(Box 6) Impact of the BOJ's JGB Purchases on the Yield Curve

The Bank has purchased JGBs to push down the overall yield curve, which in turn has affected economic activity and prices (Chart B6-1). This box attempts to quantitatively assess the impact on the formation of long-term interest rates of policy measures such as large-scale JGB purchases, the setting of a target level for long-term interest rates, and fixed-rate purchase operations, under the previous policy framework of Quantitative and Qualitative Monetary Easing (QQE) with Yield Curve Control.

Conceptually, the effects of large-scale central bank purchases of government bonds on long-term interest rates are often divided into (1) the flow effect and (2) the stock effect. The flow effect is the direct impact that central bank government bond purchases in the secondary market have in terms of pushing down yields on the bonds being purchased. On the other hand, the stock effect refers to the impact that the central banks' large holdings of government bonds have in terms of pushing down interest rates of various maturities by affecting the allocation of risk among the market participants. Recent empirical studies suggest that the stock effect tends to be more persistent than the flow effect.[37] Using the demand and supply curve framework shown in Chart B6-2, the stock effect

Chart B6-1: Yield Curves
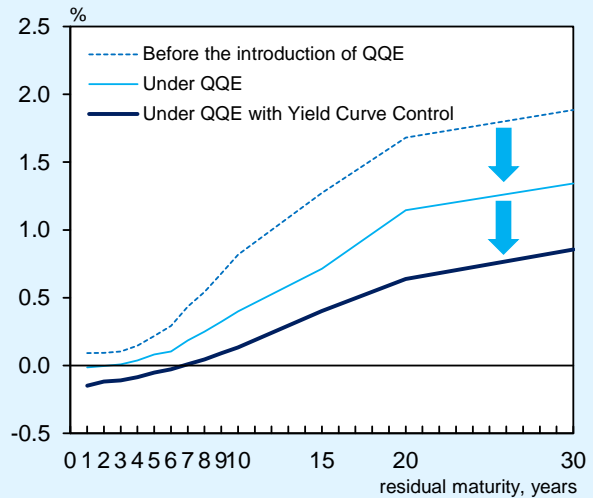
Source: Bloomberg.
Note: Figures for "before the introduction of QQE" are the average from January 3, 2012, to April 3, 2013; for "under QQE," the average from April 4, 2013, to September 20, 2016; and for "under QQE with Yield Curve Control," the average from September 21, 2016, to March 18, 2024.
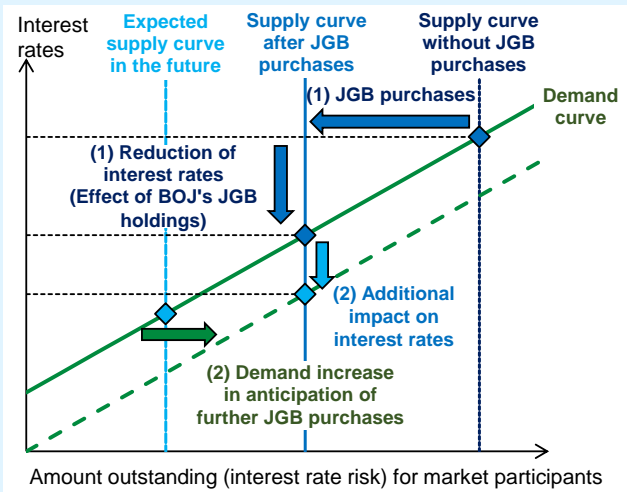
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[37] See, for example, the following studies.

Bernanke, B. S. (2020), "The New Tools of Monetary Policy," *American Economic Review*, vol. 110 (4): 943-983.

Sudo, N. and M. Tanaka (2021), "Quantifying Stock and Flow Effects of QE," *Journal of Money, Credit and Banking*, vol. 53 (7): 1719-1755.
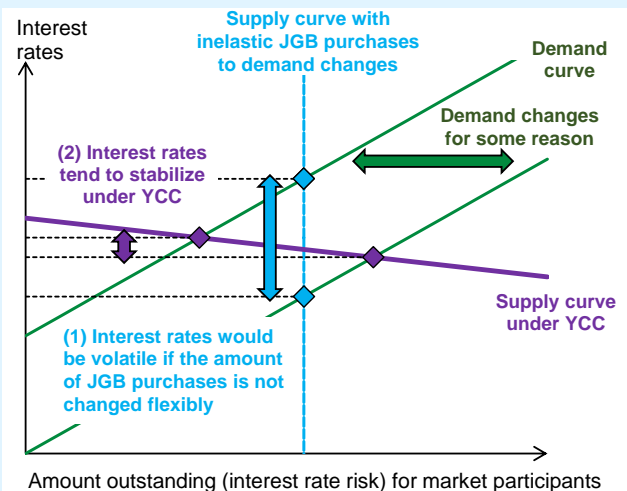
can be summarized as follows: larger central bank holdings of long-term government bonds reduce the total amount of interest rate risk for market participants, which lowers interest rates -- in particular, the term premium -- through new risk-taking by such participants. Moreover, this impact could occur before actual government bond purchases are made -- which is the so-called announcement effect -- as market participants anticipate that the central bank will purchase them in the future.

QQE with Yield Curve Control, introduced in September 2016, affects the formation of market interest rates through large-scale purchases of JGBs. From this perspective, it can be classified as a form of central bank purchases of government bonds, and the stock effect plays an important role in affecting long-term interest rates. However, since Yield Curve Control (YCC) is a framework that directly targets the level of long-term interest rates, its impact differs in several respects. First, as shown in Chart B6-3, under the framework without YCC, which targets the amount of purchases and/or holdings, interest rates could fluctuate substantially in response to changes in demand for JGBs; on the other hand, under YCC, the range within which long-term interest rates are allowed to fluctuate is fixed, so that fluctuations in interest rates are stabilized, with the amount of purchases determined endogenously in response to changes in the demand for JGBs. Second, if the Bank conducts YCC to keep interest rates strictly between the upper and lower bounds, interest rates may fall within this range in a self-fulfilling manner without

Chart B6-2: Stock Effect of JGB Purchases

Amount outstanding (interest rate risk) for market participants

Chart B6-3: Effect of Yield Curve Control on Interest Rate Fluctuations

Amount outstanding (interest rate risk) for market participants

purchases actually being made, as market participants anticipate the conduct of YCC.[38]

Although YCC has such positive effects, it should be noted that it may also lead to a deterioration in market functioning, such as suppressing the price discovery function of the market and its liquidity. Moreover, when interest rates nearly reached the upper bound under the strict conduct of YCC from around mid-2022 to early 2023, the negative impact on market functioning increased, resulting in, for example, high volatility in other financial markets, including the foreign exchange market.

Chart B6-4 shows the results of estimating simple long-term interest rate models constructed on the basis of the above considerations. First, in order to capture the stock effect of JGB purchases in such a way that the models include the effects of market participants' expectations on the Bank's future JGB holdings, the variable "expected BOJ holdings of JGBs in the future" is constructed on the basis of certain assumptions and used as an explanatory variable. Second, in order to capture the effects of setting a target range under YCC, the models include the probabilities that the targeted long-term yield exceeds the upper bound of the YCC range and that it exceeds the offer rate of "fixed-rate purchase operations for consecutive days," which are priced in the options market. As these probabilities increase, market

Chart B6-4: Estimation Results: Long-term Interest Rate Models

	Model 1	Model 2
Dependent variable:	10-year JGB yields	10-year JGB yields (sum of estimated coefficients for expected short-term interest rate component and term premium)
Expected BOJ holdings of JGBs in the future (share in total outstandings)	-0.024 ***	-0.021 ***
Probability that the upper bound of the YCC range is exceeded	-0.008 **	-0.037 ***
Probability that the offer rate of "fixed-rate purchase operations for consecutive days" is exceeded	-0.023 ***	-0.053 ***
Probability that the lower bound of the YCC range is exceeded	-0.002	0.028 ***
10-year U.S. Treasury yields	0.230 ***	0.246 ***
CPI (less fresh food and energy)	0.055 ***	0.083 ***
Uncollateralized overnight call rate	0.583 ***	0.777 ***
Constant	0.537 ***	0.473 ***
Adjusted R-squared	0.936	0.919
Estimation period	January 1997 to December 2023	

Sources: Bank of Japan; Ministry of Internal Affairs and Communications; Bloomberg; LSEG Eikon.
Notes: 1. *** and ** denote statistical significance at the 1 and 5 percent levels, respectively.
2. Expected BOJ holdings of JGBs in the future denote the estimated share of the BOJ's JGB holdings in the total amount outstanding 2 years ahead of each month, which would be realized under the assumption that the BOJ continues to purchase the same amount of JGBs in the next 2 years as in the corresponding month (up to September 2016) or purchase JGBs based on the monthly purchase schedule at that time (from October 2016). The share is calculated on the basis of the interest rate risk. The probability that the upper bound of the YCC range (the lower bound of the YCC range or the offer rate of the "fixed-rate purchase operations for consecutive days") is exceeded is the probability that long-term interest rates will exceed such level after 3 months, which is priced in the options market.
3. The coefficients in Model 2 are the sum of the coefficients of the regression results for models with the two components -- the expected short-term interest rate component and the term premium -- of the 10-year interest rates as dependent variables.

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[38] Studies (e.g., Hattori and Yoshida, 2023) show that, after the introduction of YCC, fluctuations in 10-year interest rates have indeed been contained.

Hattori, T. and J. Yoshida (2023), "Yield Curve Control," *International Journal of Central Banking*, December 2023: 403-438.

participants' expectations that the likelihood of the Bank's response to prevent interest rates from rising becomes high in the future will be factored into market prices in advance. The estimation results show that all variables, including other control variables, have a statistically significant impact. Using these results, Chart B6-5, which presents a decomposition of developments in long-term interest rates, shows that long-term interest rates are pushed down by about 1.0 percentage point on average, mainly through the stock effect, although the results from such simple models should be interpreted with considerable latitude.[39] Moreover, Chart B6-6 -- which shows the results when applying the same models to interest rates with different maturities and decomposes the changes in the yield curve -- indicates that, since the introduction of QQE in 2013, large-scale monetary easing has pushed down not only 10-year interest rates but the yield curve as a whole.

In March 2024, the Bank changed its policy framework from the previous large-scale monetary easing, including the framework of QQE with Yield Curve Control, and decided to conduct monetary policy by guiding the short-term interest rate as a primary policy tool. As a result, long-term interest rates are now basically formed in financial markets, and the effects of setting the YCC range seen in Chart B6-5 in terms of putting downward pressure on long-term interest rates are likely to

Chart B6-5: Sources of Changes in Long-Term Interest Rates
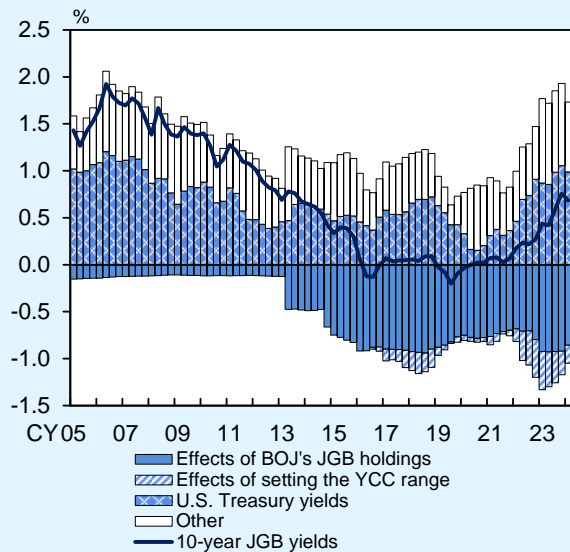
Sources: Bank of Japan; Ministry of Internal Affairs and Communications; Bloomberg; LSEG Eikon.
Note: Figures are calculated based on the average coefficients of Models 1 and 2 in Chart B6-4. "Effects of BOJ's JGB holdings" are calculated on the basis of the coefficients on the expected BOJ holdings of JGBs in the future, and "effects of setting the YCC range" are calculated based on the coefficients on the probabilities in Chart B6-4 (such as the probability that the upper bound of the YCC range is exceeded).

Chart B6-6: Sources of Changes in the Yield Curve
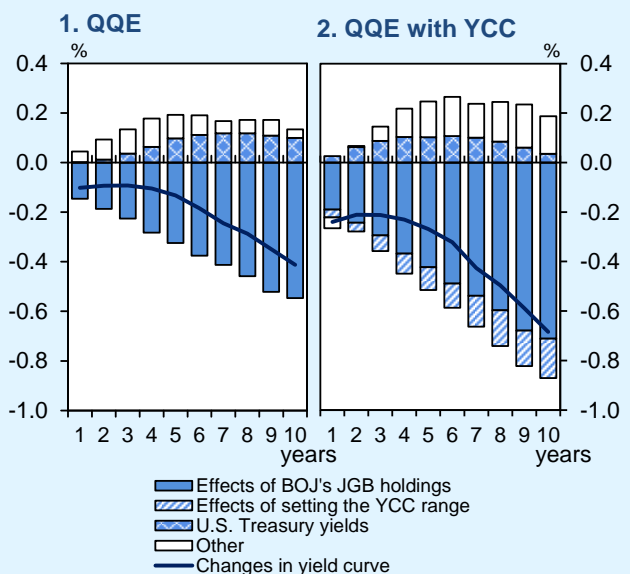
Sources: Bank of Japan; Ministry of Internal Affairs and Communications; Bloomberg; LSEG Eikon.
Notes: 1. In the left-hand chart, figures are the average from April 2013 to August 2016 relative to the average from January 2012 to March 2013. In the right-hand chart, figures are the average from September 2016 to March 2024 relative to the average from January 2012 to March 2013.
2. Figures are calculated on the basis of Models 1 and 2 in Chart B6-4, but for each maturity from 1 year to 10 years. In the estimations, U.S. Treasury yields for the corresponding maturities are used.

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[39] In the March 2021 *Assessment for Further Effective and Sustainable Monetary Easing*, the Bank shows the empirical results that its JGB purchases have significantly pushed down long-term interest rates by about 1.0 percentage point on average, using slightly different model specifications.

have shrunk substantially.[40] On the other hand, the Bank's JGB holdings are expected to remain at high levels for the time being. The basic ideas and estimation results described in this box imply that the Bank's ongoing purchases and holdings of JGBs will continue to affect the formation of the yield curve, mainly through the stock effect. The quantitative results presented here should be interpreted with considerable latitude as the effects of JGB purchases may differ over time. That said, based on these circumstances, the Bank will continue to achieve appropriate financial conditions while responding to developments in economic activity and prices by guiding the short-term interest rate as a primary policy tool.

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[40] The Bank decided in the March 2024 Monetary Policy Meeting that, in the case of a rapid rise in long-term interest rates, it will make nimble responses by, for example, increasing the amount of JGB purchases, regardless of the monthly schedule of JGB purchases. Although it is difficult to quantify the effects of this statement using the analytical framework in this box since it does not indicate a specific target level of the long-term yield in advance, it is expected to contribute to the stable formation of long-term interest rates in a manner similar to the setting of an upper bound under YCC.