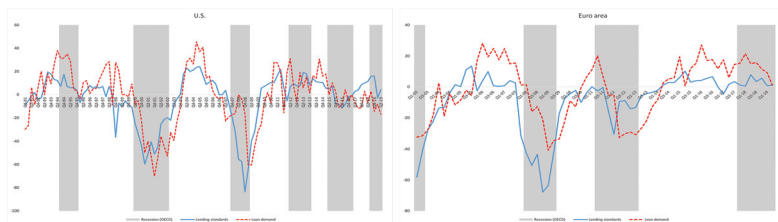


# Online Appendixes to “Bank Lending Standards, Loan Demand, and the Macroeconomy: Evidence from the Korean Bank Loan Officer Survey”

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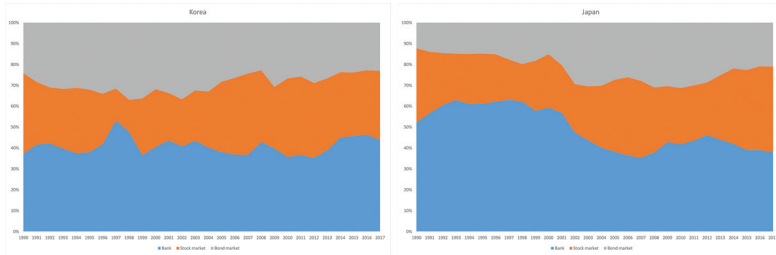
## Appendix A. Additional Figures and Tables

**Figure A.1. Lending Standards and Loan Demand: United States (left) and Euro Area (right)**



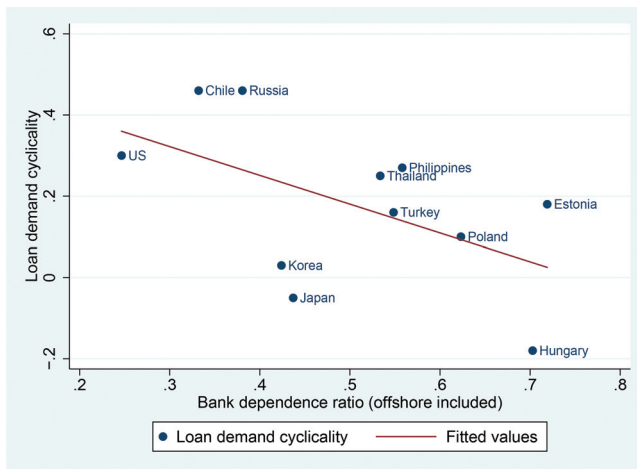
**Notes:** These graphs show changes in lending standards towards new business loans (solid) and demand for business loans (dashed) in the United States (left) and the euro area (right). Shaded areas denote the recession dates defined by the OECD. The sign of the lending standards in the original data is reversed so that a decrease denotes tightening. See appendix C for further details on the construction of indexes.

**Figure A.2. Financial Market Structure: Korea and Japan**



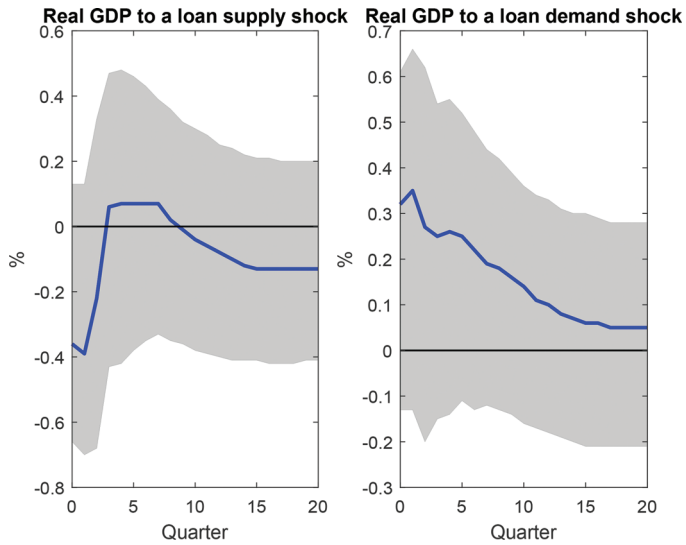
**Note:** This graph shows changes in the relative share of bank loans, bonds, and equities in private borrowing in Korea (left) and Japan (right).

**Figure A.3. Banking-Sector Dependency and the Cyclicity of Loan Demand: Offshore Banking Included**



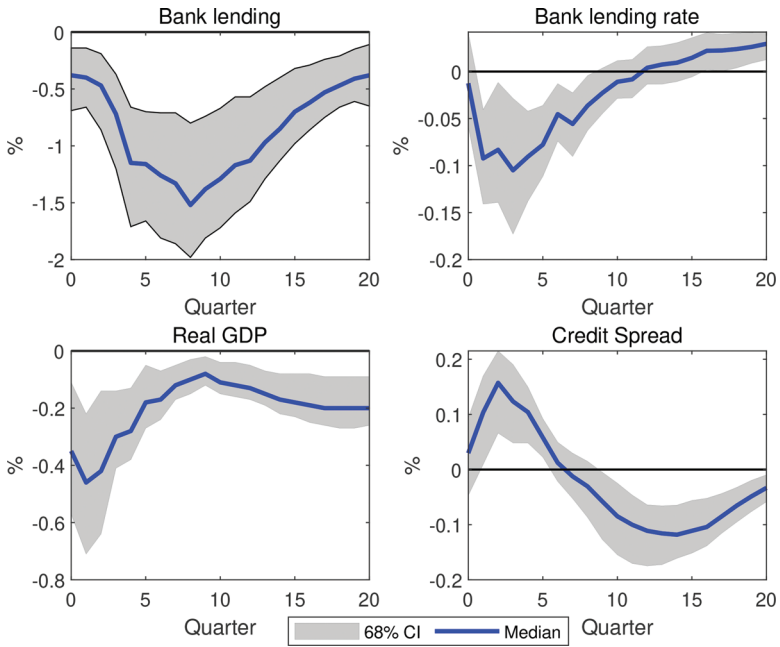
**Notes:** Bank dependence ratio is the ratio of bank credit to the private sector that is expressed as a percentage of the sum of bank credit plus bond and equity market capitalization. A higher value of the indicator suggests a financial structure that is more bank oriented (Gambacorta, Yang, and Tsatsaronis 2014). Bank loan officer surveys of emerging economies available for more than 30 quarters are included. The bank loan officer survey for Hungary is at a semi-annual frequency before 2009:Q1. The cyclicity of loan demand is taken from table 1 in the main paper.

**Figure A.4. The Response of Output: Conventional Identifying Assumptions Using the Bank Loan Spread**



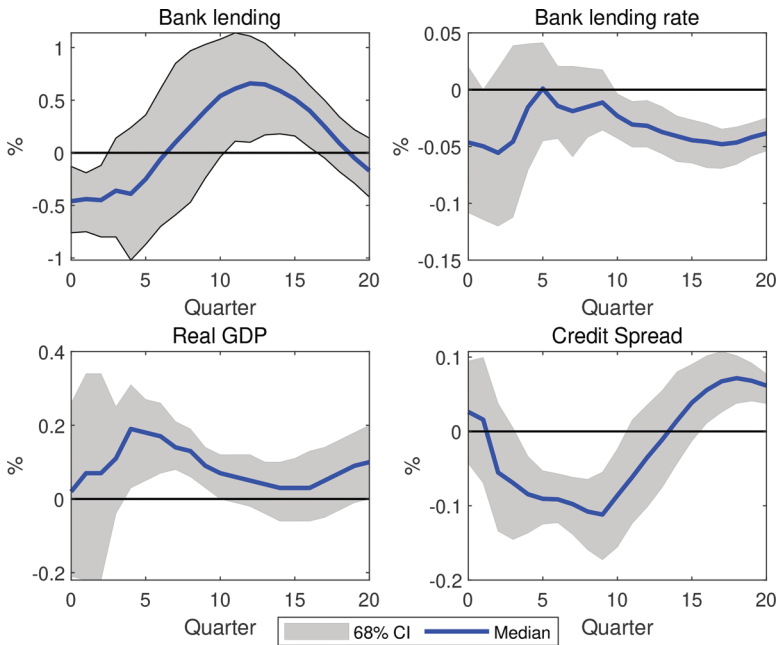
**Notes:** A negative loan supply shock (left) and a loan demand shock (right) are identified by restrictions on the spread and the volume of bank loans. The solid blue lines plot the median impulse responses, and the shaded areas note their 16th and 84th percentile bands from 200 accepted draws.

**Figure A.5. The Responses to a Negative Loan Supply Shock: Including the Credit Spread**

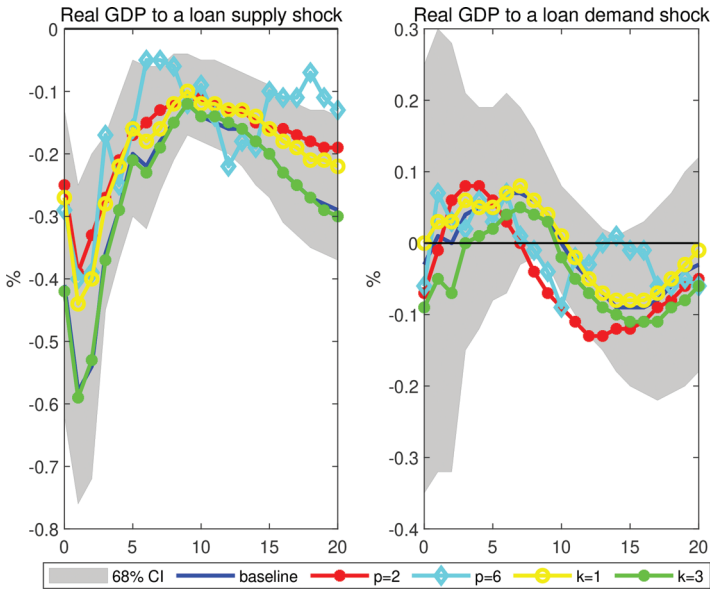


**Note:** The solid blue lines plot the median impulse responses, and the shaded areas note their 16th and 84th percentile bands from 200 accepted draws.

**Figure A.6. The Responses to a Negative Loan Demand Shock: Including the Credit Spread**

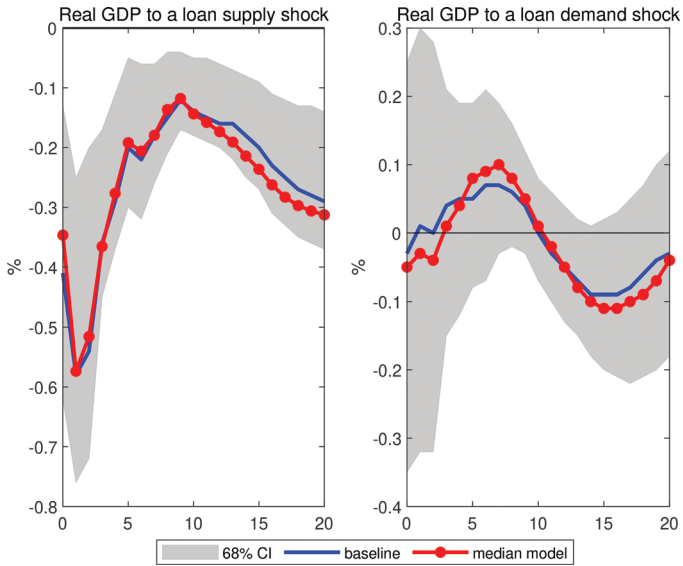


**Note:** The solid blue lines plot the median impulse responses, and the shaded areas note their 16th and 84th percentile bands from 200 accepted draws.

**Figure A.7. The IRFs in an Alternative Specification**

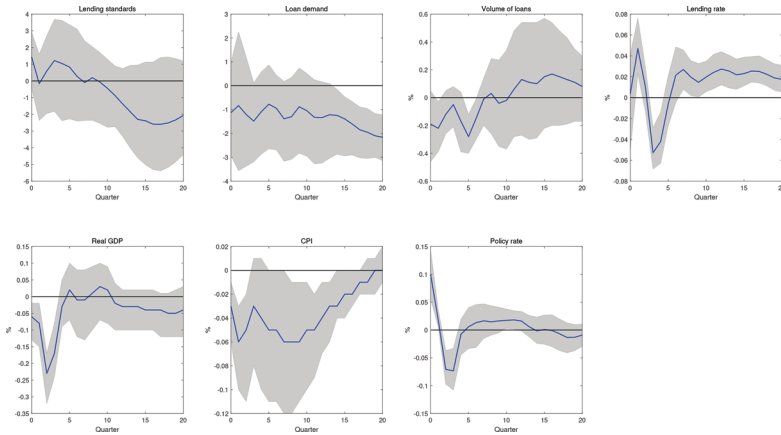
**Notes:** The solid blue lines plot the median impulse responses, and the shaded areas note their 16th and 84th percentile bands from 200 accepted draws of the baseline model ( $p = 4$  and  $k = 2$ ).  $p = 2$  and  $p = 6$  correspond to the VAR model estimated with two and six lags, respectively.  $k = 1$  and  $k = 3$  correspond to the VAR model imposing restrictions for one and three quarters, respectively.

**Figure A.8. IRFs in a Median Model**



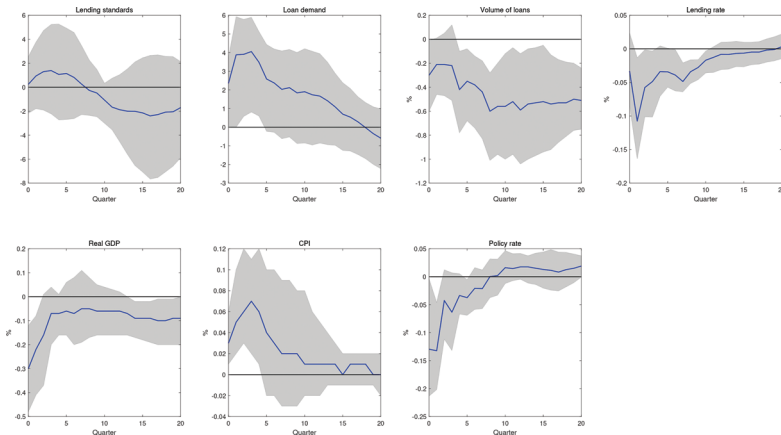
**Notes:** The solid blue lines plot the median impulse responses, and the shaded areas note their 16th and 84th percentile bands from 200 accepted draws of the baseline model. The circled red line plots the impulse responses from a median model.

**Figure A.9. The Responses to a Positive Monetary Policy Shock: Extended Model**



**Note:** The solid blue lines plot the median impulse responses, and the shaded areas note their 16th and 84th percentile bands from 200 accepted draws of the extended model.

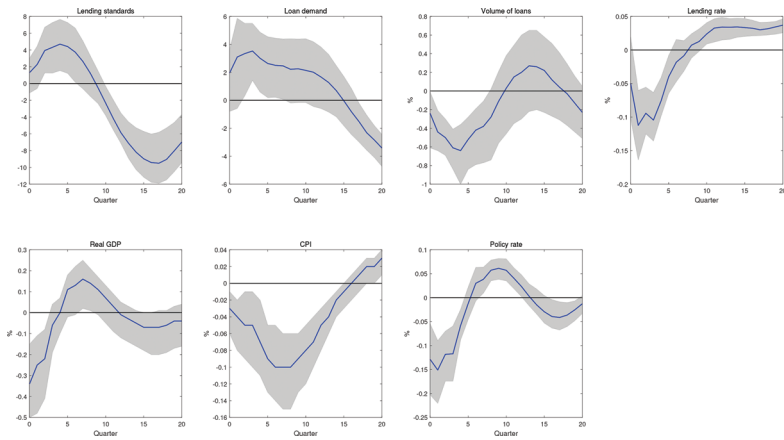
**Figure A.10. The Responses to a Negative Aggregate Supply Shock: Extended Model**



**Note:** The solid blue lines plot the median impulse responses, and the shaded areas note their 16th and 84th percentile bands from 200 accepted draws of the extended model.

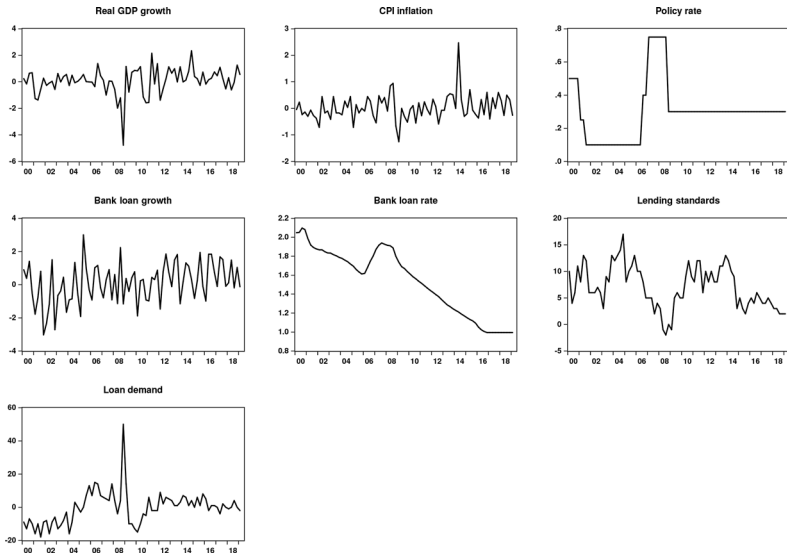


**Figure A.11. The Responses to a Negative Aggregate Demand Shock: Extended Model**



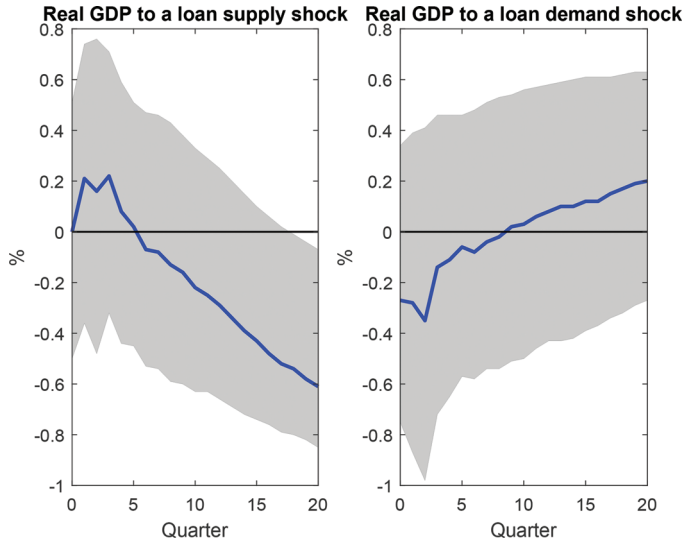
**Note:** The solid blue lines plot the median impulse responses, and the shaded areas note their 16th and 84th percentile bands from 200 accepted draws of the extended model.

**Figure A.12. Japanese Economic Data: 2000:Q1–2019:Q2**



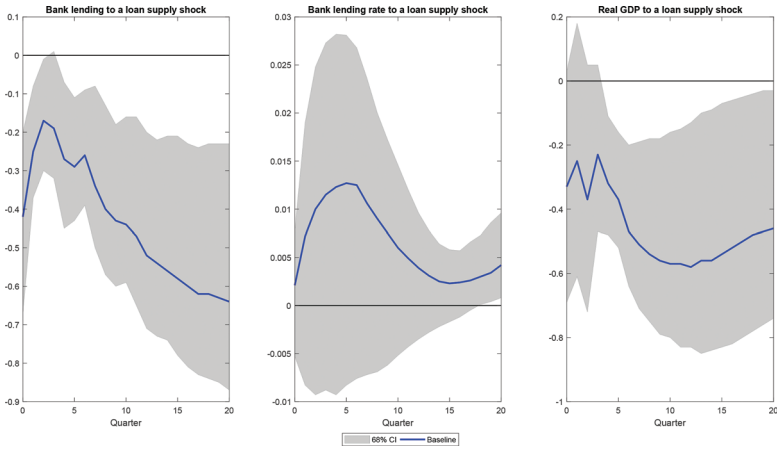
**Notes:** Bank loan growth, real GDP growth, and the inflation rate are the quarter-on-quarter growth of CPI deflated total bank loans to the business sector, real GDP, and the level of CPI, respectively. The policy rate is measured by the overnight call rate. All data are taken from the Bank of Japan.

**Figure A.13. The Response of Output: Conventional Identifying Assumptions Using the Lending Rate (Japanese case)**



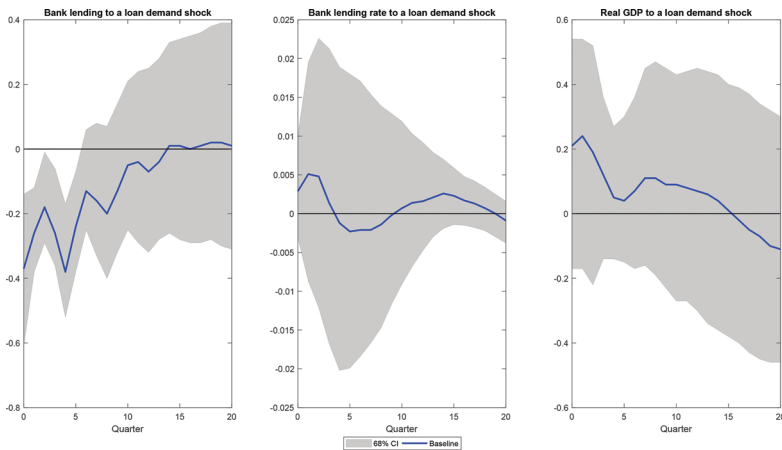
**Notes:** A negative loan supply shock (left) and a loan demand shock (right) are identified by restrictions on the bank lending rate and the volume of bank loans. Solid blue lines plot the median impulse responses, and the shaded areas note their 16th and 84th percentile bands from 200 accepted draws.

**Figure A.14. The responses to a Negative Loan Supply Shock: Japanese Case**



**Note:** Solid blue lines plot the median impulse responses, and the shaded areas note their 16th and 84th percentile bands from 200 accepted draws.

**Figure A.15. The Responses to a Negative Loan Demand Shock: Japanese Case**



**Note:** Solid blue lines plot the median impulse responses, and the shaded areas note their 16th and 84th percentile bands from 200 accepted draws.

## Appendix B. Short-Run Restrictions Using Bank Loan Officer Survey

In addition to the baseline results using sign-restriction VARs with preferred identifying assumptions, one might still be interested in the effect of bank loan supply and demand shocks on the macroeconomy using standard short-run restrictions (i.e., Cholesky ordering) in which changes in lending standards and loan demand are directly used as a proxy for the supply and demand shocks. If these changes correctly capture the relevant bank loan dynamics and are orthogonal to each other, additional identifying assumptions (i.e., sign restrictions) would be unnecessary, and inferences of the structural shocks would be straightforward. However, if these changes are a noisy proxy for the structural shocks, additional sign restrictions should be necessary to obtain cleaner causal inferences.

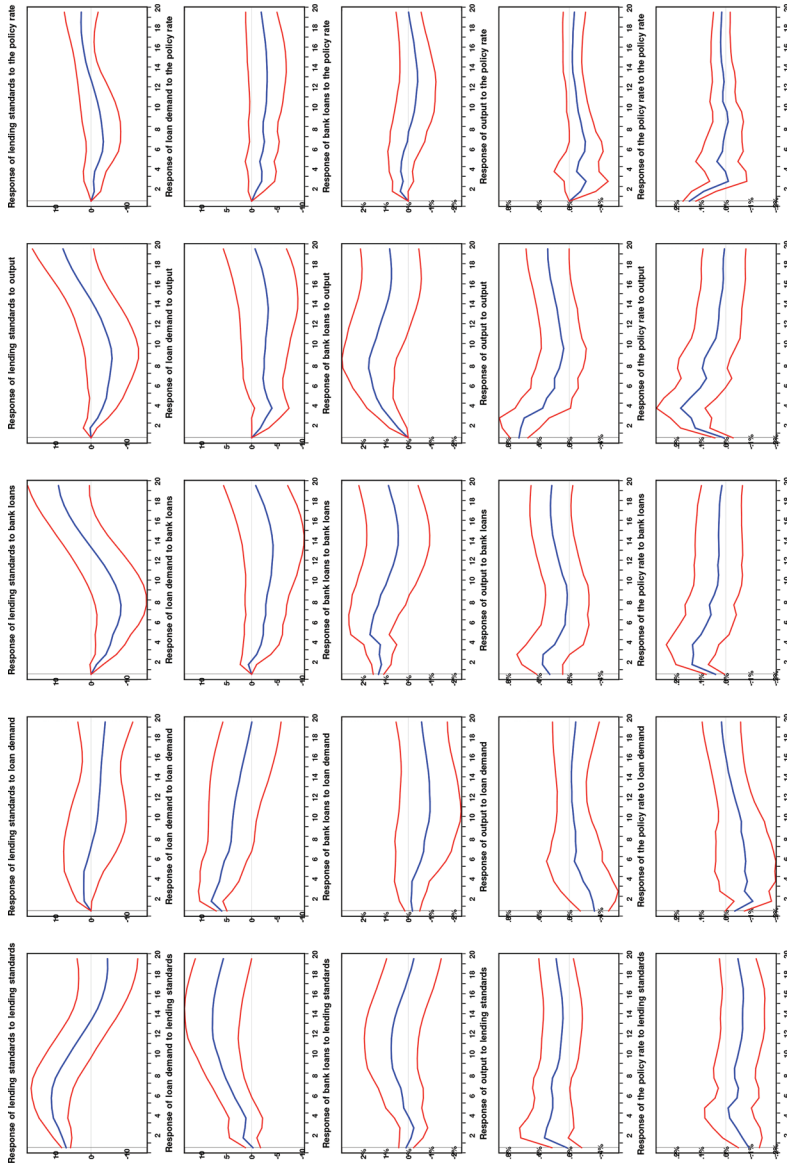
To test this hypothesis, we estimate the VAR model using short-run restrictions in which the Cholesky ordering is as follows: lending standards, loan demand, the volume of bank loans, real GDP, and the policy rate. Consistent with the baseline analysis using sign restrictions, the (log) level of variables enter the VAR system, and four lags are included. To facilitate the comparison with most existing studies using a standard approach, the VAR model is estimated by OLS, and 95 percent confidence intervals are plotted.

Figure B.1 summarizes every impulse response function from estimating the model using short-run restrictions, which helps interpret the results in the baseline analysis.<sup>1</sup> In response to a positive shock to lending standards (i.e., relaxing lending standards), loan demand increases persistently and significantly, but bank loans hardly respond. This result suggests that the shock to lending standards cannot be interpreted as a structural credit supply shock. Bank loans do not increase to a positive shock to loan demand either, suggesting that one cannot use lending standards and loan demand as a proxy for the structural loan supply and demand shocks. However, output decreases in response to the positive loan demand shock as

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<sup>1</sup>Note that the shock in this exercise is always positive, so the response should switch its sign to be comparable to the baseline model.

Figure B.1. Impulse Response Functions of the VAR Model Using Short-Run Restrictions



Note: The VAR model is estimated by OLS, and 95 percent confidence intervals are plotted.

in the case using sign restrictions, which is consistent with our interpretation of a loan demand shock in the presence of credit market imperfection.

Investigating the effects of other macroeconomics shocks further sheds light on the link between lending standards, loan demand, and the macroeconomy. A positive shock to bank loans is followed by an increase in output, as predicted by ample research on the credit-output nexus. Thus, the information in the quantity of credit should not be ignored when identifying a credit supply or demand shock. In response to credit expansion, the central bank raises the policy rate significantly, and banks tightened their lending standards considerably, which is a standard policy mix to contain a credit boom.

The responses to the positive GDP shock are central to understanding the somewhat puzzling results we found in the baseline analysis. In response to the economic expansion, bank loans to the business sector increase persistently, which is consistent with the prediction of the credit-output nexus. However, a loan demand declines in response to the positive output shock, which reinforces the consequence of credit market imperfection on credit markets. An increase in a firm's net worth due to economic expansions allows firms to access an alternative source of financing via public debt markets, thereby reducing their dependence on bank loans: i.e., the unique role of bank loans in ameliorating information asymmetry becomes less critical during good times. This is why incorporating the information from the bank loan officer survey helps capture the causal link from supply or demand of credit to output. The responses to monetary policy tightening are standard and do not require further discussions.

## **Appendix C. Bank Lending Survey Data**

### *C.1 The U.S. Senior Loan Officer Survey*

The U.S. bank loan officer survey was introduced in 1967, though the frequency and questions have changed several times since. The data are gathered from the quarterly Federal Reserve Board's Senior Loan Officer Opinion Survey on Bank Lending Practices (SLOOS) of senior loan officers at commercial banks. On the credit supply

side, this survey queries banks about changes in their lending standards for the major categories of loans to households and businesses. On the credit demand side, it inquires banks as to whether they have experienced a change in loan demand from households and businesses.

The Federal Reserve Board usually conducts the survey four times annually, and up to 80 U.S. commercial banks participate in each. We only report changes in the lending standards and the loan demand from the business sectors at the aggregate level. The main questions used in this paper are, “Over the past three months, how have your bank’s credit standards for approving applications for C&I loans or credit lines—other than those to be used to finance mergers and acquisitions—to large and middle market firms changed?” for lending standards and “Apart from normal seasonal variation, how has demand for C&I loans changed over the past three months?” for loan demand. See <http://www.federalreserve.gov/boarddocs/SnLoanSurvey> and Bassett et al. (2014) for a complete description of the panel selection criteria, the wording of individual questions, and methods used to conduct the survey.

### *C.2 The Euro-Area Bank Lending Survey*

The national central banks of the Eurosystem request quarterly information on lending standards and the loan demand from a representative sample of banks in each country. By the end of 2015, 141 banks had participated. Although the survey provides information about both firms and households, we focus only on firm-related surveys. The main questions used in this paper are, “Over the past three months, how have your bank’s credit standards as applied to the approval of loans or credit lines to enterprises changed?” for lending standards and “Over the past three months, how has demand for loans or credit lines to business loans changed at your bank, apart from normal seasonal fluctuations?” for loan demand. See Ciccarelli, Maddaloni, and Peydro (2015) for a complete description of the panel selection criteria, the wording of individual questions, and methods used to conduct the survey.



*C.3 Chile (2003:Q1–2019:Q1)*

**Title:** Bank Lending Survey

**Source:** Central Bank of Chile

**Coverage:** Commercial lending towards large enterprises and small to medium-sized enterprises (SMEs) by commercial banks

**Main Questionnaires for Lending Standards:** Approval standards for commercial loans over the past three months: (a) Less restrictive to some degree, (b) No change, (c) More restrictive to some degree.

**Main Questionnaires for Loan Demand:** Demand for new commercial loans (applications) to its bank over the past three months: (a) Stronger in some degree, (b) No change, (c) Weaker in some degree.

*C.4 Estonia (2011:Q1–2019:Q1)*

**Title:** Bank Lending Survey

**Source:** Bank of Estonia

**Coverage:** Commercial lending towards enterprises

**Main Questionnaires for Lending Standards:** Changes in credit standards over the past three months.

**Main Questionnaires for Loan Demand:** Changes in demand for loans or credit lines over the past three months.

**Note:** The diffusion index (DI) is the weighted difference between the share of banks reporting that credit standards have been tightened and the share of banks reporting that they have been eased. A positive diffusion index indicates that a larger proportion of banks have tightened credit standards, whereas a negative diffusion index indicates that a larger proportion of banks have eased credit standards. The demand index will, therefore, be positive if a larger proportion of banks have reported an increase in loan demand.

*C.5 Hungary (2002:Q3–2019:Q1)*

**Title:** Senior Loan Officer Opinion Survey on Bank Lending Practices

**Source:** Hungarian National Bank

**Coverage:** Corporate loans (nonfinancial corporations (total))

**Main Questionnaires for Lending Standards:** Please indicate your bank's willingness to grant loans or credit lines to enterprises now as opposed to the last period. (net change indicator)

**Main Questionnaires for Loan Demand:** Apart from normal seasonal variation, how has demand for loans or credit lines to enterprises changed over the past period? (net change indicator)

**Note:** Up to 2008, the survey is semi-annual.

*C.6 Japan (2002:Q1–2019:Q2)*

**Title:** Senior Bank Loan Officer Opinion Survey on Bank Lending Practices at Large Japanese Banks

**Source:** Bank of Japan

**Coverage:** Large firms' loans

**Main Questionnaires for Lending Standards:** Over the past three months, how have your bank's credit standards for approving applications for loans from firms and households changed?

**Main Questionnaires for Loan Demand:** How has demand for loans from firms changed over the past three months according to industry and firm size?

**Note:** DI for the demand for loans = (percentage of respondents selecting "substantially stronger" + percentage of respondents selecting "moderately stronger"  $\times$  0.5) – (percentage of respondents selecting "substantially weaker" + percentage of respondents selecting "moderately weaker"  $\times$  0.5).

DI for credit standards = (percentage of respondents selecting "eased considerably" + percentage of respondents selecting "eased

somewhat"  $\times 0.5$ ) – (percentage of respondents selecting “tightened considerably” + percentage of respondents selecting “tightened somewhat”  $\times 0.5$ ).

The sample of surveyed banks was reviewed in April 2018. Among domestically licensed banks (excluding several banks) and shinkin banks that hold current accounts with the Bank of Japan, the 50 largest banks in terms of the average amount outstanding of loans during fiscal 2016 cooperate with the survey. The aggregated loan amount of the surveyed 50 banks accounts for 75 percent of the total amount outstanding of loans held by all domestically licensed banks and shinkin banks (the average during fiscal 2018).

The classification of firms is as follows. Large firms: corporations with capital of 1 billion yen or over with more than 300 regular employees (“wholesaling” and “services” capitalized at 1 billion yen or over with more than 100 regular employees; and “retailing” and “food and beverage services” capitalized at 1 billion yen or over with more than 50 regular employees). Small firms: corporations and private unincorporated enterprises with a capital of 300 million yen or less or with 300 regular employees or less (“wholesaling” capitalized at 100 million yen or less or with 100 regular employees or less; “retailing” and “food and beverage services” capitalized at 50 million yen or less or with 50 regular employees or less; and “other services” capitalized at 50 million yen or less or with 100 regular employees or less). Medium-sized firms: corporations that are not included in the above two categories.

### *C.7 Korea (2002:Q1–2019:Q1)*

**Title:** Survey on Financial Institution Lending Practices

**Source:** Bank of Korea

**Coverage:** Business-sector loans by commercial banks (excluding Korea Development Bank and the Export-Import Bank of Korea)

**Main Questionnaires for Lending Standards:** Over the past three months, how have your bank’s lending standards towards loans to large-sized (or small and medium-sized) firms changed?

**Main Questionnaires for Loan Demand:** Apart from seasonality, how has demand for loans from large-sized (or small and medium-sized) firms changed over the past three months?

**Note:** The index is constructed from the weighted average of the number of respondents, as follows:

$$DI = (1 \times \# \text{ of substantial increase} + 0.5 \times \# \text{ of somewhat increase}) \\ - (1 \times \# \text{ of substantial decrease} + 0.5 \times \# \text{ of somewhat decrease}) \quad (1)$$

For the lending standards survey, a reading above zero means that the number of banks that restricted their lending compared to the last quarter outnumbered the number of lenders that eased their lending. For the loan demand survey, a reading above zero means the number of banks that experienced increased loan demand from the business sector compared to the last quarter outnumbered the number of lenders that experienced reduced loan demand.

### *C.8 Poland (2004:Q1–2019:Q1)*

**Title:** Senior Loan Officer Survey: Corporate Sector

**Source:** National Bank of Poland

**Coverage:** Enterprise loans

**Main Questionnaires for Lending Standards:** Over the last three months, how have your bank's credit standards for approving applications for loans or credit lines to large enterprises and SMEs changed? If your bank's policies have not changed over the last three months, please report them as unchanged even if they are restrictive or accommodative relative to longer-term norms. If a type of loans is not offered by your bank, please use the answer "not applicable."

**Main Questionnaires for Loan Demand:** Over the last three months, how has the demand for loans or credit lines to corporate customers changed at your bank, apart from normal seasonal fluctuations? If a type of loans is not offered by your bank, please use the answer "not applicable."

**Note:** For lending standards, the difference between the percentage of responses “eased considerably” and “eased somewhat” and the percentage of responses “tightened considerably” and “tightened somewhat” is used. A negative index indicates a tendency of tightening credit standards. For loan demand, the difference between the percentage of responses “increased considerably” and “increased somewhat” and the percentage of responses “decreased considerably” and “decreased somewhat” is used. A positive index indicates an increase in demand.

### *C.9 Philippines (2009:Q1–2019:Q1)*

**Title:** Senior Bank Loan Officer’s Survey

**Source:** Central Bank of the Philippines

**Coverage:** Enterprise loans

**Main Questionnaires for Lending Standards:** In this period, how have your bank’s credit standards, in general (in terms of enforcement and policies), changed relative to last quarter, apart from the normal seasonal fluctuations?

**Main Questionnaires for Loan Demand:** In this period, how has the demand for loans or credit lines to enterprises changed relative to last quarter, apart from the normal seasonal fluctuations?

**Note:** Diffusion index for credit standards = (% of respondents selecting “tightened considerably” + % of respondents selecting “tightened somewhat”) – (% of respondents selecting “eased considerably” + % of respondents selecting “eased somewhat”).

Diffusion index for loan demand = (% of respondents selecting “increased considerably” + % of respondents selecting “increased somewhat”) – (% of respondents selecting “decreased considerably” + % of respondents selecting “decreased somewhat”).

### *C.10 Russia (2010:Q4–2019:Q1)*

**Title:** Bank Lending Condition Survey

**Source:** Central Bank of the Russian Federation

**Coverage:** Bank lending to large and small/medium companies

**Main Questionnaires for Lending Standards:** The parameter “general lending conditions” gives an assessment of the general changes in credit availability for each category of borrowers: its tightening indicates a decrease in the availability of loans, easing an increase in availability.

**Main Questionnaires for Loan Demand:** Parameters in the section “Changes in demand for loans” characterize current changes in demand for loans or expectations for the future changes.

**Note:** Indexes of changes in bank lending conditions represent diffusion indexes of tightening of bank lending conditions in comparison with the previous period. Weighted net percentage balance (“diffusion indexes”) ranges from  $-100$  (every bank eased from the previous period) and  $+100$  (every bank tightened). Indexes of loan demand are represented in percentage points and have values from  $-100$  (all banks indicated a significant decrease in demand for loans) up to  $+100$  (all banks indicated a significant increase in demand for loans). These indexes are calculated using the following formula:  $DI = N_{-2} + 0.5 \times N_{-1} - 0.5 \times N_{+1} - N_{+2}$ , where DI is the diffusion index, in percentage points.

$N_{-2}$ : share of banks reported about a significant tightening of lending conditions;

$N_{-1}$ : share of banks reported about a moderate tightening of lending conditions;

$N_{+1}$ : share of banks reported about a moderate easing of lending conditions;

$N_{+2}$ : share of banks reported about a significant easing of lending conditions.

### *C.11 Thailand (2007:Q4–2019:Q1)*

**Title:** Credit Conditions Survey

**Source:** Bank of Thailand

**Coverage:** Corporate loans

**Main Questionnaires for Lending Standards:** Overall realized net change for credit standards.

**Main Questionnaires for Loan Demand:** Overall realized net change demand for loans and credit lines.

**Note:** The Credit Conditions Survey is conducted quarterly by the Bank of Thailand, reviewing opinions of senior loan officers. The questionnaires are sent out at the end of the last month of the surveyed quarter and are compiled by the first month of the next quarter. The survey results are presented in the diffusion index (DI) format, which varies between  $-100$  and  $100$ . The DI is a weighted average score from a five-level scale, with the weight for each financial institution corresponding to its outstanding loan market share. The DI can be interpreted as follows:

$DI < 0$  indicates credit contraction or tightening of credit policy.

$DI = 0$  indicates unchanged credit growth or credit policy.

$DI > 0$  indicates credit expansion or easing of credit policy.

### *C.12 Turkey (2005:Q1–2019:Q1)*

**Title:** Bank Loans Tendency Survey

**Source:** Central Bank of the Republic of Turkey

**Coverage:** Loans to enterprises

**Main Questionnaires for Lending Standards:** Overall realized net change for credit standards.

**Main Questionnaires for Loan Demand:** Overall realized net change demand for loans and credit lines.

**Note:** Indexes are measured in net percent (percent easing minus percent tightening).

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