HIAS-E-144

Impact of Quantitative Easing on Bank Lending to Different Industries or Sectors

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August 24, 2025

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Impact of Quantitative Easing on Bank Lending to Different Industries or Sectors*

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Abstract We empirically investigate the impact of the Bank of Japan's (BOJ) monetary policy on the lending behaviors of regional banks during the period of quantitative easing (QE). We focus particularly on the credit supply from banks to different industries or sectors, with an emphasis on manufacturing and real estate-related industries. Our results indicate that the BOJ's QE policy promoted bank lending to the estate-related industries or sectors but not to the manufacturing industry. Our findings align with recent studies on the limitations of overall credit supply in influencing the business cycle and economic growth. Furthermore, Our results suggest that the BOJ has limited ability to halt the recession through lending channels under the QE policy.

Keywords: quantitative easing, bank lending, regional banks, excess reserve, dynamic panel model

JEL Classification Code: E44 E52 E58 G21

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*The author is grateful to Shin-ichi Fukuda, Masaharu Hanazaki, Takeo Hoshi, Yoshiyuki Nakazono, Etsuro Shioji, and Yukihiro Yasuda for helpful comments. This paper was presented at the JER-HIAS-Kakenhi Conference, "Macroeconomics and Japan's Reality: Effects of Monetary and Fiscal Policies", Aug. 24-25, 2025 for valuable discussions. The author also thanks the conference participants for their helpful comments and suggestions. All errors are the author's responsibility.

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1 Introduction

The adjustment to the monetary base has been one of the most significant policy measures in recent decades, during which Japan's economy has experienced a prolonged recession. In Japan, the monetary base increased from 62 trillion yen in fiscal year (FY) 1999 to 650 trillion yen in FY 2022. The ratio of the monetary base to GDP rose from 11.70% to 114.69% over the same period. Given the standard credit creation process in a market economy like Japan, it is difficult to conceive that such a large-scale expansion of the monetary base could have real economic effects without corresponding actions from private banks.

This study empirically investigates how the large-scale increase in the monetary base affected bank lending, with a particular focus on credit allocation across different industries or sectors. While many previous studies examine the impact of monetary policy on the total amount of bank lending, our empirical strategy focuses on how these effects vary across industries or sectors, particularly the manufacturing and real estate-related sectors. Our analysis is motivated by the following considerations.

After the Global Financial Crisis, many studies have examined the consequences of credit booms (Schularick and Taylor, 2012; Dell'Ariccia et al., 2016; Baron and Xiong, 2017; Gertler et al., 2020; Diamond et al., 2022). On the one hand, banking and financial crises are widely acknowledged to be preceded by credit booms. On the other hand, defining a credit boom and determining the optimal scale of financial intermediation remain open questions. For example, Dell'Ariccia et al. (2016) define 1987–1988 as the credit boom period in Japan within the broad sample of 1970–2008. However, we can observe from Fig. 1 that Japan's bank credit was continuously in an expansionary state from 1980 to 1990. This credit expansion contributed to the asset bubble in the late 1980s, which had severe serious consequences. The entire cycle lasted for about three decades.

At the end of the last century, Hoshi and Kashyap (1999) argued that restoring financial intermediation to a normal state requires a significant contraction of bank lending. Their argument was based on comparison with financial development in the United States. Examining the effects of monetary policy on bank lending during a period when overall credit was expected to shrink is therefore of critical importance.

Analyzing the impact of monetary policy on the distribution of bank lending also provides insights into the transmission mechanism of monetary policy. The effectiveness of the "money view" versus the "lending view" (or "credit view") has been a major topic in monetary economics (Bernanke, 1993; Kashyap and Stein, 1994). However, these views are often difficult to distinguish. For example, Komiya (1976) effectively explained the

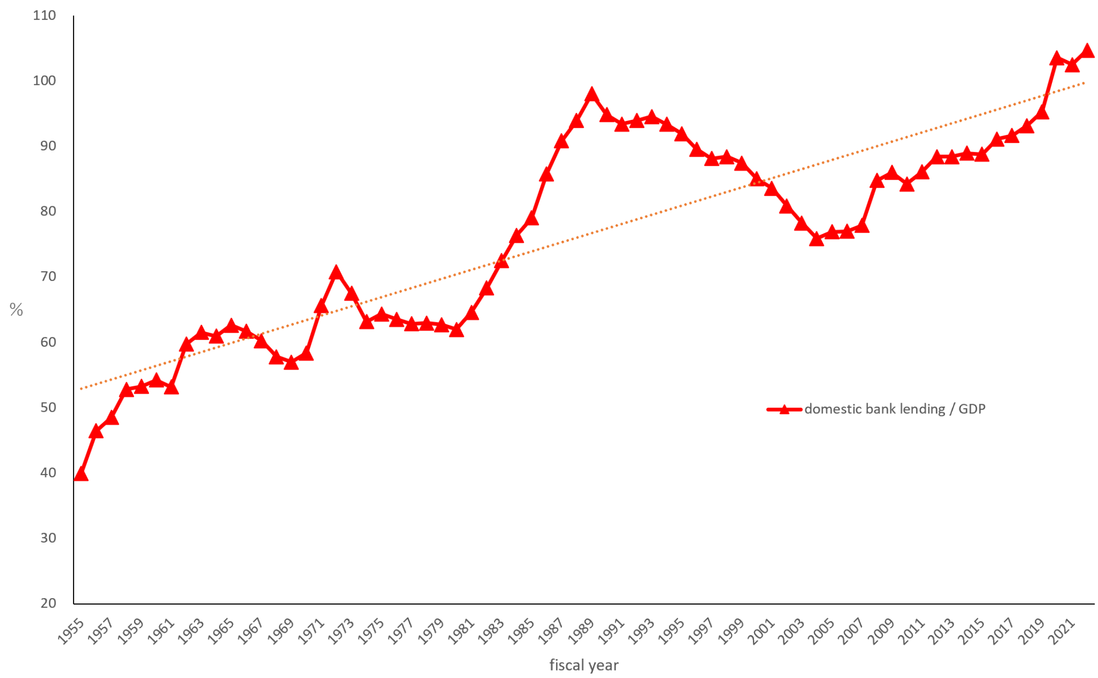

Fig. 1: Bank lending to GDP ratio
Source: The Bank of Japan and the Cabinet Office website.

causes of the high inflation in 1973–1974, the most severe in postwar Japan. However, during that period, changes in the money supply closely mirrored changes in bank lending.

Over the last few decades, the correlation between money supply and bank lending has weakened significantly. From January 1955 to December 1989, the correlation coefficient between monthly M2 and domestic bank lending was 0.9970, but this number dropped to 0.5826 between January 1990 and March 2023. The mainstream lending view literature focuses on the aggregate amount of credit (Bernanke, 1993; Kashyap and Stein, 1994). However, as shown in Fig.2, the composition of bank lending in Japan has changed significantly over the last few decades. These trends may reflect structural shifts in bank lending, making Japan a valuable case study for understanding the transmission mechanism of monetary policy.

Over the past quarter-century, the Bank of Japan (BOJ) has consistently implemented highly aggressive monetary policy under various names[1] even when the scope for further interest rate reductions was limited. In this paper, we simply refer to Japan's monetary policy from FY 1999 to 2022 as quantitative easing (QE). As noted earlier, the monetary base reached record-high levels in both absolute terms and relative to GDP. Some studies

[1]These include policies such as "zero interest rate policy," "quantitative easing," "quantitative and qualitative monetary easing," "negative interest rate policy," "forward guidance," "yield curve control" etc., often accompanied by large-scale asset purchasing.

(Bowman et al., 2015; Montgomery and Volz, 2019; Shioji, 2020; Harimaya and Jinushi, 2023) have empirically examined the impact of these policies on private bank lending. While these studies generally find that monetary policy had a positive effect on bank lending, they also agree that the effects were at best weak. Furthermore, these studies typically use total lending as the dependent variable, without examining structural changes in the lending pattern caused by QE. To our knowledge, no research has explored this aspect in the context of Japan.

Recent studies emphasize the importance of credit allocation across industries (Beck et al., 2012; Mian et al., 2017; Mian and Sufi, 2018; Bezemer et al., 2019; Chakraborty et al., 2018, 2020; Ivashina et al., 2022; Müller et al., 2024). These findings suggest that credit distribution across industries not only affects short-term economic fluctuations but also has long-term growth implications. Given the aggressive monetary policies in Japan and their limited real economic impact, it is natural to ask how the BOJ's policies influenced bank lending across different industries.

Our central hypothesis is that the unconventional monetary policy in Japan failed to stimulate lending to growth-promoting industries. Understanding the causes and consequences of credit distribution is challenging. While we rely on prior studies to assess the consequences of credit allocation, in this study, we quantify the effects of QE on bank lending to different industries. Our objective is to identify evidence consistent with this hypothesis.

Our sample covers FY 1999–2022, corresponding to Japan's era of unconventional monetary policy. The sample includes regional and second-tire regional banks, which we collectively refer to as "regional banks." Our empirical results indicate that monetary policy had a limited effect on overall lending. The significant and persistent positive effects were only observed in real estate-related industries. In contrast, lending to manufacturing was only weakly and even negatively affected by QE. These results align with macroeconomic indicators, such as inflation and real GDP growth, which exhibited only weak responses to monetary policy during this period. Given that real estate-related lending, including household credit, is not strongly associated with economic growth, our findings suggest that analyses of the lending channel should consider both total credit volume and shifts in credit composition.

Our paper makes the following important contributions. First, it is the first to investigate how monetary policy in Japan affects bank lending across different industries or sectors. We classify industries according to whether they are more sensitive to financial market conditions or more exposed to feedback effects through collateral values. We find that the interaction between monetary policy and the real economy has weakened in recent decades compared with earlier periods. Evaluating the effectiveness of monetary policy therefore requires attention to the qualitative aspects of credit creation, in particular changes in the composition of lending. Second, our results highlight that the heterogeneous responses of bank lending across industries to quantitative easing may have contributed to the weak ability of monetary policy to stimulate the real economy. While our focus is limited to the industry composition of bank lending, the estimation results are consistent with findings from previous studies as well as Japan's weak macroeconomic performance.

The remainder of this paper is organized as follows. Section 2 provides an overview of monetary policy and bank lending trends. Section 3 discusses related literature and introduces our hypotheses. Section 4 outlines the methodology used in the empirical analysis. Section 5 details data and sample construction. Section 6 presents empirical results. Finally, Section 7 concludes with caveats and some future research directions.

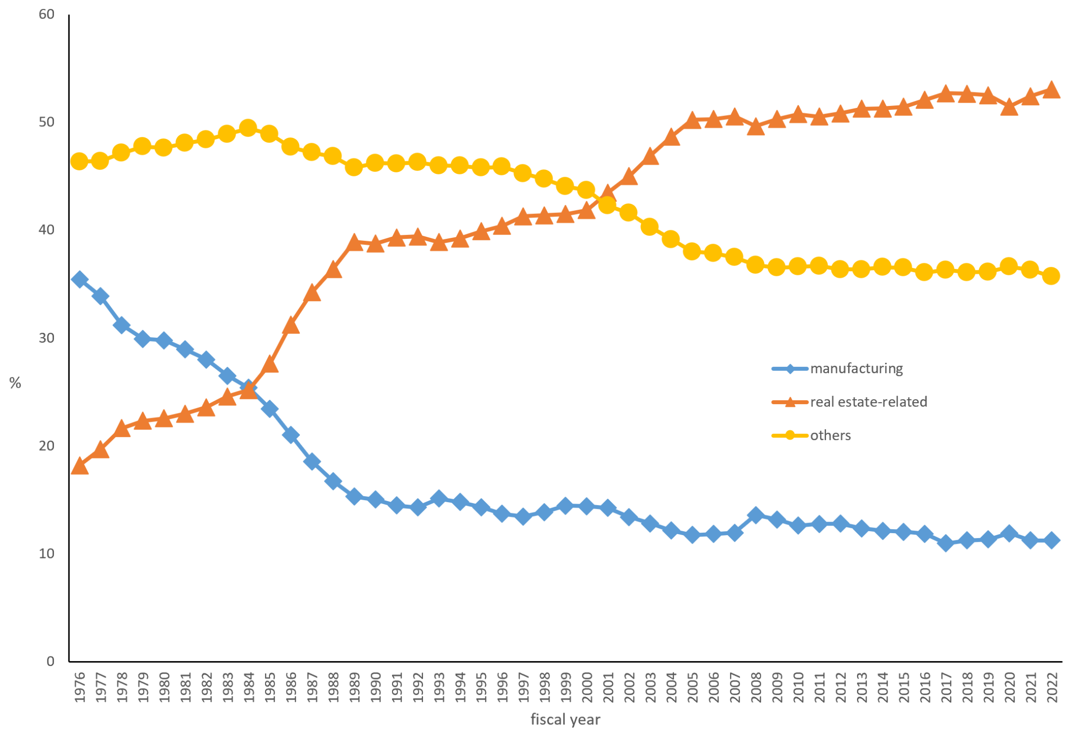

Fig. 2: Lending share to manufacturing, real estate-related, and other industries
Source: The Bank of Japan website. *Note:* Real estate-related industry includes Real estate industry, Finance and insurance industry, and Households sector.

2 Monetary policy in recent Japan

Japan was the first country to implement unconventional monetary policy, although the term "unconventional" only came into common use after many other countries adopted similar policies. Our primary concern is to underst and how Japan's unconventional monetary policy affected bank lending across different industries and sectors. Before detailing data construction, methodology, and empirical results, we must first examine the decision-making process of monetary policy during the sample period and the key characteristics that may have significantly influenced economic performance. As this process has already been well documented in other studies,[2] we focus only on key aspects that are crucial to our arguments.

Interest rate control and liquidity provision are the two fundamental instruments of monetary policy. Normally, these instruments are inseparable. For instance, when a central bank conducts open market operations, such as purchasing government bonds from private banks, it simultaneously provides additional liquidity and lowers interest rates. However, when the interest rate approaches zero, there is little room left for further downward adjustment. In such cases, the central bank must find new ways to stimulate the economy, even if the policies are unconventional. This is precisely what happened in Japan since the latter half of the 1990s.

During the 5,883 trading days from April 1, 1999, to March 31, 2023, which corresponds to our sample period, the uncollateralized overnight call rate ranged from -0.081% to 0.715%. Notably, for 4,915 days (84% of the period), the call rate remained within a narrow band between -0.081% and 0.10%. These figures suggest that the policy interest rate may not be a suitable indicator of the BOJ's monetary policy impact, as it remained within a narrow range during this period.

Conversely, the central bank's liquidity provision exhibited significant variability during the same period. The ratio of monthly realized to legally required reserves fluctuated widely, ranging from 101.09% to 3,976.24%, with an average of 1,400.77% from April 1999 to March 2023. Notably, during 115 months (40% of the period), the ratio exceeded 1,000.00%. These observations suggest that banks' reserve holdings could serve as a more appropriate indicator of monetary policy stance.

The term "unconventional" applies not only to the unusual target of monetary policy but also to the challenges posed to traditional economic theories. For instance, standard textbooks describe the credit creation process under the assumption that banks never hold excess reserves, and the IS-LM model fails to explain the effects of monetary policy when interest rates reach zero. Furthermore, the widely accepted statement that "inflation is always and everywhere a monetary phenomenon, produced in the first instance by an unduly rapid growth in the quantity of money"[3] has been called into question. From FY 1999 to 2022, the average annual growth rates of monetary base, M2, real GDP, and the GDP deflator were 11.55%, 2.93%, 0.68%, and -0.43%, respectively. The large gap between the growth rates of the monetary base and M2, as well as the differences between inflation and M2 growth after controlling for GDP growth rate, remain difficult to explain. Understanding the exact impact of monetary policy is therefore crucial for policymakers seeking to make adequate decisions to revive the economy and for theorists striving to develop models with more realistic assumptions.

Our empirical discussion assumes that changes in financial institutions' behavior, particularly banks, are a necessary – though not necessarily sufficient – condition for monetary policy to influence the economy effectively. Understanding how bank lending responds to monetary policy is crucial for assessing its effectiveness, especially in Japan, where the financial system is dominated by the banking sector.

[2]Shioji (2020) provided an excellent and explicit discussion of unconventional monetary policy in Japan.

[3]Friedman (1968, 18).

3 Related literature

Two strands of previous studies are closely related to our research. One focuses on the impact of monetary policy on bank lending in Japan, and the other explores the interaction of credit allocation with monetary policy, business cycle or economic growth. We first review studies on the impact of monetary policy in Japan and then discuss recent studies on credit allocation.

To date, several studies have examined the impact of the QE policy in Japan. Ferreira-Lopes et al. (2022) employ a meta-analysis method to evaluate recently published studies on this issue. Their focus is not on bank loans but directly on output or economic growth. They find that 47% of their sample reported significantly positive effects of monetary policy on output, 45% were nonsignificant, and 8% were significant but negative. This result suggests that, at least for economic growth, the effectiveness of the QE policy in Japan is uncertain.

Here, we focus on several studies that use a sample of Japanese banks and similar estimation models to ours. Bowman et al. (2015) is one of the pioneering studies exploring the impact of unconventional monetary policy on bank lending in Japan. They analyze a sample of Japanese banks, including city, trust, long-term credit, regional, and second-tire regional banks, investigating the effect of monetary policy on bank lending from 2000 to 2009. They define liquidity (the sum of cash holdings, call loans, and outstanding Current Account Balances (CABs)) as the proxy measure for monetary policy and conclude that the impact of monetary policy on bank lending is significantly positive, but economically small.

Montgomery and Volz (2019) extend the sample to include data from 2000 to 2015, finding a significantly positive impact of unconventional monetary policy on bank lending. Shioji (2020) further extends the sample period to 2019, developing a more direct measure of monetary policy for individual banks. He concludes that the effect of monetary policy on bank lending was nonexistent before 2015 but significantly positive after 2016. Shioji (2020) also finds that the effects of reserves and government bond holdings are almost identical. Given that banks increase reserves by selling government bonds to the BOJ, this result suggests that the combined effects of government bond and reserve holdings may be limited.

Recently, Harimaya and Jinushi (2023) used government bond purchases by the BOJ as the policy measure and investigated their effect on bank lending for regional banks in Japan from 2001 to 2020. They concluded that the lending-promoting effect strengthened after September 2013, corresponding to the introduction of Quantitative and Qualitative Easing (QQE). Because BOJ bond purchases are common to all banks, including time dummies would substantially reduce the variation available to identify policy effects. Their analysis therefore relies on not controlling for such dummies, which may be viewed as a limitation.

These studies share the following characteristics: (1) They use data from individual banks, focusing on the supply side; (2) The dependent variable is bank lending, with independent variables including a proxy measure for monetary policy at the bank level and other variables indicating the banks' condition, typically asset size, nonperforming loan ratio, and capital equity ratio; (3) The explanatory variables include the lagged value of the dependent variable, and dynamic panel estimation methods are employed to address econometric issues; (4) All these studies show, at least partially or conditionally, some form of positive effects of monetary policy on bank lending; and (5) None of these studies consider the possibility that the effects of monetary policy may differ for bank lending on different industries or sectors.

However, these studies also have some important differences. First, the definitions of the dependent variables vary. While Bowman et al. (2015), Montgomery and Volz (2019), and Harimaya and Jinushi (2023) use the time difference of the logarithm of bank lending (the growth rate) as the dependent variable, Shioji (2020) defines the dependent variable as the loan-to-asset ratio. Second, the proxy measures for monetary policy differ. Bowman et al. (2015) and Montgomery and Votz (2019) use liquidity asset as the proxy measure for the aggressiveness of monetary policy, while Harimaya and Jinushi (2023) use the amount of government bond purchases by the BOJ as the proxy. In contrast, Shioji (2020) defines the ratio of "Cash and Equivalents" (the sum of cash holdings and deposits at the BOJ) to assets as a proxy. We argue that the measure defined by Shioji (2020) is the most reasonable, particularly for bank-level data. We will revisit this point in the following sections.

Building on these studies and the discussion in previous sections, we investigate how the QE policy in Japan has influenced bank lending to different industries or sectors. We believe that answering to this question clearly is crucial for accurately identifying the macroeconomic effects of the QE policy.

The second strand of relevant literature examines how credit allocation interacts with policy and other economic dynamics. Beck et al. (2012) decompose bank lending into lending to households and lending to enterprises. They define business credit as the sum of loans to industry, construction, services, agriculture, and trade. Their estimation results show that enterprise credit positively enhances economic growth, while household credit does not.

Chakraborty et al. (2018) distinguish between mortgage and commercial lending. They find that firms borrowing from banks that are active in strong housing markets have significantly lower investment. They also identify a "crowding-out" effect, where lending opportunities in the real estate market lead banks to reduce commercial lending, having a negative real effect to the economy. In Chakraborty et al. (2020), the same authors report a similar crowding-out effect following the mortgage-backed securities purchases by the US Federal Reserve after the Global Financial Crisis.

Ivashina et al. (2022) classified four distinct loan types: asset-based loans, cash flow loans, trade financing, and leasing. The difference between the first two types is that asset-based loans are secured by tangible assets, while cash flow loans are typically secured by a range of unencumbered assets. They conclude that it is important to account for heterogeneity in loan types when analyzing the economic significance of credit market disruptions.

Müller and Verner (2024) focus on the differences between credit expansions to the tradable and non-tradable sectors. They emphasize that credit supply to the tradable sector is associated with sustained output and productivity growth without a higher risk of financial crises. In contrast, the non-tradable sector is more financing-constrained and more exposed to feedbacks through collateral values and domestic demand linkage. In their empirical results, they find that credit expansions to the non-tradable sector predict subsequent growth slowdowns and financial crises, but credit expansions to the tradable sector do not.

These studies classify the lending types based on different criteria. A common feature of these studies is that they distinguish sectors that are particularly sensitive to relaxations in financial conditions from those that are less sensitive. Such relaxations may result from financial deregulation or, more frequently, from the central bank's monetary easing policy. Typically, lending to households, non-tradable or real estate-related sectors are more prone to feedbacks through collateral values and domestic demand. In this study, we construct our measures of lending based on the same consideration and empirically identify how these measures influenced by the central bank's QE policy.

4 Methodology

When using bank level data to estimate the supply function, the endogeneity problem is likely to arise. To get unbiased and consistent results, it is necessary to assume that the unobserved demand factors are only randomly correlated with the error term. Given that "relationship banking" or "main bank relationships" are frequently used to describe the behavior of Japanese banks, there is no reason to believe that this assumption is realistic in a standard panel regression. We adopt the following methods to solve this problem. First, we take the lagged values for all of the explanatory variables. This can help mitigate the endogeneity problem. Second, we take the prefectural economic variables to control the possible influences from demand side. And third, all regressions are estimated using two-step system GMM (Generalized Method of Moments) with lag variables as instrument.

Our main focus is on the impact of monetary policy on private bank lending to different industries or sectors, The estimation model is as follows:

$$L_{it} = \alpha L_{it-1} + \beta M_{it-1} + X_{it-1}\gamma + w_t + v_i + u_{it} \tag{1}$$

where i and t represent bank i in period t. L denotes bank lending, M is a proxy measure of monetary policy, and X represents a matrix of other variables that capture banks'characteristics and regional economic conditions. w and v are unobserved bank-specific and time effects, and u is a random error term.

System GMM approach involves estimating the differenced and level equations simultaneously. In the differenced equation, the lagged level variables are used as instruments, while in the level equation, lagged differenced variables are used, under the following assumptions:

$$E(L_{it-k}\Delta u_{it}) = 0; E(M_{it-k}\Delta u_{it}) = 0; E(X_{it-k}\Delta u_{it}) = 0, k \geq 2$$

$$E(\Delta L_{it-k}v_i) = 0; E(\Delta M_{it-k}v_i) = 0; E(\Delta X_{it-k}v_i) = 0, k \geq 1$$

In a long-period dataset, many lagged variables could serve as instruments exists. In the estimation, we control for k between 2 and 5 to avoid potential over-identifying problems.

Two kinds of test are necessary for the validity of instruments. The first is the Sargan test of over-identifying restrictions, which tests the null hypothesis that the restrictions are valid. The second test checks for the autocorrelations in the error term. In this case, the absence of second-order autocorrelation is required to justify the estimation model.

In the system GMM, we employ a two-step estimation process to estimate the covariance matrix of the moment conditions, utilizing information obtained from the first step. The potential bias is corrected under a correction procedure suggested by Windmeijer (2005).

By estimating (1), we can identify the impact of QE policy to lending to different industries or sectors. It is possible that the lending pattern may reflect changes in the regional industrial structure. However, to the extent that such changes may be time- or regional-specific, their influences should be well controlled by the prefectural economic indicators and the fixed effects.

5 Data

We construct a dataset for Japanese regional banks covering the period from FY 1999 to 2021. The sample includes banks under holding companies. Data are primarily drawn from non-consolidated financial statements, sourced mainly from Nikkei NEEDS Financial Quest (FQ). We also hand-collect data from the Japanese Bankers Association website and banks' securities reports.

5.1 Data construction: industrial or sectoral lending

FQ provides data of individual banks' balance sheets and income statements, along with lending categorized into 12 industries or sectors. The classification includes: Manufacturing; Fishery, Agriculture and Forestry; Mining; Construction; Wholesale and Retail trade; Finance and Insurance; Real Estate; Transportation and Communication Services; Electric Power, Gas, Water Utility; Services; Local Government; Individual and Others.

However, data for key variables are often incomplete, requiring manual collection from alternative sources, such as individual bank securities reports, annual reports, and disclosure magazines. Managing this data necessitates careful attention, since in some cases only consolidated data are available for industrial or sectoral lending.

We examined the differences between consolidated and non-consolidated data on industrial or sectoral lending by calculating correlation coefficients when both data types were available. The correlation coefficient is 0.9996 for regional banks among different industries or sectors, while it is 0.8706 for city banks. This suggests that the mixing of consolidated and non-consolidated industrial lending data has a negligible effect for regional banks but a more significant effect for city banks. This is another reason we focus exclusively on regional banks in this study. As discussed by Shioji (2020) and Harimaya and Jinushi (2023), include the substantial differences in business models between regional and the city banks. For example, the average loan-to-deposit ratio of city banks dropped from 102.88% at the end of FY 1999 to 47.43% at the end of FY 2022, whereas regional banks maintained a relatively stable at around 75-80%. We use annual data in the estimation because semiannual industrial lending data are not available.

5.2 Data construction: proxy measure of QE policy

Different studies use various measures to proxy monetary policy. Some use the liquidity asset ratio (e.g., Bowman et al., 2015; Montgomery and Votz, 2019), while others use government bond purchases by the central bank (e.g. Harimaya and Jinushi 2023). Shioji (2020) employs "Cash and Equivalents" from consolidated statements. We believe that the proxy measure defined by Shioji (2020) is more appropriate because the amount of excess reserve is the most direct indicator of monetary policy stance.

However, we face the same issue of the differences between data from consolidated and stand-alone statements. Deposit data of individual banks at the BOJ, based on non-consolidated statements, are only available before FY 2012. We have to connect these data from consolidated statements after FY 2013 with non-consolidated data before FY 2012.

We checked the correlation coefficient between "Cash and Equivalents" from consolidated data and the sum of "Cash" and "Bank of Japan Deposits" from non-consolidated data for the FY 1999–2012 when both of the sources were available. The correlation coefficient is 0.9969 for regional banks, indicating minimal differences.

Banks that went bankrupt during the period are excluded from the sample due to abnormal data, even prior to bankruptcy. We also exclude bank-year observations involving mergers or acquisitions. The final sample includes 115 regional banks, with 76 banks providing balanced panel data for FY 1999–2021.

5.3 Definition of L

The variable *loan* represents "Loans and Bills Discounted." We categorize industrial or sectoral lending into three groups: manufacturing (*manu*), real estate-related (*esta*), and other lending (*othe*). While there were changes in the official industry classification during the period, the manufacturing category remained consistent. The classification of the other two groups was also unaffected, because we combined smaller industries and sectors into relatively larger categories.

The category *esta* includes lending to Finance and Insurance, Real Estate and Individual and Others. These three sectors are combined for several reasons: (1) banks often extend lending to the real estate industry through financial or insurance companies, and (2) the distinction between "Real Estate" and "Individual and Others" (mainly housing loans) is not always clear. For example, some banks redefined their past lending records, adjusting amounts between these two categories. Furthermore, lending to these three sectors tends to be more sensitive to credit booms. During the so-called bubble era in the late 1980s, lending to these three sectors grew faster than other industries. *othe* is the difference between *loan* and the sum of *manu* and *esta*. Our classification follows the same logic used in Beck et al. (2012) for "lending to households", Mian et al. (2017) for "household debt", Chakraborty et al. (2018) for "mortgage lending", and Müller and Verner (2024) for "non-tradable lending".

We refer to *loan*, *manu*, *esta*, and *othe* as total lending, manufacturing lending, lending to real estate-related industries and lending to other industries, respectively. The dependent variables are defined as $\Delta ln(loan)$, $\Delta ln(manu)$, $\Delta ln(esta)$, and $\Delta ln(othe)$.

We also consider lending shares as dependent variables. Lending shares, r_manu, r_esta and r_othe are defined as the ratio of lending to each sector relative to total lending, while r_loan represents the loan-to-deposit ratio.

5.4 Definition of M

The proxy measure of monetary policy, boj, is defined as the outstanding CABs held by banks at the BOJ before FY 2012 and the differences between "Cash and Equivalents" and "Cash" after FY 2013. We use $\Delta ln(boj)$ in the regression models to capture the strength of monetary policy transmission to banks.

We refine Shioji (2020)'s proxy by excluding cash-holdings from reserves, as these are less affected by the monetary policy. While Shioji (2020) uses reserve-to-asset ratio, we focus on the growth rate of outstanding CABs, which offers a more straightforward interpretation of policy effects.

5.5 Definition of X

The variable $size$ represents the logarithm of total assets and controls for scale effects. $self$ refers to the capital ratio, obtained from the Japanese Bankers Association website. The nonperforming loan ratio, npl, is defined as the ratio of "Risk-Monitored Loans" to "Loans and Bills Discounted" before FY 2019, and the difference between "Normal Claims (Financial Reconstruction Law)" and "Total Claims (Financial Reconstruction Law)" to "Loans and Bills Discounted" after FY 2020.[4] $self$ and npl control for the soundness of banks' management, while l_rate represents the ratio of "Interest on Loans and Discounts" to "Loans and Bills Discounted," controlling for interest revenue. $\Delta ln(depo)$ represents the growth rate of deposits, controlling for the source of bank funding.

We use three variables to proxy demand forces: g_cfpr (growth rate of prefectural private capital formation), n_imm (net immigrant rate per 10,000 people), and emp (prefectural unemployment rate). These variables are provided by FQ.

Some caveats should be noted. First, lending to manufacturing firms may be more illiquid than lending to other sectors. However, given the importance of the law of large numbers for banking industry, managing a sufficient number of firms with expiring contracts should not pose significant issues.

Second, after FY 2000, banks significantly increased their lending to local governments, with the average lending share to local governments rose from 3.34% in FY 1999 to 11.56% in FY 2022. Since lending to local government may reflect fiscal policy and political influences, we classify it as a part of $othe$.

We estimate the influence of monetary policy on total lending, manufacturing lending, lending to real estate-related industries and lending to other industries. We separately regress each equation for three periods: FY 1999–2022, FY 1999–2012, and FY 2013–2022. These periods are referred to as the "whole period," "first half," and "second half," respectively. The second half corresponds to the period of Abenomics, during which the

[4] The data on "Risk-Monitored Loans" are not available after FY 2020. The differences between these definitions differ slightly, but the differences are small for periods where both definitions are available.

administraion started a "bold monetary policy". For this period, it warrants additional investigation.

6 Empirical results

6.1 Descriptive statistics

Table 1 provides the descriptive statistics of the variables used in the regression analysis. Notably, the sample does not include city banks.

The average of the growth rate of outstanding CABs ($\Delta ln(boj)$ and the ratio of CABs level to deposits (r_boj) during the entire period are 23.41% and 5.49% respectively. These values are larger in the second half period compared to the first half period, where $\Delta ln(boj)$ increased from 18.12% in the first half to 32.17% in the second half, and r_boj rose from 2.14% to 11.06%. These changes reflect the start of the QQE policy in April 2013. The high level of r_boj suggests that a significant portion of outstanding CABs was held as excess reserves.[5]

There are considerable variations in the lending growth rates across industries. Lending to real estate-related industries ($\Delta ln(esta)$) had an average growth rate of 3.36%, with a higher growth rate observed in the second half of the period. The share of lending to real estate-related industries (r_esta) constitutes the largest portion of total lending and continues to increase over time. In contrast, the growth rate of lending to manufacturing ($\Delta ln(manu)$) is negative across all periods, though these changes are not statistically significant. Lending shares to the manufacturing (r_manu) remain around 10%, showing a declining trend.

Bank size ($size$) steadily increased over time, though substantial differences remain between banks. The nonperforming loan ratio (npl) averaged 4.29% across the entire period, with a marked decline in the second half, suggesting that nonperforming loans became less of a concern. The capital ratio ($self$) exhibits significant variation, indicating differing business conditions across the sample banks.

Lending interest rates (l_rate) is lower in the second half period than the first half, which is consistent with the introduction of more aggressive monetary policy, particularly the negative interest rate policy. These lower interest rates may place a significant burden on bank management since banks traditionally earn revenue from the interest on loans. The differences in financial conditions across banks are expected to influence lending behavior.

The last three rows in Table 1 show the conditions of regional economies. The growth rate of prefectural private capital formation (g_cfpr) improved from negative in the first half to 2.11% in the second half period. The unemployment rate declined over time, while net immigration remained negative in all periods. These regional differences reflect demand-side factors that may influence bank lending.

[5] Legal reserves also include cash holding, and the required required ratio ranges from 0.05% to 1.87%, depending on the type and scale of deposits.

6.2 Main results

Tables 2-4 show the baseline estimation results regarding the impact of the BOJ's QE policy on bank lending to various industries. The results for the entire period, as well as for the first and second halves, are presented.

Table 2 presents the results for the entire period. The Sargan test indicates that all instruments are valid, and the Arellano-Bond test confirms the absence of second-order autocorrelation in the error terms.

Asset size ($size$) has a significant negative impact on total lending and lending to other industries. However, its effect on lending to real estate-related industries and manufacturing is not statistically significant. The nonperforming loan ratio (npl) negatively influences lending growth for all industries or sectors, while the capital ratio ($self$) positively affects lending growth. These results are consistent with theoretical predictions.

The growth rate of deposits ($\Delta ln(depo)$) negatively influences lending to all industries or sectors. Lending interest rates (l_rate) negatively affect total lending, real estate-related industries, and other industries, but not manufacturing. The growth rate of prefectural private capital formation (g_cfpr) positively impacts lending to manufacturing and other industries, but negatively affects total lending and real estate-related lending. Unemployment ($unemp$) does not affect lending to manufacturing, but positively influences total lending, real estate-related industries, and other industries. Net immigrant rate (n_imm) positively and significantly affect lending to total lending, manufacturing lending, lending to other industries or sectors. However, it shows no impact to lending to real estate-related industries.

Lagged lending significantly affects current lending in manufacturing, but its effect is negative for total lending. For real estate-related and other industries, lagged lending does not significantly influence current lending.

The impact of the growth rate of outstanding CABs ($\Delta ln(boj)$) is the main focus of this study. The results indicate a significant positive effect on lending to real estate-related industries, with a smaller but still significant positive effect on total lending and lending to other industries. However, the effect is not statistically significant for manufacturing.

6.3 Subperiod results

Tables 3 and 4 report the results for the first and second halves of the sample period, respectively. The significantly positive impact of the QE policy on lending to real estate-related industries is consistently observed across both subperiods. In the first half, the QE policy also positively influenced total lending and lending to other industries. In contrast, the effect on manufacturing lending is significantly negative in both subperiods.

Although the Sargan and Arellano-Bond tests justify the model specifications for all industries in Tables 4, the estimation for $\Delta ln(esta)$ in Table 3 fails the Arellano-Bond test. However, specifications for $\Delta ln(loan)$, $\Delta ln(manu)$ and $\Delta ln(othe)$ are confirmed as valid.

These results suggest that the impact of monetary policy on bank lending is heterogeneous across different industries and sectors. The positive effect on real estate-related industries and the negative effect on manufacturing highlight the differing implications of

QE for different sectors of the economy.

6.4 Estimation results on lending shares

Following Shioji (2020), we also examine the impact of monetary policy on lending shares, defined as the ratio of lending to each industry relative to total lending. The results for the lending shares of manufacturing, real estate-related industries, and other sectors are presented in Tables 5-7. We also include the ratio of total lending to deposits (r_loan) as an additional variable.

As expected, we find that the lending shares of each industry strongly depend on their lagged values. However, relatively fewer explanatory variables significantly affect lending shares comparing to lending growth. This is not surprising. As Table 1 shows, lending share are much more stable than the growth rates of lending.

The impact of the QE policy on lending shares is consistent with the results from Tables 2-4. In each period, the growth rate of outstanding CABs ($\Delta ln(boj)$) positively affects the lending share for real estate-related industries. The effect is also significant for manufacturing, but in the opposite direction.

6.5 The influence of credit composition on bank lending

Finally, we explore how the credit composition of each bank affects lending expansion. We introduce interaction terms between $\Delta ln(boj)$ and the lending shares to manufacturing and real estate-related industries (r_manu and r_esta). The results are presented in Table 8.

For the entire period and the first half of the sample, the interaction terms do not significantly influence lending expansion. However, in the second half, the interaction term with the manufacturing lending share is negative, while the term with the real estate-related lending share is positive. These coefficients are statistically significant at the 5% level in both cases.

These results suggest that after the introduction of QQE, banks with a larger share of their lending directed toward real estate-related industries responded more actively to the monetary policy by expanding their lending.

6.6 Robustness

Given that the system GMM estimation uses many lagged variables as instruments, missing values in unbalanced data could affect the results (Verbeek and Nijman, 1992). To address this, we re-estimate the models using a balanced data sample of 76 banks. The results for the impact of monetary policy on lending to each industry remain qualitatively similar to those in Tables 2-8, indicating that the issue of unbalanced data does not significantly affect our findings.

We also redefine the industry classifications by separating "Individual and Others" from "Real Estate" and "Financial and Insurance" sectors. The positive impact of monetary policy on lending is still observed in the separated sectors.

Furthermore, we modify the definition of *boj* to include banks' cash holdings. The results do not change significantly.

7 Conclusion

Instead of considering total lending volume as the primary target of the lending channel, we separately examined the impact of monetary policy on bank lending across different industries, particularly the manufacturing and real estate-related industries. We find that the BOJ's QE policy had a limited influence on total lending and even a negative influence on manufacturing lending. A positive effect was observed persistently only in lending to the real estate-related industries. Furthermore, in the QQE period, it is the banks that heavily depend their lending on the real estate-related industries actively responded monetary policy to extend lending.

Combining our results with those of previous studies (Beck et al., 2012; Arcand et al., 2015; Mian et al., 2017; Bezemer and Zhang, 2019; Bezemer et al., 2023), we conclude that Japan's monetary policy has had limited effectiveness in mitigating recessionary conditions over the past few decades. To the extent that lending to the real estate industry and household sector does not contribute to economic growth, QE policies have not–and likely will not–improve the fundamental health of the economy.

Several caveats are in order. Over the past quarter-century, so-called unconventional monetary policy has encompassed various measures, including signaling announcements and stock purchasing. This study focuses solely on the impact of increases in the BOJ's current account balances on regional bank lending. We do not attempt to evaluate the effects of other aspects of monetary policy.

Shifts in lending across industries may also be deeply influenced by changes in banking regulations (Bezemer et al., 2023). Structural changes in bank lending can be examined from other perspectives. For example, banks may alter their collateral requirements (Ivashina et al., 2022). Furthermore, whether the behavior of Japanese banks in recent decades aligns with the "search for yield" hypothesis (Martinez-Miera and Repullo, 2017) warrants further investigation from both theoretical and empirical perspectives. Exploring how monetary policy interacts with bank lending in these directions could enhance our understanding of the monetary policy transmission mechanism and, consequently, help identify more effective ways to improve economic conditions.

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Table 1: Descriptive statistics

	whole period, FY 1999-2021				first half period, FY 1999-2012				second half period FY 2013-2021			
	mean	sd	min	max	mean	sd	min	max	mean	sd	min	max
moneytary policy variables												
$\Delta ln(boj)$	0.2341	1.14	-4.62	6.31	0.1812	1.34	-4.62	6.31	0.3217	0.68	-3.18	4.52
r_boj	5.4968	7.19	0.00	66.77	2.1350	2.21	0.00	13.04	11.0639	8.91	0.05	66.77
lending variables												
$\Delta ln(loan)$	0.0167	0.04	-0.20	0.20	0.0075	0.03	-0.18	0.13	0.0319	0.03	-0.20	0.20
$\Delta ln(manu)$	-0.0088	0.07	-0.41	0.39	-0.0137	0.08	-0.41	0.39	-0.0006	0.06	-0.34	0.29
$\Delta ln(esta)$	0.0336	0.05	-0.51	0.30	0.0299	0.05	-0.21	0.30	0.0397	0.04	-0.51	0.27
$\Delta ln(othe)$	0.0046	0.06	-0.48	0.60	-0.0102	0.05	-0.48	0.30	0.0290	0.06	-0.37	0.60
r_loan	75.6221	7.87	51.70	119.19	75.4783	6.97	53.28	113.36	75.8608	9.17	51.70	119.19
r_manu	10.7421	4.78	1.33	26.87	11.6417	4.88	2.12	26.87	9.2653	4.22	1.33	20.01
r_esta	46.6531	10.65	23.49	95.40	44.3527	10.11	23.49	90.50	50.4293	10.45	30.84	95.40
r_othe	42.6048	8.83	3.27	64.76	44.0055	8.38	7.24	64.76	40.3053	9.07	3.27	64.30
bank condition variables												
$size$	14.5357	0.93	12.08	16.89	14.3913	0.89	12.08	16.40	14.7756	0.95	12.36	16.89
npl	4.2884	2.75	0.78	19.01	5.4627	2.76	1.29	19.01	2.3372	1.21	0.78	14.04
$self$	10.0196	2.00	0.45	20.03	9.9182	1.93	0.45	17.15	10.1879	2.10	5.85	20.03
l_rate	1.8809	0.61	0.70	3.59	2.2315	0.42	0.72	3.56	1.2984	0.38	0.70	3.59
$\Delta ln(depo)$	0.0195	0.03	-0.27	0.25	0.0144	0.03	-0.27	0.25	0.0281	0.03	-0.26	0.19
local economy variables												
g_cfpr	-0.0774	7.20	-28.03	41.70	-1.3964	7.46	-28.03	22.06	2.1166	6.15	-20.79	41.70
$unemp$	3.8074	1.29	1.10	8.40	4.4429	1.11	2.20	8.40	2.7509	0.77	1.10	5.70
n_imm	-13.9395	21.55	-170.11	73.04	-12.9745	22.21	-170.11	73.04	-15.5439	20.31	-54.39	63.11

Note: boj is outstanding CABs, r_boj is outstanding CABs to deposit ratio, $loan, manu, esta$, and $othe$ are total lending, lending to manufacturing, lending to real estate-related industries, and lending to other industries, respectively. r_loan is loan to deposit ratio, r_manu, r_esta, and r_othe are loan shares. $depo$ is deposits, $size$ is the logarithm of total assets, npl is the ratio of nonperforming loans, $self$ is the capital ratio, l_rate is the lending interest rate. $g\_cfpr, unemp, n\_imm$ are growth rate of prefectural private capital formation, unemployment rate and the numbers of net immigrants from other prefectures per 10,000 person.

Table 2: Estimation results for loan growth, FY 1999-2021

	(1)	(2)	(3)	(4)
	$\Delta ln(loan)$	$\Delta ln(manu)$	$\Delta ln(esta)$	$\Delta ln(othe)$
$size_{-1}$	-0.0063***	-0.0015	-0.0008	-0.0039***
	(-8.20)	(-1.58)	(-1.20)	(-3.72)
npl_{-1}	-0.0047***	-0.0027***	-0.0028***	-0.0039***
	(-14.01)	(-5.59)	(-8.91)	(-9.64)
$self_{-1}$	0.0014***	0.0048***	0.0022***	0.0017***
	(5.52)	(12.06)	(6.95)	(5.28)
$\Delta ln(depo)_{-1}$	-0.0956***	-0.2402***	-0.2220***	-0.2549***
	(-3.76)	(-12.31)	(-8.27)	(-5.92)
l_rate_{-1}	-0.0273***	0.0026	-0.0092***	-0.0133***
	(-10.78)	(0.93)	(-4.09)	(-3.32)
g_cfpr_{-1}	-0.0002***	0.0002***	-0.0003**	0.0002*
	(-3.55)	(3.46)	(-3.27)	(2.46)
$unemp_{-1}$	0.0025***	0.0005	0.0020*	0.0023***
	(3.81)	(0.70)	(2.06)	(3.67)
n_imm_{-1}	0.0001***	0.0001***	0.0000	0.0001***
	(6.12)	(5.01)	(1.62)	(3.34)
$\Delta ln(loan)_{-1}$	-0.1418***			
	(-4.51)			
$\Delta ln(manu)_{-1}$		0.1081***		
		(3.99)		
$\Delta ln(esta)_{-1}$			0.0502	
			(1.80)	
$\Delta ln(othe)_{-1}$				0.0210
				(0.39)
$\Delta ln(boj)_{-1}$	0.0053***	-0.0004	0.0088***	0.0064***
	(7.62)	(-0.20)	(4.43)	(3.51)
time dummy	✓	✓	✓	✓
Sargan test	0.9709	0.9486	0.9970	0.9376
Arellano-Bond test AR(2)	0.0571	0.1564	0.3778	0.3482
Number of banks	115	115	115	115
Observations	2283	2264	2264	2264

Note: The Sargan test reports the p-value of the J-statistic for over-identifying restrictions. The Arellano-Bond test AR(2) reports the p-value of the second-order autocorrelation test. t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 3: Estimation results for loan growth, FY 1999-2012

	(1)	(2)	(3)	(4)
	$\Delta ln(loan)$	$\Delta ln(manu)$	$\Delta ln(esta)$	$\Delta ln(othe)$
$size_{-1}$	-0.0073***	0.0038*	-0.0011	-0.0076***
	(-8.88)	(2.39)	(-1.20)	(-9.10)
npl_{-1}	-0.0035***	-0.0023***	-0.0023***	-0.0039***
	(-24.34)	(-5.25)	(-11.03)	(-13.06)
$self_{-1}$	0.0034***	0.0060***	0.0022***	0.0035***
	(14.63)	(10.63)	(5.38)	(11.40)
$\Delta ln(depo)_{-1}$	0.0549***	-0.1446***	0.0280	-0.0539***
	(4.20)	(-10.68)	(1.75)	(-4.00)
l_rate_{-1}	-0.0197***	0.0132**	-0.0013	-0.0174***
	(-8.07)	(2.97)	(-0.31)	(-5.90)
g_cfpr_{-1}	-0.0000	0.0003***	0.0001	0.0003***
	(-0.97)	(3.53)	(1.12)	(4.24)
$unemp_{-1}$	0.0056***	-0.0019**	0.0001	0.0025***
	(11.72)	(-3.02)	(0.17)	(4.09)
n_imm_{-1}	0.0001***	0.0000	0.0000	0.0001***
	(6.72)	(0.57)	(1.06)	(4.20)
$\Delta ln(loan)_{-1}$	-0.2890***			
	(-19.80)			
$\Delta ln(manu)_{-1}$		0.0324*		
		(2.07)		
$\Delta ln(esta)_{-1}$			-0.2106***	
			(-12.13)	
$\Delta ln(othe)_{-1}$				-0.1508***
				(-10.02)
$\Delta ln(boj)_{-1}$	0.0034***	-0.0046***	0.0042***	0.0046***
	(11.05)	(-4.04)	(6.08)	(6.83)
time dummy	✓	✓	✓	✓
Sargan test	0.2120	0.3032	0.3610	0.3551
Arellano-Bond test AR(2)	0.1209	0.2195	0.0425	0.5791
Number of banks	114	114	114	114
Observations	1381	1362	1362	1362

Note: The Sargan test reports the p-value of the J-statistic for over-identifying restrictions. The Arellano-Bond test AR(2) reports the p-value of the second-order autocorrelation test. *t*-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 4: Estimation results for loan growth, FY 2013-2021

	(1) $\Delta ln(loan)$	(2) $\Delta ln(manu)$	(3) $\Delta ln(esta)$	(4) $\Delta ln(othe)$
$size_{-1}$	-0.0014	-0.0062***	-0.0022**	0.0006
	(-1.48)	(-5.08)	(-2.72)	(0.59)
npl_{-1}	-0.0076***	-0.0002	-0.0088***	0.0055***
	(-14.18)	(-0.50)	(-23.92)	(7.35)
$self_{-1}$	0.0013***	0.0035***	0.0015***	0.0006
	(4.56)	(7.29)	(5.76)	(1.30)
$\Delta ln(depo)_{-1}$	-0.2304***	-0.2458***	-0.1322***	-0.1967***
	(-9.54)	(-12.10)	(-8.17)	(-7.70)
l_rate_{-1}	-0.0058**	-0.0082***	-0.0193***	-0.0277***
	(-2.80)	(-4.01)	(-7.86)	(-9.73)
g_cfpr_{-1}	-0.0002***	0.0004***	-0.0004***	0.0000
	(-5.18)	(5.39)	(-5.66)	(0.37)
$unemp_{-1}$	0.0049***	0.0006	0.0021	0.0093***
	(5.24)	(0.65)	(1.87)	(7.29)
n_imm_{-1}	-0.0000	0.0001***	-0.0000	0.0000
	(-0.68)	(6.85)	(-1.35)	(0.98)
$\Delta ln(loan)_{-1}$	-0.0758**			
	(-3.15)			
$\Delta ln(manu)_{-1}$		0.0689***		
		(3.29)		
$\Delta ln(esta)_{-1}$			-0.0681***	
			(-3.37)	
$\Delta ln(othe)_{-1}$				-0.1686***
				(-6.40)
$\Delta ln(boj)_{-1}$	0.0011	-0.0123***	0.0040***	0.0009
	(1.67)	(-8.23)	(4.70)	(1.10)
time dummy	✓	✓	✓	✓
Sargan test	0.6493	0.4139	0.4656	0.6333
Arellano-Bond test AR(2)	0.3278	0.6498	0.1185	0.8391
Number of banks	103	103	103	103
Observations	902	902	902	902

Note: The Sargan test reports the p-value of the J-statistic for over-identifying restrictions. The Arellano-Bond test AR(2) reports the p-value of the second-order autocorrelation test. *t*-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 5: Estimation results for loan share, FY 1999-2021

	(1)	(2)	(3)	(4)
	r_loan	r_manu	r_esta	r_othe
$size_{-1}$	0.0646	-0.0083	0.2065	-0.2421**
	(0.69)	(-0.21)	(1.91)	(-3.00)
npl_{-1}	-0.1103***	0.0104*	0.0616***	-0.0575***
	(-5.57)	(2.20)	(4.36)	(-4.05)
$self_{-1}$	0.0166	0.0294***	0.0014	-0.0259**
	(0.79)	(6.68)	(0.14)	(-2.71)
$\Delta ln(depo)_{-1}$	5.4596***	0.3509***	1.0490***	-1.6330***
	(11.96)	(4.10)	(3.53)	(-4.35)
l_rate_{-1}	0.5934***	-0.0517	0.6342***	-0.8269***
	(3.71)	(-0.83)	(3.76)	(-6.68)
g_cfpr_{-1}	-0.0011	0.0029**	-0.0097**	0.0111***
	(-0.27)	(2.86)	(-2.95)	(4.19)
$unemp_{-1}$	-0.1606***	-0.0453**	0.0590*	-0.0246
	(-5.62)	(-2.87)	(2.38)	(-1.27)
n_imm_{-1}	-0.0010	0.0005	-0.0004	0.0008
	(-0.74)	(1.57)	(-0.24)	(0.46)
r_loan_{-1}	1.0313***			
	(113.71)			
r_manu_{-1}		0.9635***		
		(180.78)		
r_esta_{-1}			0.9880***	
			(162.38)	
r_othe_{-1}				0.9991***
				(142.72)
$\Delta ln(boj)_{-1}$	-0.0216	-0.1118***	0.3315***	-0.1676***
	(-0.30)	(-6.86)	(6.90)	(-5.33)
time dummy	✓	✓	✓	✓
Sargan test	0.9912	0.8990	0.9676	0.9614
Arellano-Bond test AR(2)	0.2459	0.8055	0.2431	0.3643
Number of banks	115	115	115	115
Observations	2283	2268	2268	2268

Note: The Sargan test reports the p-value of the J-statistic for over-identifying restrictions. The Arellano-Bond test AR(2) reports the p-value of the second-order autocorrelation test. t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 6: Estimation results for loan share, FY 1999-2012

	(1) r_loan	(2) r_manu	(3) r_esta	(4) r_othe
$size_{-1}$	0.0648	0.0669***	-0.0100	-0.0387
	(1.64)	(3.51)	(-0.39)	(-1.37)
npl_{-1}	-0.0524***	0.0016	0.0469***	-0.0659***
	(-3.30)	(0.28)	(4.72)	(-4.79)
$self_{-1}$	0.0011	0.0309***	-0.0184	0.0025
	(0.04)	(5.43)	(-1.20)	(0.23)
$\Delta ln(depo)_{-1}$	6.6297***	0.2354***	0.1496	-0.3553*
	(13.78)	(3.41)	(0.73)	(-1.97)
l_rate_{-1}	1.3064***	0.3264***	-0.2492*	0.0159
	(10.31)	(6.83)	(-2.57)	(0.21)
g_cfpr_{-1}	0.0165***	0.0034**	-0.0211***	0.0166***
	(5.72)	(2.98)	(-7.00)	(5.82)
$unemp_{-1}$	-0.0905**	-0.0072	-0.0430**	-0.0117
	(-2.71)	(-0.53)	(-2.68)	(-1.06)
n_imm_{-1}	0.0059***	-0.0007*	-0.0022*	0.0022**
	(3.87)	(-2.20)	(-2.46)	(3.08)
r_loan_{-1}	0.8608***			
	(62.66)			
r_manu_{-1}		1.0007***		
		(267.04)		
r_esta_{-1}			1.0250***	
			(351.00)	
r_othe_{-1}				1.0219***
				(286.93)
$\Delta ln(boj)_{-1}$	-0.4530***	-0.0909***	0.3177***	-0.2142***
	(-10.04)	(-8.25)	(11.04)	(-8.81)
time dummy	✓	✓	✓	✓
Sargan test	0.3160	0.2735	0.3296	0.4558
Arellano-Bond test AR(2)	0.0415	0.5850	0.2213	0.3548
Number of banks	114	114	114	114
Observations	1381	1366	1366	1366

Note: The Sargan test reports the p-value of the J-statistic for over-identifying restrictions. The Arellano-Bond test AR(2) reports the p-value of the second-order autocorrelation test. t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 7: Estimation results for loan share, FY 2013-2021

	(1)	(2)	(3)	(4)
	r_loan	r_manu	r_esta	r_othe
$size_{-1}$	-0.3837***	-0.0547***	0.0049	-0.1391*
	(-4.29)	(-6.77)	(0.09)	(-2.02)
npl_{-1}	-0.5299***	0.0099*	-0.0096	0.0595***
	(-10.39)	(2.26)	(-0.56)	(4.35)
$self_{-1}$	0.0147	0.0038	0.0308*	0.0104
	(0.68)	(0.86)	(2.17)	(1.18)
$\Delta ln(depo)_{-1}$	1.4788	0.4430***	2.5019***	-3.4141***
	(1.93)	(4.50)	(4.23)	(-6.14)
l_rate_{-1}	0.9581***	0.1223***	-0.5194***	-0.2729
	(5.79)	(4.07)	(-3.32)	(-1.93)
g_cfpr_{-1}	-0.0102*	0.0018*	-0.0093***	0.0083***
	(-2.26)	(2.47)	(-4.10)	(4.13)
$unemp_{-1}$	0.1820*	0.0266	-0.0735	0.1263**
	(2.15)	(1.68)	(-1.65)	(3.15)
n_imm_{-1}	0.0091***	0.0014***	-0.0049***	-0.0020
	(5.35)	(6.10)	(-4.69)	(-1.91)
r_loan_{-1}	0.9051***			
	(97.41)			
r_manu_{-1}		0.9921***		
		(215.09)		
r_esta_{-1}			1.0133***	
			(163.69)	
r_othe_{-1}				0.9814***
				(182.57)
$\Delta ln(boj)_{-1}$	0.4309***	-0.0777***	0.1159**	-0.1050***
	(10.17)	(-4.44)	(2.97)	(-3.37)
time dummy	✓	✓	✓	✓
Sargan test	0.6229	0.4420	0.4107	0.5603
Arellano-Bond test AR(2)	0.9916	0.2847	0.9724	0.7973
Number of banks	113	113	113	113
Observations	902	902	902	902

Note: The Sargan test reports the p-value of the J-statistic for over-identifying restrictions. The Arellano-Bond test AR(2) reports the p-value of the second-order autocorrelation test. *t*-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 8: Estimation results, additional evidence

	(1)	(2)	(3)
	$\Delta ln(loan)$	$\Delta ln(loan)$	$\Delta ln(loan)$
	FY 1999-2021	FY 1999-2012	FY 2013-2021
$size_{-1}$	-0.0052***	-0.0015	-0.0014
	(-7.80)	(-1.26)	(-0.82)
npl_{-1}	-0.0041***	-0.0030***	-0.0065***
	(-14.30)	(-8.98)	(-7.03)
$self_{-1}$	0.0018***	0.0033***	0.0019***
	(7.96)	(8.02)	(4.14)
$\Delta ln(depo)_{-1}$	-0.1930***	-0.1651***	-0.2488***
	(-6.99)	(-4.03)	(-4.21)
l_rate_{-1}	-0.0199***	0.0039	-0.0068
	(-9.70)	(1.01)	(-1.56)
g_cfpr_{-1}	0.0001	0.0001	-0.0002
	(1.52)	(1.50)	(-1.85)
$unemp_{-1}$	0.0033***	0.0038***	0.0040*
	(5.32)	(5.50)	(2.07)
n_imm_{-1}	0.0001***	0.0001**	0.0001
	(3.89)	(3.22)	(1.23)
$\Delta ln(loan)_{-1}$	-0.0366	-0.0214	-0.0532
	(-1.15)	(-0.45)	(-0.73)
$\Delta ln(boj)_{-1}$	0.0022*	0.0018*	0.0021
	(2.24)	(2.00)	(0.95)
$\Delta ln(boj)_{-1} \times r\_esta_{-1}$	-0.0000	-0.0001	0.0002**
	(-0.53)	(-1.18)	(3.18)
$\Delta ln(boj)_{-1} \times r\_manu_{-1}$	-0.0003	-0.0001	-0.0012**
	(-1.66)	(-0.35)	(-3.26)
time dummy	✓	✓	✓
Sargan test	0.9660	0.2476	0.3155
Arellano-Bond test AR(2)	0.2224	0.5065	0.3458
Number of banks	115	114	103
Observations	2268	1366	902

Note: The Sargan test reports the p-value of the J-statistic for over-identifying restrictions. The Arellano-Bond test AR(2) reports the p-value of the second-order autocorrelation test. t-statistics are in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.