sales (deflated by the GDP deflator), share of total	1	1	1

No	Data description	Trans	SA	Slow
33.	Financial Statements Statistics of Corporations by Industry: Wholesale trade and Retail trade, Sales (deflated by the GDP deflator), share of total	1	1	1
34.	Financial Statements Statistics of Corporations by Industry: Real estate, Sales (deflated by the GDP deflator), share of total	1	1	1
35.	Financial Statements Statistics of Corporations by Industry: Services, Sales (deflated by the GDP deflator), share of total	1	1	1
Housing starts				
36.	Housing starts	5	1	0
Real inventories, orders, and unfilled orders				
37.	Industrial production: Inventories（2010=100）	5	1	1
Stock prices				
38.	TOPIX(2005=100)	5	0	0
39.	Real stock price（Nikkei 225 deflated by the GDP deflator）	5	0	0
Exchange rates				
40.	Real effective exchange rate	5	0	0
Interest rates				
41.	Interest rate: Long-term Prime Lending Rates adopted and released by Mizuho Bank	1	0	0
42.	Interest rate: Government bond yield (10-year)	1	0	0
43.	Financial Statements Statistics of Corporations by Industry: All industries, Interest cost/ liability with interest	1	0	1
44.	Financial Statements Statistics of Corporations by Industry: Manufacturing, Interest cost/ liability with interest	1	0	1
45.	Financial Statements Statistics of Corporations by Industry: Construction, Interest cost/ liability with interest	1	0	1
46.	Financial Statements Statistics of Corporations by Industry: Transport and Postal activities, Interest cost/ liability with interest	1	0	1
47.	Financial Statements Statistics of Corporations by Industry: Electricity, Gas, Heat supply and Water, Interest cost/ liability with interest	1	0	1
48.	Financial Statements Statistics of Corporations by Industry: Wholesale trade and Retail trade, Interest cost/ liability with interest	1	0	1
49.	Financial Statements Statistics of Corporations by Industry: Real estate, Interest cost/ liability with interest	1	0	1
50.	Financial Statements Statistics of Corporations by Industry: Services, Interest cost/ liability with	1	0	1
Money and credit quantity aggregates				
51.	Flow of Funds Accounts: depository corporations, Asset, Loans (deflated by the GDP deflator)	5	0	0
52.	Financial Statements Statistics of Corporations by Industry: Liability, Bank loans (deflated by the GDP deflator)	5	1	0
53.	Tokyo Shoko Research, LTD, Corporate bankruptcies (number of cases)	5	1	1
54.	Tokyo Shoko Research, LTD, Corporate bankruptcies (amount of liability)	5	0	1
55.	Money stock: M1 (average amounts outstanding, trillions of yen)	5	1	0
56.	Money stock: M2 (average amounts outstanding, trillions of yen)	5	1	0
57.	Monetary base (adjusted for reserve requirement change)	5	1	0
58.	Depository Institute reserve, total (adjusted for reserve requirement change)	5	0	0
59.	Loans and Bills Discounted by Sector: Banking Accounts of Domestically licensed banks, Shinkin Banks, Total (deflated by the GDP deflator）	5	1	0
60.	Loans and Bills Discounted by Sector: Banking Accounts of City banks, total (deflated by the GDP deflator), share of total	1	1	0
61.	Loans and Bills Discounted by Sector: Banking Accounts of Regional banks, Total (deflated by the GDP deflator), share of total	1	1	0
62.	Loans and Bills Discounted by Sector: Banking Accounts of Shinkin banks, Total (deflated by the GDP deflator), share of total	1	1	0

No	Data description	Trans	SA	Slow
63.	Loans and Bills Discounted by Sector: Banking Accounts of Domestically licensed banks, Shinkin Banks, Manufacturing (deflated by the GDP deflator), share of total	1	1	0
64.	Loans and Bills Discounted by Sector: Banking Accounts of Domestically licensed banks, Shinkin Banks, Construction (deflated by the GDP deflator), share of total	1	1	0
65.	Loans and Bills Discounted by Sector: Banking Accounts of Domestically licensed banks, Shinkin Banks, Transport and Postal activities (deflated by the GDP deflator), share of total	1	1	0
66.	Loans and Bills Discounted by Sector: Banking Accounts of Domestically licensed banks, Shinkin Banks, Electricity, Gas, Heat supply and Water (deflated by the GDP deflator), share of	1	1	0
67.	Loans and Bills Discounted by Sector: Banking Accounts of Domestically licensed banks, Shinkin Banks, Wholesale trade and Retail trade (deflated by the GDP deflator), share of total	1	1	0
68.	Loans and Bills Discounted by Sector: Banking Accounts of Domestically licensed banks, Shinkin Banks, Real estate (deflated by the GDP deflator), share of total	1	1	0
69.	Loans and Bills Discounted by Sector: Banking Accounts of Domestically licensed banks, Shinkin Banks, Services (deflated by the GDP deflator), share of total	1	1	0
70.	Loans and Bills Discounted by Sector: Banking Accounts of Domestically licensed banks, Shinkin Banks, Local Governments (deflated by the GDP deflator), share of total	1	1	0
71.	Loans and Bills Discounted by Sector: Banking Accounts of Domestically licensed banks, Shinkin Banks, Households (deflated by the GDP deflator), share of total	1	1	0
72.	Loans and Bills Discounted by Sector: Banking Accounts of City banks, Manufacturing (deflated by the GDP deflator), share of total	1	1	0
73.	Loans and Bills Discounted by Sector: Banking Accounts of City banks, Construction (deflated by the GDP deflator), share of total	1	1	0
74.	Loans and Bills Discounted by Sector: Banking Accounts of City banks, Real estate (deflated by the GDP deflator), share of total	1	1	0
75.	Loans and Bills Discounted by Sector: Banking Accounts of City banks, Services (deflated by the GDP deflator), share of total	1	1	0
76.	Loans and Bills Discounted by Sector: Banking Accounts of Regional banks, Manufacturing (deflated by the GDP deflator), share of total	1	1	0
77.	Loans and Bills Discounted by Sector: Banking Accounts of Regional banks, Construction (deflated by the GDP deflator), share of total	1	1	0
78.	Loans and Bills Discounted by Sector: Banking Accounts of Regional banks, Real estate (deflated by the GDP deflator), share of total	1	1	0
79.	Loans and Bills Discounted by Sector: Banking Accounts of Regional banks, Services (deflated by the GDP deflator), share of total	1	1	0
80.	Loans and Bills Discounted by Sector: Banking Accounts of Shinkin banks, Manufacturing (deflated by the GDP deflator), share of total	1	1	0
81.	Loans and Bills Discounted by Sector: Banking Accounts of Shinkin banks, Local governments (deflated by the GDP deflator), share of total	1	1	0
82.	Loans and Bills Discounted by Sector: Banking Accounts of Shinkin banks, Households (deflated by the GDP deflator), share of total	1	1	0
83.	Loans and Bills Discounted by Sector: Banking Accounts of Domestically licensed banks, Shinkin Banks, Real estate (deflated by the GDP deflator), share of total	5	1	0
84.	Loans and Bills Discounted by Sector: Banking Accounts of City banks, Real estate (deflated by the GDP deflator), share of lending to real estate	1	1	0
85.	Loans and Bills Discounted by Sector: Banking Accounts of Regional banks, Real estate (deflated by the GDP deflator), share of lending to real estate	1	1	0
86.	Flow of Funds Accounts: Financial institution other than Central bank, Asset, Industrial securities, Commercial paper (deflated by the GDP deflator)	5	0	1
87.	Flow of Funds Accounts: Financial institution other than Central bank, Asset, Securities (deflated by the GDP deflator)	5	0	1
88.	Flow of Funds Accounts: Banks, Asset, Industrial securities, Commercial paper (deflated by the GDP deflator)	5	0	1
89.	Flow of Funds Accounts: Banks, Asset, Shares (deflated by the GDP deflator)	5	0	1
90.	Flow of Funds Accounts: insurance, Asset, Industrial securities, Commercial paper (deflated by the GDP deflator)	5	0	1
91.	Flow of Funds Accounts: insurance, Asset, Shares (deflated by the GDP deflator)	5	0	1
92.	Flow of Funds Accounts: securities companies, Asset, Industrial securities, Commercial paper (deflated by the GDP deflator)	5	0	1
93.	Flow of Funds Accounts: securities companies, Asset, Shares (deflated by the GDP deflator)	5	0	1

No	Data description	Trans	SA	Slow
94.	Flow of Funds Accounts: public financial institutions, Asset, Industrial securities, Commercial paper (deflated by the GDP deflator)	5	0	1
95.	Flow of Funds Accounts: public financial institutions, Asset, Shares (deflated by the GDP	5	0	1
96.	Financial Statements Statistics of Corporations by Industry: All industries, Liability, Bonds (deflated by the GDP deflator)	5	0	1
97.	Financial Statements Statistics of Corporations by Industry: Manufacturing, Liability, Bonds (deflated by the GDP deflator), share of total	1	0	1
98.	Financial Statements Statistics of Corporations by Industry: Construction, Liability, Bonds (deflated by the GDP deflator), share of total	1	0	1
99.	Financial Statements Statistics of Corporations by Industry: Transport and Postal activities, Liability, Bonds (deflated by the GDP deflator), share of total	1	0	1
100.	Financial Statements Statistics of Corporations by Industry: Electricity, Gas, Heat supply and Water, Liability, Bonds (deflated by the GDP deflator), share of total	1	0	1
101.	Financial Statements Statistics of Corporations by Industry: Wholesale trade and Retail trade, Liability, Bonds (deflated by the GDP deflator), share of total	1	0	1
102.	Financial Statements Statistics of Corporations by Industry: Real estate, Liability, Bonds (deflated by the GDP deflator), share of total	1	0	1
103.	Financial Statements Statistics of Corporations by Industry: Services, Liability, Bonds (deflated by the GDP deflator), share of total	1	0	1
Price indexes				
104.	Urban Land Price Index of Six Large City Areas, Commercial	5	0	1
105.	Urban Land Price Index; Nationwide, excluding Six Large City Areas, Commercial	5	0	1
106.	Urban Land Price Index of Six Large City Areas, Residential	5	0	1
107.	Urban Land Price Index; Nationwide, excluding Six Large City Areas, Residential	5	0	1
108.	Urban Land Price Index; Nationwide, Commercial	5	0	1
109.	Urban Land Price Index; Nationwide, Residential	5	0	1
110.	GDP deflator	5	1	1
111.	GDP: Private final consumption expenditure deflator	5	1	1
112.	GDP: Private housing investment deflator	5	1	1
113.	GDP: Real Private non-residential investment deflator	5	1	1
114.	GDP: Real Government final consumption expenditure deflator	5	1	1
115.	GDP: Public fixed capital formation deflator	5	1	1
116.	GDP: Durable goods deflator	5	1	1
117.	GDP: Semi-durable goods deflator	5	1	1
118.	GDP: Non-durable goods deflator	5	1	1
119.	GDP: Services deflator	5	1	1
120.	Corporate Goods Price Index: Crude oil	5	0	0
121.	CPI excluding fresh food (adjusted to exclude the effects of changes in the consumption tax	5	0	1
122.	The Nikkei Commodity Index of 42 items, fiber	5	0	1
123.	The Nikkei Commodity Index of 42 items, steel materials	5	0	1
124.	The Nikkei Commodity Index of 42 items, nonferrous metals	5	0	1
125.	The Nikkei Commodity Index of 42 items, Lumber & Wood products	5	0	1
126.	The Nikkei Commodity Index of 42 items, Chemicals	5	0	1
127.	The Nikkei Commodity Index of 42 items, Petroleum	5	0	0
128.	The Nikkei Commodity Index of 42 items, Pulp & Paper	5	0	1
129.	The Nikkei Commodity Index of 42 items, Food	5	0	1
130.	The Nikkei Commodity Index of 42 items, Other	5	0	1
131.	CGPI excluding consumption tax	5	0	1
132.	CGPI export price index (contract currency basis)	5	0	1
133.	CGPI import price index (contract currency basis)	5	0	1
Earnings				
134.	Monthly Labour Survey, Total cash earnings（2010=100）(nominal)	5	1	1
135.	Monthly Labour Survey, Scheduled cash earnings（2010=100）(nominal)	5	1	1
Others（Commodity prices, US variables）				
136.	Crude Oil prices (Dubai oil)	5	0	0
137.	U.S. GDP: Real Gross domestic expenditure (GDE=GDP)	5	1	0
138.	U.S. CPI: all items	5	1	0

Table 2: Selected list of administrative guidance

Target borrowers	Guideline number	Implementation period	Summary of requests made to banks	Numerical target	Correlation with the dummy variable of QR
Non-targeted	3,153	July 1951 : 1991*	Banks should limit unimportant lending, such as that related to speculation, amusement activities, or spending on luxuries. Banks should coordinate with other financial institutions when lending to large counterparties.	N	0.231
Non-targeted	1,083	Mar. 1953 : 1991*	Banks should lend to important industries and should make efforts to curb non-essential and non-urgent lending. Banks should facilitate lending to SMEs.	N	0.231
Non-targeted	1,421	Nov. 1957 : 1991*	Banks should limit their deposit-to-lending ratio equal to or below 80%, and make efforts to reduce the ratio if it already exceeds that value.	Y	0.231
Non-targeted	1,152	May 1979 : 1991*	When providing credit guarantees, financial institutions should examine and confirm that the size of the guarantee is not excessive, and the appropriate balance of size of deposit and lending is maintained.	N	-0.012
Non-targeted	901	Apr. 1982 : 1986*	Banks should construct their composition of balance sheet so that four variables, deposit-to-lending rate, capital account-to-deposit ratio, liquid asset-to-deposit ratio, and real-estate assets that serve for business-to-capital account ratio, are equal to or below the target values.	Y	-0.190
Non-targeted	Administrative circular	Apr. 1993 : 1996*	In line with the governmental decision included in "Comprehensive Package of Economic Measures," lending should be reinforced.	N	-0.165
Non-targeted	Administrative circular	June 1995 : 1996*	In line with the governmental decision included in "Package of measures to reinforce 'Immediate Measures Responding to the Yen Appreciation and Current State of the Economy,'" financial intermediation should be facilitated.	N	-0.108
SME	506	Mar. 1970 : 1977*	Attention should be paid so that the effects of contractionary monetary policy are not unduly passed on to SMEs.	N	0.298
SME	515	Feb. 1971 : 1977*	Consideration should be made to recent government initiatives for SMEs and economic difficulties facing SMEs.	N	0.298
SME	2,756	Aug. 1971 : 1977*	Facilitation of financial intermediation should be maintained and special consideration should made for SMEs.	N	0.298
SME	427	Feb. 1973 : 1991*	Efforts should be made to increase lending to SMEs so as to mitigate adverse effects of economic circumstances on SMEs.	N	0.255
SME	2,250	July 1973 : 1977*	Efforts should be made to maintain the size of lending to SMEs at the current level or above.	Y	0.249
SME	Administrative circular	Nov. 1977 : 1991*	Efforts should be made to increase lending to SMEs so as to mitigate adverse effects of economic circumstances on SMEs.	N	-0.058
SME	534	Mar. 1981 : 1991*	Continuing consideration should be made for facilitation of financial intermediation to SMEs.	N	0.042
SME	627	Apr. 1992 : 1996*	Continuing consideration should be made for facilitation of financial intermediation to SMEs.	N	-0.190
SME	2,047	Nov. 1992 : 1996*	Continuing consideration should be made for facilitation of financial intermediation to SMEs.	N	-0.177
SME	176	Feb. 1993 : 1996*	Continuing consideration should be made for facilitation of financial intermediation to SMEs.	N	-0.171
SME	2,165	Nov. 1993 : 1996*	Continuing consideration should be made for facilitation of financial intermediation, including lending to SMEs.	N	-0.152

Target borrowers	Guideline number	Implementation period	Summary of requests made to banks	Numerical target	Correlation with the dummy variable of QR
SME	Administrative circular	Sep. 1993 : 1996*	Smooth funding should be facilitated, including that to SMEs.	N	-0.158
SME	212	Feb. 1994 : 1996*	Further preparation should be made so as to deal with demand for funding, including that of SMEs.	N	-0.145
SME	2,315	Dec. 1994 : 1996*	Continuing consideration should be made for facilitation of financial intermediation, including lending to SMEs.	N	-0.124
SME	840	May 1995 : 1996*	Continuing consideration should be made for facilitation of financial intermediation, including lending to SMEs.	N	-0.108
SME	2,036	Nov. 1995 : 1996*	Continuing consideration should be made for facilitation of financial intermediation to SMEs.	N	-0.090
Coal mining industry	1,473	Oct. 1961 : 1976*	About 1.5 billion yen should be lent to the coal mining industry at the end of the year.	Y	0.358
Household	3,246	Oct. 1974 : 1991*	Continuing consideration should be made for housing loans.	N	-0.100
Household	2,565	Nov. 1985 : 1991*	Efforts should be made for provision of consumer loans to encourage households' consumption.	N	0.221
Household	1,197	June 1987 : 1996*	Efforts should be made for provision of consumer loans to encourage households' consumption.	N	0.083
Household	Administrative circular	Sep. 1993 : 1996*	Continuing consideration should be made for housing loans.	N	-0.158
Real estate	4,075	Nov. 1972 : 1991*	Given that land price stabilization is an important economic issue in Japan, the government has been requesting financial institutions to appropriately conduct their lending that serves for real-estate purchase. Financial institutions should recognize their public nature, and when conducting lending for real-estate purchase, banks should pay attention not to invoke criticism that financial institutions are contributing to cornering of real-estate, and should appropriately respond to social demand such as residential investments.	N	0.249
Real estate	247	Jan. 1973 : Dec. 1973	Regardless of borrower’s industry, financial institutions should limit independently the growth rate of lending to real estate transactions equal to or below that of total lending, except for lending to public institutions committed to residential development and housing loans to households.	Y	
Real estate	2,992	Sep. 1973 : 1974*	Financial institutions should consider limiting lending to construction activities that the Cooperation Body of Construction Investment Adjustment has recommended be postponed or reduced in scale, and for consumer loans other than home loans.	N	0.603
Real estate	4,279	Dec. 1973 : Dec. 1974	Financial institutions should contain the growth rate of lending to real estate industry and hotel business equal to or below the growth rate of total lending.	Y	
Real estate	589	Feb. 1974 : Dec. 1974	For lending for land purchase, use of the land and progress of plans for use of the land should be carefully examined even if the loan has already been made. If examination shows that there are inappropriate loans, measures should be taken, including refusal of renewal of bill, renewal of agreement, and collection of these loans.	N	0.488
Real estate	Administrative circular	Mar. 1975 : 1991*	Loans for land acquisition need to be controlled. Specifically, loans for land acquisition for the purpose of resale should be restricted stringently.	N	-0.148

Target borrowers	Guideline number	Implementation period	Summary of requests made to banks	Numerical target	Correlation with the dummy variable of QR
Real estate	4,481	Dec. 1974 : 1981*	Though guideline No. 4279 and No. 589 will be abolished at the end of this year, financial institutions should continuously limit loans for land acquisition for the purpose of resale or non-essential and non-urgent purposes, giving special consideration to loans to SMEs and home loans.	N	-0.188
Real estate	Administrative circular	July 1985 : 1991*	Efforts should be made not to contribute to land transactions with inappropriate prices or speculative hoarding and selling of land.	N	0.209
Real estate	800	Apr. 1986 : Dec. 1991	Financial institutions should make efforts to provide appropriate loans that do not invite criticism that financial institutions are contributing to speculative hoarding and selling of land. They should report biannually the status of their lending to the real-estate and construction industries for the following one year.	N	0.246
Real estate	3,065	Dec. 1986 : Dec. 1991	As for loans for land acquisition, financial institutions should examine land use and the progress of plans for use of the land. Loans related to speculative hoarding and selling of real estate should not be conducted. Financial institutions should report biannually the status of their lending to the real-estate and construction industries until March 1988.	N	0.221
Real estate	2,741	Oct. 1987 : Dec. 1991	As for loans for land acquisition in the supervised area covered by the National Land Use Planning Act, it should be confirmed that more than six weeks have passed without receiving notice of non-recommendation by the National Land Agency. The land use and progress of plans for use of the land should be examined.	N	0.339
Real estate	2,442	Oct. 1989 : Dec. 1991	Loans to activities related to land should be made stringently. Loans to non-bank money lenders should be examined so that the loans will not be used for speculative hoarding and selling of land.	N	0.556
Real estate	555	Mar. 1990 : Dec. 1991	We (the MOF) believe that balanced volume of lending is needed so as to deal with land price issues. Financial institutions should limit the growth rate of lending to the real estate industry equal to or below that of total lending except for lending to public institutions committed to residential development. Lending to real-estate, construction, and non-bank industries should be reported.	Y	
Real estate	2,425	Dec. 1991 : Feb. 1994	If growth of lending to the real estate industry by financial institutions exceeds that of total lending growth by more than 3%, continuously for more than two months, the MOF plans to issue an alert, and if growth of lending to the real estate industry exceeds that of total lending growth by more than 5%, continuously for more than two months, the MOF plans to give guideline to restrict loan volume, taking financial and economic activity into account.	Y	-0.038
Real estate	Administrative circular	Aug. 1992 : 1996*	Eased lending criteria of the bubble era should be corrected, but necessary funding to the real economy should be maintained.	N	-0.184

Notes: 1. Administrative guidelines that have "*" in the ending dates of implementation are those for which the ending dates are not explicitly reported in "Collection of Ministry of Finance Banking Bureau Administrative guidance (the collection of guidelines)," but the collection no longer lists the guidance in the specified year and beyond.

2. "Administrative circular" is administrative guidance which was given by the manager of the Banks Division of the Banking Bureau. The status of "Administrative circular" is lower than "Administrative guidance", which was given by the Director of the Banking Bureau.

3. SME stands for Small and Medium-sized Enterprises.

4. "Y" in the Numerical Target column indicates the guideline has a numerical target, and "N" otherwise.

5. "Dummy variable of QR" consists of document number 247, 4279, 555.

Source: "Collection of Ministry of Finance Banking Bureau Administrative Guidance", Kinzai Institute for Financial Affairs, inc.

Table 3: Quantitative Restriction and Window Guidance

	QR	WG
Authority responsible for the instrument	- Ministry of Finance (currently, Financial Service Agency)	- Bank of Japan
Instrument	- Administrative document made by Banking Bureau of MOF	- Guidance made by Banking Department of BOJ
Requirement made to banks	- To contain growth rate of lending to the specific sector to less than that of total lending	- To contain total lending volume below the level of what BOJ sees as appropriate
Purpose	- To correct excessive lending for firms associated with land purchases (guideline No. 247) - To mitigate upsurge of land price from financial side (guideline No. 555)	- To supplement to monetary policy through other policy instruments such as changes in official discount rate, market operation by buying and selling of bills and bonds, and deposit reserve requirement ratios
Targeted financial institutions	- Institutions under MOF's supervisory power (All financial institutions) - For institutions below, QR was conducted by corresponding supervisors. - Shinkin bank (direct supervisors are prefectural government). - Labor bank (direct supervisors are Ministry of Labor*) *Current Ministry of Health, Labor and Welfare	- Coverage was expanded in a stepwise manner; - 1957～ City bank, long term credit bank - 1964～ City bank, long term credit bank, trust bank (banking account), Regional bank - 1973～ City bank, long term credit bank, Regional bank, mutual bank, top rank of Shinkin bank, top rank of foreign banks in Japan
Implementation period	- Implemented twice in the history - January 1973～ December 1973 (guideline No. 247) - December 1973～ December 1974 (guideline No. 4,279) - March 1990～December 1991 (guideline No. 555)	- Implemented every month until 1964, and implemented every quarter in the years beyond until Q2 1992 when abolished
Targeted loan type	- 1970s-1: Regardless of borrower's industry, lending for real estate purchase except for lending to public institution committed to residential development and housing loan to household (guideline No. 247) - 1970s-2: Lending to real estate industry (guideline No. 4,279) * Lending for real estate purchase is also guided to be restricted but there are no numerical target. - 1990s: Lending to real estate industry except for lending to public institution committed to residential development (guideline No. 555)	- Total lending volume

Sources: QR: *Ginkokyoku genko tsutatsushu* ("Collection of Ministry of Finance Banking Bureau Administrative Guidance"), Kinzai Institute for Financial Affairs, inc.
WG: *Setsumei Shiryou (sonota 1)*("Banking Department explanatory material: Others 1"), reference code: 40318, Bank of Japan Archives.

Table 4: Structure of WG

(1) Four stages of WG and their requirements to banks

Stage 1. Guidance that asks banks not to increase their lending amount:

From a macroeconomic perspective, BOJ decides total amount of lending increase, and allocate lending amount to each banks taking into account the balance with the same type of banks and banks' lending position at the time.

Stage 2. Guidance that asks banks to contain their lending amounts:

From a macroeconomic perspective, BOJ decides lending amounts, regardless of banks' own lending plans. In some cases, banks' lending plans are taken into consideration in BOJ's decision.

Stage 3. Guidance based on banks' fund position:

BOJ asks each bank to adjust its own lending plan from the perspective of fund position.

Stage 4. Respect banks' own lending plans

In principle banks' own lending plans are respected by BOJ.

(2) Implementation period of four stages of WG

1972	Q1	Stage 3	1979	Q1	Stage 2	1986	Q1	
	Q2			Q2			Q2	
	Q3			Q3			Q3	
	Q4			Q4			Q4	
1973	Q1	Stage 1	1980	Q1		1987	Q1	Stage 4*
	Q2			Q2			Q2	
	Q3			Q3			Q3	
	Q4			Q4	Gradual lifting of Stage 2		Q4	
1974	Q1		1981	Q1		1988	Q1	
	Q2			Q2	Stage 4		Q2	
	Q3			Q3			Q3	
	Q4			Q4			Q4	
1975	Q1	Gradual lifting of Stage 1	1982	Q1		1989	Q1	
	Q2			Q2			Q2	
	Q3			Q3			Q3	Guidance to reduce lending amount**
	Q4			Q4			Q4	
1976	Q1		1983	Q1		1990	Q1	
	Q2			Q2			Q2	
	Q3			Q3			Q3	
	Q4			Q4			Q4	
1977	Q1		1984	Q1		1991	Q1	
	Q2			Q2			Q2	
	Q3	Stage 4		Q3			Q3	Abolishment of WG
	Q4			Q4				
1978	Q1		1985	Q1				
	Q2			Q2				
	Q3			Q3				
	Q4			Q4				

Note: 1. During the period denoted by *, while Stage 4 continued, the BOJ asked banks to maintain year-on-year growth rate at zero.
2. During the period denoted by **, the BOJ asked banks to reduce their lending on a year-on-year basis.
Source: Internal documents archived in the Institute for Monetary and Economic Studies, Bank of Japan.

Table 5: Summary statistics of industry group data

Type of business	Loans share of total loans (%, 1985-1989 average)	Land Assets holding relative to net worth (%, 1989 average)	Stock holding relative to net worth (%, 1989 average)
Manufacture of food	2.5	25	6
Manufacture of textile products	1.5	27	10
Manufacture of lumber and wood products, except furniture	0.5	48	9
Manufacture of pulpe, paper, and paper products	1.3	31	11
Printing and allied industries	0.9	31	5
Manufacture of chemical and allied products	3.8	15	6
Manufacture of petroleum and coal products	1.8	72	9
Manufacture of ceramic, stone and clay products	1.4	28	8
Iron and steel	3.3	29	18
Non-ferrows metals and products	1.3	21	11
Fablicated metal products	1.6	30	6
Manufacture of production machinery	2.4	16	8
Manufacture of business oriented machinery	0.7	15	3
Manufacture of electrical machinery, equipment, and supplies	3.7	9	5
Motor vehicles, parts and accessories	2.0	15	6
Miscellaneous transportation equipment	1.2	26	22
Miscellaneous manufacturing industries	1.8	27	4
Construction	7.8	41	12
Electricity	8.0	19	0
Gas, heat sypply and water	0.4	23	0
Transport and postal services	8.2	39	4
Wholesale trade	21.0	40	19
Retail trade	7.6	64	13
Services	15.5	69	11

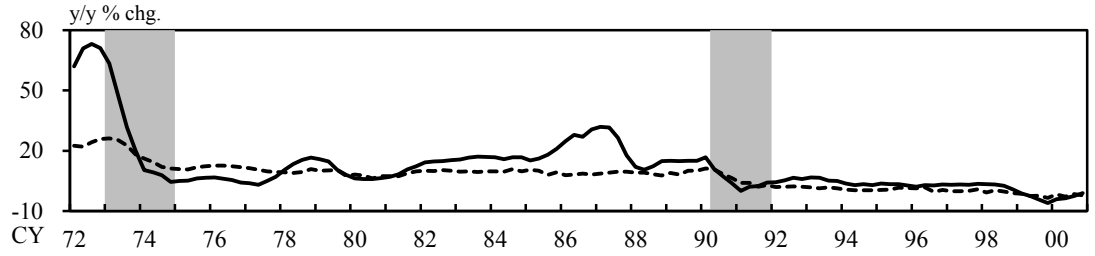
Capital size	Loans share of total loans (%, 1985-1989 average)	Land Assets holding relative to net worth (%, 1989 average)	Stock holding relative to net worth (%, 1989 average)
1 thousand to 5 thousand	28	67	14
5 million to 100 million yen	9	109	15
100 million to 1 billion yen	16	62	12
1 billion yen or over	47	20	9

Notes: Figures based on "Financial Statements Statistics of Corporations by Industry (quarterly surveys)", which is a sampling survey targeting commercial corporations in Japan. All commercial corporations are classified by type of business (in accordance with the "Japan Standard Industrial Classification") and by capital size (under 2 million yen; 2-3 million yen; 3-5 million yen; 5-10 million yen; 10-20 million yen; 20-50 million yen; 50-100 million yen; 100 million to 1 billion yen; and 1 billion yen or over), then extracted as samples. The sample size is around 50 thousand, out of a total size of around 2.8 million, in 2008).

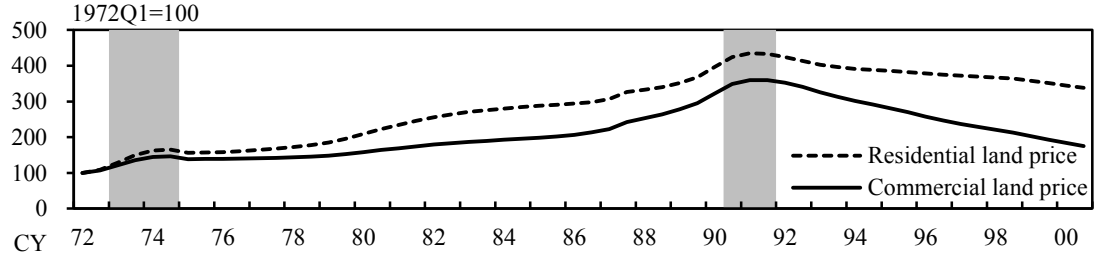
Source: the Ministry of Finance

Figure 1: Developments of the key macroeconomic variables

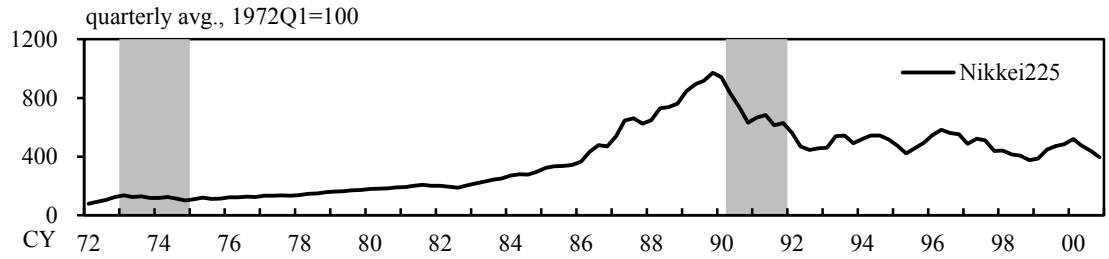
(1) Lending



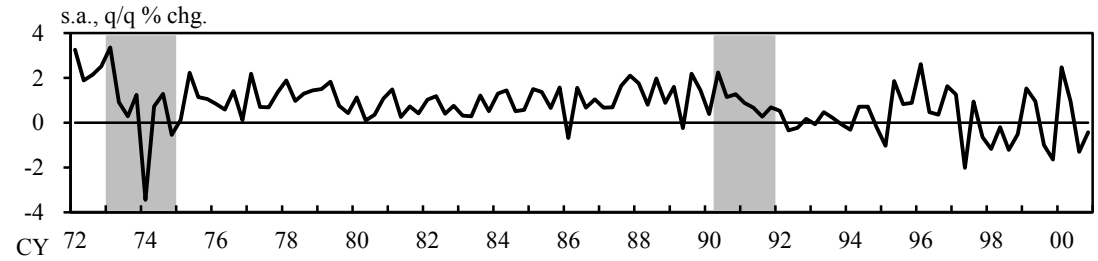
(2) Land price



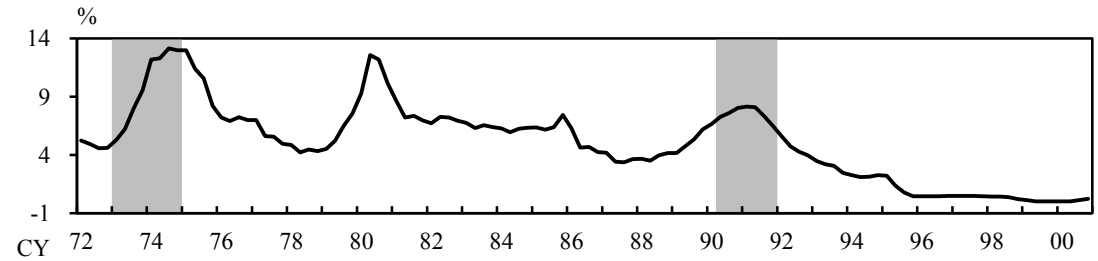
(3) Stock price



(4) Real GDP



(5) Short-term interest rate

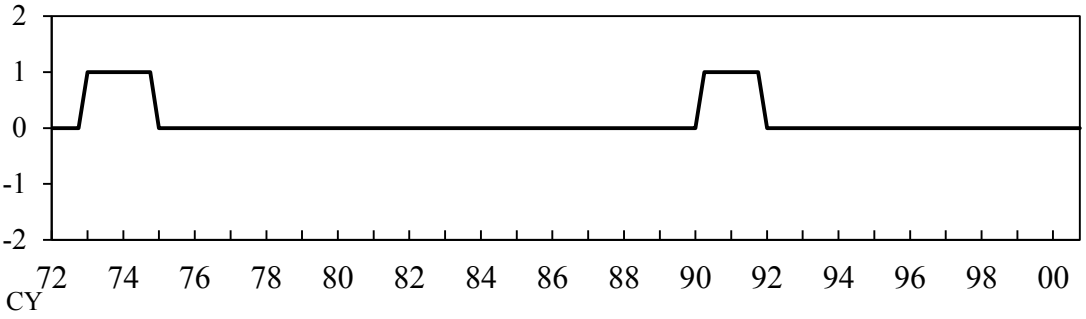


Notes: 1. Shaded areas indicate the implementation period of QR (Quantitative Restriction).
2. Shading is shown on a quarterly basis for the panels of Lending, Stock price, real GDP, and Short-term interest rate, and on a semi-annual basis for the Land price panel.

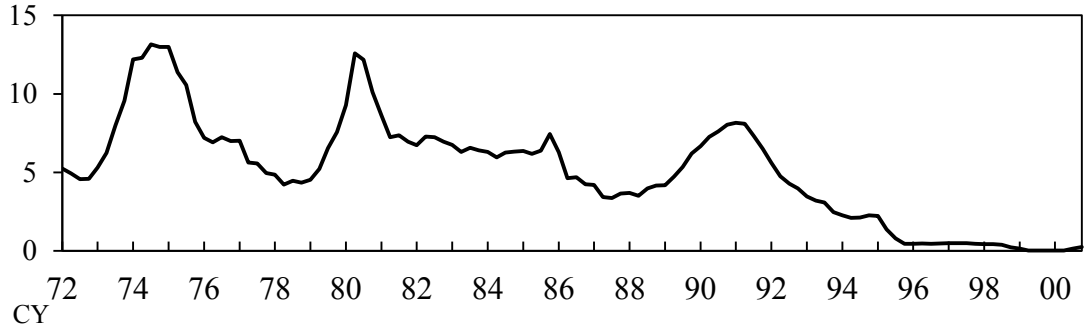
Source: Bank of Japan, Japan Real Estate Institute, and Bloomberg.

Figure 2: Estimated shocks to QR and a short-term interest rate

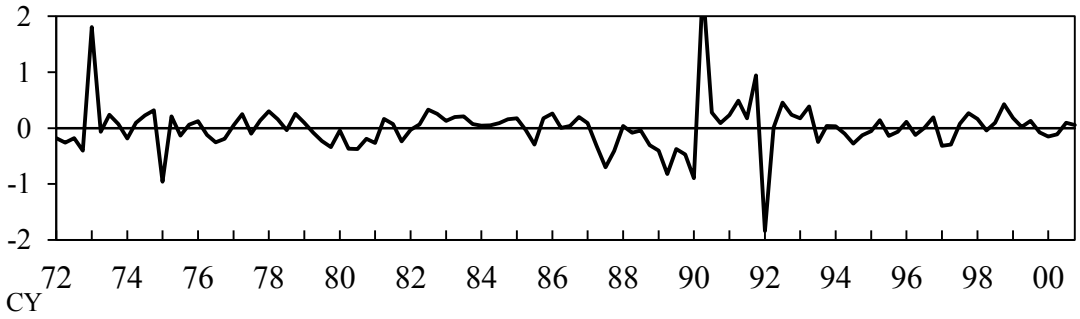
(1) Our measure of Quantitative Restriction



(2) Short-term interest rate



(3) Shocks to Quantitative Restriction



(4) Shocks to a short-term interest rate

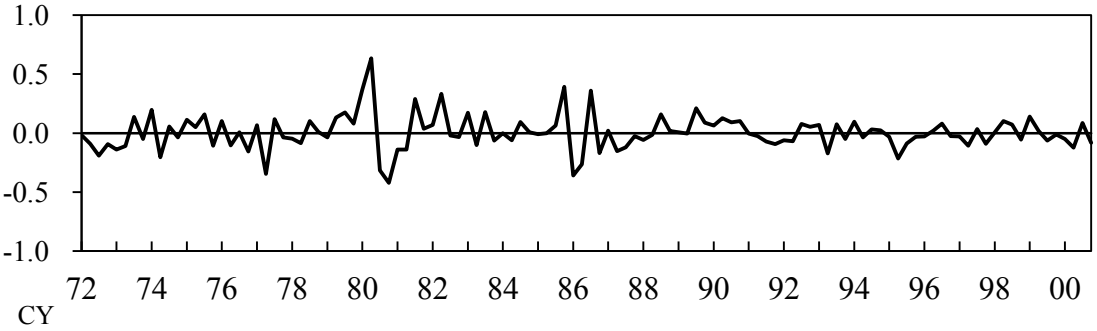
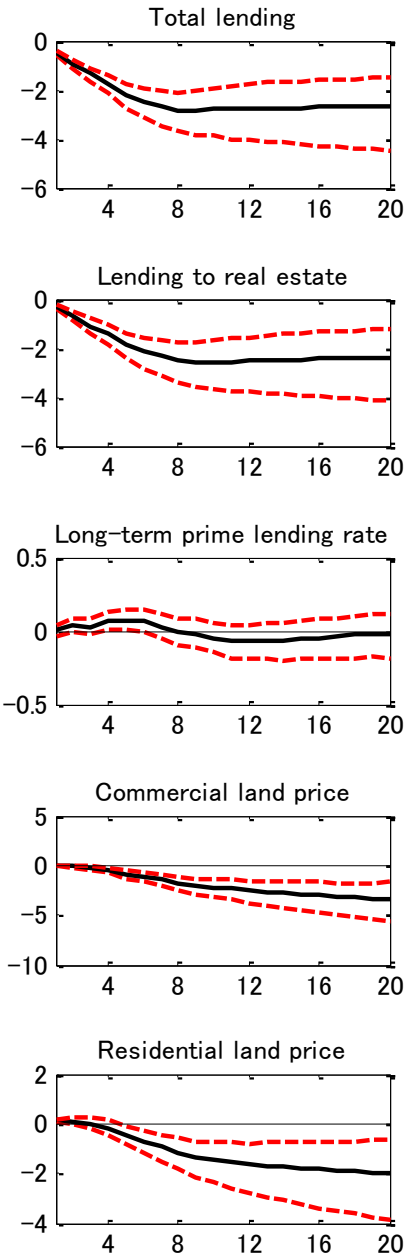
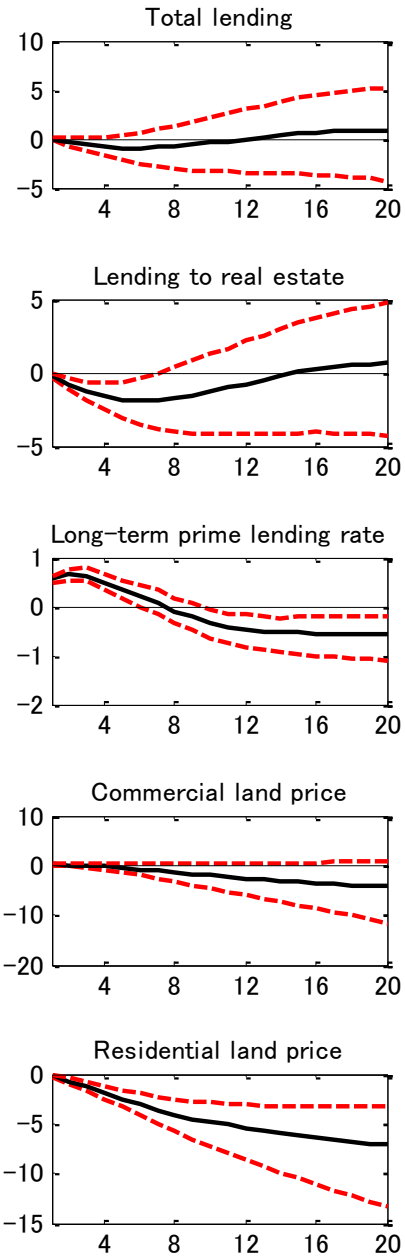


Figure 3: Impulse response function
of bank-related variables

(1) Quantitative Restriction

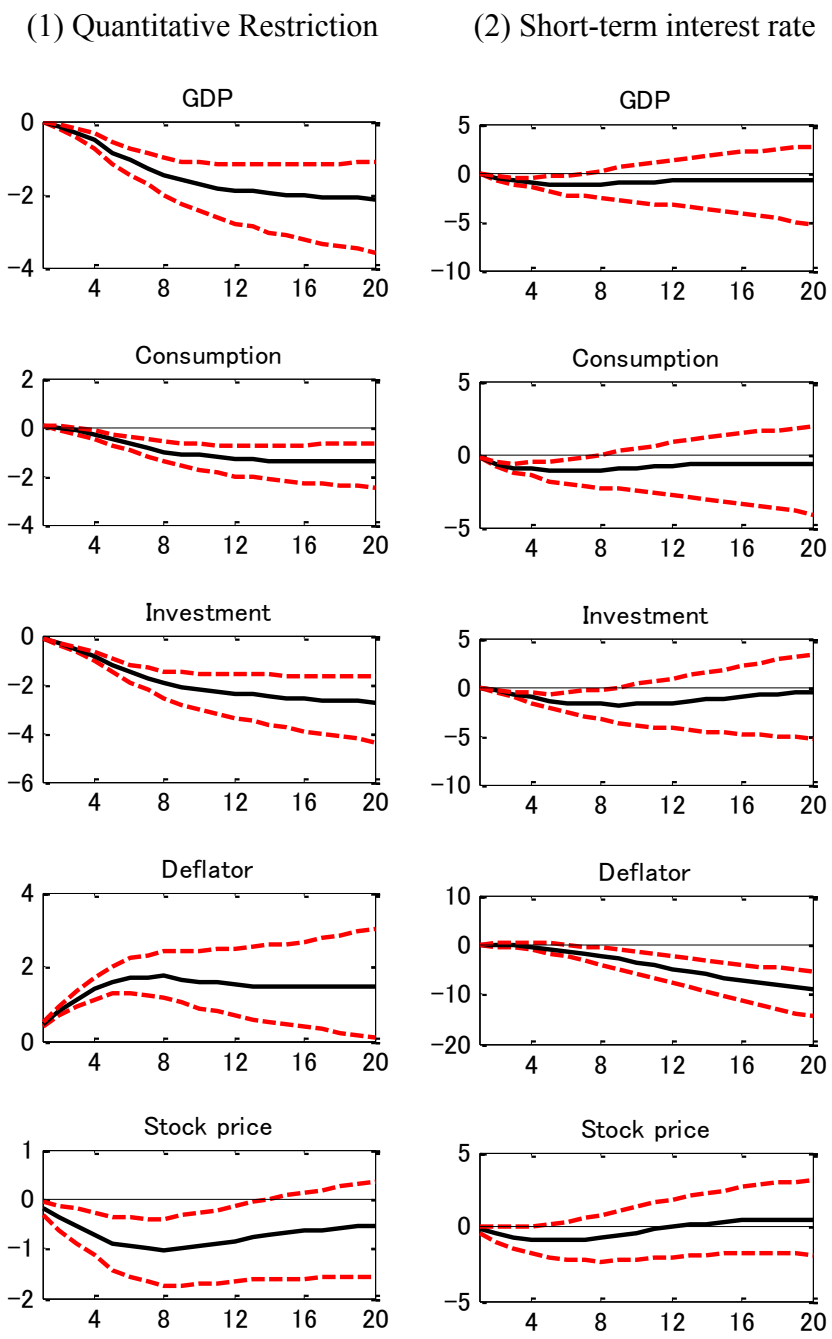


(2) Short-term interest rate



Notes: 1. Impulse response function to a unit positive shock to QR and short term interest rate are shown.
2. The dotted lines represent the 90% confidence intervals, the x-axis represents the number of quarters after a shock, and the y-axis represents percentage deviation from trend.

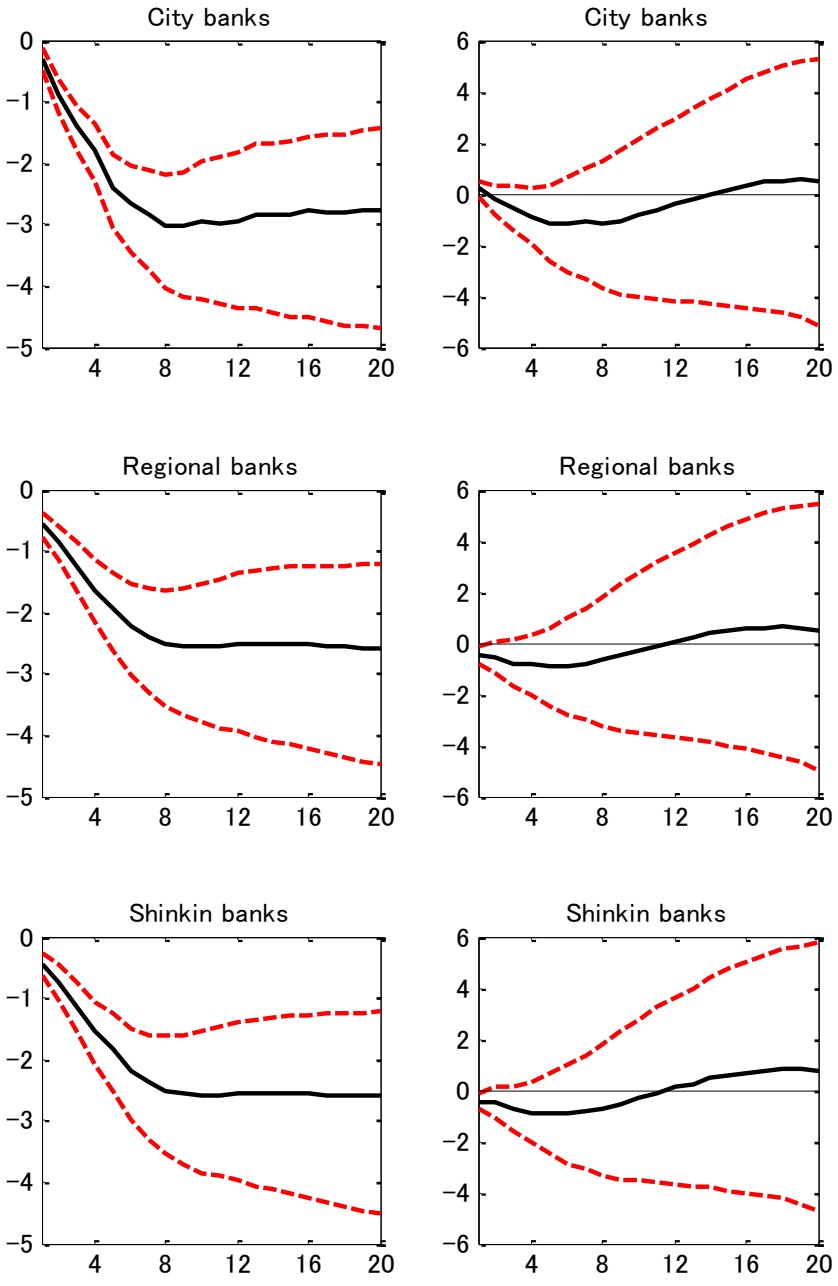
Figure 4: Impulse response function
of macroeconomic variables



Notes: 1. Impulse response function to a unit positive shock to QR and short term interest rate are shown.
2. The dotted lines represent the 90% confidence intervals, the x-axis represents the number of quarters after a shock, and the y-axis represents percentage deviation from trend.

Figure 5: Impulse response function
of lending by bank type

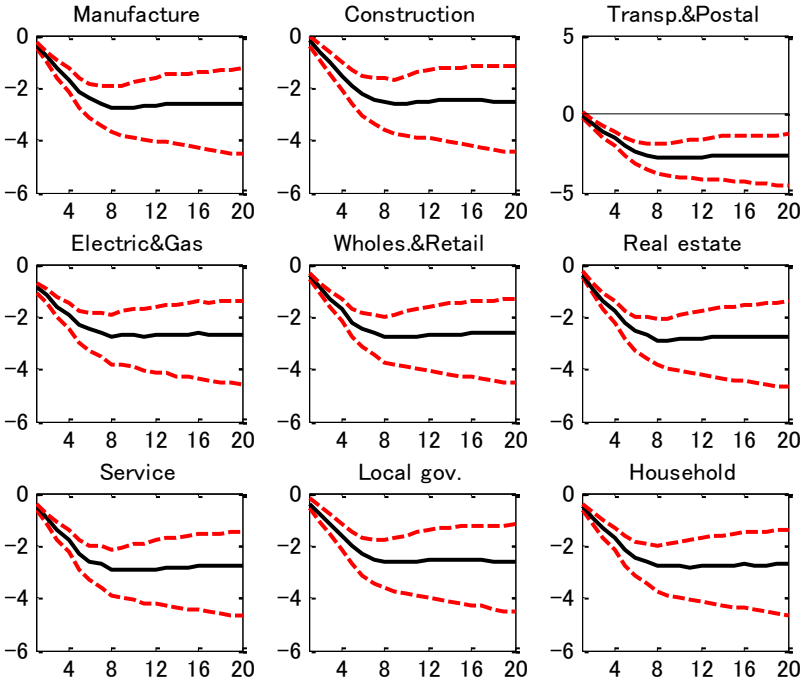
(1) Quantitative Restriction　　(2) Short-term interest rate



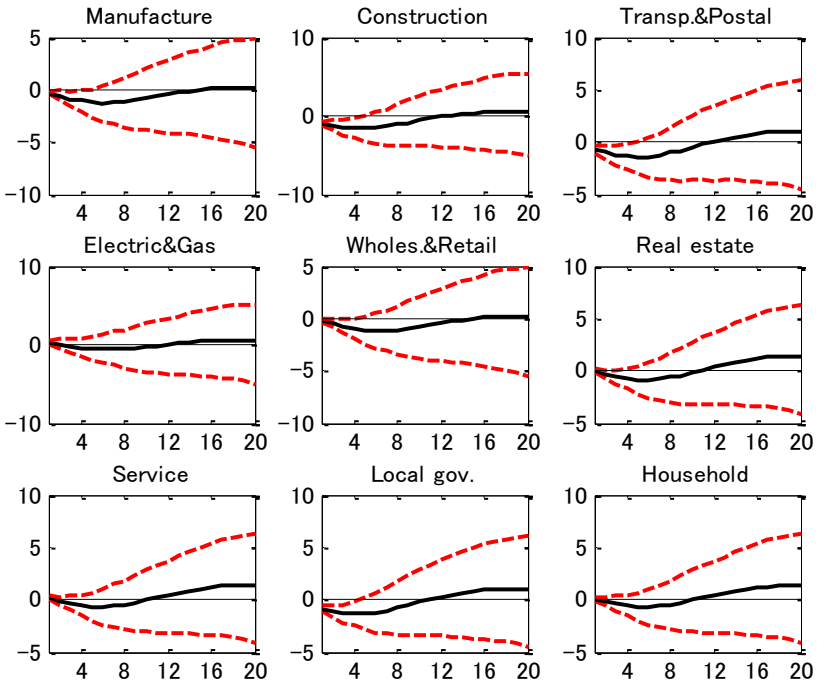
Notes: 1. Impulse response function to a unit positive shock to QR and short term interest rate are shown.
2. The dotted lines represent the 90% confidence intervals, the x-axis represents the number of quarters after a shock, and the y-axis represents percentage deviation from trend.

Figure 6: Impulse response function of lending
by borrowing sector

(1) Impulse response to shocks to Quantitative Restriction



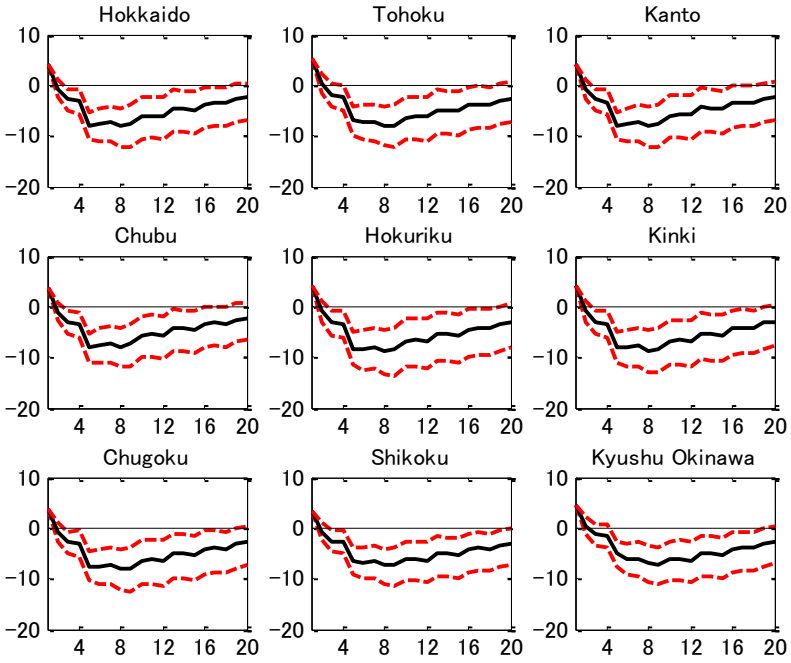
(2) Impulse response of a short-term interest rate



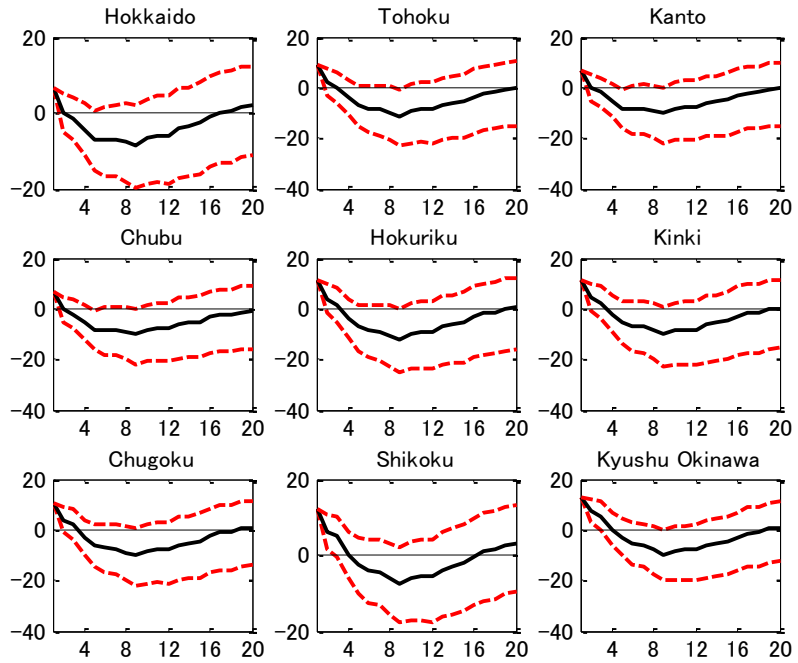
Notes: 1. Impulse response function to a unit positive shock to QR and short term interest rate are shown.
2. The dotted lines represent the 90% confidence intervals, the x-axis represents the number of quarters after a shock, and the y-axis represents percentage deviation from trend.

Figure 7: Impulse response function of business condition across regions

(1) Impulse response to shocks to Quantitative Restriction



(2) Impulse response of a short-term interest rate

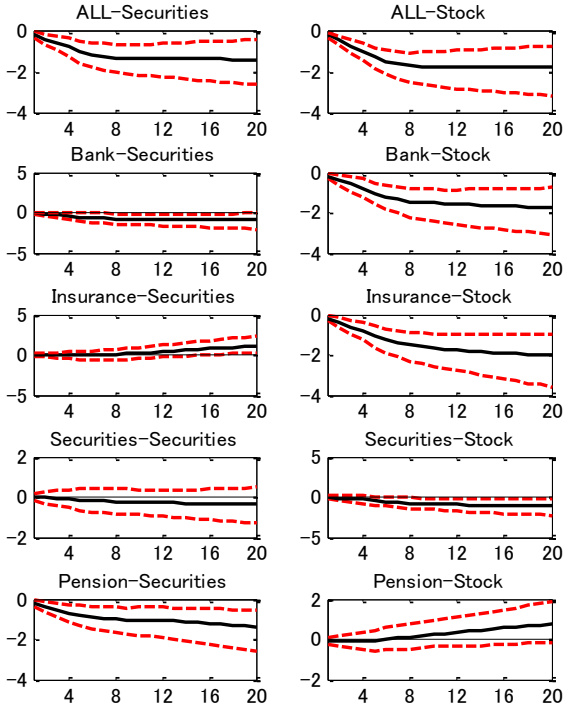


Notes: 1. We use the business condition duffusion index (D.I.) in the TANKAN as our measure of business condition. The D.I. is based on a survey conducted by the Bank of Japan. In the survey, responding enterprises are asked to choose one alternative among three as the best descriptor of prevailing conditions, primarily in the light of individual profits, excluding seasonal factors, at the time of the survey. The alternatives are (1) Favorable, (2) Not so favorable, and (3) Unfavorable. Responses are aggregated into the D.I. as follows:
DI (percent points) = Percentage share of enterprises responding Choice (1) minus Percentage share of enterprises responding Choice (3).

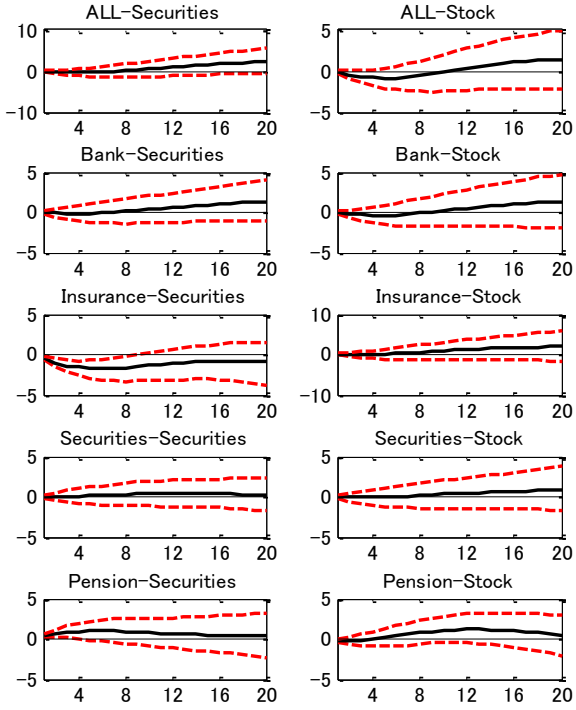
2. Impulse response function to a unit positive shock to QR and short term interest rate are shown. The dotted lines represent the 90% confidence intervals, the x-axis represents the number of quarters after a shock, and the y-axis represents percentage deviation from trend.

Figure 8: Impulse response function of financial intermediation other than banks' lending

(1) Impulse response to shocks to Quantitative Restriction



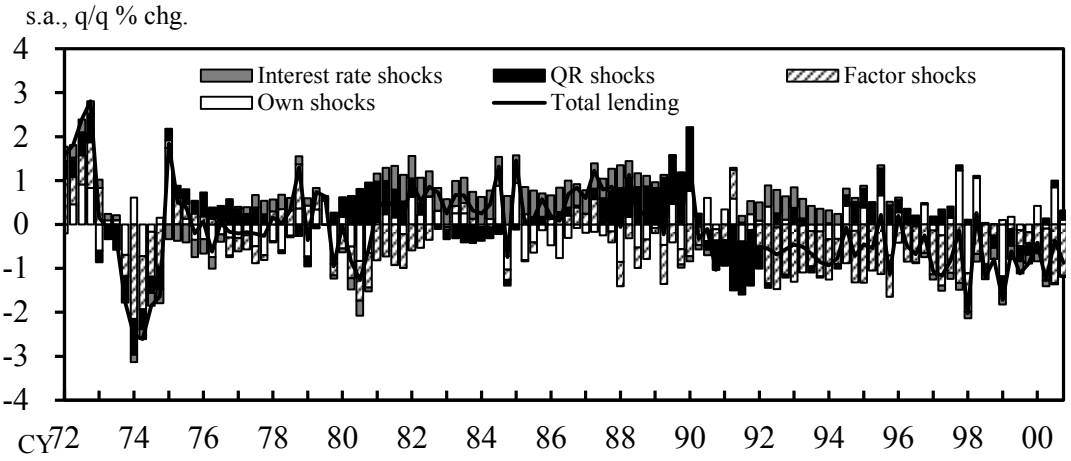
(2) Impulse response of a short-term interest rate



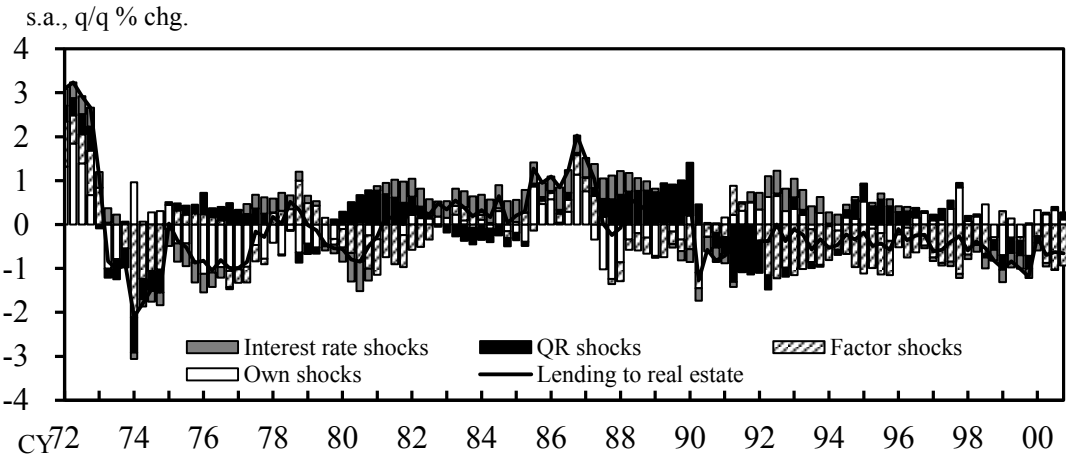
Notes: 1. Impulse response function to a unit positive shock to QR and short term interest rate of financial intermediation other than banks' lending are shown.
Left panels show securities purchase by all financial intermediaries, banks, securities companies, and pension funds. Right panels show stock purchase of these financial intermediaries.
2. The dotted lines represent the 90% confidence intervals. The x-axis represents the number of quarters after a shock, and the y-axis represents percentage deviation from trend.

Figure 9: Historical Decomposition

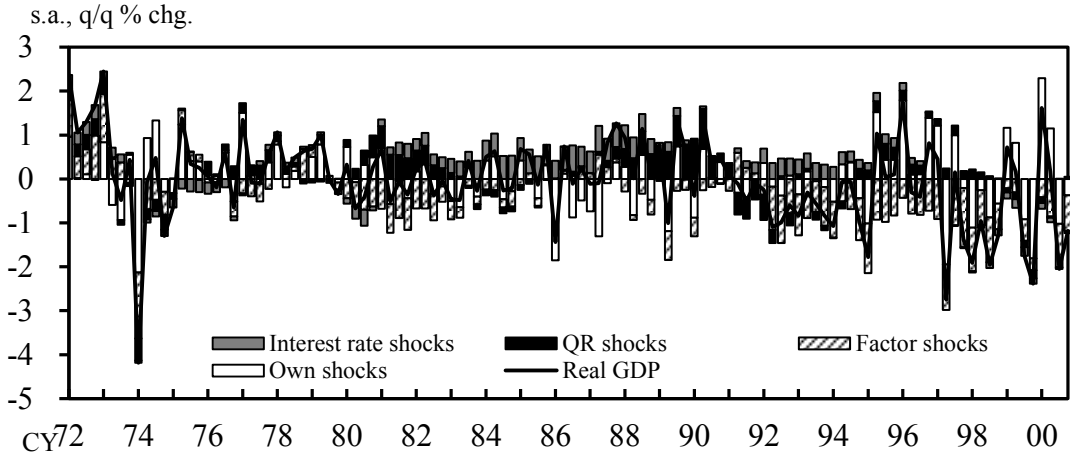
(1) Total lending



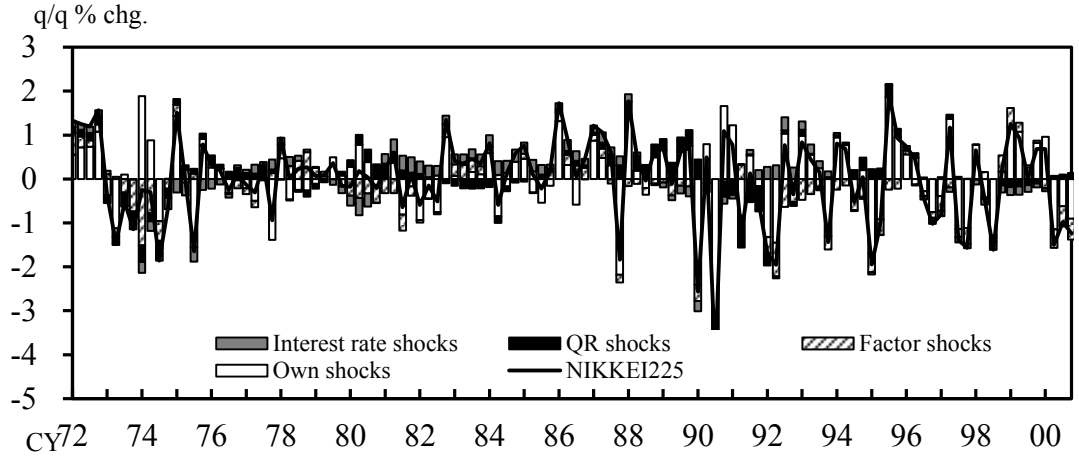
(2) Lending to real estate



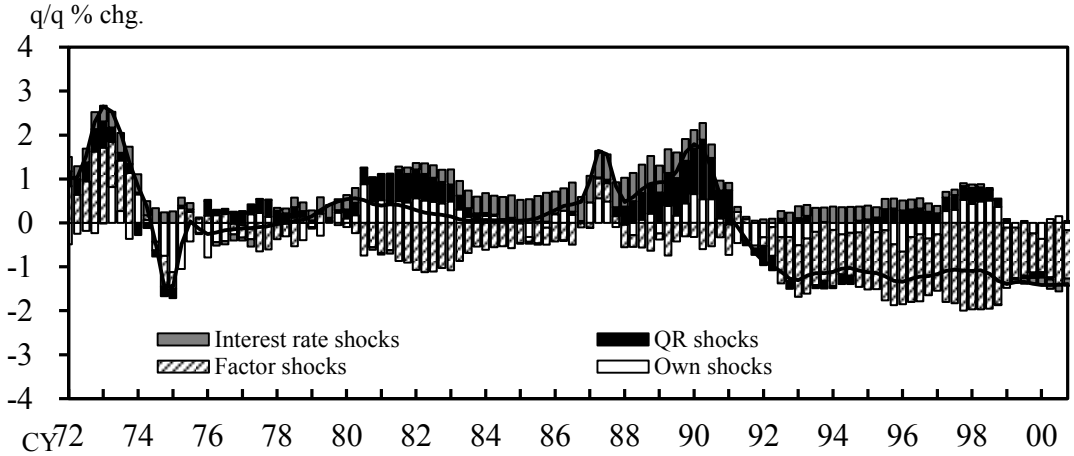
(3) Real GDP



(4) Stock price



(5) Commercial land price



(6) Residential land price

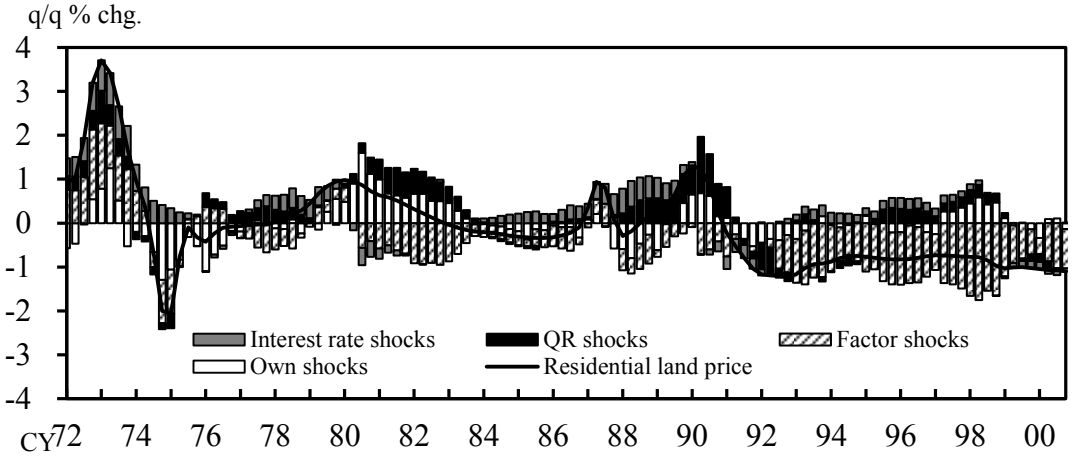
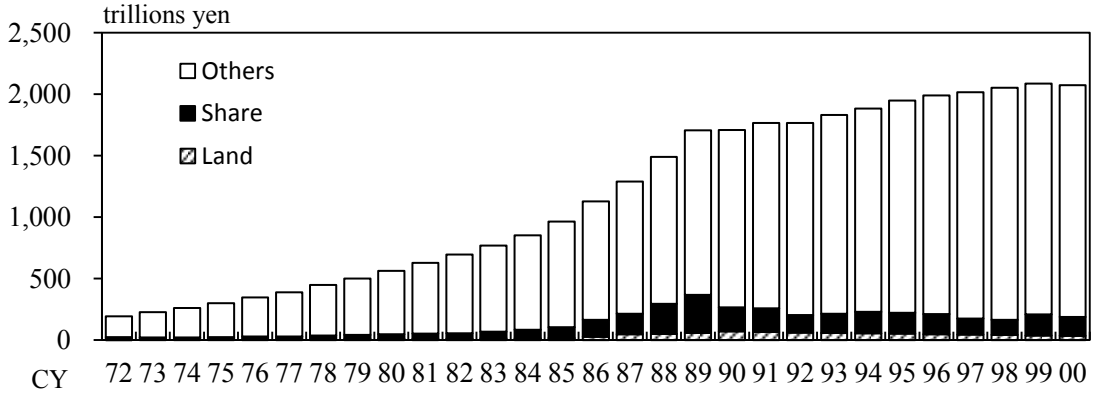
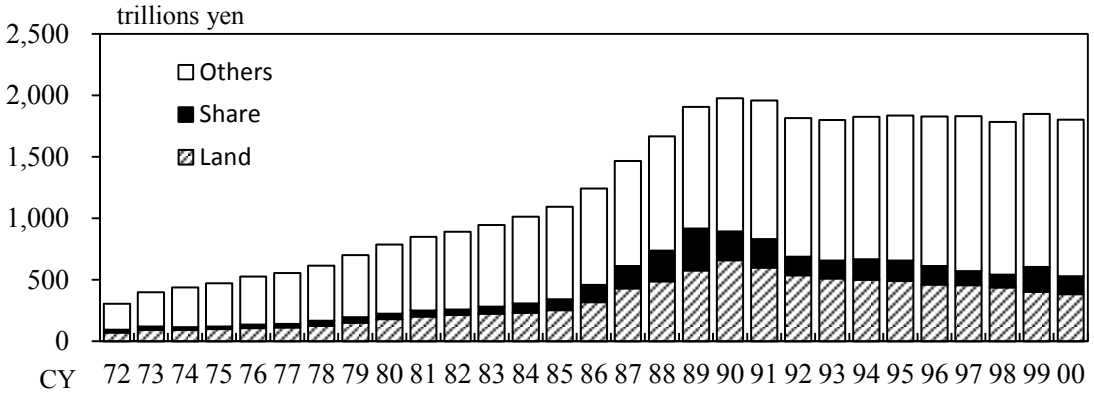


Figure 10: Land asset holding in the private sector

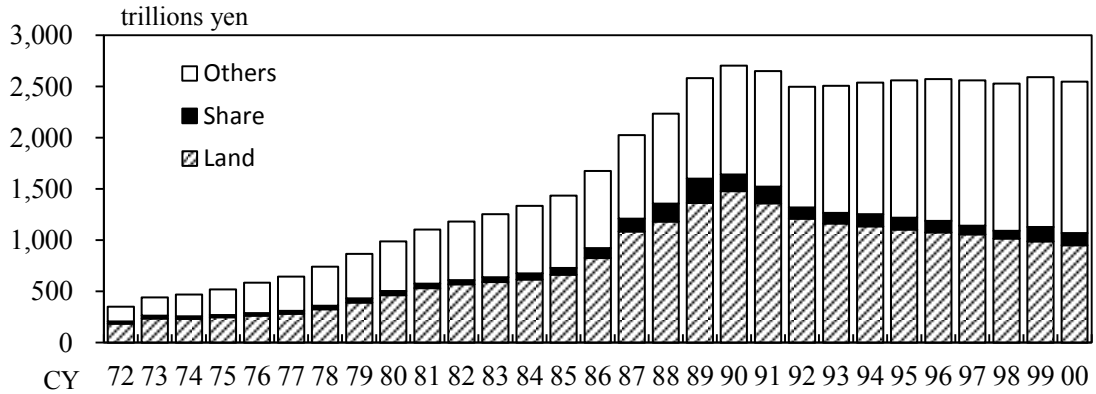
(1) Financial institutions



(2) Non-financial institutions



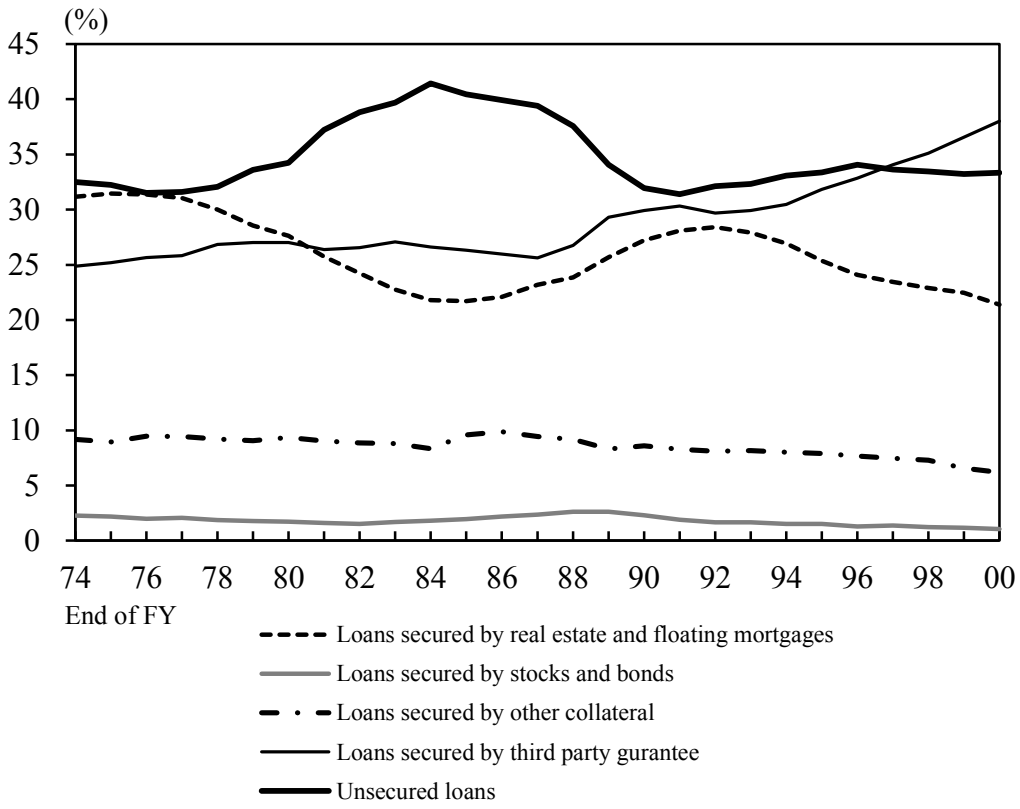
(3) Household



Source: Cabinet Office.

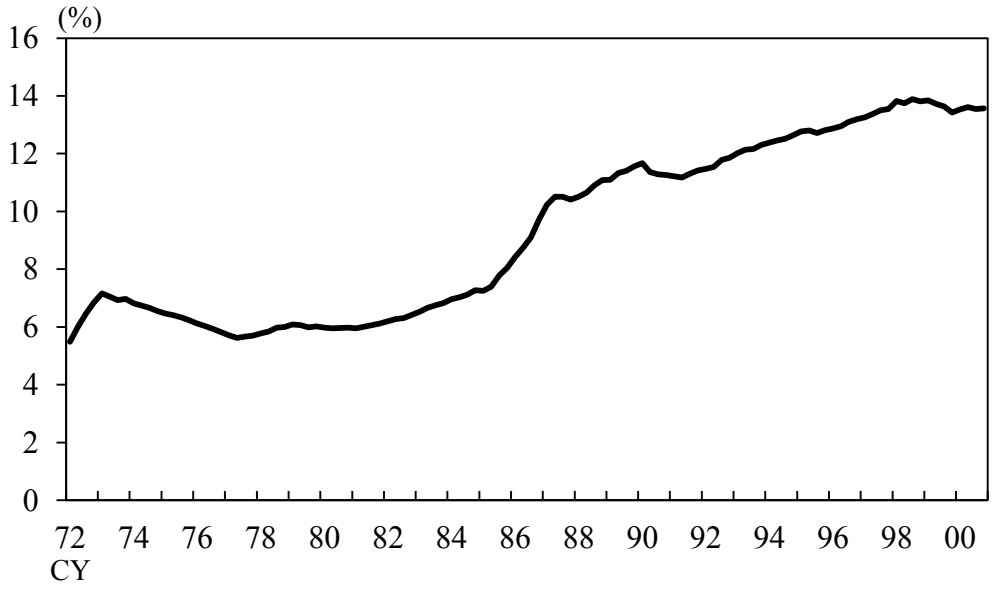
Figure 11: Collateral use of land asset and lending to real estate industry

(1) Share of loans by collateral types



Source: Bank of Japan.

(2) Share of bank's lending to real estate industry



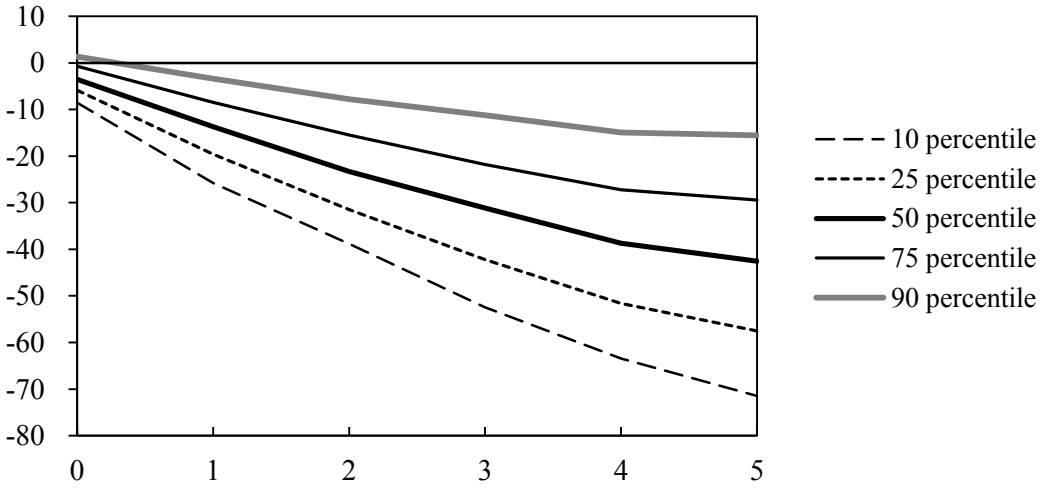
Source: Bank of Japan.

Figure12: Summary statistics and impulse response of sampled banks

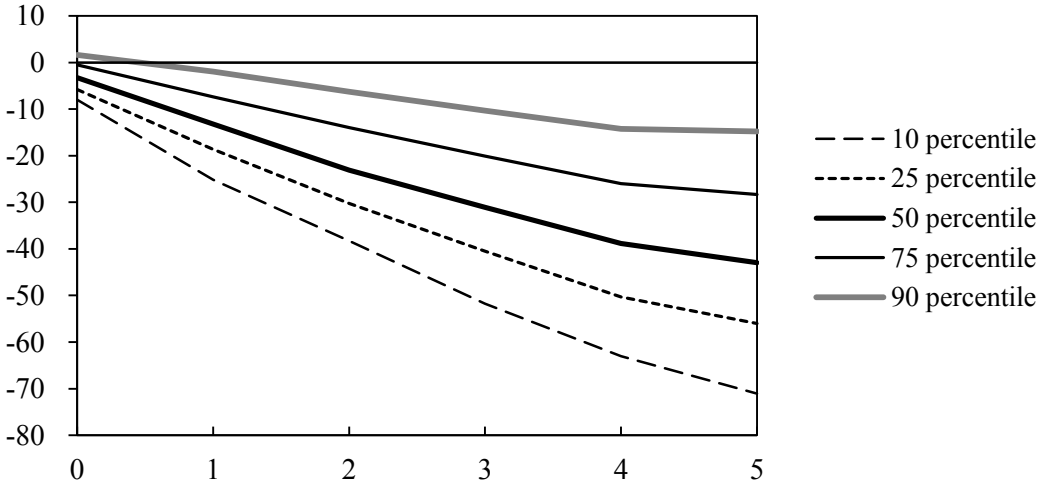
(1) Summary statistics of individual bank data used in the analysis

Number of sampled banks	112
Share of lending to real estate industry to total lending as of 1989 (%), average of sampled banks	8
Size of land holding relative to net worth as of 1989 (%), average of sampled banks	31
Size of stock holding relative to net worth as of 1989 (%), average of sampled banks	58

(2) Impulse response of total lending of individual bank



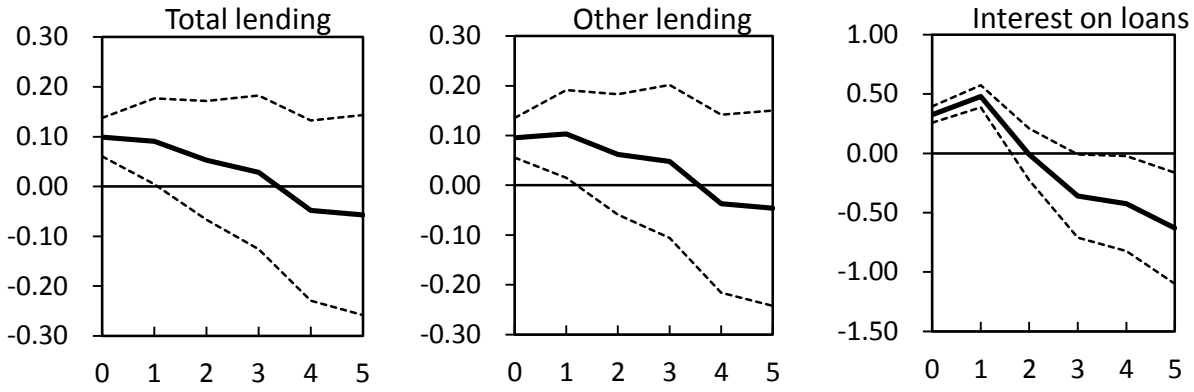
(3) Impulse response of lending to non-real-estate industry of individual bank



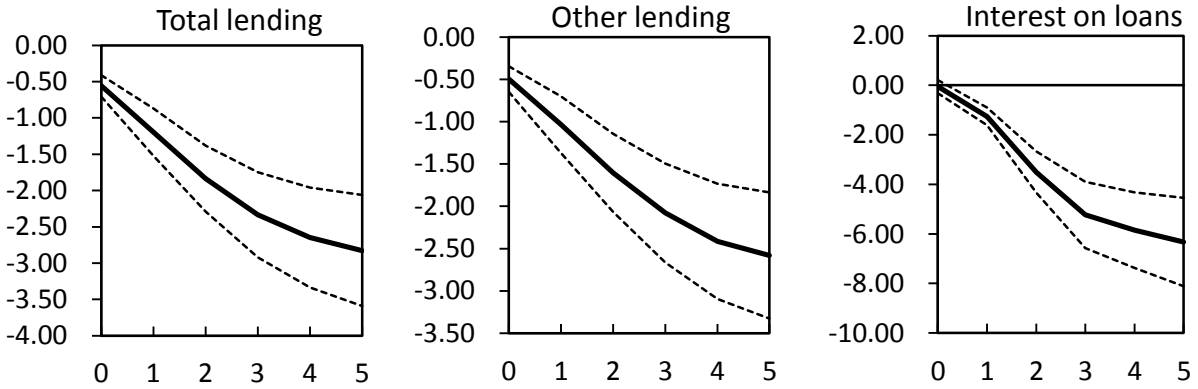
Notes: 1. Distribution of impulse response function to a unit positive shock to QR across 112 individual banks is shown.
2. The x-axis represents the number of years after a shock, and the y-axis represents percentage deviation from trend.

Figure13: Relationship between lending and balance sheet variables among individual bank

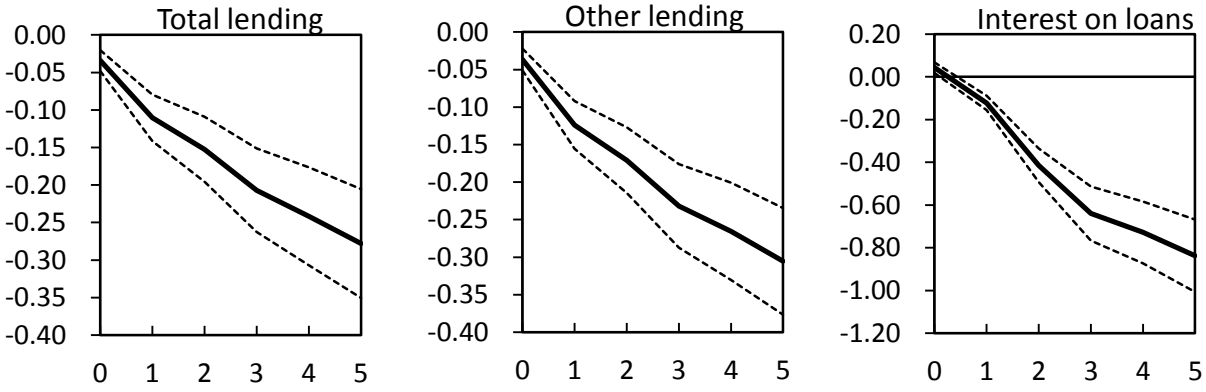
(1) Estimated coefficient on land asset holding-to-net worth ratio



(2) Estimated coefficient on share of lending to real-estate industry over total lending



(3) Estimated coefficient on stock holding-to-net worth ratio

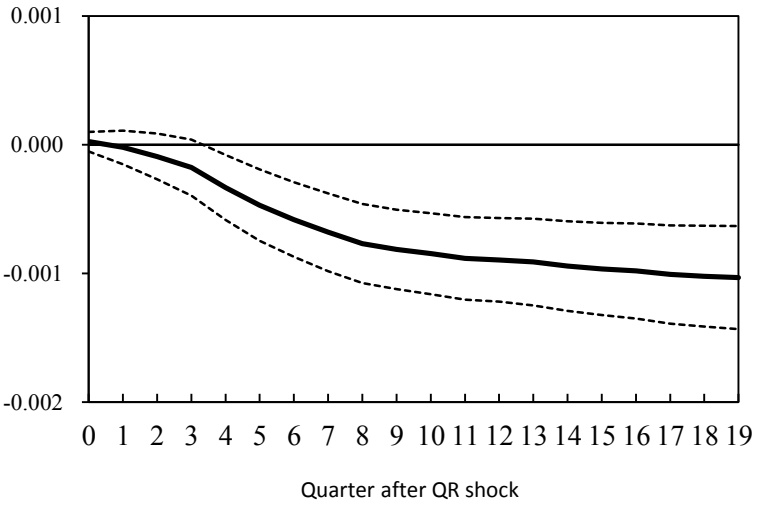


Notes: 1. Estimated coefficients of the regression in which impulse response of total lending, lending to non-real estate industry, or interest income of an individual bank h-th year after a contractionary shock to QR is used as the dependent variable, and its balance sheet variables as of 1989 is used as the explanatory variable.

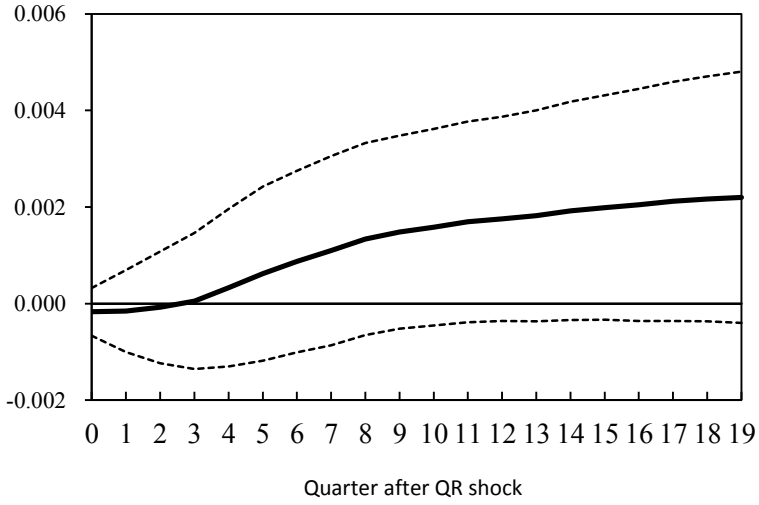
2. The dotted lines represents 95% confidence intervals. The x-axis represents the number of year after a shock, and the y-axis represents a estimated coefficient on the balance sheet variable of

Figure 14: Relationship between borrowing and balance sheet variables among industry group

(1) Estimated coefficient on land asset holding-to-net worth ratio



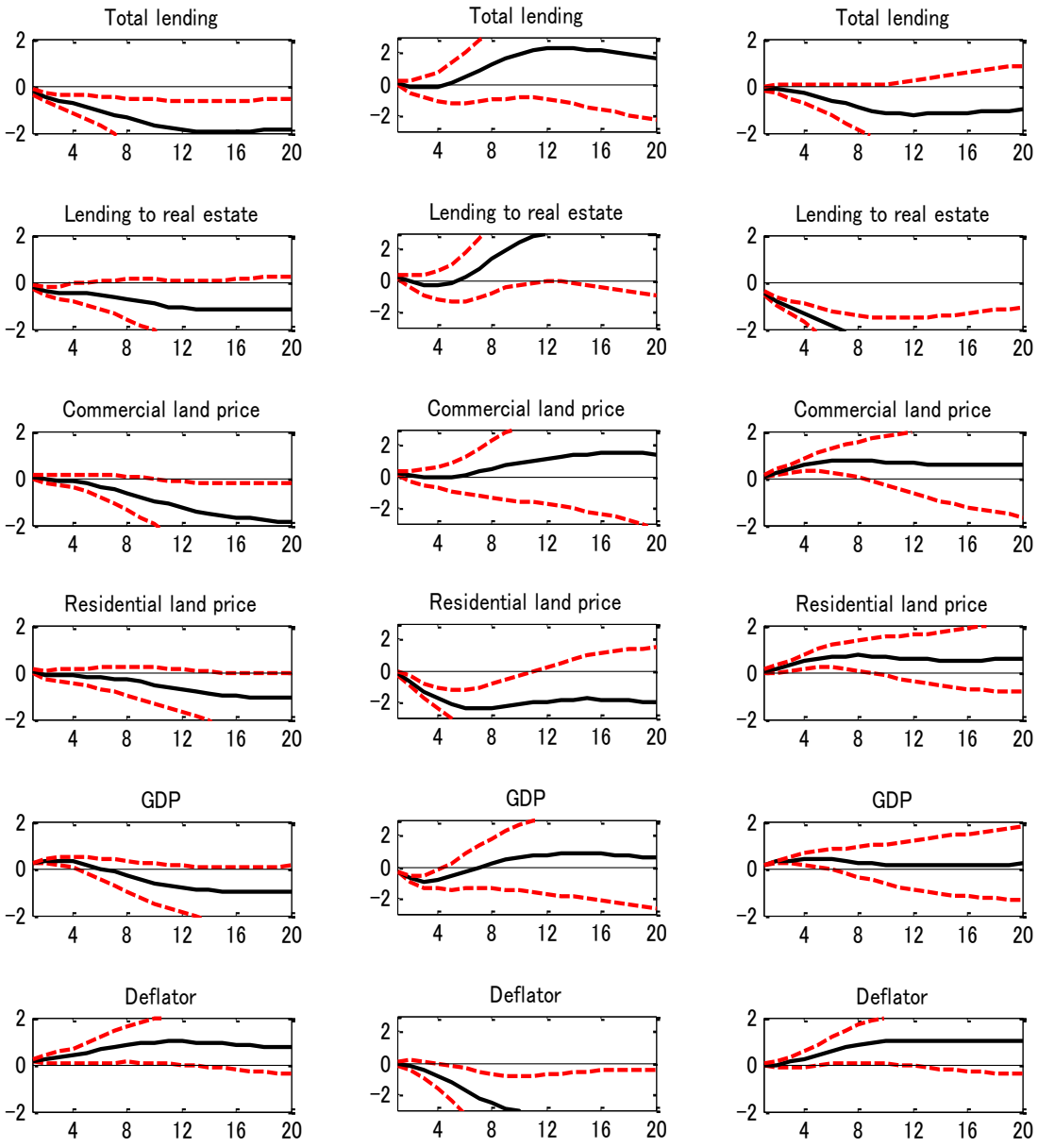
(2) Estimated coefficient on stock holding-to-net worth ratio



Notes: 1. Estimated coefficients of the regression in which impulse response of borrowing from banks of each industry group at h-th quarter after a contractionary shock to QR is used as the dependent variable, and its balance sheet variables as of 1989 is used as the explanatory variable.
2. The dotted lines represent the 95% confidence intervals. The x-axis represents the number of quarters after a shock, and the y-axis represents a estimated coefficient on the balance sheet variable of industry group.

Appendix 1: Impulse response of FAVAR that includes WG

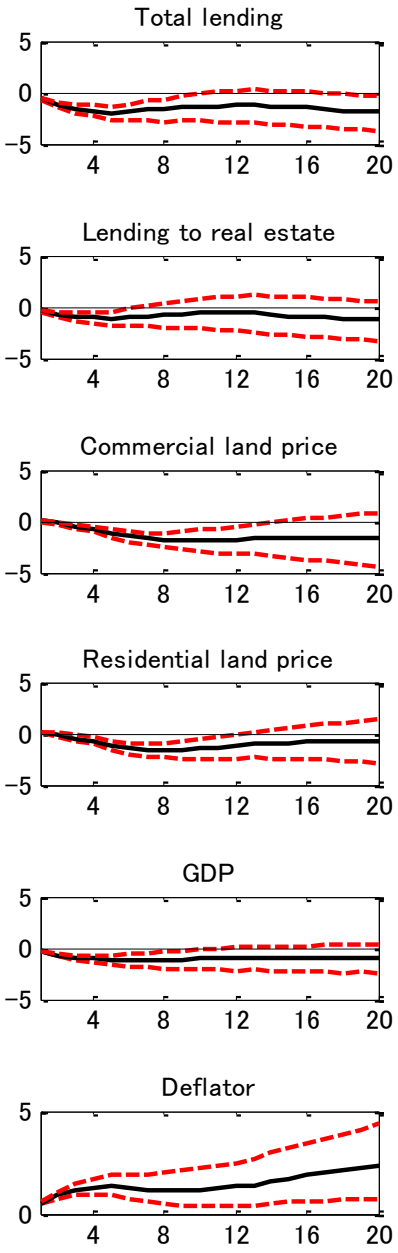
(1) Quantitative Restriction (2) Short-term interest rate (3) Window Guidance



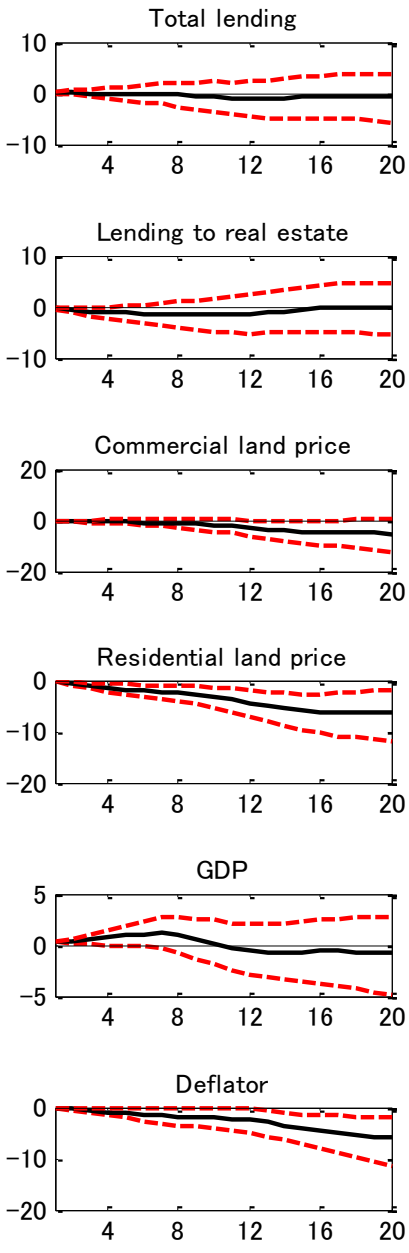
Notes: 1. Impulse response function to a unit positive shock to QR, short term interest rate and WG are shown.
2. The dotted lines represent the 90% confidence intervals, the x-axis represents the number of quarters after a shock, and the y-axis represents percentage deviation from trend.

Appendix 2: Impulse response of FAVAR when a larger number of unobserved factors are employed

(1) Quantitative Restriction



(2) Short-term interest rate

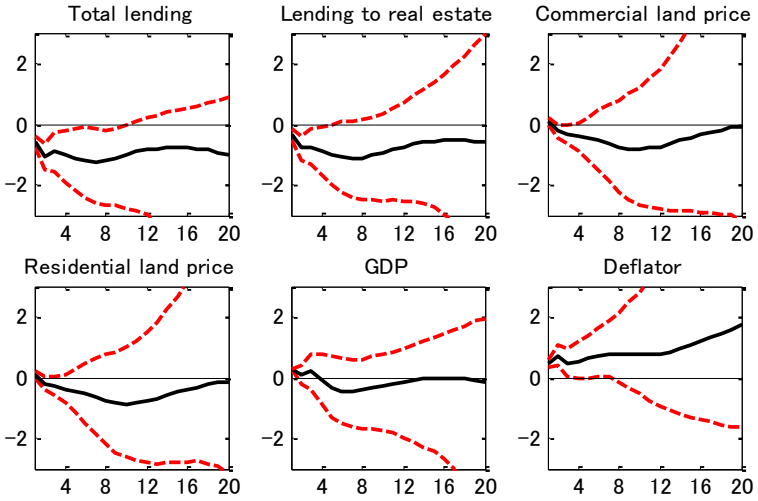


Notes: 1. Impulse response function to a unit positive shock to QR is shown.
2. The dotted lines represent the 90% confidence intervals, the x-axis represents the number of quarters after a shock, and the y-axis represents percentage deviation from trend.

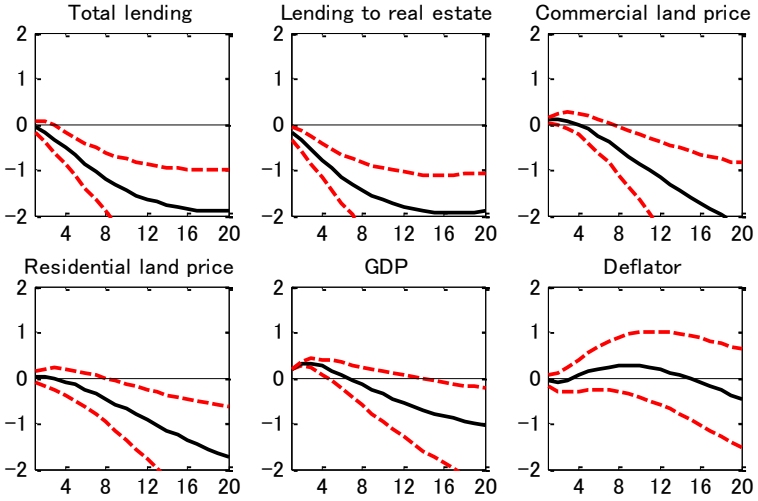
Appendix 3: Impulse response of FAVAR based on the subsample data

Impulse response to shocks to Quantitative Restriction

(1) the 1970s



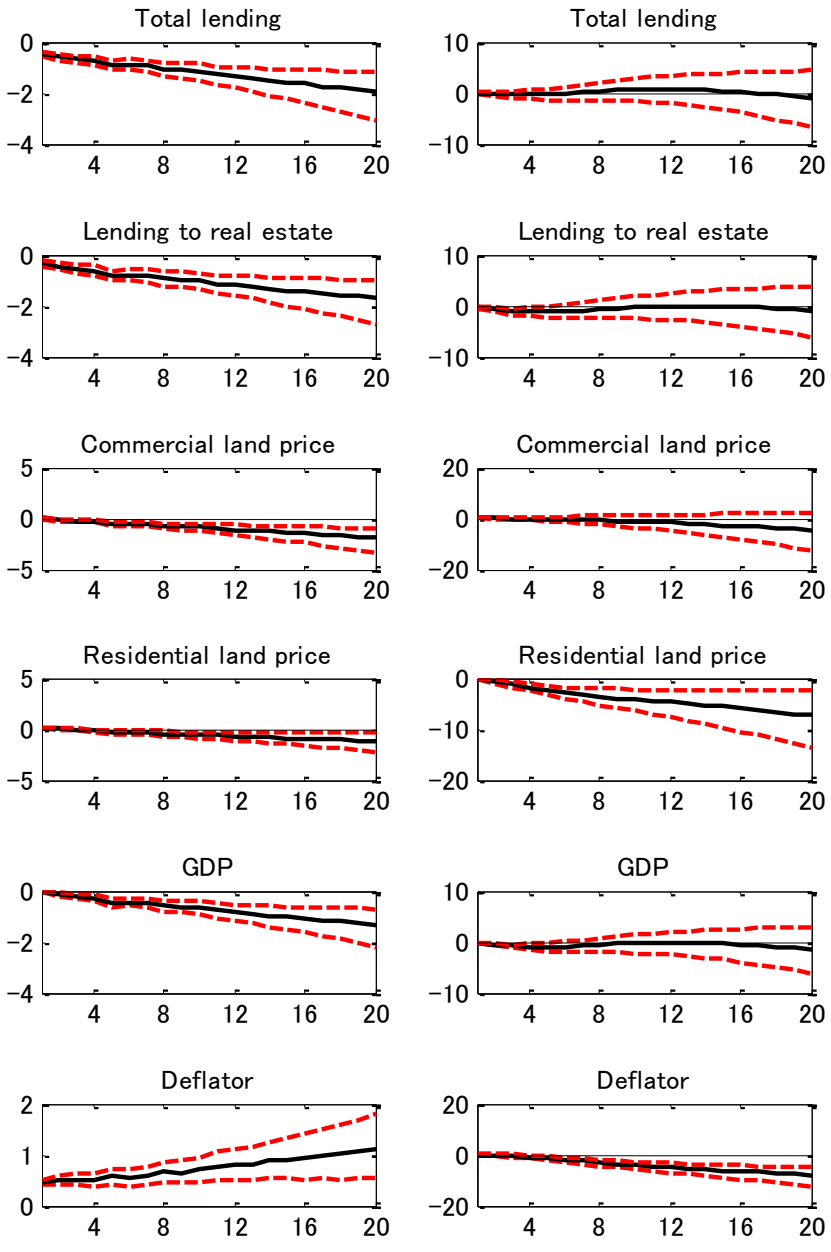
(2) the 1980s onward



Notes: 1. Impulse response function to a unit positive shock to QR is shown.
2. The dotted lines represent the 90% confidence intervals, the x-axis represents the number of quarters after a shock, and the y-axis represents percentage deviation from trend.
3. Sample data are divided into two subsample data, "the 1970s" and "the 1980s onward." The first subsample spans a period from the beginning of the data period to one period before the 9th business cycle peak (1972Q2 to 1979Q4), and the second subsample spans a period from the 9th business cycle peak to the 13th business cycle peak (1980Q1 to 2000Q4<end period of the data>).

Appendix 4: Impulse response of FAVAR that treats dummy as a shock

(1) Quantitative Restriction　　(2) Short-term interest rate



Notes: 1. Impulse response function to a unit positive shock to QR is shown.
2. The dotted lines represent the 90% confidence intervals, the x-axis represents the number of quarters after a shock, and the y-axis represents percentage deviation from trend.