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Information Effects of Monetary Policy

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Abstract

This study assesses two central bank announcements about monetary policy and the central bank's assessment of the economic outlook. We examine whether these two components influence macroeconomic and financial variables under the effective lower bound (ELB) of short-term nominal interest rates in Japan. We identify two shocks: a surprise policy tightening that raises interest rates and reduces stock prices and the complementary positive central bank information shock that raises both. We find that the two shocks have different effects on the Japanese economy. In fact, a contractionary monetary policy shock decreases inflation rates, whereas a positive central bank information shock *increases* inflation rates. The evidence suggests that announcements conveying the central bank's assessment of the economic outlook play a certain role in the transmission mechanism of monetary policy under the ELB. However, our study shows that the two series of shocks do not induce changes in output. This suggests that they have a limited impact on the economy.

JEL Classification: E52; E62; G12
Keywords: information effects; monetary policy shock; unconventional monetary policy

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1 Introduction

The identification of monetary policy shocks and their effects under the effective lower bound (ELB) have been central issues among macroeconomic researchers and central bankers.[1] However, existing studies provide scant evidence of the macroeconomic effects of unconventional monetary policies in Japan because of the difficulty in identifying monetary policy shocks.[2] A few exceptions are Hanisch (2017), Kimura and Nakajima (2016), Koeda (2019), and Nagao et al. (2021). They show that unconventional monetary policy shocks significantly affect the output gap but report mixed evidence as to whether expansionary unconventional monetary policy shocks increase inflation rates. In addition to the limited literature on the effects of monetary policies on macroeconomic variables in Japan, past studies ignore the information effects of the bank's assessment of the economic outlook.

Based on a new simplified approach proposed by Jarociński and Karadi (2020), we decompose the Bank of Japan's announcements into information on monetary policy and the central bank's assessment of the economic outlook. Using these two components, this study examines the information effects (Jarociński and Karadi, 2020; Nakamura and Steinsson, 2018) of monetary policy on Japan's macroeconomic and financial variables. To this end, we estimate a Bayesian structural VAR and identify monetary policy and information shocks. Our estimation relies on minute-by-minute data. Following the literature on identifying monetary policy shocks, we rely on high-frequency data to identify changes in financial variables during a half-hour window starting 10 minutes before and ending 20 minutes after the monetary policy announcement.

There are two findings. First, we provide evidence that inflation rates decrease in response to a contractionary monetary policy shock while they *increase* in response to a positive information shock. However, both a monetary policy shock and an information shock do not cause changes in output. Second, we find that the sizes of the impacts of the shocks are small. Although identified shocks cause changes in inflation rates, interest rates, stock prices, and bond premiums, they have no sizable impacts.

Our results suggest that an unexpected increase in interest rates is not always contractionary or tight; a transmission mechanism exists that allows inflation rates to rise

[1] Figure 1 shows the development of the target overnight call rate. Since 2000, the target rate has remained almost zero.

[2] The existing literature on unconventional monetary policies mainly examines the magnitude of monetary policies on financial markets (Dell'Ariccia et al., 2018; D'Amico et al., 2012; Gagnon et al., 2011; Hamilton and Wu et al., 2012; Kuttner, 2018; Swanson, 2017). Arai (2017), Kubota and Shin-tani (2022), Eser and Schwaab (2016), Ghysels et al. (2016), and Krishnamurthy (2018) examine the effects of unconventional monetary policies by the Bank of Japan and the European Central Bank on government bond yields. Inoue and Rossi (2019) examine the relationship between monetary policy and exchange rates. There is a consensus among researchers regarding the accommodative effects of unconventional monetary policies on financial markets.

even when interest rates rise unexpectedly. The evidence suggests that information effects play a certain role in the Japanese economy even under the ELB. However, our study also suggests that both a monetary policy shock and an information shock under the ELB have only a limited effect on the economy. The evidence of the limited effect means that central banks are facing a harsh reality.

The remainder of this paper is organized as follows. Section 2 presents the strategy for identifying monetary policy shocks. Section 3 explains the structural VAR model we use and shows impulse responses to a monetary policy shock. Section 4 discusses the macroeconomic implications shown in our results. Section 5 concludes the paper.

2 Identification of monetary policy shocks and information shocks

We estimate a Bayesian structural VAR and identify monetary policy and information shocks. The approach is based on that of Jarociński and Karadi (2020). The model we use includes five endogenous variables. Here, y_t and m_t are denoted as a vector of macroeconomic and financial variables observed in month t and a vector of surprises measured by financial instruments observed in month t, respectively. To construct m_t, we sum intraday surprises occurring in month t on days with monetary policy announcements.[3] Our baseline model is a VAR model with m_t and y_t:

$$\begin{pmatrix} m_t \\ y_t \end{pmatrix} = \sum_{p=1}^{P} \begin{pmatrix} 0 & 0 \\ B^p_{YM} & B^p_{YY} \end{pmatrix} \begin{pmatrix} m_{t-p} \\ y_{t-p} \end{pmatrix} + \begin{pmatrix} 0 \\ c_Y \end{pmatrix} + \begin{pmatrix} u^m_t \\ u^y_t \end{pmatrix}, \quad (1)$$

where m_t includes intraday changes in interest rates and stock indices. We use changes in 3-month Euroyen futures and (the logarithm of) TOPIX around the monetary policy meeting. Our estimation relies on minute-by-minute data. Consistent with the literature on the identification of monetary policy shocks, we collect 3-month ahead Euroyen future rates (EYF3) and TOPIX during a half-hour window starting 10 minutes before and ending 20 minutes after the announcement.[4]

Here, y_t includes monthly changes in interest rates (one-year government bond yields), TOPIX, GDP deflator, GDP, and excess bond premium. We use monthly (real) GDP and GDP deflator published by Japan Center Economic Research from January 2007. The excess bond premium is calculated by the AA corporate bond spread between

[3]Note that m_t is zero in the months with no monetary policy announcements.

[4]For the robustness check, we collect 6-, 9-, and 12-month ahead Euroyen futures rates during the same window, which are denoted as EYF6, EYF9, and EYF12. We confirm that the baseline results are similar when we use EYF6, EYF9, and EYF12 instead of using EYF3.

one-year Japanese government bond and corporate bond (AA) yields.[5] In Equation (1), we impose zero restrictions on the impact of m_{t-p} and y_{t-p} on m_t. The assumption relies on the exogeneity of monetary surprises (m_t). Using Equation (1), we estimate a Bayesian structural VAR and identify two structural shocks from the monetary policy and central bank information. The sample period ranges from January 2007 to December 2019.

Following Jarociński and Karadi (2020), we use changes in one-year government bond yields as a low-frequency indicator of monetary policy to capture the impact of forward guidance. The advantage of using longer-term bond rates rather than overnight call rates remains a valid measure of the stance of monetary policy even under the ELB. We include monthly real GDP and the GDP deflator in order to capture the more frequent dynamics of macroeconomic and financial variables than when using quarterly GDP and GDP deflator series. Finally, we include the excess bond premium as an indicator of financial conditions, which could amplify the impact of shocks on macroeconomic variables.

We identify two structural shocks transmitted through the Bank of Japan's announcements. Our methodology for identification is based on that of Jarociński and Karadi (2020). While we use a VAR model, our approach relies on two assumptions about announcement surprises to isolate these shocks. One is high-frequency identification and the other is sign restriction. First, we assume that announcement surprises m_t are affected by only two announcement shocks, monetary policy, and the Bank of Japan's information, and not by any other shocks. This assumption is justified because m_t is measured during a half-hour window starting 10 minutes before and ending 20 minutes after the monetary policy announcement. It is unlikely that shocks unrelated to a central bank announcement systematically occur during the window. Second, we assume that a monetary policy shock is a negative co-movement shock associated with an interest rate increase and a drop in stock prices. We also assume that a central bank information shock is a positive co-movement shock associated with an increase in both interest rates and stock prices. The assumption of negative and positive co-movements allows us to separate the two central bank announcement shocks. Given these assumptions, we employ the standard Bayesian prior for the VAR parameters using the same setting Jarociński and Karadi (2020) and generate the posterior draws of shocks and associated impulse responses using the Gibbs sampler.[6]

Figure 2 shows the series of the two shocks identified with sign restrictions. The figure reports that the largest (expansionary) monetary policy shock occurred in January 2016. These negative shocks reflected the launch of the negative-interest-rates policy (NIRP) in January 2016; the Bank of Japan announced the introduction of "quantita-

[5]Corporate bond yields (AA) are collected from Rating and Investment Information, Inc.

[6]We follow the procedure proposed by (Jarociński and Karadi, 2020; Rubio-Ramírez et al., 2010).

tive and qualitative monetary easing with a negative interest rate." Although the bank's governor, Haruhiko Kuroda, denied that such a policy was being considered when responding to questions in the Diet, the Bank of Japan decided to introduce the NIRP. As the introduction of the NIRP was unexpected, the shocks were large.

Regarding an information shock, the figure reports that the largest (positive) shock occurred in December 2009. In December 2009, two monetary policy meetings were held: the first one was the unscheduled meeting on December 1 and the other was on December 18. The unscheduled meeting was held to decide to introduce a new funds-supplying operation to encourage a further decline in longer-term interest rates. In the other meeting on December 18, the Bank of Japan clarified the understanding of medium- to long-term price stability. The policy changes and announcements are identified to be the large (positive) information shocks: they reflect the Bank of Japan's assessment of the economic outlook which is not "priced" in financial markets.

3 Impulse responses

3.1 Benchmark results

We examine whether an information shock and a conventional monetary policy shock significantly impact macroeconomic and financial variables. Figure 3 shows the impulse responses of interest rates (one-year bond yields), the stock index (TOPIX), output, inflation, and excess bond premiums using data from 2007 to 2019. The left and right panels in Figure 3 show impulse responses to a contractionary monetary policy shock and a (positive) central bank information shock, respectively.[7] The responses show that a contractionary monetary policy shock significantly influences one-year government bond yields, inflation, and excess bond premiums. In response to a contractionary monetary policy shock, there is a significant rise in bond yields by approximately 0.005%, which satisfies the sign restrictions by construction. Inflation rates significantly decrease immediately after the occurrence of a contractionary monetary policy shock. The decline is not large but significant. Excess bond premium significantly decreases in response to a contractionary monetary policy shock. It seems puzzling: the decline in excess bond premium is not consistent with the prediction of standard theory. We interpret that it reflects the zero lower bound of corporate bonds. The Bank of Japan introduced the NIRP in January 2016. The NIRP has sunk government bond yields into negative territory. For example, ten-year government bond yields turned negative after February 2016. However, corporate bond yields remained in positive territory possibly due to the zero lower bound. Thus, negative monetary policy shocks can induce the

[7] Note that both a contractionary monetary policy shock and a positive central bank information shock correspond to an increase in interest rates (Euroyen rates).

divergence between yields of risk-free bonds and risky ones, which entail the responses of bond premium as shown in Figure 3.[8]

Impulse responses to a positive central bank information shock contrast with the results shown in the left panel of Figure 3. First, TOPIX increases by 1.0% in response to a positive information shock, which satisfies the sign restrictions by construction.[9] Output is not positively associated with an information shock, which is not similar to Jarociński and Karadi (2020). This is the case for the responses to a contractionary monetary policy shock shown in the left panel. It seems that the two series of shocks do not induce changes in output during the sample period. Meanwhile, inflation rates increase by 0.03% in response to a one-standard-deviation (positive) information shock. The gradual response suggests that central bank information shocks are positively associated with inflation rates. The responses suggest that an unexpected increase in interest rates is not always contractionary or tight.

3.2 Robustness check (1): Intraday changes in EYF12

The estimation results are robust when intraday changes in interest rates are calculated by EYF12, as shown in Figure 4. Figure 4 shows that the results are similar to those in Figure 3. The left panel shows the responses of macroeconomic and financial variables to a contractionary monetary policy shock. In response to a contractionary monetary policy shock, there is a significant rise in bond yields by approximately 0.005%. Inflation rates decrease just after the occurrence of a contractionary monetary policy shock, but the decline is small. Excess bond premium significantly decreases in response to a contractionary monetary policy shock.

The right panel shows how a positive information shock influences macroeconomic and financial variables. A one-standard-deviation (positive) information shock increases bond yields and TOPIX by approximately 0.005% and 1%, respectively. The reactions of the financial variables are similar to those in Figure 3. Output is not associated with a positive information shock, which is the same result as seen in Figure 3. Meanwhile, inflation rates increase by 0.03% in response to a positive information shock. The evidence supports our benchmark results.

[8] In addition to the ZIRP, the measurement issue of the financial condition might be important as a potential reason why the excess bond premium falls significantly in response to a contractionary monetary policy shock. Gilchrist and Zakrajšek (2012) decompose the observed corporate bond spread into two components — firm-specific information on expected defaults and a residual component (excess bond premium) — and show that the latter has significant predictive power. As we use the AA corporate bond spread as a proxy for the excess bond premium without decomposition, the forward-looking component of the corporate bond spread might not be correctly captured in the series.

[9] Our results suggest that a contractionary monetary policy shock does not cause the TOPIX to decrease. This is puzzling and not consistent with Jarociński and Karadi (2020). We conjecture that the reason is due to the BOJ's massive purchase of exchange-traded funds (ETFs).

3.3 Robustness check (2): Subsample analysis from the actual changes in monetary policy decisions

Using the subsamples, we further check the robustness. We use the subsamples from intraday changes in Euroyen futures during a half-hour window when the Bank of Japan officially changes the course of monetary policy. The robustness check focuses on important policy announcements that induce large surprises for financial markets such as the launch of Comprehensive Monetary Easing (CME) in 2010 and Quantitative and Qualitative Monetary Easing (QQE) in 2013.

Figures 5 and 6 show that the estimation results are robust when we use the subsamples from the actual policy changes in interest rates calculated by EYF3 and EYF12, respectively. The figures show that the results are similar to those in Figure 3. Both a contractionary monetary policy shock and a positive information shock cause a rise in bond yields by 0.005%. TOPIX increases in response to a positive information shock by 1.0% or more. The figures show that output is not associated with the two series of shocks. Meanwhile, inflation rates decrease in response to a contractionary monetary policy shock and increase to a positive information shock. The robustness check confirms that our benchmark results do not change when we use the subsamples.

4 Macroeconomic implications

This section discusses macroeconomic implications based on evidence shown in the previous section. Our results in Section 3 support those in Jarociński and Karadi (2020) while there is a difference in the macroeconomic impacts. First, a contractionary monetary policy shock and a positive information shock influence macroeconomic and financial variables. We show evidence that inflation rates decrease in response to a contractionary monetary policy shock while they increase to a positive information shock. In this sense, our results suggest that an unexpected increase in interest rates is not always contractionary or tight. The evidence suggests that information effects play a certain role in the Japanese economy, even under the ELB.

Regarding macroeconomic variables, however, the output is not associated with the two series of shocks. This is the difference between our study and Jarociński and Karadi (2020). In Jarociński and Karadi (2020), a contractionary monetary policy shock decreases output while a positive information shock increases it. Our results imply that monetary policy during the sample period from 2007 to 2019 does not significantly influence output in Japan. The structural analysis behind the reason is left for our future research.

Second, the impacts of the two series of shocks are small. Our results suggest that inflation rates respond to a positive information shock by 0.03%, while output is not associated with the two series of shocks. Jarociński and Karadi (2020) also report that the impacts are small; a contractionary monetary policy shock and a positive information shock induce changes in output and inflation rates at most by 0.1% and 0.05%, respectively. It is suggested that the two sets of shocks have a limited impact on macroeconomic variables.

Our results imply a new challenge for central banks. Theoretically, the only effective tool left for the central bank under the ELB is forward guidance. It can be done by the management of expectations (Eggertsson and Woodford, 2003), which potentially induces changes in long-term interest rates. However, as for Japan, our study reveals that expectations are difficult to manage even with the unprecedented monetary policies such as the CME and the QQE. The lesson from our study poses a serious challenge to central banks under the long-term liquidity trap (Fujiwara et al., 2015). Central banks are facing a harsh reality.

5 Conclusion

Central bank announcements simultaneously convey information about monetary policy and the bank's assessment of the economic outlook. In this study, we decompose central bank announcements into information about monetary policy and the central bank's assessment of the economic outlook following the same procedure as Jarociński and Karadi (2020). Using high-frequency data, we examine whether these two components influence macroeconomic and financial variables under the ELB.

We find that a contractionary monetary policy shock and a positive information shock influence macroeconomic variables as well as financial variables. As for macroeconomic variables, we find that inflation rates decrease in response to a contractionary monetary policy shock while they increase to a positive information shock. As for financial variables, we find that identified shocks cause changes in interest rates, stock prices, and bond premiums, in line with the theoretical prediction.

We also find that the two series of shocks have no sizable impacts on the economy. Our results suggest that inflation rates respond to a one-standard-deviation positive information shock only by 0.03%. As for output, we provide evidence that the two series of shocks do not induce changes in output. This is the case when we estimate the impacts on financial variables. Thus, our study suggests that the two series of shocks have only a limited effect on the economy.

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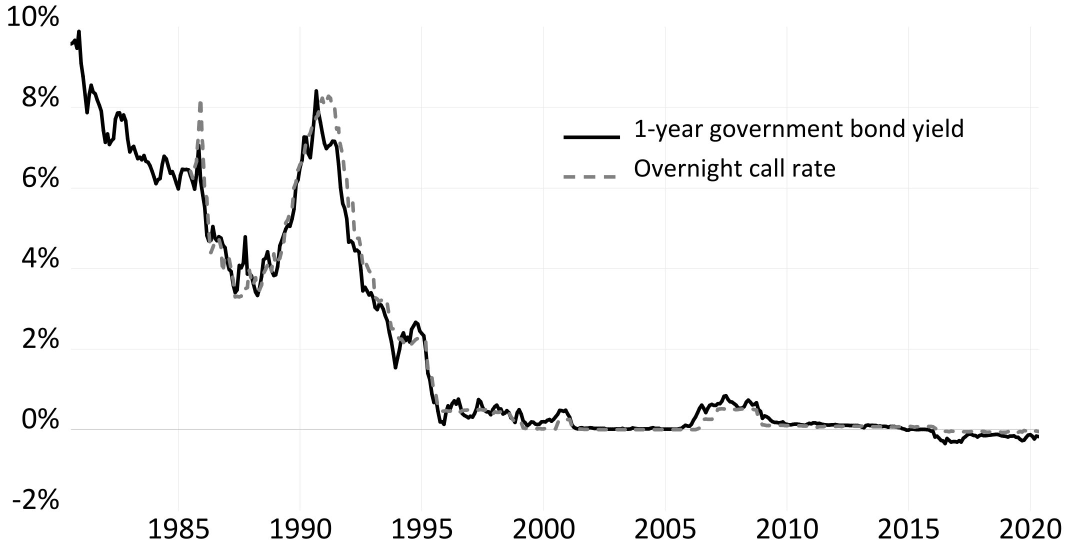

Figure 1: Development of the target overnight call rate (Source: Bank of Japan)

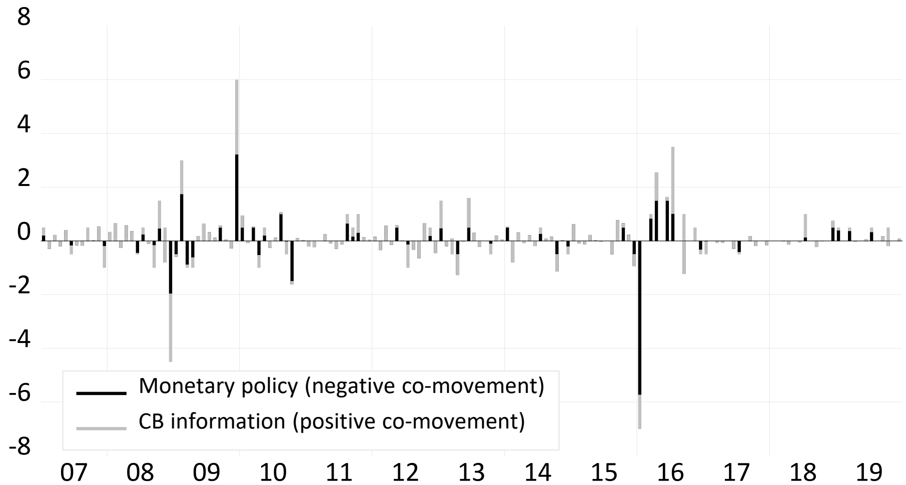

Figure 2: Contributions of shocks (basis points). The series are aggregated to the monthly frequency.

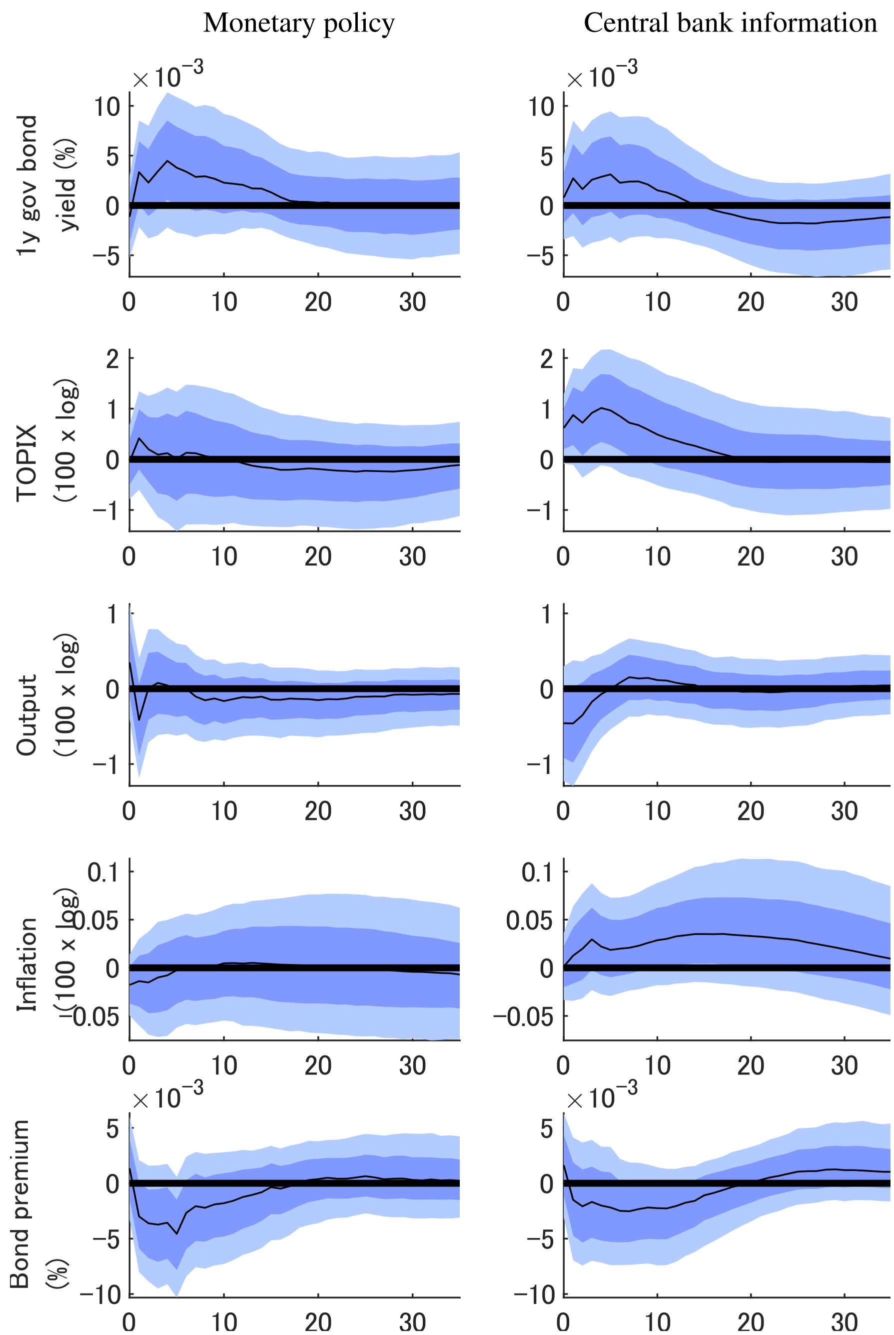

Figure 3: Impulse responses to one-standard-deviation shocks by sign restrictions. Intraday changes in interest rates during a half-hour window starting 10 minutes before and ending 20 minutes after the monetary policy announcement are calculated by EYF3. The Left and right panels show the impulse responses to a contractionary monetary policy shock (negative co-movement) and a positive central bank information shock (positive co-movement). The horizontal axis indicates months. Median (line), percentiles 16–84 (darker band), percentiles 5–95 (lighter band). Endogenous variables include yields on one-year government bonds, TOPIX, monthly GDP, monthly GDP deflator, and excess bond premium.

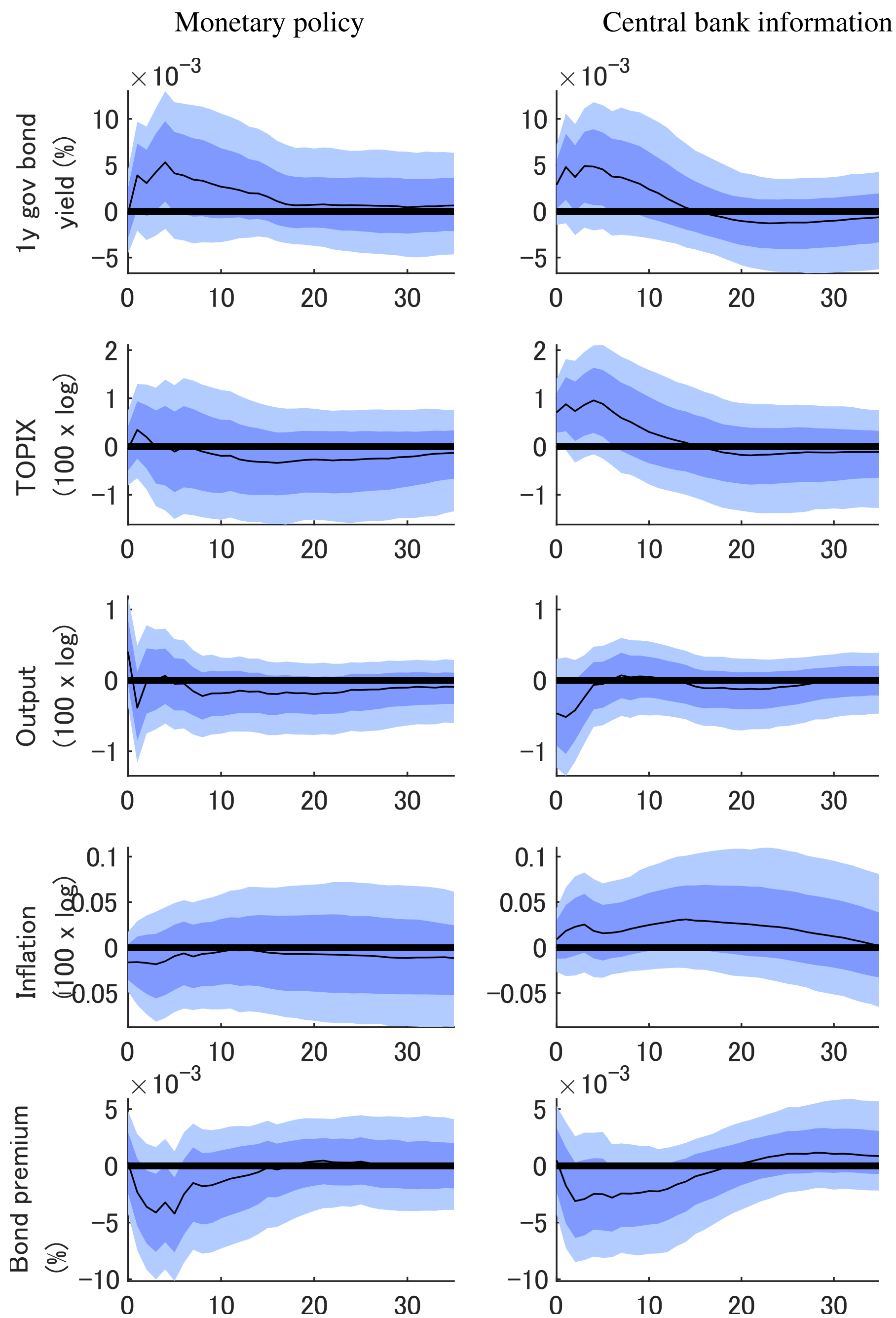

Figure 4: Robustness check (1): Impulse responses to one-standard-deviation shocks by sign restrictions. Intraday changes in interest rates during a half-hour window starting 10 minutes before and ending 20 minutes after the monetary policy announcement are calculated by EYF12. The left and right panels show the impulse responses to a contractionary monetary policy shock (negative co-movement) and a positive central bank information shock (positive co-movement). The horizontal axis indicates months. Median (line), percentiles 16–84 (darker band), percentiles 5–95 (lighter band). Endogenous variables include yields on a one-year government bond, TOPIX, monthly GDP, monthly GDP deflator, and excess bond premium.

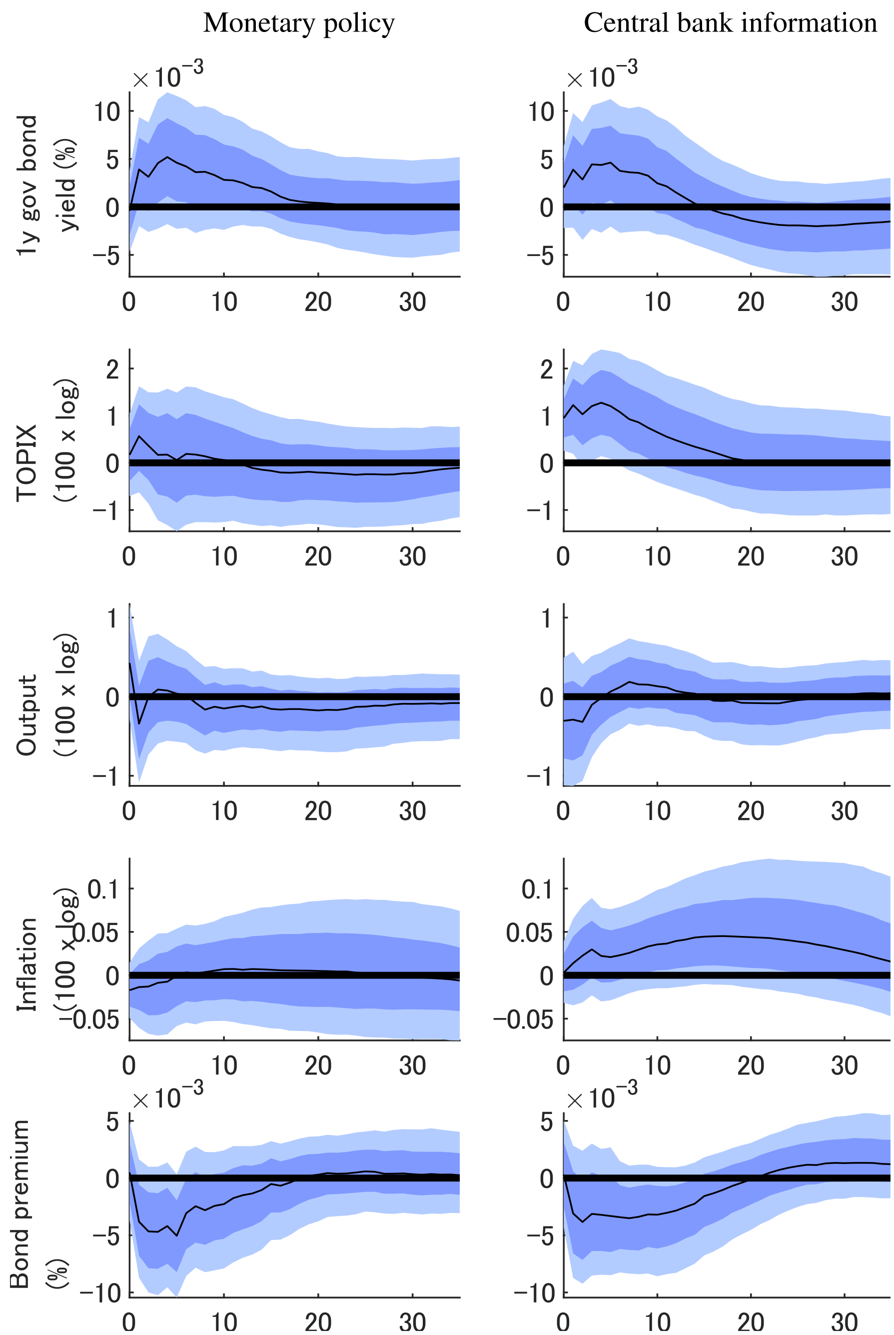

Figure 5: Robustness check (2): The subsample analysis. Intraday changes in interest rates are calculated by EYF3 during a half-hour window when the Bank of Japan officially changes the course of monetary policy. The left and right panels show the impulse responses to a contractionary monetary policy shock (negative co-movement) and a positive central bank information shock (positive co-movement). The horizontal axis indicates months. Median (line), percentiles 16–84 (darker band), percentiles 5–95 (lighter band). Endogenous variables include yields on one-year government bonds, TOPIX, monthly GDP, monthly GDP deflator, and excess bond premium.

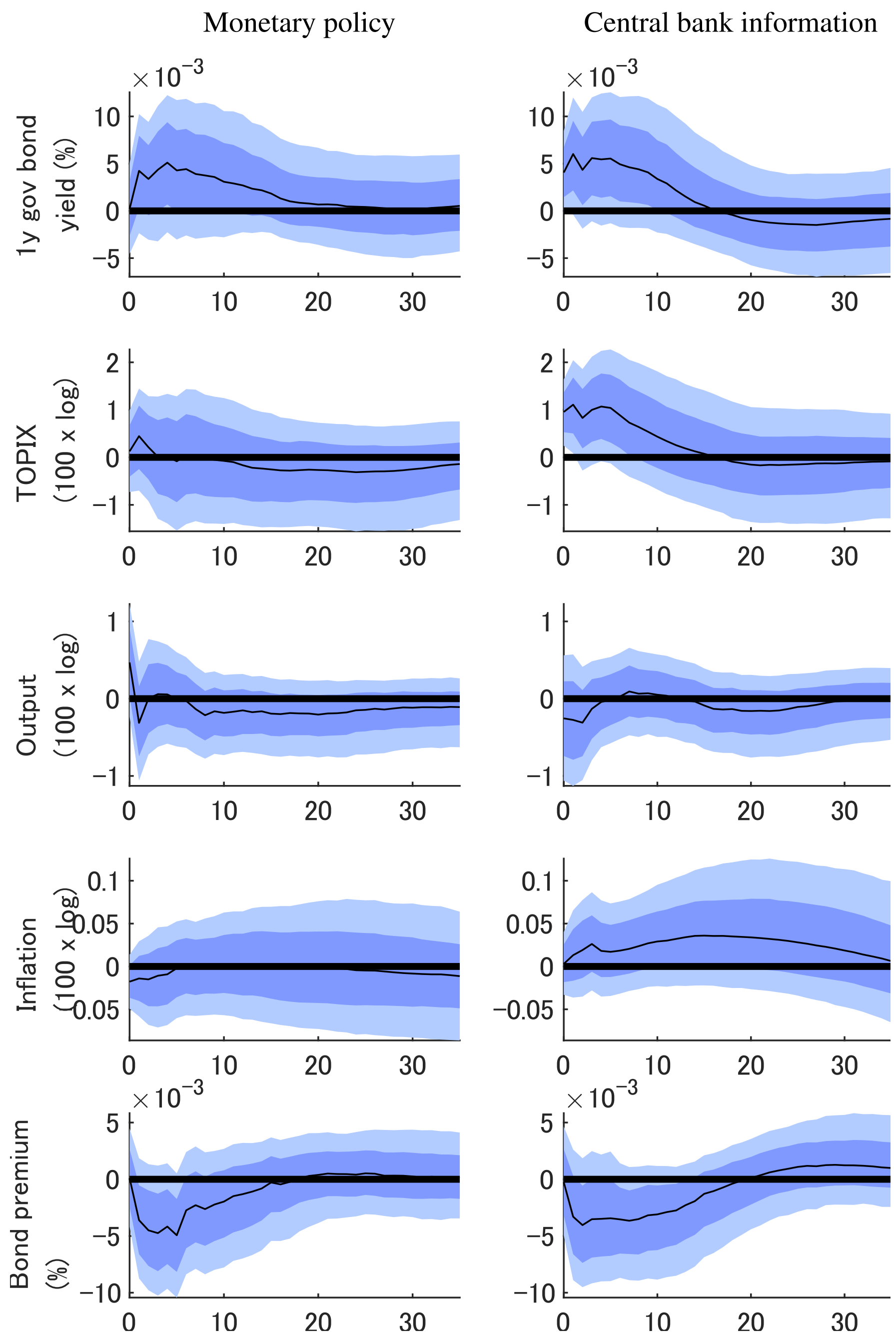

Figure 6: Robustness check (3): The subsample analysis. Intraday changes in interest rates are calculated by EYF12 during a half-hour window when the Bank of Japan officially changes the course of monetary policy. The left and right panels show the impulse responses to a contractionary monetary policy shock (negative co-movement) and a positive central bank information shock (positive co-movement). The horizontal axis indicates months. Median (line), percentiles 16–84 (darker band), percentiles 5–95 (lighter band). Endogenous variables include yields on one-year government bonds, TOPIX, monthly GDP, monthly GDP deflator, and excess bond premium.