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Heterogeneous Bank Loan Responses to Monetary Policy and Bank Capital Shocks: A VAR Analysis Based on Japanese Disaggregated Data*

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Abstract

In this paper, we study bank loan responses to monetary policy and bank capital shocks using Japan's disaggregated data sorted by borrower firms' size and industry. Employing a block recursive VAR, we demonstrate that bank loan responses exhibit large sectoral heterogeneity. Among a broad range of indicators about borrower firms' characteristics, the heterogeneity is tightly linked to borrower firms' liability conditions. Firms with a lower capital ratio tend to experience larger drops in bank loans following a contractionary monetary policy shock and/or a negative bank capital shock. In addition, we find that firms' substitution motive from alternative financial measures also explains the heterogeneity, while the firms' inventory motive that is stressed in the empirical literature for U.S. banks does not. Our results indicate the importance of considering a compositional shift of bank loans across borrower firms in implementing accommodative monetary policy and capital injection policy.

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1. Introduction

Since the outbreak of the financial crisis in 2007, a growing number of policy debates have focused on how to recover banks' lending activities. In particular, governments in developed countries have conducted an unprecedented amount of monetary easing and capital injection into the banks. These policy initiatives were primarily aimed at restoring the functioning of the financial system and recovering banks' lending activities, thereby mitigating the adverse feedback loop of the crisis.

In this paper, we study how monetary policy and bank capital influence the size and portfolio of bank loans on a disaggregated level. To this end, we use Japan's bank loan disaggregated series sorted by borrower firms' size and industry. We estimate the responses of bank loan portfolios to monetary policy shocks and bank capital shocks. We then investigate the heterogeneity of bank loan responses across borrower firms and its determinants by looking at a broad range of indicators about borrower firms' characteristics.

In analyzing bank loan behaviors, in contrast to the widely used approach targeting the aggregate bank loan series, we chose to use disaggregated bank loan series for two reasons. First, some existing studies report a substantial compositional change in aggregate bank loans after the macroeconomic shocks (Haan, Sumner, and Yamashiro [2007, 2009]; Mora and Logan [2010]). As Den Haan, Sumner, and Yamashiro (2007) point out, when disaggregated components of bank loans react differently to a shock, particularly when they are offsetting each other, it is no longer relevant to focus on the aggregate bank loan series. Second, by comparing the responses of disaggregated bank loans with different borrower firms' characteristics, it is possible to identify a factor that is crucial in determining size of bank loans after the shocks.

To this end, we employ a block recursive VAR following Davis and Haltiwanger (2001) and Lee and Ni (2002). We first identify the monetary policy shock and bank capital shock using macroeconomic variables; second, we estimate the responses of bank loans to the shocks for different types of borrower firms. We then conduct cross-sectional analysis by examining the statistical linkage between the size of bank loan responses and borrower firms' characteristics.

Our findings are as follows. First, the monetary policy shock and the bank capital shock yield highly heterogeneous responses of bank loans across sectors. Adverse macro shocks, that is, a contractionary monetary policy shock and a negative bank capital shock, tend to decrease bank loans at the aggregate level and those to non-manufacturing industries, while they tend to increase bank loans to large manufacturing industries.

Second, the sensitivity of bank loan responses to shocks depends on borrower firms' liability conditions, in particular, the ratio of capital to assets. In response to adverse macro shocks, firms with a lower ratio experience a more severe drop in bank loans. Firms' substitution motive between bank loans and alternative financial measures such as corporate bond issuance also explains a portion of heterogeneity in the response of bank loans to a bank capital shock. By contrast, it is revealed that inventory-related variables that are stressed in existing studies about U.S. banks are not linked with the bank loan responses. Third, though firms' liability conditions are significantly related to bank loan responses, a portion of heterogeneity accounted for by these borrower firms' liability conditions is limited, implying that not only borrower firms' conditions (loan demand side) but also banks' conditions (loan supply side) may be key to determining bank loan portfolios.

Our results also indicate the importance of considering a compositional shift of bank loans in implementing monetary policy and capital injection policy. Facing Japan's lost decades in the 1990s and 2000s, accommodative monetary policy and capital injection policy were repeatedly implemented. Our results imply that those policies shifted banks' funds from large manufacturing firms to other firms.

The remainder of the paper is organized as follows: Section 2 reviews literature. Section 3 describes our empirical methodology, and Section 4 explains data. Section 5 reports empirical results, and Section 6 discusses the results. Section 7 concludes.

2. Literature Review

Several studies have already revealed that economic responses to monetary policy differ across firms' sizes and industries. For example, Gertler and Gilchrist (1994) analyze economic responses such as sales and bank loans to a monetary policy shock for small and large manufacturing firms. They find that small firms account for a disproportionate share of the manufacturing decline in response to monetary policy tightening. The closest research to ours is that by Den Haan, Sumner, and Yamashiro (2007, 2009), who analyze the responses of disaggregated bank loans for different types of borrowers to a monetary policy shock in U.S. and Canadian economies. They report that monetary tightening decreases real estate and consumer loans, while it increases commercial and industrial loans.[1]

[1] See also Gertler and Gilchrist (1993); Kashyap, Stein, and Wilcox (1993); Kashyap, Lamont, and Stein (1994); Morgan (1994); Carlino and Defina (1998); and Covas and Den Haan (2007) for earlier related literature. For example, Carlino and Defina (1998) examine heterogeneous effects of monetary policy across regions in the United States.

Another strand of related literature concerns a consequence of a bank capital shock.[2] In particular, regarding its heterogeneous impacts, Hancock, Liang, and Wilcox (1995) estimate a panel VAR model using U.S. banks' data and report that the effects of a bank capital shock on large banks' portfolios are different from those on small banks' portfolios. They also report that bank loan components, commercial and industrial loans, single-family real estate loans, and commercial real estate loans all respond positively to a positive shock to the banks' capital. Mora and Logan (2010) show that, based on the U.K. data, the negative bank capital shock leads to a decrease in bank loans to non-financial firms and an increase in bank loans to households.

Our paper highlights broader sectoral differences compared with the existing studies by using Japan's data. We use the bank loan series that are disaggregated both by borrower firms' size and industry and examine detailed compositional changes in the bank loan portfolio in response to both monetary policy and bank capital shocks.

From a theoretical perspective, Bernanke, Gertler, and Gilchrist (1999) formally discuss the source of sectoral heterogeneity in bank loan responses using the seminal financial accelerator model. They extend their financial accelerator model by incorporating two heterogeneous firms and demonstrate that firms facing higher external finance costs adjust their investment more in response to the same-sized monetary policy shock. Gertler and Gilchrist (1994) put the emphasis on the accessibility to capital markets. They argue that small firms rely heavily on bank loans because of the lack of means to directly finance their projects, such as issuance of equity or corporate bonds. Those studies are to some degree consistent with the current paper, as they emphasize the importance of borrower firms' financial conditions in explaining bank loan dynamics.

In contrast to Bernanke, Gertler, and Gilchrist (1999), who consider only the credit constraint of non-financial firms and abstract from the bank capital, our study also sheds light on the role of bank capital in banks' loan activity. Along this line, our analysis relates to theoretical studies such as Bernanke and Blinder (1988), Goodfriend and McCallum (2007), Van den Heuvel (2008), and Hirakata, Sudo, and Ueda (2009). These studies underscore the importance of banks' financial conditions in determining bank loans from various perspectives. In particular, Hirakata, Sudo, and Ueda (2009) incorporate credit constraints of both banks and non-financial firms into an otherwise standard DSGE model and discuss the role of bank capital shocks in explaining U.S.

[2] See also Peek and Rosengren (1997, 2000), where the authors use a novel identification strategy and show that a negative shock to Japanese banks' capital decreases their bank loans to firms operating in the United States. Hirakata, Sudo, and Ueda (2010, 2011) estimate a DSGE model for the U.S. and Japanese economies to examine the macroeconomic impacts of shocks to bank capital.

business cycles.

A question to which an answer has not been agreed upon in the literature is why sectoral heterogeneity in bank loan responses is so large that, for instance, a contractionary monetary policy shock or a negative bank capital shock increases bank loans to some sectors and reduces bank loans to other sectors. An explanation given by Bernanke and Gertler (1995) is related to borrower firms' inventory motive. They argue that in response to to monetary tightening, firms' inventories increase, which in turn increases demand for loans by more than a reduction in a portion of bank loan supply that serves for the firm's production. Den Haan, Sumner, and Yamashiro (2007, 2009), however, cast doubt upon that explanation by controlling the behavior of inventories and give another explanation by emphasizing not borrower firms' decisions but banks' loan portfolio decisions due to the banks' characteristics. However, they admit that the formal theoretical background to explain portfolio changes from the banks' side does not exist. Through the disaggregated level analysis, we aim to provide a clue to understanding the determinants of heterogeneity observed in bank loan responses.

Finally, regarding the Japanese economy, from a macroeconomic empirical perspective, our paper is related to those of Bayoumi (2001) and Miyao (2002), among many others, who employ VAR to analyze the effects of monetary policy on the aggregate economy. From a financial and microeconomic perspective, our study is in line with the literature that explores the allocation of bank credits, such as Sekine, Kobayashi, and Saita (2003); Peek and Rosengren (2005); and Caballero, Hoshi, and Kashyap (2008).

3. Empirical Methodology

Our empirical methodology follows the method developed by Davis and Haltiwanger (2001) and Lee and Ni (2002). The VAR model consists of two separate blocks: a macroeconomic block and a sectoral block.

Mathematically, our block recursive VAR model has the following form:

$$A_0 X_t = A_0 B(L) X_t + u_t ,$$

or

$$A_0 \begin{pmatrix} X_{1t} \\ X_{2t} \end{pmatrix} = A_0 \begin{pmatrix} B_{11}(L) & 0 \\ B_{21}(L) & B_{22}(L) \end{pmatrix} \begin{pmatrix} X_{1t} \\ X_{2t} \end{pmatrix} + \begin{pmatrix} u_{1t} \\ u_{2t} \end{pmatrix}.$$

X_{1t} is an N_1 dimensional column vector of macroeconomic variables, and X_{2t} is an N_2 dimensional column vector of disaggregated variables for a specific sector. $B(L)$ is a block recursive matrix of polynomials of the lag operator L. A_0 is assumed to be

a lower triangular matrix, so that the reduced-form residuals can be decomposed into structural shocks, u_t.

The above equations imply that macroeconomic variables do influence sectoral variables,[3] but sectoral variables do not influence macroeconomic variables. Parameters in the two blocks are estimated block recursively. That is, macroeconomic parameters are estimated only from the macroeconomic data, while sectoral parameters are estimated using macroeconomic data as well as disaggregated data. Identified monetary policy shocks and bank capital shocks are thus identical for all sectors.

For the sectoral block in the equation above, for illustrative purposes, we arbitrarily select a set of variables in one sector that differs from other sectors in terms of industry and size. For each sectoral block, we construct and estimate the above VAR model independently from each other. As Davis and Haltiwanger (2001) argue, this specification does not prejudge the issue of whether structural macro shocks influence each sector's variables through allocative or aggregate channels.[4]

Our macroeconomic variables contain six variables: real aggregate bank capital, real gross domestic product (GDP), the consumer price index (CPI), real aggregate bank loans, the call rate, and the real stock price.[5] Detailed data descriptions are provided in the next section.

Macroeconomic shocks are identified by recursive restriction. Motivated by Sims (1992), Miyao (2002), and Sims and Zha (2006), we use the real stock price as an information variable to identify monetary policy shocks.[6] The real stock price is assumed to be the most endogenous, as in Sims and Zha (2006), considering that the real stock price is determined in the financial market, taking account of all available information in the economy. That is, the real stock price responds to all contemporaneous shocks. Regarding a monetary policy shock, we closely follow Sims (1992) and Den Haan, Sumner, and Yamashiro (2007, 2009) except for one thing.

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[3] Recently, Gabaix (2011) and Acemoglu et al. (2012) argue that idiosyncratic shocks can account for an important part of aggregate fluctuations.

[4] Foerster, Sarte, and Watson (2011) identify sectoral shocks and an aggregate shock, explicitly taking into account a sectoral linkage of production across sectors by constructing a multi-sector general equilibrium model using an input-output matrix.

[5] Den Haan, Sumner, and Yamashiro (2007, 2009) use an index for real economic activity, the CPI, aggregate bank loans, and the policy rate, together with disaggregated bank loans. In our paper, we use disaggregated bank loans in the following sectoral block estimation.

[6] Sims (1992) includes data for exchange rates and commodity prices so as to properly identify macroeconomic shocks. In our case, including those market prices in the estimation does not significantly change the results. Our specification that includes the stock price is in line with Miyao (2002), who points out the importance of the stock price in considering Japan's monetary policy transmission mechanism.

Monetary policy is the most endogenous except for the real stock price:[7] monetary policy responds to all contemporaneous shocks except for the stock price shock. Regarding a bank capital shock, studies are few. Hancock, Liang, and Wilcox (1995) assume that bank capital is more exogenous than bank loans, that is, bank capital does not respond to a contemporaneous bank loan shock. Although their focus is on loan activity at the individual bank level, we apply their ordering to our macroeconomic model, assuming that bank capital does not respond to any contemporaneous shocks, including a monetary policy shock. Because we focus on the effects of the monetary policy shock and the bank capital shock exclusively, other restriction specifications do not matter for our estimation results reported below.

As for the sectoral block, we construct a VAR model comprising four endogenous variables and six exogenous variables. Endogenous variables are real bank loans to each group, real liquid liability plus corporate bonds minus short-term bank loans to the group, real sales in each group, and a ratio of capital to total assets in each group. Our focus is on bank loans, but to control the effects on bank loans stemming from real-side and balance-sheet factors, we include sales and capital ratios in the system. We include real liquid liability plus corporate bonds minus short-term bank loans to examine firms' substitution of financial source between bank loans and other finance measures. Exogenous variables are those used in the macroeconomic block.

Lags are two quarters, and the numbers are selected by the AIC. Because one lag is optimal according to SIC, we check the robustness of our estimation result under one-lag specification as well in a later section.

4. Data

Sample periods range from 1984Q1 to 2008Q2. The start time is chosen to coincide with that of the Great Moderation. Our sample ends in the middle of the most recent financial crisis, due to the disconnection of the statistics in Financial Statements Statistics of Corporations by Industry. Our sample includes the important periods of Japan, such as the asset market bubble in the late 1980s, its bust in the early 1990s, and the financial crisis in 1997 to 1998. We check robustness against the sample selection below.

As we stated above, in the macroeconomic block, we use six data series: real bank capital, real GDP, the CPI, real bank loans, the call rate, and the real stock price. As for the CPI, the effects of the consumption tax are adjusted. As for bank capital, taking into

[7] Den Haan, Sumner, and Yamashiro (2007, 2009) argue that such an order is reasonable for quarterly data. For monthly data, monetary policy can be considered the most exogenous.

account major revisions in the Flow of Funds Accounts Statistics, the data before 1997Q3 are backwardly extrapolated using the changes in total market values of listed stocks with level adjustment based on the ratio of the market series over the Flow of Funds series from 1997Q4 to 1998Q3.[8] Market values are taken from the Tokyo Stock Exchange. Bank loans are taken from Financial Statements Statistics of Corporations by Industry from the Ministry of Finance. This statistics include aggregate and disaggregated quarterly series of individual firms' accounting data. When we use these statistics, we adjust sample discontinuities of the original data at the beginning and the end of each period. The stock price is that of TOPIX. Real variables are denominated by the GDP deflator. All of the data except for the call rate are converted in logarithm levels and seasonally adjusted for the use of estimation. The call rate is used for estimation without such conversions. The data series are shown in Figure 1.

In the sectoral block, we use four endogenous variables: real bank loans, real liquid liability plus corporate bonds minus short-term bank loans, real sales, and capital ratios. All of the data are taken from Financial Statements Statistics of Corporations by Industry from the Ministry of Finance. Liquid liability other than short-term bank loans includes bills and accounts payable, borrowings from others, commercial papers, and so on. Disaggregated data are categorized by industry and size (see Table 1 for details). The number of industries is 22 and includes all industries, manufacturing, real estate, construction, and services. The size is categorized into large, medium, and small firms by firms' book-valued capital. Therefore, we have 66 sectoral blocks in total. All variables are seasonally adjusted. Real variables are denominated by the GDP deflator and transformed in logarithm levels.[9]

5. Estimation Results

In this section, we report estimation results for both the macroeconomic and sector blocks. To obtain confidence intervals, we employ the Bootstrap simulation 1,000 times.

5.1 Macroeconomic block

[8] For example, there is a revision in the classification of financial institutions as well as a shift to mark-to-market valuation from book value of the balance sheet. Data before 1997 are available on the new basis only for the annual series. We confirm that our method of constructing the quarterly data on the new basis yields almost the same movement as that obtained from the Flow of Funds Accounts Statistics on an annual basis.

[9] An exception is real liquid liability other than short-term bank loans. We make seasonal adjustments for both liquid liquidity and short-term bank loans. In some samples, seasonally adjusted liquid liability becomes smaller than seasonally adjusted short-term bank loans. Therefore, instead of a logarithm, we use the ratio of real liquid liability other than short-term bank loans as its mean.

Figure 2 demonstrates the impulse responses of macroeconomic variables. The left and right panels show impulse responses to a positive policy rate shock and a positive bank capital shock, respectively. From the top, impulse responses are those of real bank capital, real GDP, the CPI, real bank loans, the call rate, and the real stock price. Black solid and red dashed lines represent the mean and the one standard error confidence interval, respectively.

We first consider a contractionary monetary policy shock associated with a rise in the call rate. As the left panel shows, a monetary tightening decreases bank capital, real GDP, bank loans, and stock prices. The CPI increases initially, suggesting the presence of the price puzzle. The CPI then decreases after a couple of years. Those responses are generally in line with the prediction of standard macroeconomic theory.

Second, we look at responses to a positive bank capital shock. The shock boosts real GDP and increases the CPI, bank loans, the call rate, and stock prices as well as bank capital.

Figure 3 demonstrates the time path of two identified structural shocks. The monetary policy shock tends to be negative during the asset price bubble in the late 1980s and then becomes positive around 1991, in the peak of the bubble. From 1992 to 1993, the shock becomes negative again, reflecting a policy accommodation in the wake of the bubble burst. After the mid-1990s, the shock fluctuates less than in previous years, partly due to the zero lower bound on nominal interest rates. As for the bank capital shock, the graph implies that it increases during the bubble period in the late 1980s. After the bubble burst in the early 1990s, a large, unexpected disruption is often observed. From 1997 to 1998, when the Japanese banking crisis took place, it is observed that large and negative shocks persistently hit the bank capital.

5.2 Sectoral block

Next, we discuss estimation results in the sectoral block. We calculate impulse responses to the contractionary monetary policy shock and the positive bank capital shock for 44 types of firms that are different in industry and size. In Figures 4 and 5 (and Figures A-1 and A-2 in the Appendix), black dotted and red solid lines indicate mean impulse responses for large and small firms, respectively. Dashed lines indicate one standard error confidence intervals. A top left panel in each figure represents impulse responses of bank loans at the aggregate industry level, and other panels represent those at the disaggregated industry level.

Figures 4 and A-1 show the impulse responses of bank loans to a contractionary monetary policy shock for small and large firms. We find significant heterogeneity

across firms' industries and sizes. On one hand, in non-manufacturing firms, the contractionary monetary policy shock decreases bank loans. In particular, large wholesale firms and small real estate firms are faced with a plunge in bank loans. Small manufacturing firms also decrease bank borrowings. On the other hand, the same shock appears to increase bank loans in large manufacturing firms. In particular, large iron firms, large non-ferrous firms, and large electric machinery firms experience a surge in bank loans.

Figures 5 and A-2 show the impulse responses of bank loans to a positive bank capital shock for small and large firms. We again observe largely heterogeneous bank loan responses across sectors. Although most results are insignificant, the confidence interval is relatively tight for all and non-manufacturing industries, suggesting that the positive bank capital shock is likely to increase bank loans. In addition, red lines are positioned over black dotted lines, suggesting that bank loans to small firms increase more than those to large firms in response to a positive bank capital shock. Comparing across industries, we find that firms in wholesale, real estate, and service industries witness an increase in their bank borrowings by a large amount in response to a positive bank capital shock. All those results imply the importance of lenders' balance sheet conditions in financial intermediation, which is often referred to as the bank lending channel.[10] In some sectors, however, a positive bank capital shock decreases bank loans. Examples of these firms include large firms in iron, non-ferrous, gas, and service industries.

6. Interpretations of the Estimation Results

In this section, we investigate what drives the large sectoral heterogeneity in bank loan responses, in particular, why the adverse macro shocks, that is, a contractionary monetary policy shock and a negative bank capital shock, increase bank loans to firms in certain industries and not others.

6.1 Borrower firms' characteristics

To explore the determinants of heterogeneous bank loan responses to macroeconomic shocks, we examine borrower firms' characteristics for 66 firm groups consisting of 22 industries and three capital sizes. For each group, we first construct indicators that summarize firms' financial and economic conditions over the sample periods. We then

[10] See Bernanke and Blinder (1988), Goodfriend and McCallum (2007), Van den Heuvel (2008), and Hirakata, Sudo, and Ueda (2009).

examine how those indicators are correlated with the degree of bank loan responses.[11]

We divide indicators into four categories, each of which bears a different aspect of economic conditions. The indicators in the first category contain information about borrower firms' liability side: the ratio of capital to assets, the ratio of bank borrowings to assets, and the ratio of corporate bonds to assets.[12] As we discussed above, the importance of borrower firms' liability conditions is underscored by Gertler and Gilchrist (1994) and Bernanke, Gertler, and Gilchrist (1999). Gertler and Gilchrist (1994), in particular, emphasize the importance of accessibility to capital markets. We employ the indicators as a proxy for such firms' accessibility to the market. If the argument in Gertler and Gilchrist (1994) holds true, the ratio of corporate bonds to assets matters for bank loan responses to the two shocks.

The indicators in the second category are related to the maturity of borrower firms' finances: the ratio of long-term bank borrowings to assets, the ratio of short-term bank borrowings to assets, the ratio of cash and deposit holdings to assets, and the ratio of liquid assets to liquid liabilities. By making use of the second category, we deepen the analysis regarding the first category and examine whether borrower firms' liquidity matters for bank loan responses.

The indicators in the third category capture borrower firms' flow side: the interest coverage ratio and the growth rate of sales.[13] The interest coverage ratio reflects not only borrower firms' profitability but also their liability conditions, and the growth rate of sales reflects the degree of firms' economic activity.

The indicators in the final category are related to firms' inventories: a correlation between inventory growth and sales growth and the ratio of the standard deviation of inventory growth to the standard deviation of sales growth. Bernanke and Gertler (1995), stressing the relationship between inventories and bank loans, argue that in response to an adverse shock, firms try to finance costs associated with accumulated inventory by increasing their demand for bank loans if a credit constraint is not stringent; such a channel accounts for the positive response of bank loans to an adverse shock. To examine whether a similar mechanism is present in our data series, we include the aforementioned two variables in our analysis. Suppose that the firms that increase their demand for bank loans after an adverse shock are likely to increase their inventories in response to a drop in sales brought about by the shock and that the adjustments to

[11] As Rajan and Zingales (1998) point out, a technological difference makes some industries heavily dependent on external finance and other industries not.

[12] Other liability variables include trade credits (bills and accounts payable).

[13] The interest coverage ratio is defined as the ratio of the sum of operating income and interest income to interest expenses.

inventory are quicker than those to sales; then a correlation between inventory growth and sales growth should be negative, and a ratio of the standard deviation of inventory growth to the standard deviation of sales growth should be high for that group of firms. As a correlation between inventory growth and sales growth becomes more negative or the ratio of the standard deviation of inventory growth relative to that of sales growth becomes higher, bank loans increase more in response to the contractionary shock and less in response to the expansionary shock.

To explore the determinants of heterogeneous bank loan responses, we examine how strongly those indicators regarding borrower firms' characteristics are correlated with bank loan responses. Admittedly, these borrower firms' characteristics may be endogenously related to how the bank loans respond to economic shocks, and this analytical approach does not necessarily pin down the causality from borrower firms' characteristics to bank loan responses. This analysis, however, illustrates the relative significance of each economic aspect in determining the bank loans.

6.2 Correlations between borrower firms' characteristics and bank loan responses

Table 2 provides correlations between the aforementioned firms' characteristics and bank loan responses. We choose the cumulative impulse responses (CIRs) of bank loans up to 12 quarters after shocks as the summary statistics of the bank responses.[14] In the table, the first two and the last two columns indicate correlations regarding responses to the monetary policy shock and the bank capital shock, respectively. We report two kinds of correlation: the ordinary correlation and Spearman's rank correlation, since Spearman's rank correlation is robust to outliers. Considering that Figures 4 and 5 have wide confidence intervals, we mainly focus on the results based on Spearman's rank correlation.

For illustrative purposes, we also plot CIRs and the indicators discussed above in Figures 6 and 7. A vertical axis indicates the degree of bank loan responses. A horizontal axis in the top and bottom panels indicates the ratio of capital to assets and the ratio of corporate bonds to assets, respectively. A large blue circle indicates small firms, and red and black circles indicate large and medium firms, respectively.

As for the monetary policy shock, we find that several firms' characteristics are significantly correlated with the degree of bank loan responses. First, the ratio of capital to assets has a correlation of 0.43. The top panel of Figure 6 shows its scatter plot.[15]

[14] Changes in the time horizon of 12 quarters do not significantly affect our results.
[15] Groups with a low capital ratio are small and medium real estate, medium retail trade, and

The panel suggests that as capital is scarce, the contractionary monetary policy shock tends to decrease bank loans to a greater extent.

Second, the ratios of bank borrowings to capital, both short and long, have a significant level of correlation. Namely, as bank borrowing leverages increase, the contractionary monetary policy shock tends to more significantly reduce bank loans to such firms. These first and second results are in line with Bernanke, Gertler, and Gilchrist (1999).

Third, as the bottom panel of Figure 6 shows, the ratio of corporate bonds to assets is weakly and positively correlated with CIRs, with a correlation coefficient of 0.24. Inasmuch as this indicator captures accessibility of the firms to capital markets, our result is in line with Gertler and Gilchrist (1994).

Fourth, the interest coverage ratio has a correlation of 0.54 with CIRs. As firms earn smaller profits relative to their interest payment, the contractionary monetary shock tends to decrease bank loans to the firms to a greater extent. This result suggests that not only firms' balance sheets but also their profits and losses are important determinants for the responses of bank loans to shocks.

Last, other variables are weakly correlated or uncorrelated with the CIRs of bank loans. In particular, inventory indicators display almost no correlations with the bank loan responses, suggesting that the firms' inventory motive does not seem to account for heterogeneity in bank loan responses across sectors.

Turning to the responses to the bank capital shock, we again find that several firms' characteristics are significantly correlated with the CIRs of bank loans. First, the ratio of capital to assets is highly correlated, with a coefficient value of –0.46. The top panel of Figure 7 displays the corresponding scatter plot, showing that as capital becomes scarcer, the same positive bank capital shock tends to increase bank loans to a greater extent. Second, the ratio of corporate bonds to assets also has a significant correlation, –0.39, suggesting again the importance of accessibility to the financial market. Third, the CIRs of bank loans are not correlated with the ratio of bank borrowings except for those of long-term maturities.

These results, as a whole, illustrate that borrower firms' characteristics, particularly their liability conditions, are tightly linked to bank loan responses after the shocks.

6.3 Sources of large heterogeneity

In this subsection, based on the estimation results above, we explore and discuss why

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medium services. Groups with a high capital ratio are large electrical machinery and large transportation equipment.

the macroeconomic shocks affect the amount of bank loans differently, particularly affecting bank loans in opposing directions depending on the characteristics of sectors.

First, limiting our attention to borrower firms' demand side (loan demand side), we discuss two possible reasons behind the increases in bank loans to some sectors following the adverse shocks. One is the inventory motive, as we discussed in Section 6.1. Our estimation results, however, do not seem to support this view, as the indicators related to the firms' inventories do not correlate with the CIRs of bank loans following the monetary and bank capital shocks.

Another reason is a substitution motive regarding borrower firms' finance measures.[16] Consider a firm that is less credit constrained than other firms because a wider variety of finance measures, such as corporate bonds, commercial papers, and bills and accounts payable, are available as an alternative to bank borrowings. If the borrowing costs associated with those alternative measures increase more than those associated with borrowings from banks, an adverse shock may cause the firm to increase bank borrowings and decrease alternative measures.

To examine the validity of this channel, we examine the responses of real liquid liability plus corporate bonds minus short-term bank loans to macro shocks in the sectoral block. Note that this variable includes the alternative measures, such as bills and accounts payable, borrowings from others, and commercial papers, in addition to corporate bonds and captures the amount of external finance other than bank loans. We calculate correlations between its responses and borrower firms' characteristics. If the substitution effect is strong, the correlations should have an opposite sign to those between the bank loan responses and borrower firms' characteristics. Estimation results partly support this reasoning. As for the contractionary monetary policy shock, a correlation between the response of real liquid liability other than short-term bank loans and the ratio of capital to assets is 0.09, which is insignificant. On the other hand, as for the positive bank capital shock, the correlation is 0.25, which is significant at the 5 percent level. In addition, its sign is opposite to that of the correlation coefficient between the response of bank loans and the ratio of capital to assets. For other values of borrower firms' characteristics, we find that the correlation between the response of real liquid liability other than short-term bank loans and the ratio of corporate bonds to assets is 0.40 and significant. The sign is again opposite to that of the correlation between the response of bank loans and the ratio of corporate bonds to assets. These results for the bank capital shock are consistent with our aforementioned conjecture: in

[16] For example, Kashyap, Stein, and Wilcox (1993) examine substitution between bank loans and commercial papers.

the wake of a shock, bank borrowings and alternative measures of finance are close substitutes.

In summary, among borrowers' demand side (loan demand side) factors, the firms' substitution motive between bank loans and alternative financial measures explains a portion of sectoral heterogeneity in the response of bank loans to a bank capital shock at a statistically significant level. The motive, however, does not seem to provide a full explanation for the heterogeneity, because the heterogeneous responses across sectors to a monetary policy shock are not explained by this factor.

Therefore, it is possible to argue that large heterogeneity of bank loan responses, particularly those to a monetary policy shock, may be attributed to a loan supply side, such as banks' maturity conditions, profitability conditions, and balance sheet conditions. As Den Haan, Sumner, and Yamashiro (2007, 2009) discuss, the changes in banks' maturity misalignment or balance sheet conditions following macroeconomic shocks may affect their loan portfolio decisions, leading to changes in bank loans across sectors. Along this line, Aoki and Sudo (2012) investigate the banks' portfolio decisions and show that banks under the value at risk constraint choose to hold less risky assets whenever their balance sheets are deteriorating.

6.4 Sample periods: the effects of (de)regulation and zero lower bound

Japan's financial markets and financial system experienced drastic changes in the late 1980s and early 1990s.[17] Two changes are worth noting. First, the BIS agreement in 1988 required banks to hold a sound amount of bank capital. Combined with the asset market bubble and its burst around 1990, the bank capital requirement started to play an important role in banks' loan behaviors from the early 1990s. Second, corporate bond issuance became available as a finance tool in the late 1980s and early 1990s. In the late 1970s, the bond issue criteria were so stringent that only two companies (Toyota Auto and Matsushita Electric) were qualified to issue corporate bonds. Stringent regulation of corporate bond issuance was relaxed gradually.

Those changes in economic environments around the bank loans suggest that bank loan responses to shocks may differ greatly before and after the 1980s. We conjecture that bank capital shocks mattered less. Accessibility to capital markets, captured by the ratio of corporate bonds to assets, also mattered less.

Table 2 reports correlations, showing some validity of our conjectures. In the former period of 1974Q1 to 1989Q4, the corporate bond ratio is uncorrelated with the degree of bank loan responses, although the capital ratio still is correlated with the degree of bank

[17] See Hoshi and Kashyap (1999) for detail.

loan responses.[18]

Another important issue associated with sample length is the presence of the zero lower bound of nominal interest rates. As Figure 1 shows, the short-term nominal interest rate reached almost zero in 1995 and has stayed at that level thereafter. The non-linearity stemming from the zero lower bound poses a serious challenge to accurately estimating the monetary policy shock. To check the robustness of our result from this viewpoint, we therefore estimate the model using the sample period up until 1995Q4. Table 2 shows that our results are not significantly changed from the baseline result.

6.5 Robustness

We check the robustness of our results by conducting several model modifications. Among our results, we focus on correlations between the degree of bank loan responses and liability conditions. Tables A-1 and A-2 are the summary of the following robustness check. They report Spearman's rank correlations for a monetary policy shock and a bank capital shock, respectively.

First, we impose different recursive restrictions in identifying the two macroeconomic shocks. We replace our baseline ordering of shocks with the recursive restriction proposed by Bayoumi (2001). In this setting, the call rate does not respond to a contemporaneous shock to either the real bank capital or real bank loan. Furthermore, considering that our real bank capital series contains contemporaneous information on the financial market price as it is constructed in such a way as to reflect the contemporaneous movement of banks' stock prices, we assume that the real bank capital is the most endogenous next to the real stock price. As the second column of Tables A-1 and A-2 shows, the obtained correlations under this setting hardly change from the baseline.

Second, we examine whether incorporating linkages across sectors affects the estimation results. Note that in the benchmark estimation, a sectoral block consists of only one sector with the same industry and of the same firm size. We here add the real sales of the same industry but different firm size to each sectoral block, considering that linkages among the same industry but across different firm sizes are stronger than those across industries. The third column of Tables A-1 and A-2 shows the robustness of the previous results.

Third, to check the robustness against the number of lags, we estimate the model with

[18] No correlation implies two possibilities: either macro shocks do not influence bank loans, or the degree of bank loan responses is independent of borrower firms' characteristics.

lags of one quarter. Although we do not report it in the table, the obtained correlations hardly change.

Fourth, to check the robustness against the number of variables and the way to extract the monetary policy shock and the bank capital shock, we use a Factor-Augmented VAR approach (FAVAR) as in Bernanke et al. (2005) and Favero et al. (2005). By making use of the macroeconomic factor, we reduce the number of variables in the macroeconomic block (X_{1t}) from six to three: real aggregate bank capital, a macroeconomic factor, and the call rate. The macroeconomic factor is the first principal component extracted from a set of economic variables (M_t) for which the detail is given in the Appendix, and the whole FAVAR is specified as follows:

$$M_t = \Omega(L)X_{1t} + e_t,$$
$$X_{1t} = A(L)X_{1t} + u_{1t}.$$

Identification assumptions and lag orders for the macroeconomic block and the sectoral block are the same as in the baseline model.

Results are reported in Figures A-3 and A-4 and Tables A-1 and A-2. First, Figures A-3 and A-4 show the responses of selected macroeconomic variables to the contractionary monetary policy shock and the positive bank capital shock, respectively. The general pattern of macroeconomic response that is obtained under the baseline model is maintained and further enriched by the responses of other variables—such as production, investment, and unemployment—that are not included in the baseline model. The fourth column of Tables A-1 and A-2 reports correlations between the degree of bank loan responses and liability conditions. Our bottom-line results are intact: borrower firms' liability conditions are tightly linked to the bank loan responses. However, we find some differences from the baseline model and the FAVAR model. For the monetary policy shock, the capital ratio and the interest coverage ratio of borrower firms are uncorrelated with the degree of bank loan responses. For the bank capital shock, the corporate bond ratio is uncorrelated with the degree of bank loans.

Finally, we distinguish long-term bank loans from short-term bank loans. In the benchmark model, we have used total bank loans. We replace them by either short-term or long-term bank loans and estimate the model in the same way otherwise. The fifth and last columns of Tables A-1 and A-2 reveal that the responses of long-term bank loans are more highly correlated with the borrower firms' characteristics than those of short-term bank loans.

7. Conclusion

In this paper, we investigated the determinants of bank loan responses to shocks to

monetary policy and bank capital based on borrower firms' data at a disaggregated level. Using the bank loan series disaggregated by the borrower firms' size and industry, we first estimated the bank loan responses by the block recursive VAR proposed by Davis and Haltiwanger (2001). The bank loan responses display a substantial heterogeneity across sectors. Next, to see the determinants of the heterogeneity, we constructed several indicators of borrower firms' characteristics, including those associated with their balance sheet conditions and inventories, and examined the statistical relationship between the bank loan responses and those indicators. We found that borrower firms' characteristics, particularly their liability conditions, are tightly linked to the bank loan responses and that inventory-related variables that are stressed in the existing studies are not linked with the bank loan responses. In addition, we found that a portion of heterogeneity accounted for by the borrower firms' liability condition is limited. In particular, our results do not answer a question regarding why the macroeconomic shocks change bank loans in opposing directions across sectors.

In this respect, deeper analyses on banks' portfolio decisions are called for from both empirical and theoretical perspectives. From an empirical viewpoint, analyses based on the bank loan series disaggregated by bank types, such as city bank, regional bank, and regional bank II, in Japan that differ in terms of size, maturity arrangements, and regulatory capital requirements, would be a promising avenue because it may disentangle the determinants of bank loan portfolios associated with the lender banks' side from those associated with the borrower firms' side. Along this line, Hancock et al. (1995), using the U.S. data, report that the size of the bank matters in regard to how the bank loan changes after the bank capital shock. From a theoretical viewpoint, a model that at least incorporates both credit-constrained firms and credit-constrained banks is needed.

Our results have policy implications, particularly in regard to those undertaken during Japan's lost decade. In that era, the Bank of Japan continued its accommodative monetary policy, and the Japanese government injected capital to banks to strengthen the banks' balance sheets. According to the bank loan responses to monetary policy shocks and bank capital shocks obtained in the current analysis, the outcomes of these policies may have been increases in bank loans to non-manufacturing firms such as construction and real estate industries, substituting out the loans from manufacturing firms. A possible consequence of such shift in bank loans may be the misallocation of bank credits through ever-greening or zombie-lending, as discussed by Sekine, Kobayashi, and Saita (2003); Peek and Rosengren (2005); and Caballero, Hoshi, and Kashyap (2008). The analysis of that channel, however, is left for the future research.

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Table 1: Sector classification

1. Industry

		Bank loan share
All		1.000
Manufacturing		0.207
	Food	0.019
	Textile mill products	0.005
	Pulp, paper, and paper products	0.007
	Chemical and allied products	0.023
	Iron and steel	0.015
	Non-ferrous metals and products	0.009
	Fabricated metal products	0.011
	General-purpose machinery	0.019
	Electrical machinery, equipment, and supplies	0.022
	Transportation equipment	0.011
	Other manufacturing	0.020
Non-manufacturing		0.796
	Construction	0.066
	Transmission and distribution of gas	0.004
	Transportation	0.062
	Wholesale and retail trade	0.216
	Wholesale trade	0.146
	Retail trade	0.070
	Real estate	0.202
	Services	0.164

2. Size

		Bank loan share
All		1.00
Large	Capital of 1 billion yen or over	0.422
Medium	Capital of 100 million to 1 billion yen	0.064
Small	Capital of less than 100 million yen and no less than 10 million yen	0.513

Note: Numbers in the table are the sample average of bank loan shares.

Table 2: Correlations between borrower firms' characteristics and bank loan responses

	Bank loan responses to a contractionary monetary policy shock		Bank loan responses to a positive bank capital shock	
		Spearman's rank		Spearman's rank
Liability				
Capital ratio	0.359**	0.429**	-0.428**	-0.461**
Bank borrowing ratio	-0.477**	-0.510**	-0.075	-0.058
Corporate bond ratio	0.106	0.236	-0.524**	-0.386**
Maturity				
Long-term bank borrowing ratio	-0.311*	-0.357**	0.32**	0.354**
Short-term bank borrowing ratio	-0.477**	-0.510**	-0.075	-0.058
Cash and deposit holding ratio	0.026	-0.004	0.236	0.170
Liquid asset ratio to liquid liability	0.094	0.178	-0.022	-0.061
Flow				
Interest coverage ratio	0.358**	0.541**	-0.171	-0.233
Sales growth	-0.241	-0.264*	0.174	0.194
Inventory				
Correlation between inventory growth and sales growth	0.080	-0.023	0.073	0.037
Ratio of inventory growth deviation to sales growth deviation	-0.092	0.023	0.158	0.208

Note: The number of samples is 66, consisting of 22 industries and three sizes. Asterisks ** and * indicate that coefficients are significant at the 1 (0. 3150) and 5 (0. 2423) percent levels, respectively.

Table 3: Spearman's rank correlations for differing sample periods

	Bank loan responses to a contractionary monetary policy shock			Bank loan responses to a positive bank capital shock		
	1984Q1–2008Q2	1974Q1–1989Q4	1984Q1–1995Q4	1984Q1–2008Q2	1974Q1–1989Q4	1984Q1–1995Q4
Liability						
Capital ratio	0.429**	0.027	0.474**	-0.461**	-0.413**	-0.552**
Bank borrowing ratio	-0.510**	-0.008	-0.084	-0.058	-0.252*	0.122
Corporate bond ratio	0.236	0.169	0.229	-0.386**	-0.226	-0.393**
Maturity						
Long-term bank borrowing ratio	-0.357**	-0.109	-0.458**	0.354**	0.308*	0.38**
Short-term bank borrowing ratio	-0.510**	-0.008	-0.084	-0.058	-0.252*	0.122
Cash and deposit holding ratio	-0.004	-0.023	-0.015	0.170	0.046	0.077
Liquid asset ratio to liquid liability	0.178	-0.021	0.272*	-0.061	-0.095	-0.052
Flow						
Interest coverage ratio	0.541**	-0.055	0.419**	-0.233	-0.302*	-0.377**
Sales growth	-0.264*	0.007	-0.155	0.194	-0.04	0.271*
Inventory						
Correlation between inventory growth and sales growth	-0.023	-0.063	-0.268*	0.037	0.207	0.356**
Ratio of inventory growth deviation to sales growth deviation	0.023	0.118	-0.107	0.208	-0.007	0.029

Note: The number of samples is 66, consisting of 22 industries and three sizes. Asterisks ** and * indicate that coefficients are significant at the 1 (0.31509) and 5 (0.2423) percent levels, respectively.

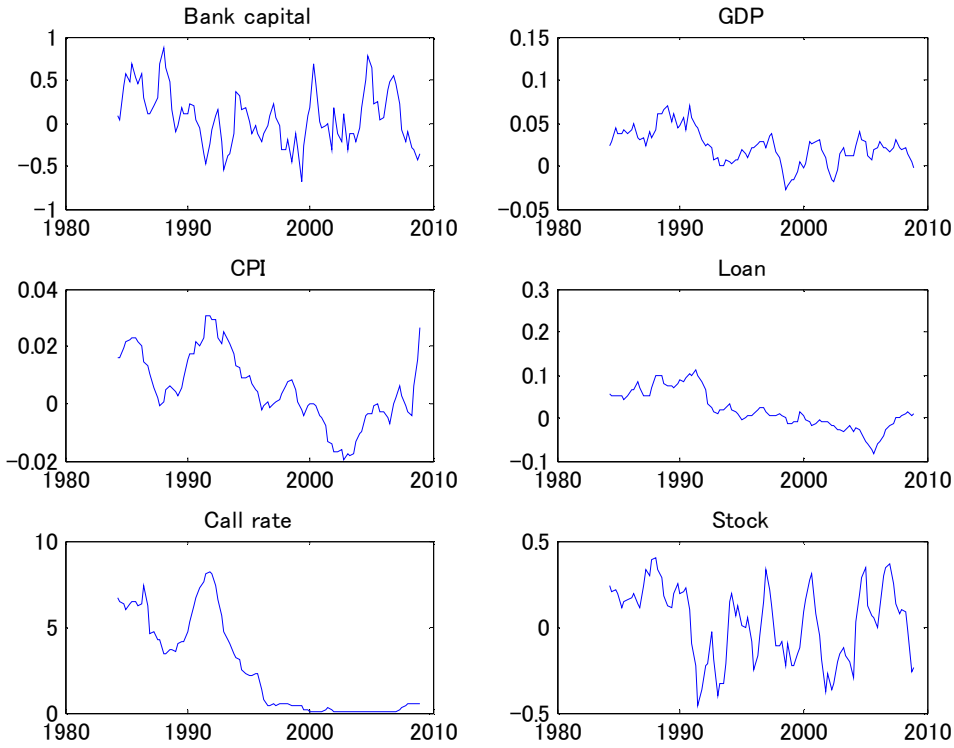

Figure 1: Macroeconomic variables

Note: Except for the call rate, the variables are shown in their first differences from a year earlier.

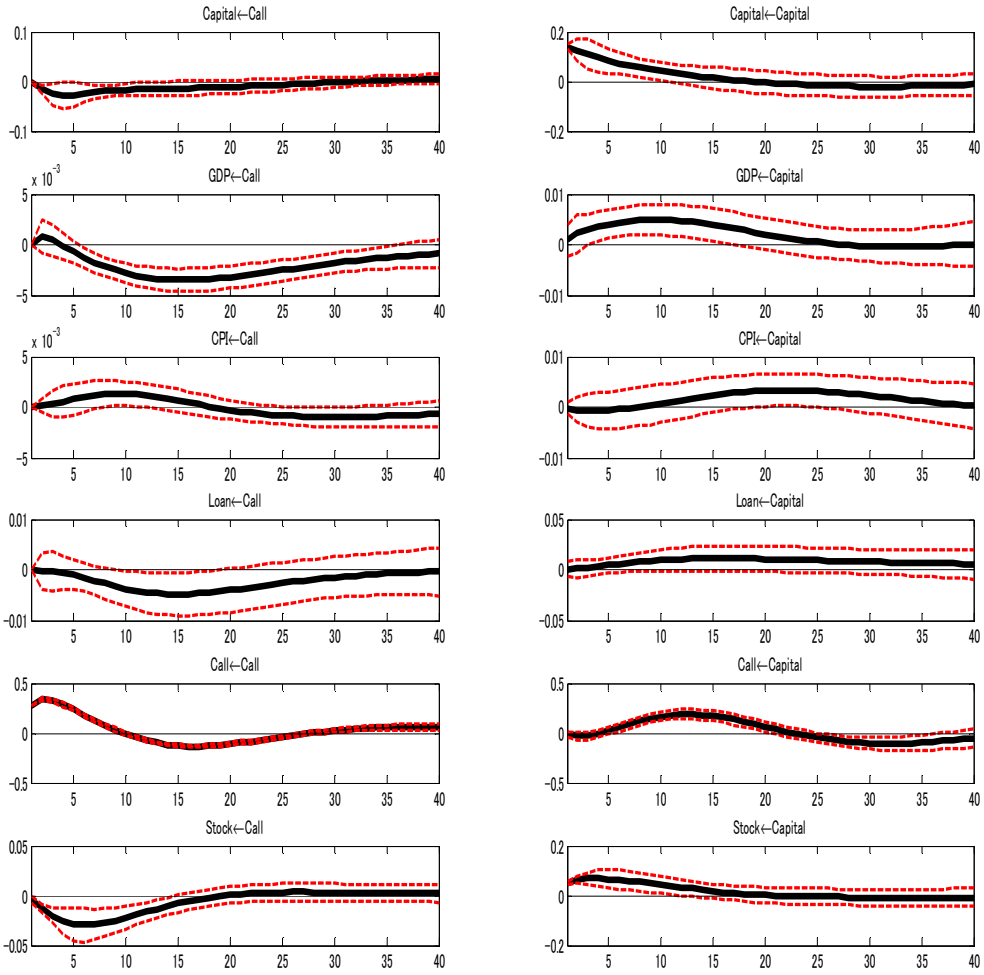

Figure 2: Impulse responses in the macroeconomic block

Note: Left and right panels are responses to the monetary policy and the bank capital shock, respectively. Thin dashed red lines indicate a one standard error confidence interval.

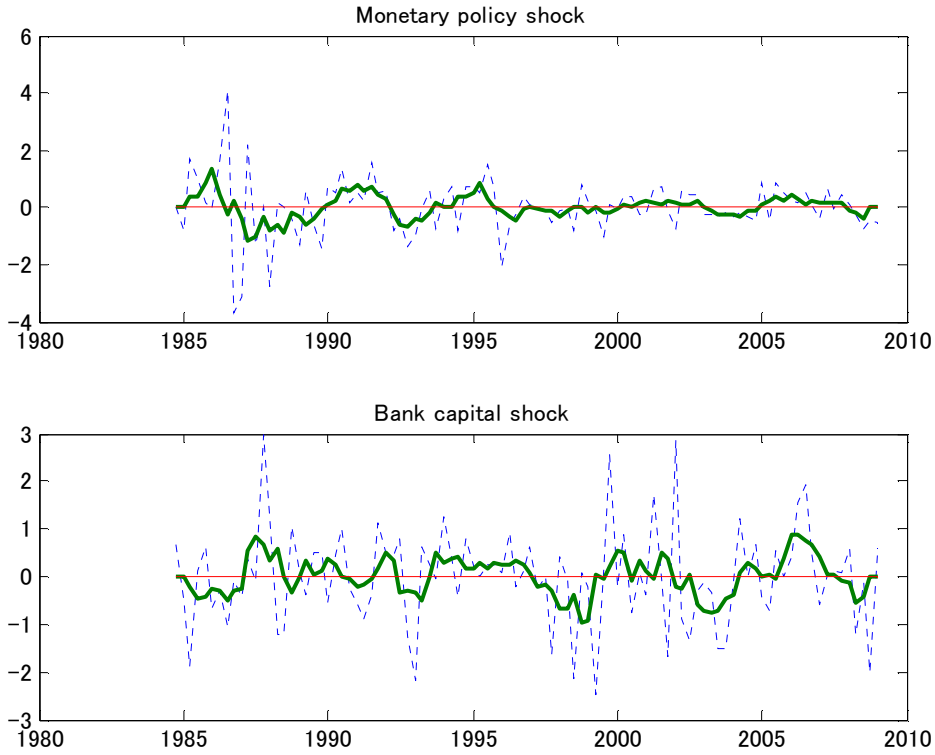

Figure 3: Identified monetary policy and bank capital shocks

Note: Solid green lines indicate the five-quarter moving average of the original shock series demonstrated by dashed blue lines.

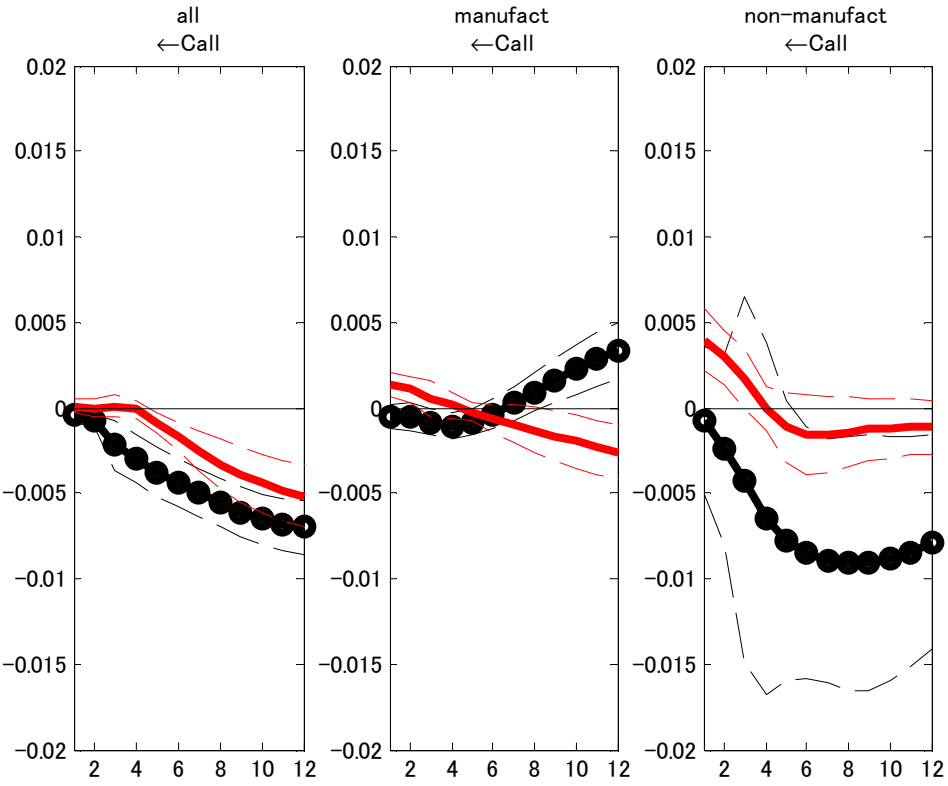

Figure 4: Impulse responses of bank loans
to the contractionary monetary policy shock

Note: Black lines with circles and red solid lines indicate impulse responses for large and small firms, respectively. Thin dashed lines indicate a one standard error confidence interval.

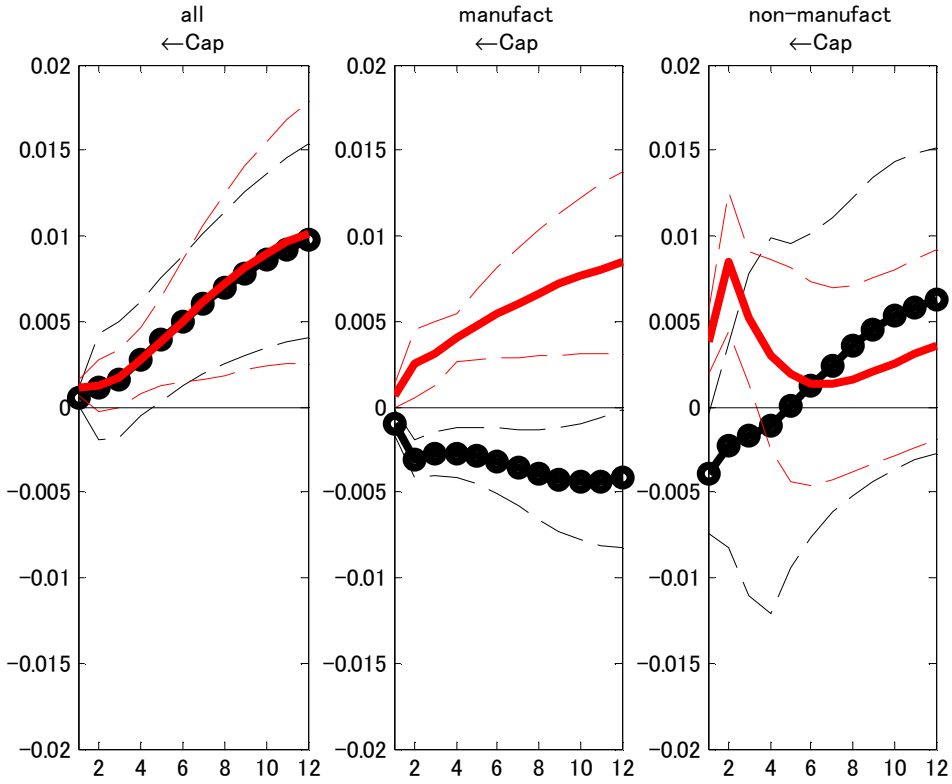

Figure 5: Impulse responses of bank loans
to the bank capital shock

Note: Black lines with circles and red solid lines indicate impulse responses for large and small firms, respectively. Thin dashed lines indicate a one standard error confidence interval.

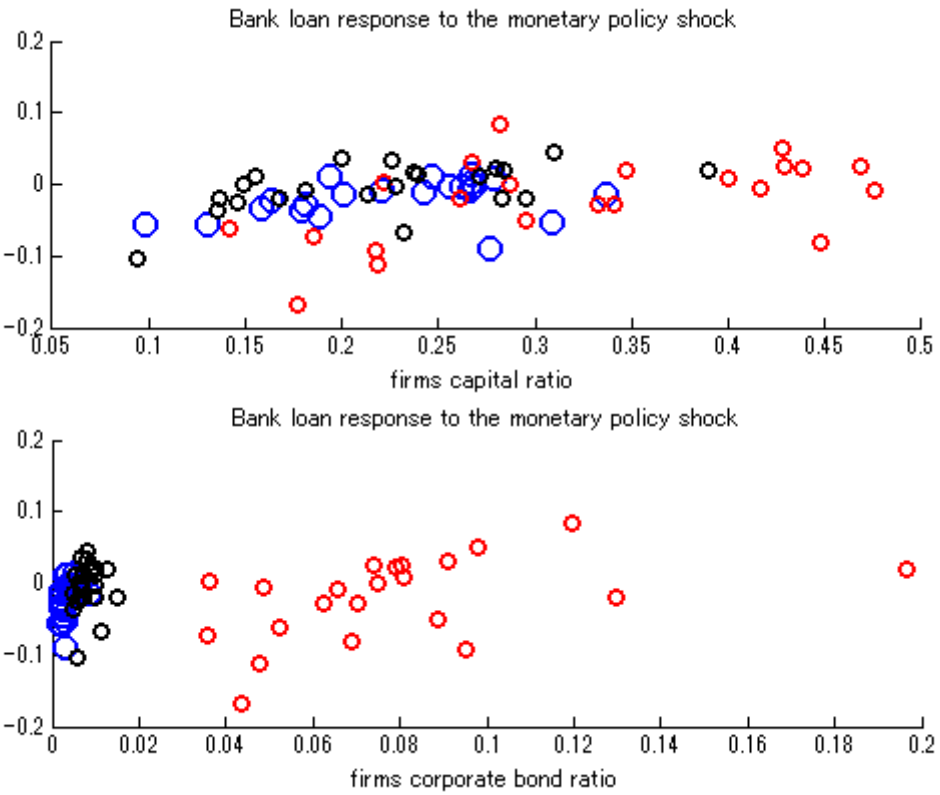

Figure 6: Bank loan response to the contractionary monetary policy shock

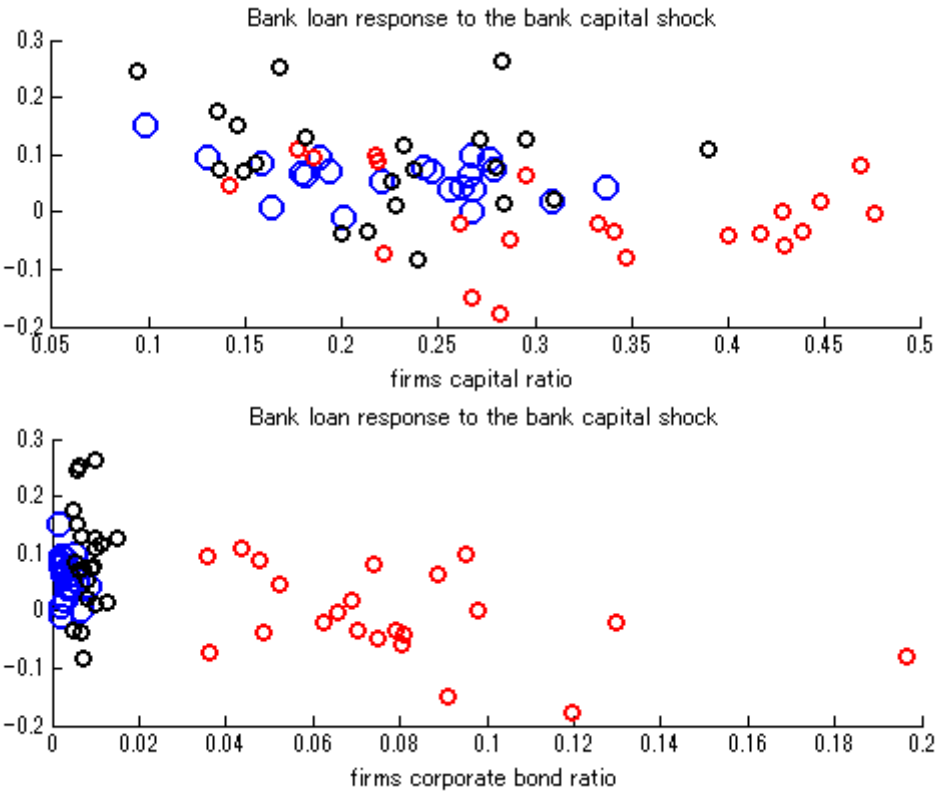

Figure 7: Bank loan response to the positive bank capital shock

Table A-1: Robustness of Spearman's rank correlations for a monetary policy shock

	Bank loan responses to a contractionary monetary policy shock					
	Benchmark	Different recursive restriction	Different sized firms included	FAVAR	Short-term bank loans used	Long-term bank loans used
Liability						
Capital ratio	0.429**	0.341**	0.489**	-0.037	0.287*	0.550**
Bank borrowing ratio	-0.510**	-0.571**	-0.446**	-0.381**	-0.171	-0.380**
Corporate bond ratio	0.236	0.165	0.237	-0.209	0.056	0.353**
Maturity						
Long-term bank borrowing ratio	-0.357**	-0.294*	-0.375**	0.025	-0.417**	-0.331**
Short-term bank borrowing ratio	-0.510**	-0.571**	-0.446**	-0.381**	-0.171	-0.380**
Cash and deposit holding ratio	-0.004	-0.017	0.051	0.051	0.212	-0.073
Liquid asset ratio to liquid liability	0.178	0.127	0.244*	-0.060	0.296*	0.214
Flow						
Interest coverage ratio	0.541**	0.525**	0.529**	0.136	0.200	0.563**
Sales growth	-0.264*	-0.247*	-0.353**	-0.181	-0.251*	-0.099
Inventory						
Correlation between inventory growth and sales growth	-0.023	0.000	-0.014	0.160	-0.043	0.059
Ratio of inventory growth deviation to sales growth deviation	0.023	0.084	-0.015	0.000	-0.170	-0.032

Note: The number of samples is 66, consisting of 22 industries and three sizes. Asterisks ** and * indicate that coefficients are significant at the 1 (0.31359) and 5 (0.24203) percent levels, respectively.

Table A-2: Robustness of Spearman's rank correlations for a bank capital shock

	Bank loan responses to a positive bank capital shock					
	Benchmark	Different recursive restriction	Different sized firms included	FAVAR	Short-term bank loans used	Long-term bank loans used
Liability						
Capital ratio	-0.461**	-0.402**	-0.483**	-0.384**	-0.332**	-0.509**
Bank borrowing ratio	-0.058	-0.059	-0.029	-0.142	0.137	0.099
Corporate bond ratio	-0.386**	-0.338**	-0.401**	-0.136	-0.197	-0.532**
Maturity						
Long-term bank borrowing ratio	0.354**	0.331**	0.390**	0.472**	0.268*	0.339**
Short-term bank borrowing ratio	-0.058	-0.059	-0.029	-0.142	0.137	0.099
Cash and deposit holding ratio	0.170	0.161	0.166	-0.095	0.092	0.286*
Liquid asset ratio to liquid liability	-0.061	-0.015	-0.082	-0.216	-0.060	-0.038
Flow						
Interest coverage ratio	-0.233	-0.173	-0.245*	-0.210	-0.246*	-0.347**
Sales growth	0.194	0.210	0.184	0.046	0.333**	0.072
Inventory						
Correlation between inventory growth and sales growth	0.037	-0.001	0.048	-0.021	-0.042	0.051
Ratio of inventory growth deviation to sales growth deviation	0.208	0.174	0.192	0.100	0.166	0.157

Note: The number of samples is 66, consisting of 22 industries and three sizes. Asterisks ** and * indicate that coefficients are significant at the 1 (0.3150) and 5 (0.2423) percent levels, respectively.

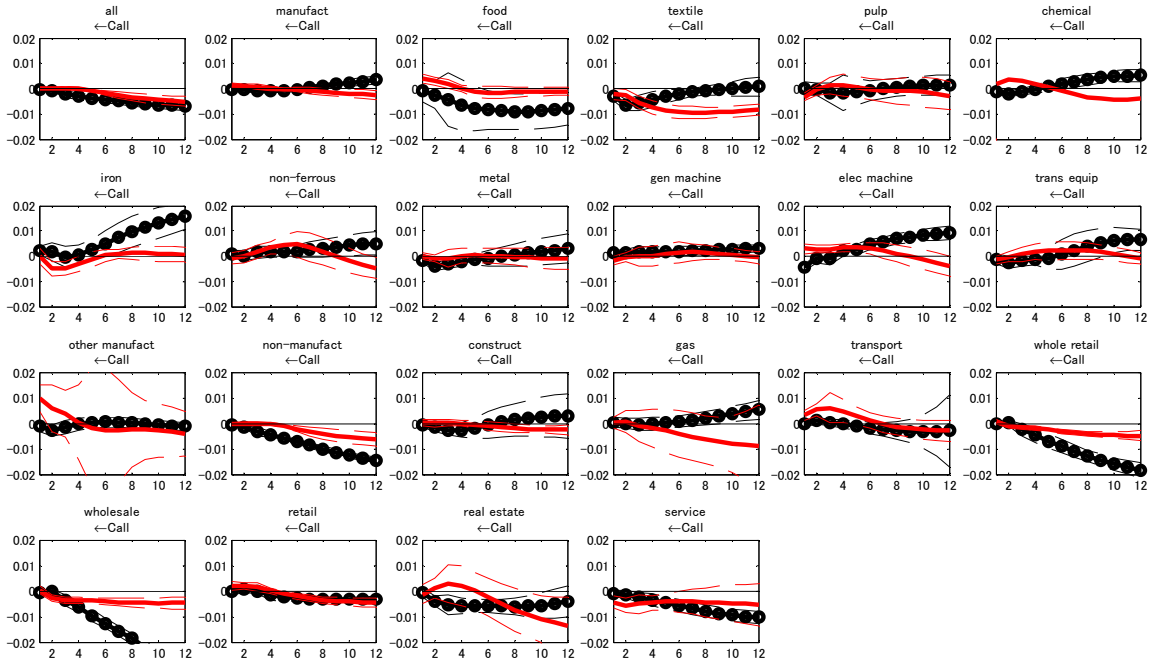

Figure A-1: Impulse responses of bank loans
to the contractionary monetary policy shock

Note: Black lines with circles and red solid lines indicate impulse responses for large and small firms, respectively. Thin dashed lines indicate a one standard error confidence interval.

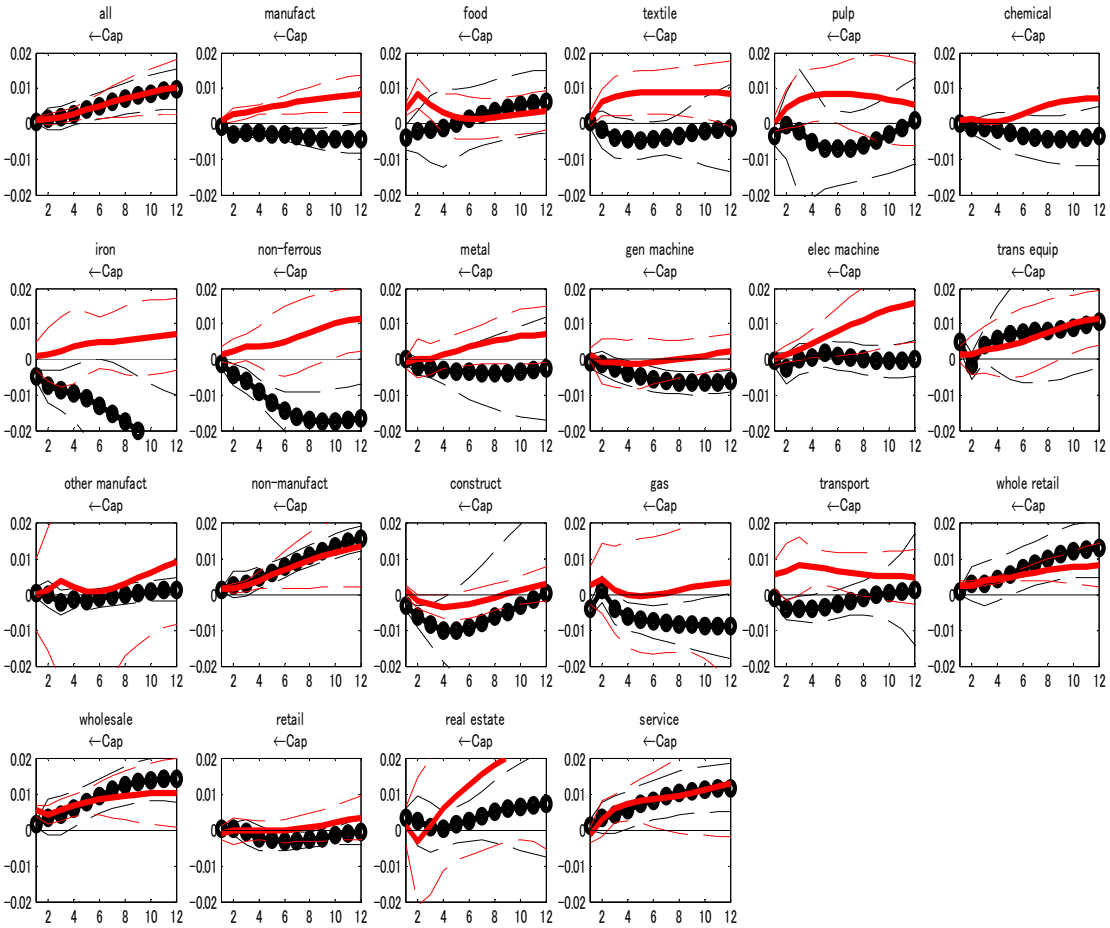

Figure A-2: Impulse responses of bank loans
to the bank capital shock

Note: Black lines with circles and red solid lines indicate impulse responses for large and small firms, respectively. Thin dashed lines indicate a one standard error confidence interval.

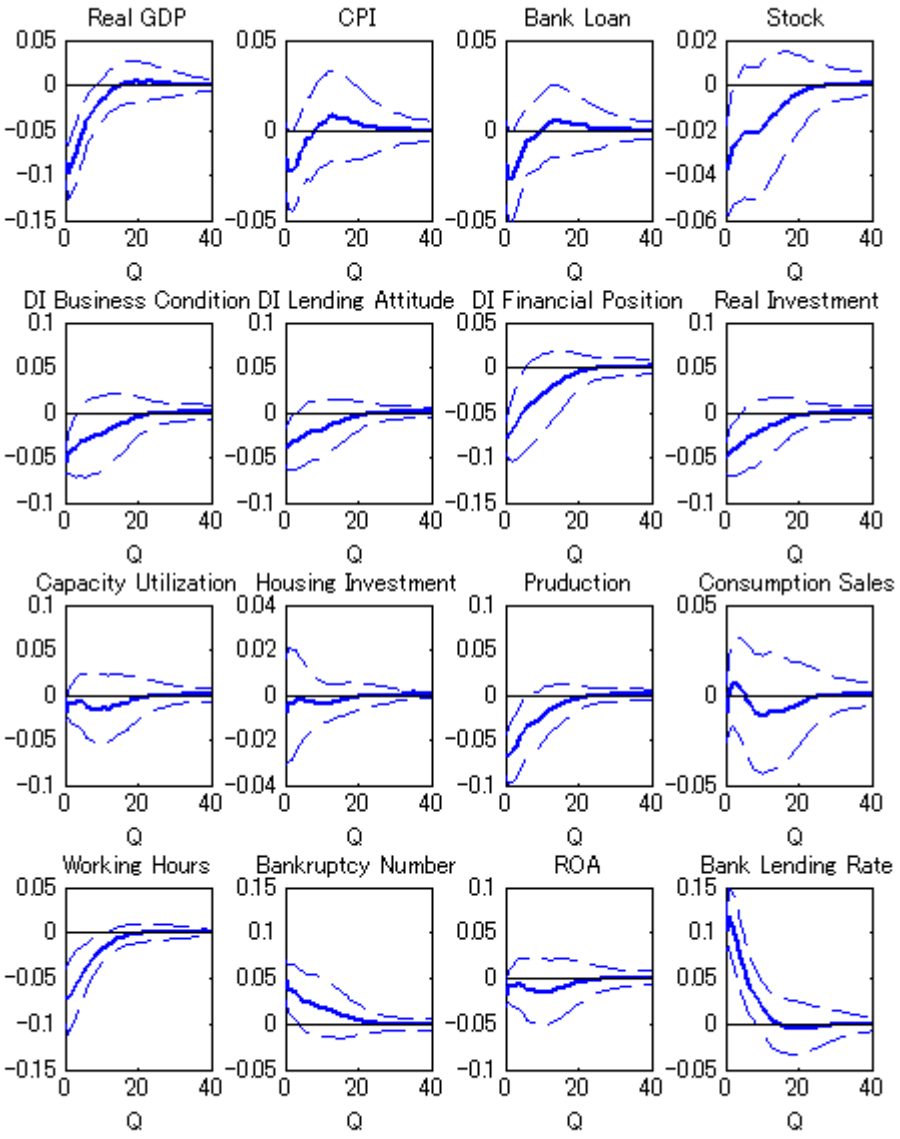

Figure A-3: Impulse responses of economic variables
to the contractionary monetary policy shock
when FAVAR is conducted

Note: Dashed lines indicate a one standard error confidence interval.

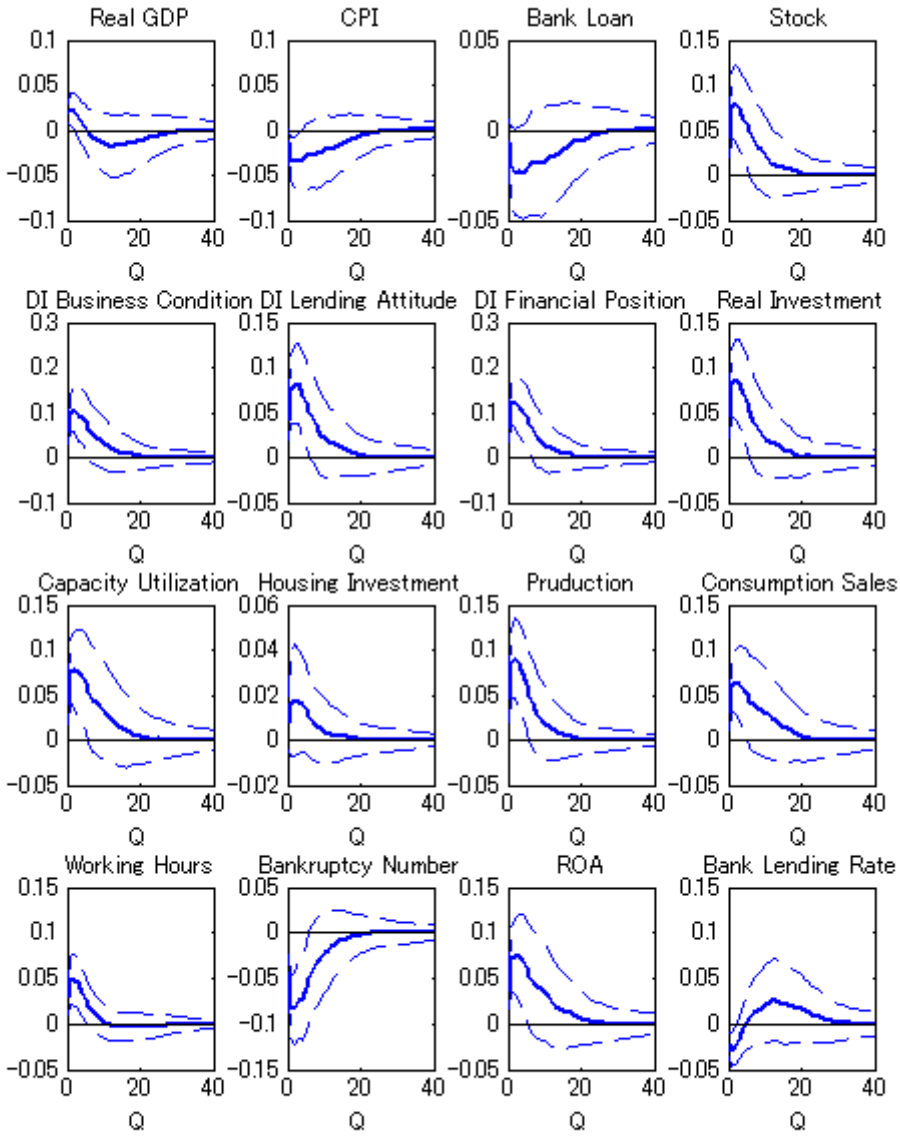

Figure A-4: Impulse responses of economic variables
to the positive bank capital shock
when FAVAR is conducted

Note: Dashed lines indicate a one standard error confidence interval.

Appendix: Factor-Augmented VAR (FAVAR)

The spirit of the Factor-Augmented Vector Auto-Regression analysis, as in Bernanke et al. (2005) and Favero et al. (2005), is to utilize as much information as possible in a data-rich environment and bring VAR analysis closer to the actual policy maker's decision-making process.

In an FAVAR, factors are extracted from a large set of economic variables, and a VAR is formulated using these factors and policy variables of interest. This (small) VAR serves as the core block of the FAVAR model, and all variables can be traced out by the factor-loading equation. This enables us to use more information in an efficient manner rather than just adding data to the list of VAR variables. The FAVAR is specified as

$$M_t = \Omega(L) X_{1t} + e_t ,$$
$$X_{1t} = A(L) X_{1t} + u_{1t} ,$$

where M_t is the set of economic variables given in the list below and X_{1t} is the macroeconomic block. In our example, the macroeconomic block consists of three variables ordered as real aggregate bank capital, a macroeconomic factor, and the call rate. The macroeconomic factor is the first principal component extracted from M_t and is shown in the figure below. This factor captures key business cycle events in Japan, such as the burst of the bubble economy in the early 1990s, the domestic banking crisis from 1997 to 1998, the IT bubble collapse in the early 2000s, and the downturn right before the collapse of Lehman Brothers in 2008.

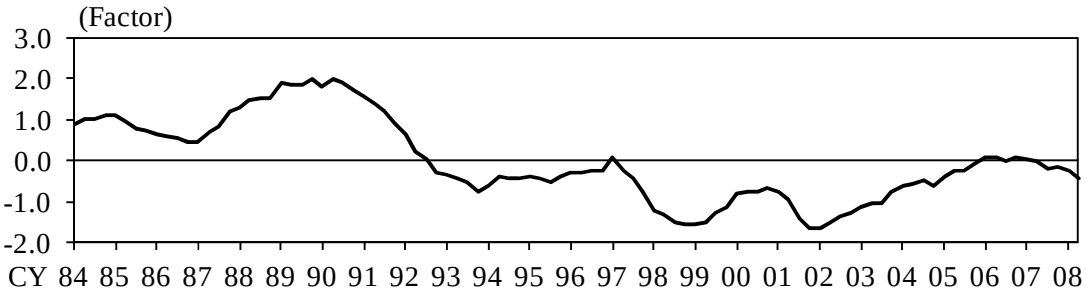

Figure A-5: The macroeconomic factor

The impulse response functions in Figures A-3 and A-4 are constructed via bootstrap as in Kilian (1998). The contractionary monetary policy shock negatively affects sentiments such as business conditions, lending attitude, and financial positions and also depresses output, production, investment, and working hours. On the other hand, the bank capital shock serves as a positive shock to the whole economy, improving sentiments, output, production, and working hours and reducing bankruptcy.

Data Description

All variables are from 1984Q1 to 2008Q2. The transformation codes (T.) are 1—no transformation; 2—sign reversed; 3—y/y growth rate; 4—q/q growth rate; 5—log transformation. An asterisk * denotes seasonally adjusted variables. These variables were standardized prior to extracting the first principle component.

Variable	T.	Source
Real output, real expenditures		
Real GDP*	5	Cabinet Office, "National Accounts"
Real investment	3	
Real consumption	3	
Real fiscal expenditure	3	
Real net exports	3	
Real trade balance	3	
GDP gap	1	Bank of Japan
Employment and hours		
Total hours worked	3	Ministry of Health, Labour and Welfare, "Monthly Labour Survey"
Unemployment rate*	1	
Labor force	3	Ministry of Internal Affairs and Communications, "Labour Force Survey"
Number of employed	3	
Number of employees	3	
Active job openings-to-applicants ratio*	1	Ministry of Health, Labour and Welfare, "Report on Employment Service"
Average hourly earnings		
Total cash earnings (nominal)	3	Ministry of Health, Labour and Welfare, "Monthly Labour Survey"
Scheduled cash earnings	3	
Consumption		
Sales at retail stores	3	Ministry of Economy, Trade and Industry, "Current Survey of Commerce"
Index of consumption expenditure level*	1	Ministry of Internal Affairs and Communications, "Monthly Report on the Family Income and Expenditure Survey"
Housing starts and sales		
Housing starts	3	Ministry of Land, Infrastructure, Transport and Tourism, "Statistics on Building Construction Starts"
Production, shipments, inventories		
Production	3	Ministry of Economy, Trade and Industry, "Indices of Industrial Production"
Shipments	3	
Inventories	3	
Index of capacity utilization (manufacturing)*	1	

Stock prices		
TOPIX (2005=100) Real stock price (Nikkei 225 deflated by the consumption-adjusted GDP deflator)	1 1	Tokyo Stock Exchange The *Nihon Keizai Shimbun*, Cabinet Office, etc.
Exchange rates		
Real effective exchange rate	1	Bank for International Settlements, "BIS effective exchange rate indices"
Interest rates		
New loans and discounts Outstanding loans and bills discounted (Total domestically licensed banks)	1 1	Bank of Japan, "Average Contract Interest Rates on Loans and Discounts"
Government bond yield (10 year)	1	Bloomberg, etc.
Credit quantity aggregates		
Loans (depository corporations/stock)	3	Bank of Japan, "Flow of Funds"
Bank loans	5	Ministry of Finance, "Financial Statements Statistics of Corporations by Industry, Quarterly"
Price indexes		
GDP deflator	1	Cabinet Office, "National Accounts"
Consumer price index (all items) tax adjusted	5	Ministry of Internal Affairs and Communications, "Consumer Price Index"
Business conditions, lending attitude, availability		
Business conditions DI ("favorable"-"unfavorable") <all industries> DI <manufacturing> Di <nonmanufacturing> [Note: Is "nonmanufacturing" appropriate here? Elsewhere it is hyphenated ("non-manufacturing").] Lending attitude DI ("accommodative"-"severe") <all industries> Financial position DI ("easy"-"tight") <all industries> Production capacity DI DI ("excessive"-"insufficient") <manufacturing>	1 1 1 1 1 2	Bank of Japan, "*Tankan*, Short-Term Economic Survey of Enterprises in Japan"
Indexes of business conditions (CI)	1	Cabinet Office, "Indexes of Business Conditions"
Corporate bankruptcies		
Number of cases Amount of liabilities	5 5	Tokyo Shoko Research Ltd., "*Tosan Geppo* (Monthly review of corporate bankruptcies)"
Corporate profits		
ROA (operating profits / total assets) Sales profit ratio	1 1	Ministry of Finance, "Financial Statements Statistics of Corporations by Industry, Quarterly"
Miscellaneous		
Land prices (residential, nationwide)	1	Ministry of Land, Infrastructure, Transport and Tourism, "Public Notice of Land Prices"

	Oil prices (WTI, Dubai)	1	Bloomberg
	Real GDP (U.S.)	4	BEA
	Consumer price index (U.S., all items)	3	BLS