

Re-evaluation of the Bank of Japan's monetary easing policy after the Global Financial Crisis

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Abstract

This paper examines the effectiveness of the Bank of Japan's non-traditional monetary policy introduced after the global financial crisis, particularly the current Quantitative and Qualitative Monetary Easing (QQE). The purpose of this paper is to compare the current QQE with the monetary policy implemented under Mr. Shirakawa, the former BOJ Governor, including the period of Comprehensive Monetary Easing (CME), covering the period of Post-Global Financial Crisis to date (Sept.2008 to June 2019). The analysis based on Bayesian vector autoregressive (BVAR) model shows that pre-QQE monetary policy has had a significant impact on the economy and the market in terms of exchange rate (real effective exchange rate), interest rate, bank lending, and industrial production. On the other hand, it is shown that QQE has no significant impact on the real economy and the market. The results of analyses in this paper show that QQE have not achieved its original objective, while the BOJ policy before QQE (2008 and March 2013) worked effectively to recover from the worst situation of the economy after the global financial crisis.

Key Words: Comprehensive Monetary Easing (CME); Quantitative and Qualitative Monetary Easing (QQE); Effectiveness of monetary policy

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Introduction

This paper aims to re-examine the effectiveness of the unconventional monetary policies of Bank of Japan (BOJ) especially the current Quantitative and Qualitative Monetary Easing (QQE) to compare with the monetary policy under

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former BOJ Governor Shirakawa, including Comprehensive Monetary Easing (CME) Policy after the Global Financial Crisis. The analysis based on the Bayesian Vector autoregressive (BVAR) model indicates that monetary policy before QQE including the period of CME had significant effects on the economy and market, including Exchange Rate, Interest rates, bank lending, and industrial production, while QQE has not put significant impact on the market nor the real economy. The results indicate that while QQE has not attained the original objectives, the BOJ policy before QQE (during 2008 and March 2013) had worked in its original purpose of stabilization of the markets / economy and achieved recovery from the worst situation after the Global Financial Crisis.

Since October 2010, the Bank of Japan under Governor Shirakawa introduced Comprehensive Monetary Easing (CME) as a non-traditional monetary policy. This includes the following policies:

(i) Call rate reduction (down from 0.1% to 0.0-0.01%); (ii) Continue zero interest rate to increase inflation expectations; (iii) Assets purchased by the Bank of Japan (ETF, government bonds, J-REIT, etc.) and (iv) establishment of special funds established for asset purchases. Even before CME, the Bank of Japan under Governor Shirakawa had already introduced special operations to increase interest rates applicable to current account balances at the Bank and loans to companies. Therefore, it will be necessary to evaluate the effectiveness of monetary easing before the introduction of CME after the Global Financial Crisis in September 2018.

The major objectives of QQE, introduced in April 2013, were to achieve economic recovery and growth with 2% annual inflation by supplying a large monetary base to the market. For this reason, QQE's focus has been on large-scale money supply in the market.

The results of the analyses in this paper show that the monetary policy including CME introduced under Mr. Shirakawa, the former Governor of the Bank, had a greater impact on the market and the real economy effectively than that of QQE in terms of real effective exchange rates, interest rates, bank lending, and industrial production. It should be noted that the stagnation of the Japanese economy immediately after the global financial crisis was mainly caused by the deterioration of the global economy and stagnant market situation, as well as the appreciation of Yen, which overlapped with the euro crisis, and stagnant exports to major trading partners including China and the United States. Even under such adverse circumstances, monetary easing by the BOJ at that time worked effectively as compared with QQE.

This paper examines the impact of the Bank of Japan's monetary easing policy

on the Japanese economy and market based on the analysis of the Bayesian VAR (BVAR) model, focusing on changes after the Global Financial Crisis. The analysis uses monetary base (MB), BOJ current account (BOJAC), money stock [M2], government bond yield, call rate, stock price (Nikkei average), real effective exchange rate (REER), bank loans, and industrial production.

The major results obtained from the analyses of this paper are as follows.

- (a) Monetary base (MB) and BOJ current account (BOJAC) from September 2008 to March 2013 had a positive impact on industrial production (especially from September 2008 to September 2010 before the introduction of CME). During the same period, it has had relatively effective for exchange rates (real effective exchange rate, REER).
- (b) MB / BOJAC had a significant impact on bank lending and interest rate level (call rate / government bond yield) in the same period.
- (c) QQE did not have a substantial effect on the market and the real economy. During QQE (April 2013 to May 2019), MB / BOJAC's impact on industrial production was limited (not statistically significant). Interest rates (JGB Yield and call rate) have not put any effect on bank lending.
- (d) Expansion of MB / BOJAC under QQE has no significant effect on Yen's exchange rate (real effective exchange rate, REER), so that QQE cannot be regarded as an important factor for the depreciation of Yen until recently.
- (e) Despite the continued monetary easing policy during QQE (Phase II) after November 2014, the results obtained in the analyses had no major changes as in the whole period (April 2013 to May 2019), and the annual inflation target of 2% remains unfulfilled.
- (f) The above results are supported not only by the impulse response function but also by the variance decomposition of each variable. Especially, the analyses on each variable of variance decomposition during the QQE period show that monetary easing under QQE had no significant impact upon industrial production, exchange rate, inflation rate as well as bank lending, as compared with that during September 2008 - March 2013.

In fact, despite substantial monetary easing by QQE, it has not put positive effect on the real economy (Fig. 1). In terms of the overall index of economic activity (CI), the real economy has not achieved a significant recovery despite the expansion of monetary easing during QQE since 2013 compared to the recovery since 2009 after the Lehman shock. (Fig. 2).

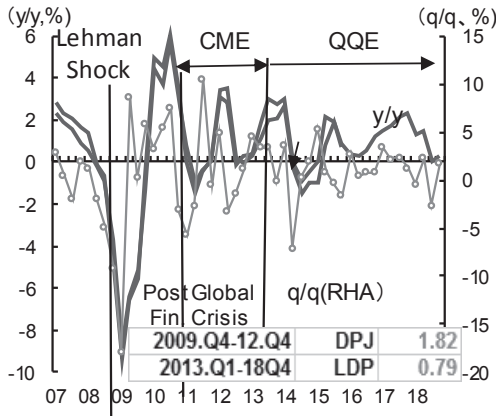


Fig.1: GDP Growth (Japan)

Source: Cabinet Office(Japan), IMF

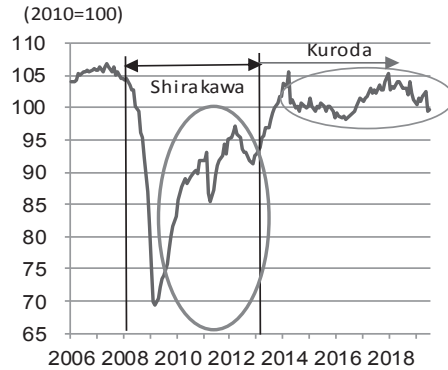


Fig.2: Japan: Economy (Composition Index)

Source: METI

In this paper, Section 1 describes the overall monetary easing policy and its impact on Japan's economy and market after the global financial crisis. Section 2 introduces relevant studies on monetary easing policies by BOJ as well as FRB/ECB, and this paper explains how to evaluate the effects of monetary easing policies after the global financial crisis based on the latest data. Section 3 is a general introduction to the analytical model (Bayesian VAR), and Section 4 is devoted to the analyses on the effects of QQE as well as that of the period under former BOJ Governor Shirakawa, including CME. The analyses are based on the Bayesian VAR model, the Granger causality test, impulse response functions, and variance decomposition of the main variables. It shows that QQE does not fulfill its original purpose of achieving economic recovery and sustainable economic growth.

1. Monetary Policy and Money/ Financial Market

1.1 General Feature of the Monetary Easing under QQE

Monetary base (MB) including BOJ's Current Account balances at the Bank of Japan (BOJ) increased significantly under the current QQE, reaching 513 trillion yen and 401 trillion yen in June 2019, respectively. This is about 100% of Japan's GDP in 2018, and the current account balances at the Bank of Japan are comparable to 77% (Fig. 3).

Although it is generally understood that Japanese yen has depreciated due to

large-scale monetary easing under QQE, the exchange rate (real effective exchange rate) has not been influenced by the increase in monetary base during the QQE period. The monetary base (MB) has not been correlated with the real effective exchange rate except for the period 2013-2015, when foreign investors withdrew allocated portfolio investment from Japan to shift to other countries, especially after the Euro Crisis was peaked over.

Under 'Abenomics' inflation target has been set at annual 2% since April 2013, however, the inflation rate (CPI increase rate) is largely associated with the real effective exchange rate REER, which is greatly influenced by the overseas economy and market environment (Fig. 4).

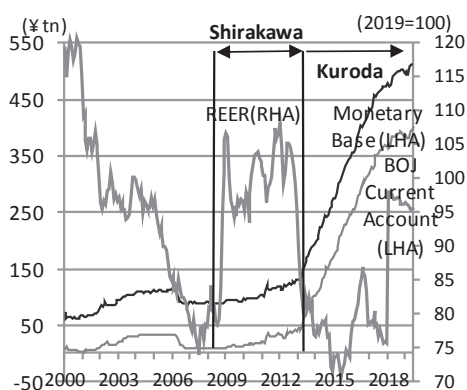


Fig.3: Monetary Base/ BOJ Current Account & REER (Japan)

Source: Bank of Japan

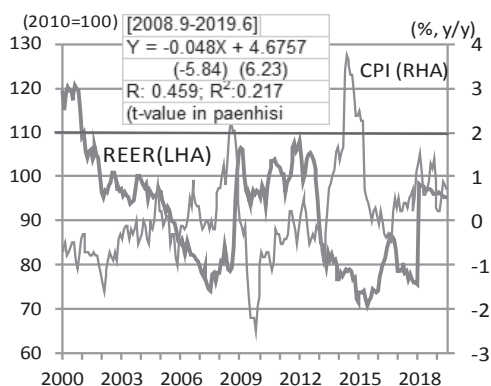


Fig4. CPI & REER (Japan)

Sources: BIS, Bureau of Statistics

Therefore, it is unreasonable to argue that monetary easing by QQE has promoted depreciation of Yen. In fact, it has been caused by changes in the global market environment. The reason behind the sharp appreciation of the yen in 2010-12 was that foreign investors diversified their portfolios following the Euro Crisis (or GIIPS crisis) and shifted to the Japanese yen as a less risky escape currency. It continued from the end of the global portfolio shift of investment to the end of 2012 when the Global Financial Crisis closed to an end. These facts indicate that the monetary easing under QQE did not achieve one of its original objectives, and that the official explanation of the inflation mechanism under QQE was wrong. Industrial production has not increased under massive monetary expansion under

QQE (Fig.5). Monetary base (MB) also has not associated with share prices¹ (Fig.6). The background of sharp rise in stock market in 2nd Quarter 2013 could be attributed to foreign investors' portfolio shift towards the Japanese market under the initial expectation of 'Abenomics'².

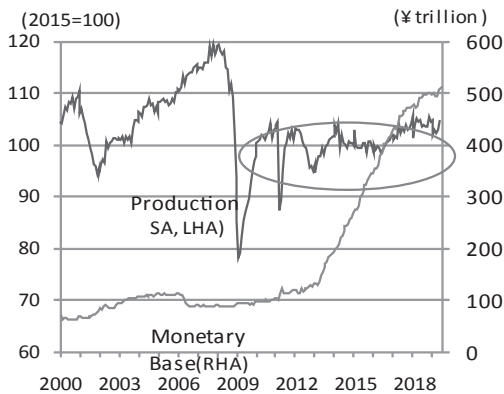


Fig.5: Monetary Base & Industrial Production (Japan)

Sources: Bank of Japan, IFS database (IMF)

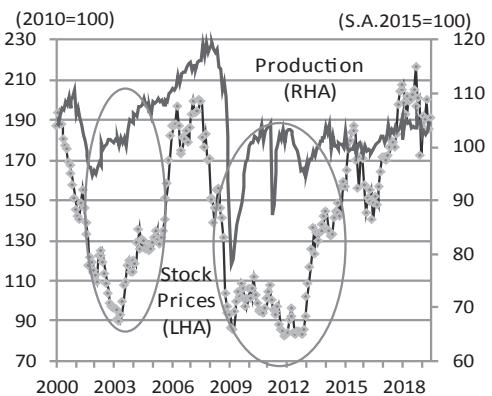


Fig.6: Stock & Production (Japan)

Sources: Bank of Japan, IFS (IMF), METI (Japan)

Despite a substantial increase in the Monetary Base and Current Account balances at the Bank of Japan since 2013, bank lending has hardly expanded, and industrial production has not increased during the QQE period, (Fig. 7,8). This suggests that bank loans may not be utilized in the domestic real economy but spent on non-productive investment during the QQE. In addition, there is no significant correlation between bank lending and the Monetary Base (MB) / BOJ current account (BOJAC) during the period. This may indicate that MB growth has little correlation with bank lending during QQE period, which is different from the

1. The analysis in this paper suggests that stock prices have not been maintained purely by market forces, but rather by some intervention by the authorities. . Stock prices during the QQE period (e.g. Nikkei 225) have been supported by ETF purchases by the Bank of Japan and the Government Pension Fund (GPIF). The Bank of Japan holds a large amount of JGBs with a very high share (46% as of December 2018), which affects the JGB prices and trading market under QQE.

2. Fukuda (2011) argues that foreign banks in Japan may have invested in the short-term financial market, rather than lending to the manufacturing industry, using excess reserves at the Bank of Japan current account. Kikuchi (2014) found that under excessive monetary easing, liquidity could be used for "speculative investment" and that monetary easing is actually a "hedge fund" for financial investment. Argues that it provides a valuable resource.

former period under Mr. Shirakawa, when bank lending increased in association with MB/ BOJAC (Fig. 8).

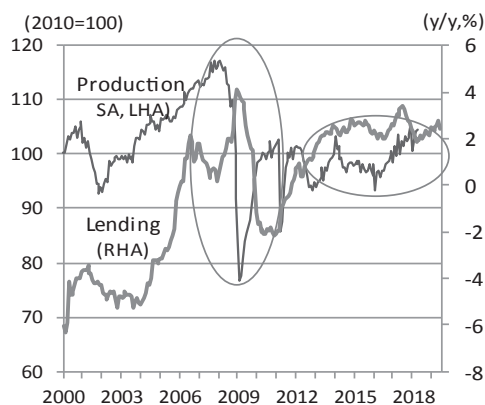


Fig.7: Lending & Production (Japan)

Sources: Bank of Japan, IFS database (IMF)

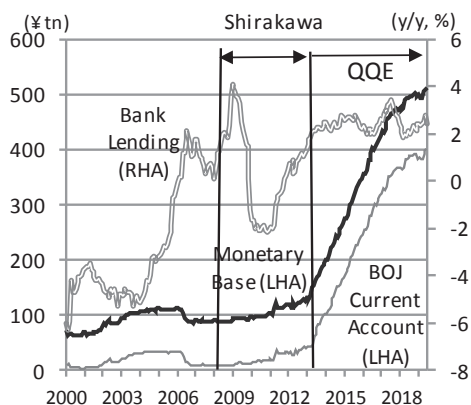


Fig.8: Monetary Base/ BOJ Current Account & Bank Lending (Japan)

Source: Bank of Japan

1.2 Effectiveness of Monetary Easing Policy

Nontraditional monetary policies, adopted in both comprehensive monetary easing (CME) and quantitative qualitative easing (QQE), are to be valued by actual performance in terms of impact on the market and the real economy.

This paper analyses the impact of monetary easing on the real economy (Industrial production) and financial market, including interest rates of call rate and government bond yield (average). Significant changes in interest rates during the period following the Global Financial Crisis under the former BOJ Governor of Shirakawa occurred before QQE (Figure 9).

It also shows that changes in M2 are closely related to capital flows (Figure 10). Particularly, M2's growth has been significantly affected by changes in capital inflows and outflows since April 2013, when QQE was introduced, and that capital flows in the market as money supply expanded. This suggests that capital and cash outflows might have caused a decline in domestic bank money stock. Furthermore, it may indicate that the money stock held by domestic financial institutions is negatively correlated with net capital inflows arising from liquidity in the global market.

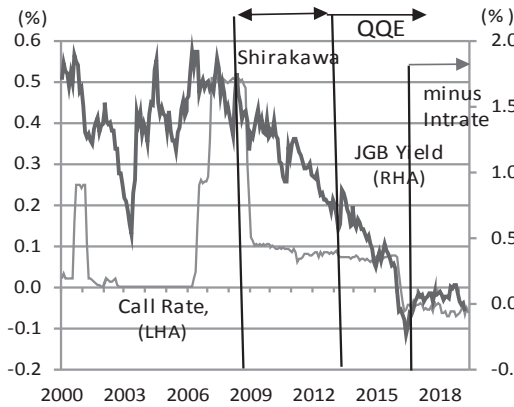


Fig.9: Call Rate & JGB Yield (Japan)

Sources: Bank of Japan, IFS database (IMF)

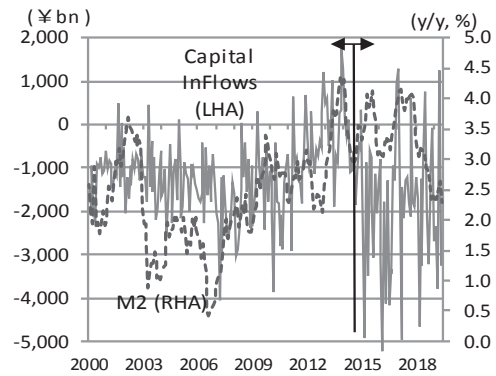


Fig.10: Capital Flows (Net) and M2

Source Bank of Japan

Therefore, monetary policy should be analyzed from the perspective of capital flows that have a major impact on the effectiveness of Japanese domestic monetary policy³.

On the other hand, the real effective exchange rate (REER) has not been changed by the massive money supply as will be described later (MB / BOJAC / M2 impulse response function), This is due to the significant appreciation of the yen caused by substantial portfolio movement of assets and currencies to the Japanese market during the euro crisis (Fig 11).

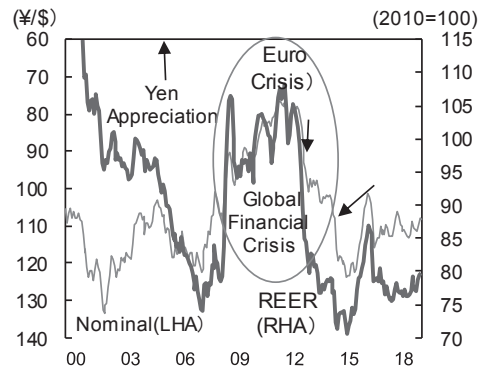


Fig.11: Yen/US\$ Exchange Rate

Sources: Bank of Japan, BIS

3. A more detailed analysis is required to illuminate these capital flows and their impact on the world market, which is outside the scope of this paper's analysis. In this regard, Ohta (2017) shows that the Bank of Japan's financial expansion under QQE has not had a major impact on the domestic market and the Japanese economy. On the other hand, this paper focuses on the comparison between monetary policy in the days of the former Bank of Japan Shirakawa governor since the Lehman shock and QQE under the Bank of Japan Kuroda.

2. Studies on the impact of monetary policy on the Japanese economy and market

Several studies have been conducted on the effects of BOJ's monetary policy on the economy and market. However, most of these have focused on the first Quantitative (Monetary) Easing Policy [QE] (April 2001-March 2006). On the other hand, there are very few studies on the evaluation on the economic and performances of QQE (April 2013 – to date) as well as monetary policies after the “Lehman Shock” (2008), including the BOJ's Comprehensive Monetary Easing (CME) introduced in October 2010 before QQE.

Some studies have shown that the first QE (2001-2006) lowered bond yields and had certain effects on the maturity and yield curves of JGBs, thereby stabilizing the market, while Shiratsuka et al. (2010) showed that the impact of QE on the real economy is not significant. The main analysis of Japanese monetary policy by Teruyama (2001) was one of the few studies based on the VAR model focused during the period 1990s before QE (2001-2006), so that it cannot be considered as a reference study for the current QQE. Another study based on the VAR model is basically an analysis that covers the period of 1990s before QE policy period (2001-2006).

Harada and Masujima (2008) argue that QE (2001-2006) was effective in the real economy through asset effects in the stock market, based on an analysis based on the VAR model. Honda, Kuroki and Tachibana (2010) also have shown the effectiveness of monetary easing under QE (2001- 2006) through the analysis based on the VAR model by adopting CPI, industrial production, current account balances at the Bank of Japan, Nikkei Stock Average, and call rate. On the other hand, Nakajima et al. (2017) showed quantitative easing shock has effectively put an expansion effect on the real economy between 2001 and 2006,

All these studies deal mainly with Quantitative Easing Policy (QE) from 2001 to 2006, so that the current QQE since 2013, which has been greatly expanded in scale, cannot be necessarily claimed that monetary easing policy has been effective for the real economy.

Several studies analyze the effects of monetary policy on the period after the global financial crisis. In a study by Honda and Tachibana (2011), who extended the period from 1996 to March 2010, monetary policy was effective in increasing industrial production through the stock market route. Honda (2014) also argued that nontraditional monetary policy worked for the real economy through several

channels, including asset effects. On the other hand, Arai (2016) pointed out that the estimated size of the financial shock on share price and the pass-through effect on the Japanese exchange rate for the period from 1998 to 2013 was significantly lower than that of the US. These studies cannot be considered as an analysis of the impact of QQE on the real economy.

As mentioned above, past research results may not be effective in assessing the “true” effectiveness of monetary easing policies after the global financial crisis (2008), particularly monetary easing that has increased significantly under QQE. There are some studies which covered the period of QQE. Miyao (2016, 2017), for example, covers two periods from March 2001 to March 2012 (before the introduction of QQE) and March 2001 to March 2015 based on the VAR model using the impulse response function. It argues that the current monetary easing policy under QQE was effective. However, the results are not persuasive for the effectiveness of QQE for the following reasons.

First, the coverage period of QQE in the study is rather short (March 2013-March 2015), but the entire period covered includes the period of the early QE in 2001-06. It is therefore difficult to measure the impact of QQE on the economy and market over the last six years accurately. It should be noted that the scale of monetary easing under quantitative easing (2001-2006) was much smaller than that of the current QQE, so that the impact on the market and the real economy would be much different from that under the QE. Secondly, it is very uncertain and not reasonable to apply the GDP growth rate in the model as a variable of GDP converted from a quarterly figure to a monthly basis to the VAR model analysis, to see the realistic movement of the real economy. It is unreasonable to argue that QQE would be effective from such an analysis; it would not be a reasonable variable to show the effect on the real economy. Third, there is a problem with robustness in the analysis because the VAR model itself used non-stationary variables that do not take the first-order difference, which would result in the problem of stationarity of the variables.

As shown in the analysis in this paper, monetary easing since 2013 is not directly related to share prices in Japan. Noguchi (2013) also argues that Japan’s monetary easing policy has not had a positive impact on the real economy. In this regard, several papers by Ohta (2013, 2014, and 2017) suggest that non-traditional BOJ monetary easing policies, particularly QQE, have not had a major impact on the real economy and domestic financial market.

Meanwhile, the effects of non-traditional quantitative monetary easing adopted by major advanced central banks, including the US Federal Reserve Board

(FRB) and the European Central Bank (ECB) have been studied by several authors. For example, Fratzscher et al. (2016) analyzed the effects of monetary easing in the United States based on multiple regression models (QE1, 2, 3). In addition, Anayaet et al. (2017) analyzed the impact of US nontraditional monetary policy on emerging markets using a global structural VAR model. In the analysis of chairs, the FRB's mitigation policy (QE2, 3) was found to have a certain effect. On the other hand, in Europe, an analysis based on VAR by Kucharcukova et al. (2016) showed that ECB monetary easing did not significantly affect production in the six non-Euro EU countries. Churm et al. (2015) also noted that monetary easing by the Bank of England had a significant and positive impact on the UK economy, by an analysis based on the BVAR model.

Since the Bank of Japan's monetary easing policy (especially QQE) leaked a large amount of funds from Japan to other countries, the Bank of Japan's monetary policy has been effective in other countries but not in the domestic economy or market in Japan. In this regard, Ohta (2017) pointed out that the BOJ's financial expansion may have contributed to the recovery of the US market and the economy based on the BVAR model. Ohta (2018) further suggested that the Bank of Japan's monetary easing had a substantial positive impact on the Chinese market and the real economy. Meanwhile, Ganelli & Tawk (2016) showed that Japan's quantitative monetary easing has had a spill over effect on Asian emerging markets. Ganelli and Tawk (2016) also suggested that spillovers from QQE to emerging Asian countries tended to be positive using global VAR models, however, QQE with changes in the monetary base (rather than with an increase in equity prices) does not yield strong nor significant spillover effects on other countries in Asia during 2000 and 2014.

On the other hand, there has been no research comparing monetary policy under the governor of the previous Bank of Japan including Comprehensive Monetary Easing (CME) with the current QQE, as a full-fledged study of the impact of the BOJ's non-traditional monetary policy on the Japanese economy and market after the Global Financial Crisis. This paper covers the latest period (September 2008 to June 2019), and the overall results of the analysis show that, after the introduction of QQE, the impact of Japan's monetary easing policy on the domestic economy and market.

In this paper the results of the analyses indicate that QQE has hardly been effective for the economic recovery in Japan. In addition, QQE policy has not been effective in the effects on the industrial production, exchange rates, interest rates, and bank lending, rather than that period (Sept.2008 - March 2013) under former

BOJ Governor Shirakawa after the Global Financial Crisis, when monetary policy had a clearer and more significant impact upon the economy.

3. Analytical Methods

3.1 General Explanation on the Methods in the Analyses

This section is devoted to analyzing the impact of monetary policy on financial and capital / financial markets, foreign exchange, and the real economy in Japan based on the BVAR model. The BOJ has officially increased its monetary base as a major pillar of QQE policy since the end of the Fed's QE3 (October 2014), The effects of Phase II of QQE, so-called "bazooka 2" since November 2014 (2019 will be also considered the effects of monetary easing on the market and the economy.

The whole period (September 2008 to May 2019) is divided into the following periods.

- (i) After the global financial crisis (including the BOJ Comprehensive Monetary Ease [CME]) [September 2008-March 2013]
- (ii) Comprehensive Monetary Easing (CME) [October 2010 to March 2013]
- (iii) Quantitative and Qualitative Monetary Easing (QQE) [April 2013 to June 2019].
- (iv) QQE 2nd (QQEII) [November 20, 2014 to June 2019]

3.2 Bayesian VAR (BVAR) Model

The difference between Bayesian vector autoregressive (BVAR) models and standard VAR models is that the former treats model parameters as random variables and assigns prior probabilities to them. The BVAR model is used to avoid the multicollinearity and overparameterization problems that often use the VAR model. Furthermore, VAR essentially cannot correctly estimate the effect of parameters on the data, and vice versa, as pointed out by Mumtaz & Rummel (2015), it may not have economic significance. Therefore, the BVAR model is used in this paper to make the VAR model economically meaningful.

$$Y_t = c + A_1 y_{t-1} + \dots + A_p y_{t-p} + \varepsilon_t$$

The above VAR model is like the AR model, but the coefficients are composed of vectors. Here, c is a constant vector. A_i and A_p are parameter matrices, Y_t is an intrinsic variable, that is, a vector of data variables, and finally ε_t is a white noise vector error term. The model depends on A_p , and models based on the VAR model

can be inaccurate if incorrectly estimated due to data or sample period limitations. Thus, using BVAR, A_p becomes affected by y_{t-p} . It will introduce a real random variable by first giving it prior information, then being affirmed, and finally giving evidence of probability (ie real probability). This model uses the Litterman-Minnesota prior model, which is a simple model in macroeconomics. This incorporates the previous idea that intrinsic variables in a VAR follow a random walk process, whereas stationary variables follow a simple AR process.

The model in this paper is based on the model given above, but it is based on Bayesian estimation. In this paper, the BVAR model, as done by Churn (2015) et al., has a loose Prior condition, and the lag order is 4 in the model settings. In this analysis, we evaluate the effects of variable changes through various channels such as the BOJ's monetary base.

3.3 Data

In this paper, Bayesian is used to estimate the prior distribution from the data, covering the period of Post-Global Financial Crisis to date (Sept.2008 to June 2019). The BVAR model is used to estimate the response to changes in several variables (shock). The target variables are monthly data, which are as follows.

- (a) Monetary Base (MB); BOJ Current Account (BOJAC); Foreign Banks' BOJ Account Excess Reserve (Fexresv); Money stock (M2) [log]
- (b) Real Effective Exchange Rate [REER];
- (c) JGB yield (JGB Yield); Call rate; Stock price [Share]
- (d) CPI [% , year-on-year]
- (e) Bank lending [% , year-on-year]
- (f) Industrial production (seasonally adjusted) [2010 = 100; 2015 = 100 (QQE period)]

Details of each variable are summarized in the following table.

Variables	Abbreviation	Sources	Sources
Monetary Base	MB	Bank of Japan (major data series)	Bank of Japan
BOJ Current Account	BOJ AC	Bank of Japan (major data series)	Bank of Japan
Foreign Banks' Reserve, BOJ Current Account	BOJ Fresv	Bank of Japan (major data series)	Bank of Japan
Money Stocks	M2	Bank of Japan (major data series)	Bank of Japan
Real Effective Exchange Rate	REER (2010=100)	BIS effective exchange rate indices	BIS
Overnight interbank rate	Call Rate	Bank of Japan (major data series)	Bank of Japan
Government Bond Yields (av.)	Yield	IFS database (IMF)	IFS database (IMF)
Consumer price	CPI (% , y/y)	Statistical Office (Japan), International Financial Statistics (IFS) database (IMF)	Statistical Office IFS(IMF)
Bank Lending	Lending (% , y/y)	Bank of Japan (major data series)	Bank of Japan
Nikkei Stock Prices (Index based)	Share	Nikkei Profile database	Nikkei Profile
Industrial Production index (seasonally adjusted)	Prods	IFS database (IMF), Ministry of Economy & Industry	IFS (IMF), METI

Note: Industrial Production index (2010=100) used for Sept.2008-Mar.2013, while Index(2015=100) is used for Apr.2013-2019

The order of each variable in the BVAR model is determined by the impact of monetary policy and its impact on the market and the real economy. In this analysis, the model based on BVAR uses each variable at the level, but each model uses the following variables.

(i) Model 1: Impact of monetary easing on the exchange rate / real economy (Monetary base (MB) / BOJ current account (BOJAC) / Foreign Banks' Reserve, BOJAC; M2; Real effective exchange rate (REER); Share price Industrial production (PROD, seasonally adjusted)

Industrial production is usually affected by real demand, which is influenced by MB and money stock (M2). Since Model 1 should have a negative correlation between the Nikkei Stock Average and the exchange rate since 2008, the stock price and the real effective exchange rate (REER) are also considered.

(ii) Model 2: Impact of monetary easing on bank lending and interest rates (MB / BOJAC; Foreign Banks' Reserve, BOJAC M2; government bond yield / call rate, bank lending) The interest rate level (e.g., call rate) will be determined by both the demand and the supply side. Therefore, the order of Cholesky is determined as 4.3.

(iii) Model 3: Impact of monetary easing on financial markets
(CPI; REER, MB / BOJAC / M2)

Model 3 analyzes the impact of monetary easing on inflation (annual % of CPI). Since domestic price levels are generally affected by exchange rates, the real effective exchange rate (REER) is also included in the model. It also examines whether interest rates affect exchange rates under the monetary easing system.

4. Evaluation on the effects of monetary easing policies on the market and the real economy

The analysis in this section compares and evaluates the actual economic and market effects of monetary easing policies on the economy and market after the global financial crisis and the period after the introduction of QQE. In particular, the impact of both comprehensive QE, undertaken by the former Bank of Japan Governor (Mr. Shirakawa), and the current QQE on the economy and markets are compared. The analysis is divided into the following periods for the whole period (September 2008 to June 2019) as follows.

- (i) After the Global Financial Crisis (including Comprehensive Monetary Easing (CME) before the introduction of QQE) [September 2008 to March 2013]
- (ii) Comprehensive Monetary Easing (CME) [October 2010 - March 2013]

(iii) Quantitative and Qualitative Monetary Easing (QQE) [April 2013 to June 2019].

(iv) QQE II [November 20, 2014 to June 2019]

The periods of (i) and (ii) are under the previous BOJ governor Shirakawa, and the periods of (i) and (ii) are under the current governor of Kuroda. The reason for considering this different period is to analyze how the impact on the market and the real economy will differ in the previous QQE period (September 2008 to March 2013). The time of former Bank of Japan Governor Shirakawa is divided into the period before CME (March 2008 to September 2010) and the CME period (October 2010 to March 20, 2013). Although this analysis cannot secure enough variables, the change is analyzed using the minimum number of lags (2) in order to distinguish the effect during the CME period from that before⁴.

The QQE period is divided into two periods; the first period (April 2013 to October 2014 to the first period) and the second period (November 2014 to June 2019) that strengthened quantitative and qualitative monetary easing. In the analysis of this paper, it will be taken up separately as the whole QQE period and the QQE Phase II period (Nov.2014 - May 2019). In this paper, the analysis focuses primarily on the impact of quantitative monetary expansion and does not discuss the impact of the BOJ's yield curve control and negative interest rate policy during the quantitative easing period.

4.1 Unit Root Test

Before the analysis on Granger causality test and impulse response functions based on BVAR model, Augmented Dickey-Fuller Test is conducted to examine the stationarity of each variable. (The detailed results of the unit root test are shown in Appendix.)

Except for the call rate and CPI increase during the period from September 2008 to April 2013, most variables remain stationary under the first order difference. In addition, the monetary base (MB [log]) and BOJ current account (BOJAC [log]) secured stationarity at the level during both the QQE period (March 2013 to May 2019) and QQE II (November 2014 to May 2019), but other variables were all stationary with first order difference. have (stationarity).

4. In this analysis, only the impact of the first model, ie MB, on real effective exchange rates, stock prices and industrial production is analyzed for two periods before and after CQE under Governor Shirakawa.

4.2 Granger Causality Test

The impact of monetary easing on the economy and markets, both immediately after the Global Financial Crisis before and after the QQE period, has been analyzed by the Granger causality test. The numerical value shows the F value which has 2 period lags for each variable. All analyzes related to the Granger causality test are based on the results of the unit root test related to the stationarity of variables. This shows the analysis results for each period shown in Table 1.

[Sept. 2008 – Mar. 2013]

The BOJ Current Account (BOJAC) had significant Granger Causality to industrial production, while Money stock (M2) also shows causality to the real effective exchange rate (REER) during the same period. On the other hand, REER is shown to have causality to CPI and bank lending and production. It should be noted that the interest rate (call rate) had granger caused foreign banks' reserves at BOJ significantly, and REER as well as stock prices during the period. It could explain the fact that foreign banks have utilized Japanese financial market significantly.

The results indicate that monetary easing policy had significant causality to the real economy and other market-related variables during the covered period before the introduction of QQE.

Table 1: Granger Causality Test

[2008.9-2013.3]	MB*	BOJAC	Fresv	M2	REER	Call Rate	Yield	CPI	Lending	Share	Prod
Monetary Base*		1.76	1.98	0.48	0.31	1.18	0.13	0.06	1.09	0.25	2.42
BOJ Current Account	0.55		1.35	1.23	0.13	1.38	0.08	0.15	1.16	0.64	4.39 **
BOJ Fresv	0.47	1.26		0.34	1.25	8.34	2.96	0.27	0.28	0.76	0.04
Money Stock (M2)	3.30 *	1.37	0.69		2.55 *	0.46	0.24	0.20	0.27	0.65	1.24
REER(2010=100)	0.26	0.42	8.74 ***	0.77		0.09	0.25	3.55 **	2.74 *	1.99	3.50 **
Call Rate	0.55	1.37	21.9 ***	0.45	0.54		1.44	2.26	3.01 ***	1.12	6.57 ***
JGB Yield	0.88	0.20	1.83	0.87	1.73	2.32		2.45	0.15	1.09	0.02
CPI (y/y)	0.28	0.39	2.93 *	1.12	0.28	0.01		3.79 **		8.19 ***	4.26 **
Bank Lending	0.11	0.12	2.71 *	0.35	1.06	7.21 **	1.61	0.36		0.10	1.79
Share (2010=100)	0.38	0.27	9.80 ***	0.10	0.21	0.60	0.68	0.39	2.21		0.63
Ind. Production	6.78 ***	10.1 ***	3.26 *	2.17	3.15 *	8.19 ***	0.14	0.14	2.69 *	0.41	
[CME(2010.10-2013.3)]	MB*	BOJAC	Fresv	M2	REER	Call Rate	Yield	CPI	Lending	Share	Prod
Monetary Base*		2.62 *	2.69 *	0.53	0.08	0.70	1.30	0.23	2.21	0.10	1.13
BOJ Current Account	2.17		1.57	0.62	0.37	1.87	1.35	0.14	2.68 *	0.04	1.30
BOJ Fresv	0.17	0.51		0.02	2.14	0.46	0.21	1.48	1.07	0.48	2.62 *
Money Stock (M2)	2.43	1.93	2.46		0.73	1.60	1.12	0.12	0.39	0.01	1.60
REER(2010=100)	0.32	0.19	1.09	2.35		0.94	3.69 **	1.46	1.36	0.73	0.05
Call Rate	0.31	1.02	3.65 **	1.22	0.80		0.78	0.15	3.58 **	0.12	3.06 *
JGB Yield	1.77	1.37	5.52 ***	0.23	0.30	0.85		0.64	0.35	0.96	1.14
CPI (y/y)	0.49	0.37	3.58 **	0.02	0.08	0.18	0.37		0.81	1.07	0.30
Bank Lending	2.29	1.56	0.95	0.34	0.26	1.22	0.59	2.73		1.44	1.56
Share (2010=100)	0.36	0.37	1.49	0.44	0.69	1.62	1.06	0.21	2.82 *		0.75
Ind. Production	8.74 ***	6.72 ***	0.79	2.04	2.97 *	11.20 ***	0.27	0.08	4.68 **	0.08	
[QQE(2013.4-2019.6)]	MB*	BOJAC	Fresv	M2	REER	Call Rate	Yield	CPI	Lending	Share	Prod
Monetary Base*		6.39 ***	2.93 *	8.03 ***	0.04	1.35	0.12	0.30	0.81	0.74	0.01
BOJ Current Account	7.83 ***		2.83 *	12.29 **	0.30	0.76	0.04	0.83	0.78	0.81	0.01
BOJ Fresv	0.87	1.35		2.00	1.84	0.45	0.13	0.95	0.68	1.12	0.07
Money Stock (M2)	8.51 ***	5.72 ***	0.80		2.17	3.99 **	0.59	0.01	1.07	1.28	0.50
REER(2010=100)	1.79	0.59	0.97	5.27 **		1.70	0.64	0.15	1.08	0.30	0.49
Call Rate	1.00	0.70	0.93	2.69 *	1.06		0.48	1.02	0.97	0.87	3.49 *
JGB Yield	2.93 *	2.45	0.89	8.00 ***	0.28	3.07 *		0.26	1.95	0.66	0.36
CPI (y/y)	0.34	0.43	0.47	0.39	0.13	0.08	0.07		0.08	0.05	1.36
Bank Lending	0.71	0.97	0.24	0.27	0.27	0.35	0.24	0.08		0.07	0.03
Share (2010=100)	0.12	0.35	4.32 **	1.75	0.70	2.25	1.28	0.03	0.11		0.38
Ind. Production	0.23	0.33	0.40	1.69	1.64	0.54	1.23	0.76	0.10	0.73	
[QQE(2014.11-2019.6)]	MB*	BOJAC	Fresv	M2	REER	Call Rate	Yield	CPI	Lending	Share	Prod
Monetary Base*		2.62 *	1.28	1.17	0.17	0.86	0.95	0.35	0.66	0.34	2.25
BOJ Current Account	2.70 *		1.45	0.94	0.45	0.62	1.50	0.42	0.62	0.53	2.23
BOJ Fresv	1.30	1.58		2.62 *	1.20	0.11	0.13	0.18	0.63	0.11	1.57
Money Stock (M2)	3.31 *	2.07	0.80		0.53	2.82 **	0.04	0.74	0.99	0.81	1.93
REER(2010=100)	2.72 *	2.07	0.10	2.82 *		1.61	1.95	0.47	0.77	0.05	1.83
Call Rate	2.37	2.03	0.61	2.29	1.53		0.31	1.40	0.67	0.68	3.62 **
JGB Yield	0.67	0.80	0.11	2.23	0.90	2.12		0.69	1.58	1.32	0.75
CPI (y/y)	0.25	0.47	1.82	0.00	0.16	0.25	0.10		0.00	0.55	0.32
Bank Lending	0.17	0.22	0.12	1.69	0.27	0.18		0.95		0.06	0.53
Share (2010=100)	0.09	0.10	2.98 *	1.58	2.31	1.60	2.41	0.22	0.43		0.52
Ind. Production	0.38	0.80	1.54	0.36	2.02	0.45	0.13	0.21	0.46	0.66	

Notes: 1. MB, BOJAC and M 2 are logarithm. .

2. 2010=100 for REER, Share Prices and Production, (2008-2013); 2015=100 for Ind Production during 2013-2019

3. All the variables indicate F-Statistics, which are basically 1st lag based ones;

4. Granger Causality tests are based on the 2 lags. Significance at 1%; 5%, 10% shown as ***, **, *, respectively.

Sources: WEO database (IMF), Bank of Japan, BIS, Statistics Office (Japan), METI (Japan), Nikkei Profile

[Oct. 2010 – Mar. 2013] (CME)

During this period, monetary base (MB) had significant causality to the BOJ current account (BOJAC), including foreign banks reserves, but there is no direct causality to share prices, industrial production, etc. During this period, only call rate and foreign banks' reserve at BOJ Granger caused to industrial production. In addition, stock prices and industrial production also show significant causality to

bank lending. It is noted that foreign banks' reserves at BOJ current account had no causality to REER and stock prices any more during the CME. It could indicate that during this period foreign financial institutions were not involved heavily in the financial market in Japan.

In general, causality to the real economy was more significant in the whole period (Sept. 2008 to Mar 2013) than that during CME. This shows that the previous period before introduction of CME had relatively significant effects on the economy and market.

[April 2013 – June 2019] (QQE)

During the QQE period, MB, BOJAC, and money stock (M2) had strong Granger causality to each other. However, MB / BOJAC / M2 had almost no significant Granger causality to other variables of industrial production, exchange rate (REER) and market-related indicators; only M2 has Granger causality to call rate, which shows that only financial market transaction-related indicators have causality, not for the real economy.

On the other hand, CPI has not Granger caused to any variable significantly, and it suggests that monetary easing under QQE does not have a significant causality to inflation rate. This is consistent with the impulse response functions and variance decomposition results based on the BVAR model described in the next section.

It is also noted that foreign banks' reserves at BOJ had no causality to any variables in the financial market. Except the stock market in Japan during the QQE period. This may indicate that the substantial money provided under QQE might have been transferred to the US and other markets, and this could be different from the former period under the Shirakawa's BOJ period.

[Nov. 2014 – June 2019] QQE II]

In QQE Phase II, as with the results of the total QQE period, the expansion of monetary base (MB) has not Granger caused to industrial production and real effective exchange rate (REER) as well as CPI. It is also shown that the MB expansion has no causal relationship with the stock price, as in the whole QQE period.

The above results indicate that quantitative qualitative easing (QQE) has generally no causality to the real economy (industrial production) and has not directly caused Yen's exchange rate (real effective exchange rate). This suggests that QQE has had no substantial impact on the Japanese economy and financial market.

It also shows that QQE has not caused to Yen's exchange rate, which cannot support the argument that monetary easing has been effective for Yen's depreciation and raising share prices. In order to verify the above results, analyses on the impulse response functions as well as variance decomposition based on the BVAR model will be shown in the following sections. Furthermore, in QQE (including QQE II), the fact that bank lending has not directly caused share prices and production activities is also shown in the impulse response functions in 4.4 and by variance decomposition (4.5).

4.3 Cholesky Decomposition and Order of Variables

When examining the impulse response function, the order of variables is determined along the Cholesky decomposition. The order of variables is determined that the variable with the most exogenous variables are set the first and the variable with the most endogenous is the last.

In order to examine the influence of each monetary base, the order of Cholesky is as follows.

In the first model (Model 1), the effect of industrial production (PROD) is placed before the real effective exchange rate (REER). This is because the yen exchange rate may affect the stock price, and the effect will be verified. In addition, since the expansion of monetary base (MB) has several channels that affect other variables, MB, BOJ current account (BOJAC), and money stock (M2) are placed last in this model.

The second model, on the other hand, examines the impact of financial expansion on financial markets and bank loans. This model looks at how money growth affected interest rates and bank lending.

In the third model, in order to see whether the expansion of money will put impact on the inflation rate, as the Reflationary arguments claim, as well as the exchange rate (REER) on the CPI rate are analyzed.

(i) Model 1 [PROD/ REER/ Share/ MB · BOJAC · Fresv · M2]

PROD

PROD REER

PROD REER Share

PROD REER Share [MB · BOJAC · Fresv · M2]

(ii) Model 2 [MB · BOJAC · Fresv · M2/ BOJ Yield/ Call Rate/ LEND]

[MB · BOJAC · M2 · Fresv]

[MB · BOJAC · M2 · Fresv] BOJ Yield

[MB · BOJAC · M2 · Fresv] BOJ Yield Call Rate

[MB · BOJAC · M2 · Fresv] BOJ Yield Call Rate LEND

(iii) Model 3 [CPI/ / REER/ MB · BOJAC · M2]

CPI

CPI REER

CPI REER [MB · BOJAC · M2]

4.4 Impulse Response Functions

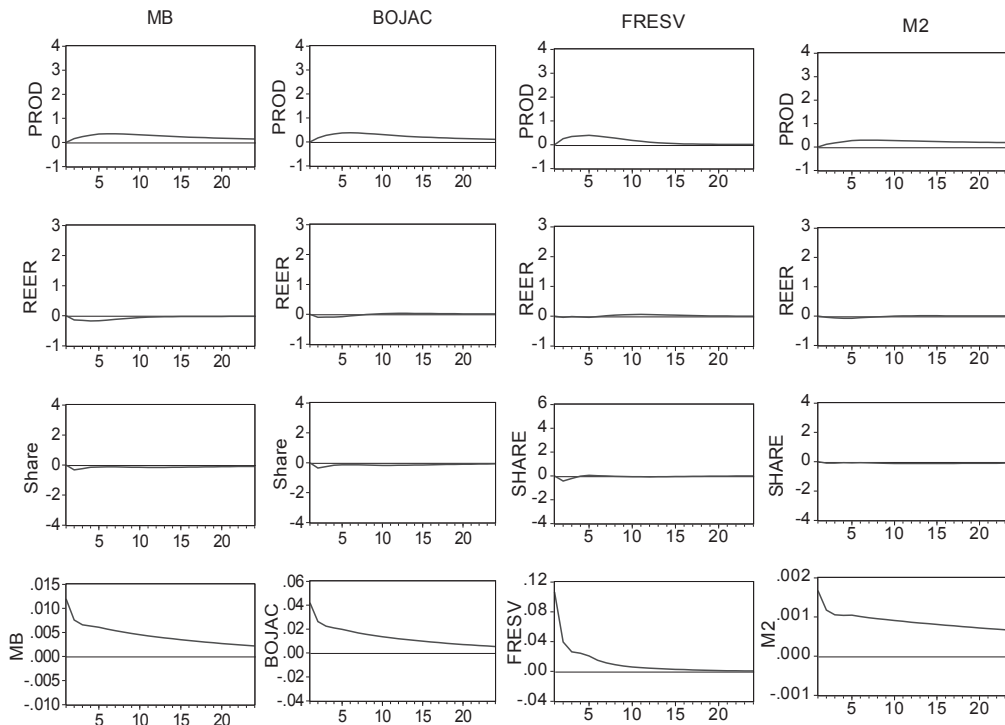
The analysis of the impulse response functions of the BVAR model is based on a level without differences for each variable. As shown below, after the Global Financial Crisis (September 2008 to March 2013), including comprehensive monetary easing (CME) monetary easing had significant effects on real effective exchange rate (REER), interest rate (government bond yield, call rate) as well bank lending. In contrast, Monetary easing policy under QQE has had little effect on market indicators, including real effective exchange rate and interest rate level. QQE has also limited impact on bank lending and industrial production (Fig. 12-1, 12-2, 12-3).

4.4.1 Impulse Response Functions (1) : Effects of MB/BOJAC/M2 on Industrial Production, REER

(a) Post- Global Financial Crisis (Sept. 2008- Mar. 2013)

The overall effect of monetary easing between September 2008 and March 2013 has had a positive impact on the real economy. The monetary base (MB), BOJ current account (BOJAC), Foreign banks' BOJ reserves (Fresv) and money stock (M2) had a significant effect on industrial production. On the other hand, the stock price response to MB / BOJAC / M2 had almost no significant effect (Fig. 12-1). The exchange rate (REER) also was not affected by MB, BOJAC, Fresv and M2 during the period.

Re-evaluation of the Bank of Japan's monetary easing policy after the Global Financial Crisis



**Fig. 12-1: BVAR Impulse Response to MM /BOJAC/ Fexresv/ M2
(Sept.2008-Mar.2013)**

It should be noted that foreign investors have actively invested in the US market as the US economy followed a recovery path at this period. Therefore, the stock price could be mainly determined by the portfolio allocation of foreign investors and the capital flows during that period. Therefore, the impact on production and financial markets was slightly different before and after the Comprehensive Monetary Easing (CME) during this period.

(b) Pre-CME (Sept.2008- Sept.2010)

During this period, the expansion of monetary easing (MB / BOJAC/ Fresv/M2) put a positive and significant response of the real economy (industrial production). On the other hand, there is no significant effect of monetary easing on the real effective exchange rate (REER) (Fig. 12-2).

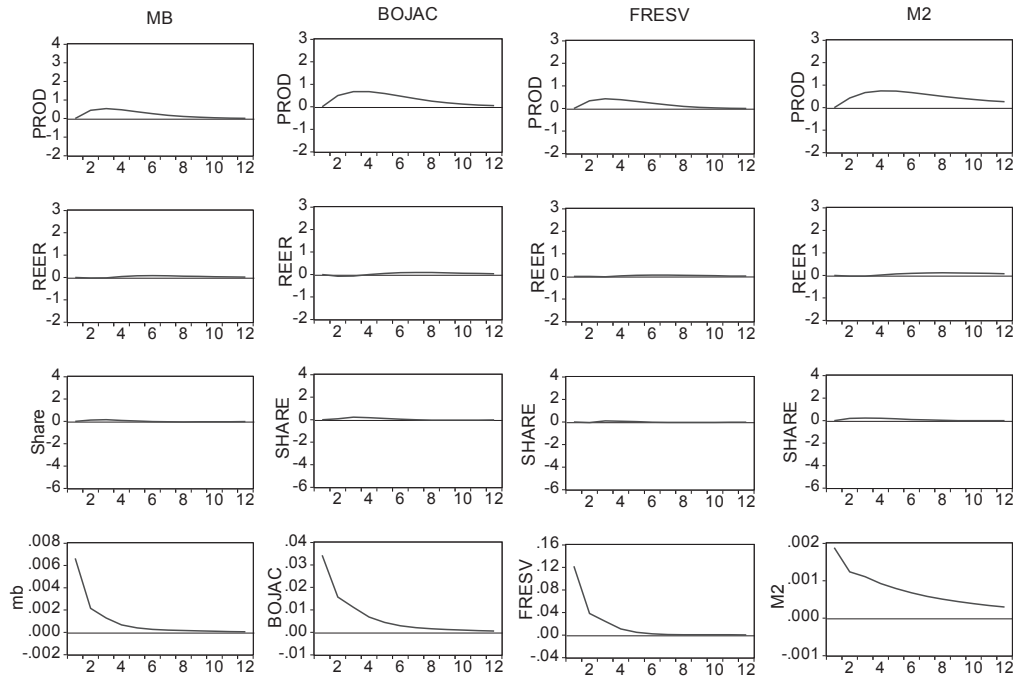
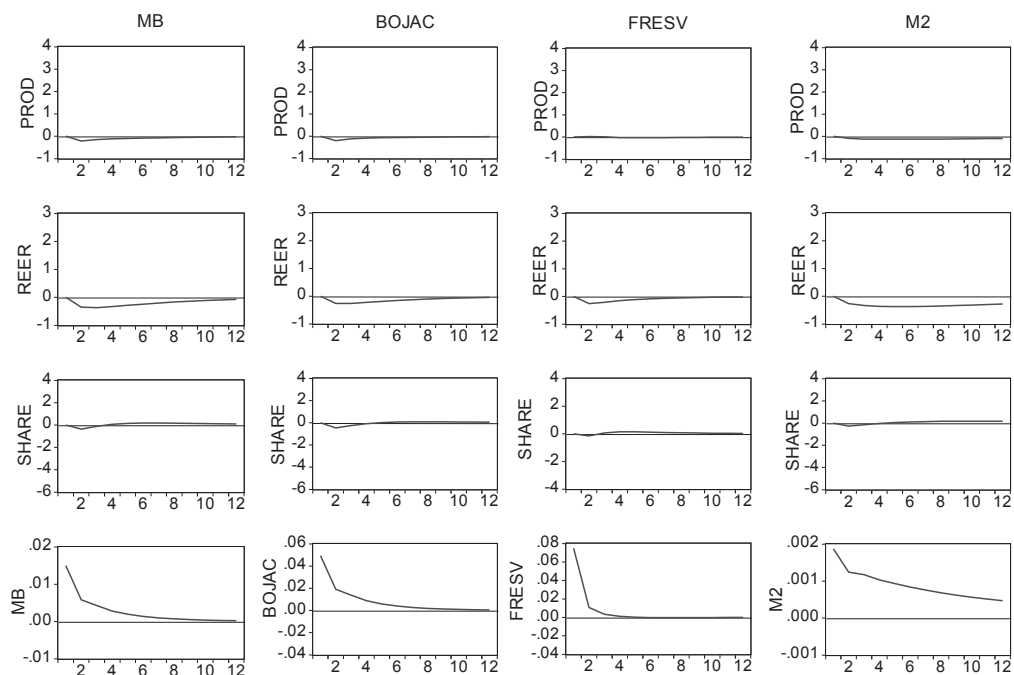


Fig. 12-2: BVAR Impulse Response to MM /BOJAC/ Fexresv/M2 (Sept.2008-Sept.2010)

(c) Comprehensive Monetary Easing [CME] (Oct. 2010 – Mar. 2013)

In the period of Comprehensive Monetary Easing (CME), the impact of MB / BOJAC / M2/ Fexresv on industrial production was not as significant as the former period (Sept 2008 – Sept. 2010), but each variable of MB / BOJAC / Fresv/ M2 was significantly effective for real effective exchange rate (REER), which shows some effects of monetary easing in foreign exchange market (Fig. 12-3). However, the shift of production facilities accelerated from Japan to Asian countries during the period, due to Yen’s sharp appreciation despite of monetary easing during this period. This would explain the background of MB’s expansion had insignificant impact on domestic industrial production.

Re-evaluation of the Bank of Japan's monetary easing policy after the Global Financial Crisis

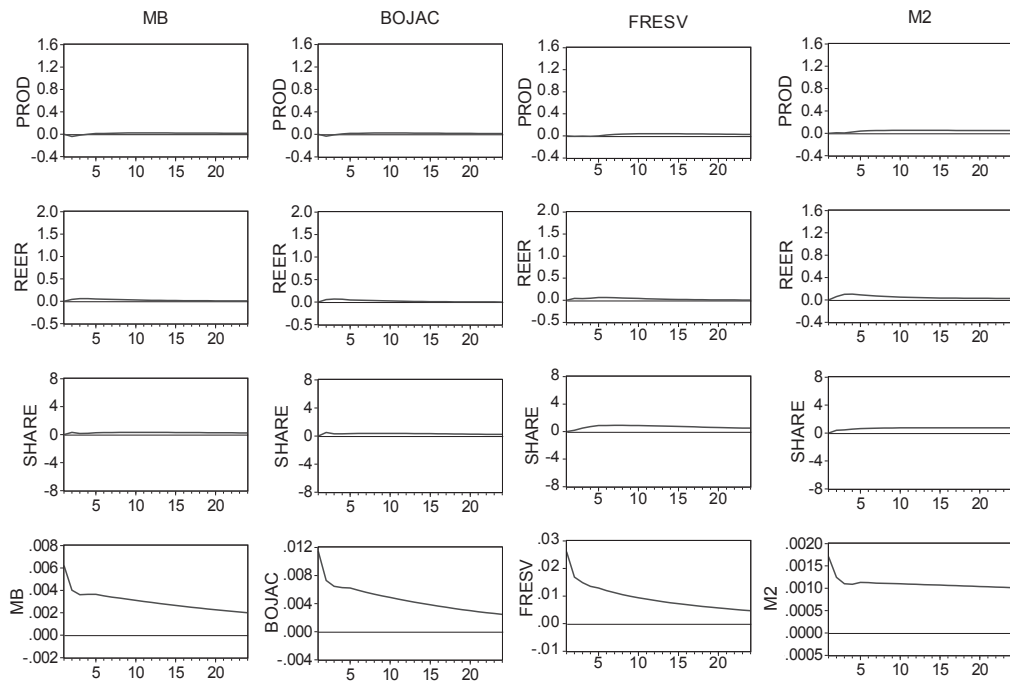


**Fig. 12-3: BVAR Impulse Response to MM /BOJAC/ Fexresv/M2
(Oct.2010-Mar.2013)**

(d) QQE (April 2013 – June 2019)

The impact of monetary easing on the real economy and the market under QQE has been limited (Fig.12-4). Impulse response function of exchange rate (REER) and share price as well as industrial production (PROD) to MB / BOJAC / Fresv/ M2 show insignificant and smaller responses, as compared with that before QQE (September 2008-March 2013).

On the other hand, the expansion of MB and M2 has little effect on the real effective exchange rate (REER). Moreover, although it is not statistically significant, it has an influence on the appreciation of exchange rate (REER) rather than depreciation. This indicates that the effect is opposite to the expected effect of monetary easing policy.



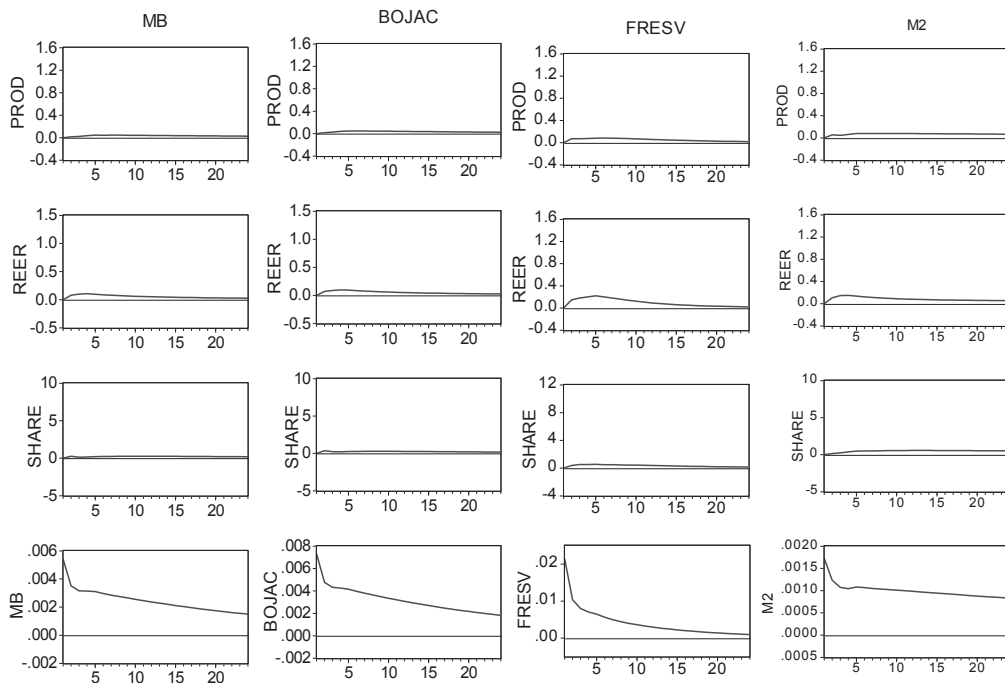
**Fig. 12-4: BVAR Impulse Response to MM /BOJAC/ Fexresv/ M2
(Mar.2013-June 2019)**

(e) QQE II (Nov. 2014 – June 2019)

Although MB / BOJAC / M2 had a slightly positive response function for industrial production, these were very limited and not statistically significant. The impulse response of the share price to MB / BOJAC also does not show a significant effect, which is the same result as the whole QQE period (Fig.12-5).

As described above, QQE’s significant monetary easing has not resulted in positive response of the real economy (industrial production), share prices, compared to the previous period. There has been no significant impact on the exchange rate (real effective exchange rate, REER) by monetary expansion during the period (QQE II).

Re-evaluation of the Bank of Japan's monetary easing policy after the Global Financial Crisis



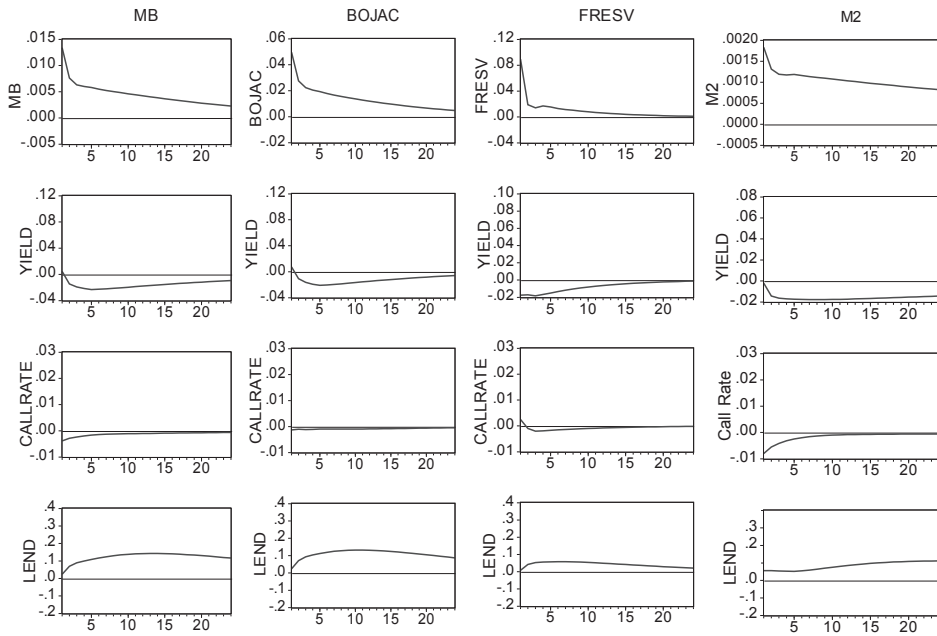
**Fig. 12-5: BVAR Impulse Response to MM /BOJAC/ Fexresv/M2
(Nov. 2014- June 2019)**

4.4.2 Impulse Response Functions (2) : Effects of MB / BOJAC / M2 on Financial Market

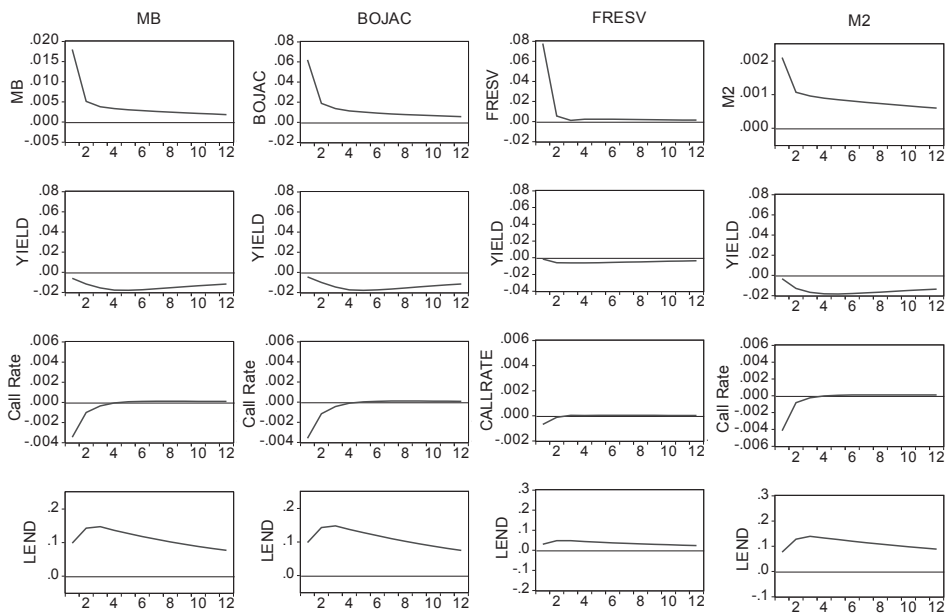
Before the introduction of QQE and during the QQE period, the expansion of the monetary base (MB), BOJ Current Account (BOJAC), Foreign banks' reserves (FRESV) and M2 will be verified using impulse response functions, as shown in the response to changes interests and bank lending.

(a) Post-Global Financial Crisis(Sept. 2008 – Mar. 2013)

During the period (September 2008 to March 2013), MB, BOJAC, and money stock (M2) had a significant positive effect on bank lending (Fig. 13-1). In addition, the MB / BOJAC expansion has worked significantly on interest rates, especially government bond yields, during this period



**Fig. 13-1: BVAR Impulse Response to MB/BOJAC/Fresv/ M2
(Sept.2008-Mar.2013)**



**Fig. 13-2: BVAR Impulse Response to MB/BOJAC/ Fresv/M2
(Oct.2010-Mar.2013)**

(b) CME (Oct. 2010 – Mar. 2013)

In the period of Comprehensive Monetary Easing (CME), Monetary Base (MB), BOJ current account balances (BOJAC), and money stock (M2) had significantly positive impact on bank lending (Figure 13-2). MB / BOJAC expansion also had some expected effect on interest rates (government bond yields/ Call Rate during this period, the effects were not large as the total period of Post-Global Financial Crisis (Sept. 2008 to March 2013).

(c) QQE (April 2013 – June 2019)

Throughout the period of QQE, the expansion of MB and BOJAC has not had a significant effect on bank lending (Figure 13-3). During the period, M2 responded positively and significantly to bank lending compared to MB / BOJAC. Although M2 might have put limited effect on bank lending, the M2 had hardly put positive response of industrial production, as the same responses of MB / BOJAC during the same period, as mentioned above.

On the other hand, the impulse response functions of the interest rates (call rate and JGB yield) to MB / BOJAC / M2 put some responses to interest rates but they are insignificant and limited.

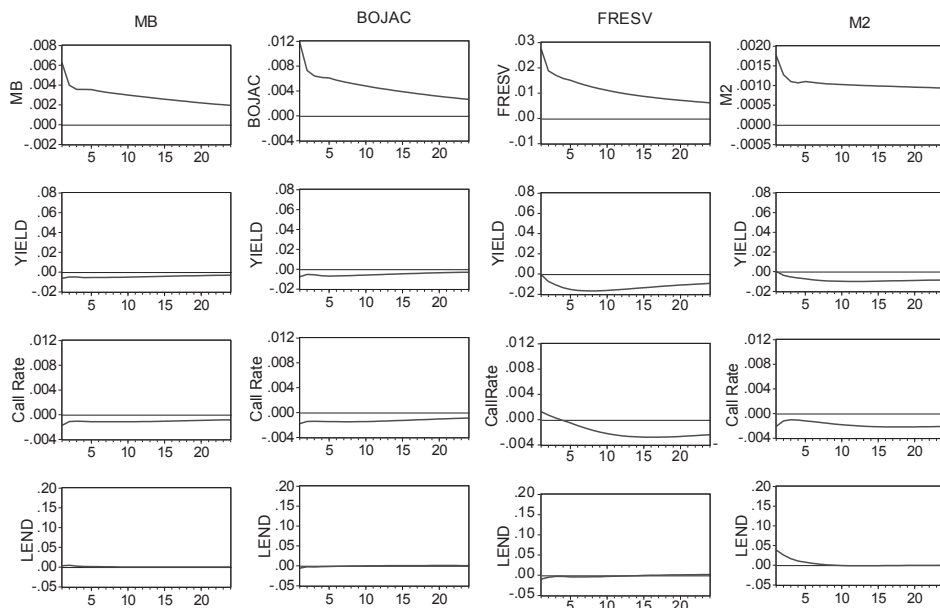
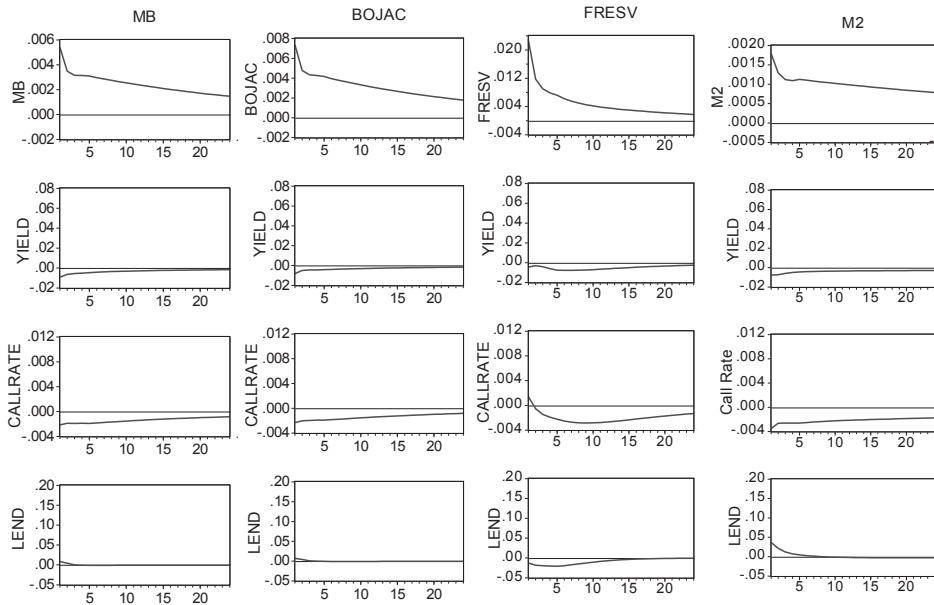


Fig. 13-3: BVAR Impulse Response to MB/BOJAC/ Fresv/M2 (Apr. 2013-June 2019)

(d) QQE Phase II] (Nov. 2014 – June 2019)

The response of Bank lending to MB / BOJCA has been very limited during the period (QQE II), and their absolute values are much smaller than that under the CQE period (Fig.13-4). In addition, the impulse response functions of interest rates (JGB Yield and Call rate) to M2 show a certain effect but limited and insignificant.

From the results of impulse response functions of the above, the monetary easing under the CME period had a significantly larger impact on bank lending, compared to the overall QQE period. In addition, the impulse responses of the interest rates (JGB yield, call rate) to money expansion during the CME period were more significant than that during the QQE period.



**Fig. 13-4: BVAR Impulse Response to MB/BOJAC/ Fresv/M2
(Nov. 2014- June 2019)**

4.4.3 Impulse Response Functions (3): Effects of MB / BOJJAC /M2 on CPI and REER

(a) Post-Global Financial Crisis (September 2008 - March 2013)

The expansion of monetary base (MB) and BOJ current account (BOJAC) had a positive impact on the rise of CPI rate, throughout the period from September 2008 to March 2013 (Figure 14-1). It is also noted that inflation rate (CPI) has affected the increase in the real effective exchange rate (REER).

(b) CME (Oct. 2010 - Mar. 2013)

In the period of Comprehensive Monetary Easing (CME), the expansion of MB and BOJ current account (BOJAC) did not have a significant effect on the increase in CPI, while it had a more significant effect on Yen's exchange rate (Real Effective Exchange Rate [REER]), as expected in theoretical argument (Fig.14-2).

On the other hand, appreciation of Yen (rise in REER) has a positive and significant effect on CPI. Although this is different from the expected results of conventional theory, it could be caused by the global market situation (especially under the Euro Crisis) in the period when a sharp appreciation of the yen triggered by the shift to the relative "safe currency" yen under the zero interest. It should be also noted that the domestic economy in Japan was in a process of recovery in those periods.

(c) QQE (April 2013 – June 2019)

The expansion of MB / BOJAC over the QQE period has little effect on inflation rate (CPI). Although M2 has a slight effect on the real effective exchange rate (REER), MB and BOJAC have almost no significant effect on CPI (Fig.14-3).

Appreciation of exchange rate (real effective exchange rate, REER) has hardly significant effect on inflation rate (CPI) during the QQE period. Although the response function of CPI to M2 has a non-significant negative effect, the overall effect is very limited. In addition, CPI has put a negative effect on the real effective exchange rate (REER), which shows putting pressure for depreciation of Yen, which cannot be explained by an ordinary theory. Thus, these results could show that monetary expansion has not put significant effects on inflation nor Yen's exchange rate. Therefore, the exchange rate levels should have been dependent on external factors such as speculation and investment in the foreign exchange market, as global investors would put general direction of portfolio allocation.

The results of the above would clearly show that monetary easing under QQE has not been effective in achieving the inflation target that was expected throughout QQE, and that there is little effect on depreciation of yen during the period. These results imply that the monetary policy under QQE has not proved any significant effects on the economy and market.

(d) QQE Phase II (November 2014 - June 2019)

The results for QQE Phase II (November 2014 to May 2019) are almost the same as the results for the entire QQE period described above. The CPI and REER response functions to MB / BOJAC / M2 show no significant effect (Figure 14-4). In addition, the response function of REER to CPI shows the same response as in the whole QQE period. It has become clear that the latter (REER's response function to CPI increase rate) has had significantly negative.

As shown above, monetary easing had a certain effect on the real effective exchange rate during the period of comprehensive monetary easing before QQE, but in the quantitative and qualitative easing (QQE) period there is no significant effect on the exchange rate (REER) nor inflation rate (CPI), despite a substantial increase in money supply. Moreover, the negative and significant response of the CPI rate to the real effective exchange rate (REER) is not as expected. The expansion of the money supply has not resulted in rising inflation rate through inflation expectations during this period, and it has not put any significant effect on depreciation of exchange rates during the QQE period.

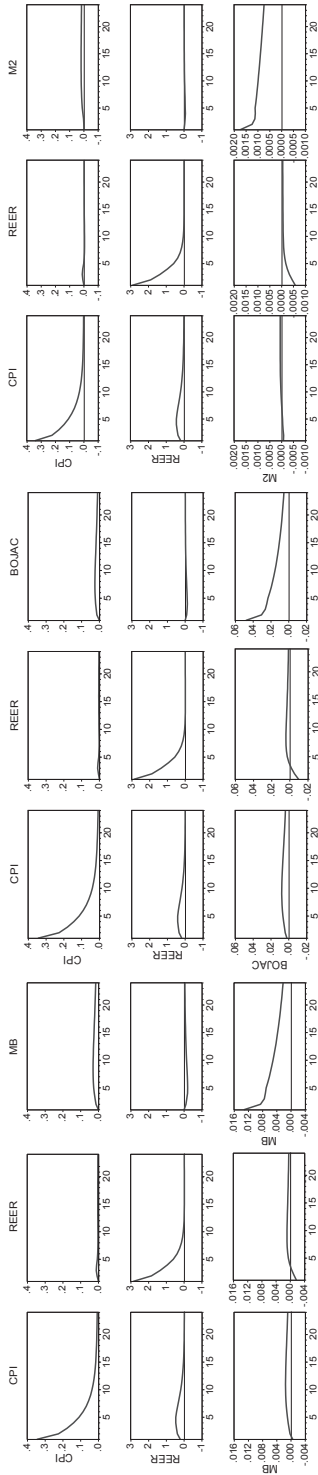


Fig. 14-1: BVAR Impulse Response to MM/BOJAC/M2 (Sept.2008 - Mar.2013)

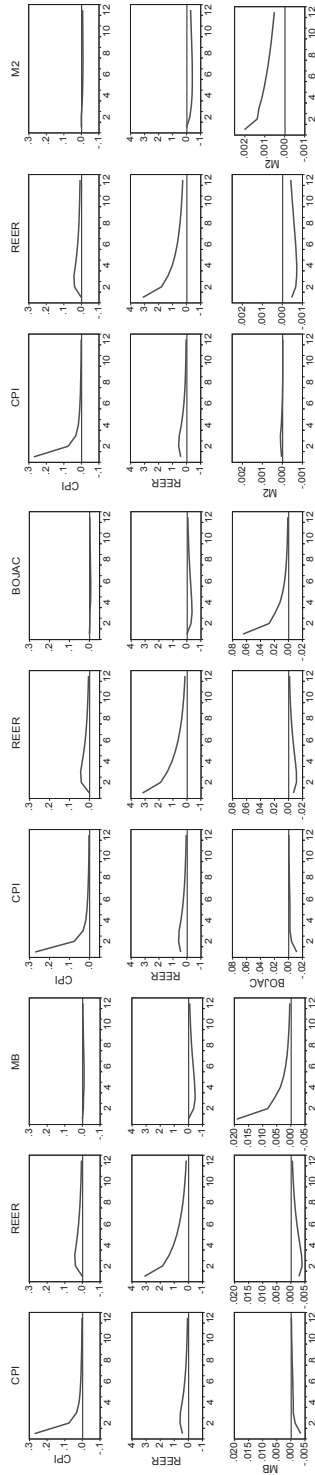


Fig. 14-2: BVAR Impulse Response to MM/BOJAC/M2 (Oct.2010 - Mar.2013)

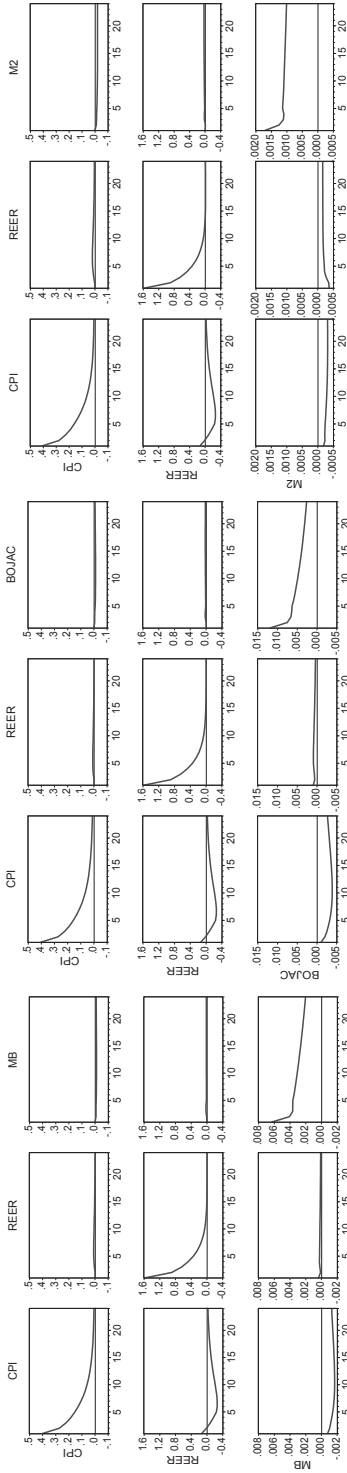


Fig. 14-3: Impulse Response to MB/BOJAC/M2 CPI/REER (Apr.2013 - June 2019)

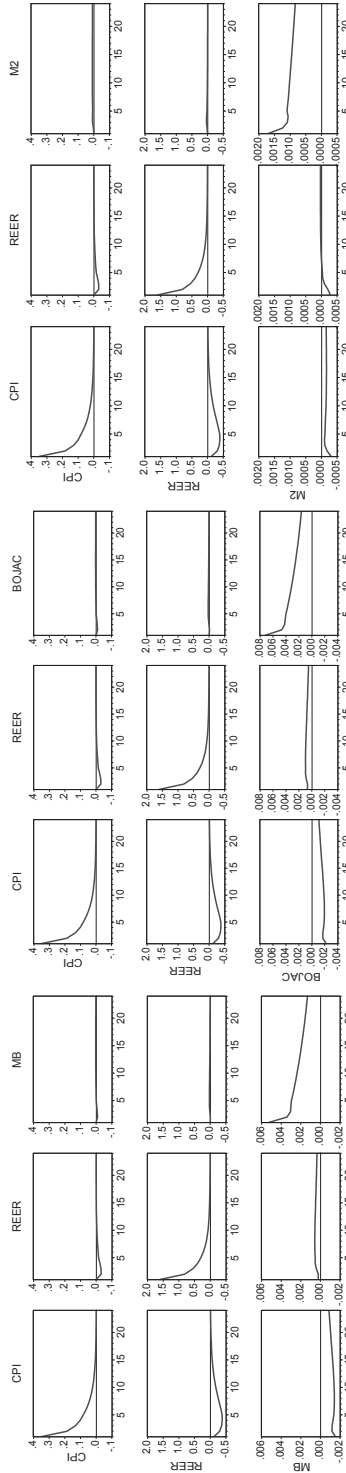


Fig. 14-4: Impulse Response to MB/BOJAC/M2 CPI/REER (Nov.2014 - June 2019)

4.5 Variance Decomposition

The variance decomposition of BVAR is to be analyzed on the important variables (industrial production, CPI, REER, and bank lending) related to monetary easing in each period before and after QQE. The results of variance comparison on the effectiveness of monetary easing policies are given as follows.

4.5.1 Effects on the Real Economy (Industrial Production)

From September 2008 to March 2013 (before QQE), monetary easing has had a significant impact on the real economy (Table 2). For example, the share of the monetary base (MB) in industrial production was 3.9% of MB in the last period of the 10th period, and 6.0% of the real effective exchange rate (REER). On the other hand, during the QQE period (April 2013 to June 2019), shares of MB and REER were only 0.22% and 0.24%, respectively.

Based on the above results, the monetary base / M2 and exchange rate (REER) had a larger impact on the real economy from September 2008 to March 2013 (before QQE including CQE) than that under QQE.

Table 2: Variance Decomposition (Industrial Production)

Sept..2008- Mar.2013	Period	S.E.	PROD	REER	SHARE	MB
	1	3.787	100.000	0.000	0.000	0.000
	2	4.295	99.091	0.656	0.124	0.129
	9	4.753	90.108	5.972	0.430	3.490
	10	4.766	89.693	5.951	0.438	3.917
Oct..2010- Mar.2013 (CME)	Period	S.E.	PROD	REER	SHARE	MB
	1	3.787	100.000	0.000	0.000	0.000
	2	3.728	98.153	1.514	0.007	0.326
	9	3.858	92.792	6.430	0.071	0.708
	10	3.861	92.700	6.512	0.071	0.717
Apr.2013- June.2019 (QQE)	Period	S.E.	PROD	REER	SHARE	MB
	1	1.256	100.000	0.000	0.000	0.000
	2	1.308	98.354	0.089	1.447	0.110
	9	1.362	95.868	0.220	3.719	0.193
	10	1.362	95.819	0.241	3.724	0.216

Sources: Bank of Japan, BIS, METI, IMF database,

4.5.2 Effects on CPI

In the variance decomposition on CPI rate, the share of MB in the 10th period was 2.4% in the period from September 2008 to March 2013 (Table 3). Although this

share is relatively small, it is larger than the 0.22% during the QQE period (April 2013 to June 2019).

On the other hand, the share of the real effective exchange rate (REER) in the 10th period was 0.16% during September 2008 and March 2013, but it was higher at 7.2% in the CME period. This may be due to the rapid appreciation of the yen caused by the Euro Crisis during the CME period. Therefore, in the QQE period when the crisis was settled, the share of REER in the variance decomposition fell to 0.16% in the 10th period.

The above results show that monetary easing under QQE has little impact on inflation, despite the 2% inflation target that has been strongly promoted. The results are also in line with the results of the impulse response functions in the former section.

Table 3: Variance Decomposition (CPI)

Sept..2008- Mar.2013	Period	S.E.	CPI	REER	MB
	1	0.347	100.000	0.000	0.000
	2	0.414	99.858	0.034	0.108
	9	0.507	97.794	0.155	2.051
	10	0.509	97.471	0.157	2.372
Oct..2010- Mar.2013 (CME)	Period	S.E.	CPI	REER	MB
	1	0.271	100.000	0.000	0.000
	2	0.285	98.068	1.893	0.039
	9	0.297	92.211	7.182	0.608
	10	0.297	92.122	7.245	0.633
Apr.2013- June.2019 (QQE)	Period	S.E.	CPI	REER	MB
	1	0.406	100.000	0.000	0.000
	2	0.490	99.977	0.000	0.023
	9	0.623	99.673	0.144	0.183
	10	0.626	99.630	0.156	0.214

Sources: Statistics Office, BOJ, BIS database

4.5.3 Effects on Exchange Rate(Real Effective Exchange Rate, REER)

The ratio of the monetary base (MB) in the variance decomposition of the real effective exchange rate (REER) in the 10th period of was 0.97% from September 2008 to March 2013 and reached 2.8% in the CME period, but it has decreased to 0.3% during the QQE period (Table 4). Likewise, the ratio of industrial production was 17.4% in the 10th period during September 2008 and March 2013, but its share fell to 1.72% during the QQE period.

Table 4: Variance Decomposition (REER)

Sept..2008- Mar.2013	Period	S.E.	PROD	REER	SHARE	MB
	1	2.567	0.154	99.846	0.000	0.000
2	3.199	3.163	95.121	1.526	0.190	
9	3.985	17.336	79.898	1.814	0.952	
10	3.990	17.422	79.779	1.826	0.973	
Oct..2010- Mar.2013 (CME)	Period	S.E.	PROD	REER	SHARE	MB
	1	2.941	3.518	96.482	0.000	0.000
2	3.616	5.950	92.649	0.475	0.926	
9	4.606	9.523	87.204	0.475	2.798	
10	4.622	9.593	87.097	0.472	2.839	
Apr.2013- June.2019 (QQE)	Period	S.E.	PROD	REER	SHARE	MB
	1	1.588	0.048	99.952	0.000	0.000
2	1.890	0.121	97.998	1.835	0.047	
9	2.371	1.630	91.284	6.797	0.289	
10	2.381	1.724	91.031	6.946	0.300	

Sources: BOJ., Nikkei Profile, BIS, IMFdatabase

The above results indicate that the impact on the exchange rate (REER) for industrial production was more important during the period prior to QQE (September 2008 to March 2013). In the same period including the Global Financial Crisis and the euro crisis, this suggests that exchange rate fluctuations had significantly been affected by the global economic and market conditions, which have had impact on the real economy (industrial production). This confirms that monetary easing under QQE had almost no significant and substantial impact on the exchange rate (REER).

4.5.4 Effects on bank lending

The ratio of monetary base (MB) in the tenth period from September 2008 to March 2013 in the variance decomposition of bank lending was 23.4% and further rose to 52.4% in the CME period (Table 5). On the other hand, the share of MB during QQE period was only 0.1%. This shows that the MB expansion did not directly lead to bank lending has not increased during the period. On the other hand, the shares of JGB yield and call rate in variance decomposition were 1.12% and 12.2%, respectively in the period from September 2008 to March 2003, while they are only 0.53% and 1.1%, respectively during the QQE period.

In this way, the interest rate (call rate / JGB yield) has significantly decreased in its share during the QQE period, and MB has not put any effect on bank lending. This would suggest that bank lending could be utilized for non-productive investment such as financial investment and/ or investment in real estate in the QQE period.

Table 5: Variance Decomposition (Bank Lending)

Sept.2008- Mar.2013	Period	S.E.	MB	Yield	CallRate	LEND
	1	0.363	0.429	1.163	17.479	80.929
2	0.447	2.702	1.457	15.060	80.780	
9	0.687	20.946	1.087	11.696	66.271	
10	0.711	23.363	1.117	12.222	63.298	
Oct..2010- Mar.2013 (CME)	Period	S.E.	MB	Yield	CallRate	LEND
	1	0.230	18.254	4.989	2.221	74.535
2	0.297	34.014	3.100	2.113	60.774	
9	0.503	51.943	1.212	1.743	45.102	
10	0.516	52.404	1.162	1.729	44.704	
Apr.2013- June.2019 (QQE)	Period	S.E.	MB	Yield	CallRate	LEND
	1	0.172	0.034	0.128	1.237	98.601
2	0.201	0.080	0.343	1.113	98.464	
9	0.234	0.083	0.501	1.055	98.361	
10	0.234	0.083	0.526	1.097	98.294	

Sources: BOJ database

As shown in the above results, the expansion of monetary base (MB) under QQE has not actually lead to an increase in bank lending in the domestic economy, and it did not increase in productive investment for the real economy (industrial production).

Concluding Remarks

This paper compares the effectiveness of BOJ's monetary policy after the Global Financial Crisis, especially those during the former BOJ Governor Shirakawa, including Comprehensive Monetary Easing (CME), and the current Quantitative and Qualitative Monetary Easing (QQE) policy under Governor Kuroda. The analyses examined the impact of the BOJ's monetary easing policy on the Japanese market / economy, with variables of industrial production, monetary base (MB), BOJ current account (BOJAC), money stock [M2], government bond yield, call rate, stock price (Nikkei index), real effective exchange rate (RERR), and bank loans are used as variables.

The result of Analyses based on Bayesian VAR (BVAR) model, large-scale monetary expansion under QQE is not effective for economic recovery and the inflation target of 2%, which has been set as an important objectives of "Abenomics" The analysis in this paper also revealed that monetary easing including CME, which was adopted under the former Governor Shirakawa, had a greater impact on the economy and market, in terms of industrial production, exchange rate (REER),

interest rates, bank lending, as compared to that under QQE. The results have shown that QQE has not have positive effect on the real economy and financial markets, as well as exchange rates. The main results of the analysis are as follows:

- (a) Monetary base (MB) and BOJ current account (BOJAC) from September 2008 to March 2013 had a positive impact on industrial production (especially from September 2008 to September 2010 before the introduction of CME). During the same period, it has had relatively effective for exchange rates (real effective exchange rate, REER).
- (b) MB / BOJAC had a significant impact on bank lending and interest rate level (call rate / government bond yield) in the same period.
- (c) QQE did not have a substantial effect on the market and the real economy. During QQE (April 2013 to May 2019), MB / BOJAC's impact on industrial production was limited (not statistically significant). Interest rates (JGB Yield and call rate) have not put any effect on bank lending.
- (d) Expansion of MB / BOJAC under QQE has no significant effect on Yen's exchange rate (real effective exchange rate, REER), so that QQE cannot be regarded as an important factor for the depreciation of Yen until recently.
- (e) Despite the continued monetary easing policy during QQE (Phase II) after November 2014 [QQE II ("Bazooka II")], the results obtained in the analyses had no major changes as in the whole period (April 2013 to May 2019), and the annual inflation target of 2% remains unfulfilled.
- (f) The above results are supported not only by the impulse response function but also by the variance decomposition of each variable. Especially, each variable of variance composition during the QQE period show that monetary easing under QQE had no significant impact upon industrial production, exchange rate, inflation rate as well as bank lending, as compared with that during September 2008 - March 2013.

The above results show that monetary policy under the former Governor Shirakawa before QQE after the global financial crisis (2008-March 2013) worked effectively when the real economy and the market were in difficult circumstances during the period. Monetary policy, including comprehensive monetary easing (CQE), in the context of yen appreciation and stagnation in exports to major trading partners including China and the United States, achieved its initial objective of market / economic stabilization. It could be said that recovery from the worst situation after the global financial crisis was achieved during the Shirakawa period.

The result of the analyses in this paper generally denies some views that

monetary easing under former Governor Shirakawa failed. Rather, it was shown that monetary easing by the Bank of Japan under Governor Shirakawa worked relatively effectively in terms of economic recovery and stabilization of the market during the Post-Global Financial Crisis period.

On the other hand, the Quantitative and Qualitative Monetary Easing (QQE) policy, which has continued until recently, has had little effects on the real economy and financial markets. It was also proved quantitatively that it did not function effectively in the financial market and exchange rate.

Although this paper does not provide a detailed mechanism of how monetary easing worked on industrial production and interest rates and bank loans in the real economy for the entire covered period, it could still demonstrate the ineffectiveness of large-scale monetary easing under QQE of Bank of Japan since the Global Financial Crisis until recently.

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Appendix : Unit Root Test

Unit Root Test (Augmented Dickey-Fuller Test) of Variables

Variables		t-Statistic	Prob.*	lag	Signifi-	Variables	t-Statistic	Prob.*	lag	Signifi-
		Level		length	cance		1st order		length	cance
							Difference			
[Sept. 2008 - Mar.2013]										
IMB(log)	None	3.1007	0.9993	2		None	-7.2197	0.0000	0	***
	Constant	0.1653	0.9677	2		Constant	-8.4066	0.0000	1	***
	Cons, Trend	-3.3838	0.0643	0 *		Cons, Trend	-8.3820	0.0000	1	***
BOJAC (log)	None	2.0129	0.9886	0		None	-7.3918	0.0000	0	***
	Constant	-0.9882	0.7513	0		Constant	-6.7710	0.0000	1	***
	Cons, Trend	-3.3860	0.0640	0 *		Cons, Trend	-6.7426	0.0000	1	***
Fexresv (log)	None	1.7873	0.9810	2		None	-6.1849	0.0000	1	***
	Constant	-6.0148	0.0000	2 ***		Constant	-6.7346	0.0000	1	***
	Cons, Trend	-4.0498	0.0130	2 **		Cons, Trend	-7.6229	0.0000	1	***
M2 (log)	None	7.5295	1.0000	10		None	-2.4644	0.0146	2	**
	Constant	-1.5049	0.5219	10		Constant	-7.8716	0.0000	9	***
	Cons, Trend	-1.8195	0.6783	10		Cons, Trend	-6.0266	0.0001	10	***
REER	None	-0.7479	0.3877	1		None	-5.4206	0.0000	0	***
	Constant	-2.3375	0.1644	1		Constant	-5.3847	0.0000	0	***
	Cons, Trend	-1.8256	0.6785	0		Cons, Trend	-5.3119	0.0003	0	***
CPI (y/y)	None	-2.1396	0.0323	1 **		None	-4.7281	0.0000	0	***
	Constant	-3.0543	0.0363	1 **		Constant	-4.7446	0.0003	0	***
	Cons, Trend	-3.4186	0.0597	1 **		Cons, Trend	-4.7504	0.0018	0	***
Call Rate	None	-5.8618	0.0000	0 ***		None	-4.0953	0.0001	0	***
	Constant	-7.9822	0.0000	0 ***		Constant	-4.2276	0.0015	0	***
	Cons, Trend	-6.7843	0.0000	0 ***		Cons, Trend	-4.6969	0.0021	0	***
JGB Yield	None	-1.5987	0.1028	0		None	-8.2661	0.0000	0	***
	Constant	-0.6602	0.8477	0		Constant	-8.6036	0.0000	0	***
	Cons, Trend	-2.8236	0.1955	0		Cons, Trend	-8.5650	0.0000	0	***
Share	None	0.4258	0.8021	1		None	-7.0756	0.0000	0	***
	Constant	-2.0491	0.2657	1		Constant	-6.9706	0.0000	0	***
	Cons, Trend	-1.8735	0.6541	1		Cons, Trend	-6.9077	0.0000	0	***
Lend	None	-1.6568	0.0918	1		None	-4.0487	0.0001	0	***
	Constant	-1.6347	0.4581	1		Constant	-4.0111	0.0028	0	***
	Cons, Trend	-1.3073	0.8753	1		Cons, Trend	-4.2376	0.0077	0	***
Production	None	-0.7395	0.3915	0		None	-5.1695	0.0000	0	***
	Constant	-2.5334	0.1134	0		Constant	-5.1310	0.0001	0	***
	Cons, Trend	-2.9695	0.1502	0		Cons, Trend	-5.1154	0.0006	0	***
[Oct. 2010 - Mar.2013] CME										
IMB(log)	None	2.3352	0.9937	2		None	-5.7572	0.0000	0	***
	Constant	-1.7315	0.4040	2		Constant	-6.1665	0.0000	0	***
	Cons, Trend	-3.3840	0.0732	0 *		Cons, Trend	-6.2576	0.0001	1	***
BOJAC (log)	None	1.4558	0.9603	1		None	-5.6123	0.0000	0	***
	Constant	-1.8285	0.3599	0		Constant	-5.9349	0.0000	0	***
	Cons, Trend	-2.9484	0.1631	0		Cons, Trend	-5.8922	0.0002	0	***
Fexresv (log)	None	0.4089	0.7944	2		None	-7.6172	0.0000	1	***
	Constant	-2.6444	0.0960	0 *		Constant	-7.4958	0.0000	1	***
	Cons, Trend	-4.3823	0.0088	1 ***		Cons, Trend	-7.4958	0.0000	1	***
M2 (log)	None	3.0156	0.9988	0		None	-4.0625	0.0002	0	**
	Constant	-0.6633	0.8407	0		Constant	-5.4938	0.0001	1	***
	Cons, Trend	-3.3377	0.0824	3 =		Cons, Trend	-5.3721	0.0009	1	***
REER	None	-0.8262	0.3490	1		None	-2.9264	0.0050	1	***
	Constant	-1.1405	0.6851	1		Constant	-3.0367	0.0441	0	**
	Cons, Trend	-1.3125	0.8638	1		Cons, Trend	-3.3907	0.0737	1	*
CPI	None	-1.8749	0.0590	1 *		None	-3.5143	0.0010	0	**
	Constant	-2.5728	0.1103	1		Constant	-3.4760	0.0165	0	**
	Cons, Trend	-2.4147	0.3646	1		Cons, Trend	-3.9252	0.0275	5	**
Call Rate	None	-0.4133	0.5236	0		None	-6.2797	0.0000	0	***
	Constant	-2.8859	0.0597	5		Constant	-6.1869	0.0000	0	***
	Cons, Trend	-2.8288	0.2003	1		Cons, Trend	-6.1059	0.0001	0	***
JGB Yield	None	-0.9117	0.3130	0		None	-7.1555	0.0000	0	***
	Constant	0.1041	0.9605	0		Constant	-8.0069	0.0000	0	***
	Cons, Trend	-2.8188	0.2027	1		Cons, Trend	-8.1949	0.0000	0	***
Share	None	0.4313	0.8003	1		None	-2.8711	0.0057	0	**
	Constant	-1.5164	0.5108	1		Constant	-2.8787	0.0606	0	*
	Cons, Trend	0.4628	0.9986	0		Cons, Trend	-3.2362	0.0980	0	*
Lend	None	-0.8057	0.3582	0		None	-3.6918	0.0006	0	***
	Constant	-0.8464	0.7905	0		Constant	-4.8368	0.0006	0	***
	Cons, Trend	-1.7565	0.6994	0		Cons, Trend	-4.8219	0.0031	0	***
Production	None	-0.5483	0.4697	3		None	-4.3603	0.0001	1	***
	Constant	-2.3333	0.1697	3 **		Constant	-4.3026	0.0023	1	***
	Cons, Trend	-2.5402	0.3081	0		Cons, Trend	-4.2106	0.0133	1	**

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[Apr.2013 - May.2019] QQE								
IMB(log)	None	-0.2377	0.5967	9	None	-3.8487	0.0002	11 ***
	Constant	-4.0376	0.0022	4 ***	Constant	-1.1657	0.6839	8
	Cons, Trend	-0.0702	0.9944	10	Cons, Trend	-2.4979	0.3282	9
BOJAC (log)	None	0.3170	0.7743	9	None	-4.9497	0.0000	11 ***
	Constant	-3.6134	0.0080	8 ***	Constant	-3.0994	0.0317	11 **
	Cons, Trend	-4.9681	0.0007	8 ***	Cons, Trend	-3.1188	0.1111	11
Fexresv (log)	None	3.3272	0.9997	0	None	-8.2584	0.0000	0 ***
	Constant	-3.5005	0.0106	0 **	Constant	-9.4594	0.0000	0 ***
	Cons, Trend	-3.2278	0.0871	0 *	Cons, Trend	-10.0514	0.0000	0 ***
M2 (dlog)	None	-0.8247	0.3548	11	None	-10.9883	0.0000	10 ***
	Constant	-0.7295	0.8313	11	Constant	-10.9622	0.0000	10 ***
	Cons, Trend	-1.0714	0.9255	11	Cons, Trend	-10.9159	0.0000	10 ***
REER	None	-0.2620	0.5885	0	None	-8.2579	0.0000	0 ***
	Constant	-2.1206	0.2373	0	Constant	-8.1990	0.0000	0 ***
	Cons, Trend	-2.0790	0.5487	0	Cons, Trend	-8.1643	0.0000	0 ***
CPI	None	-1.1665	0.2202	0	None	-6.7279	0.0000	0 ***
	Constant	-1.9363	0.3142	0	Constant	-6.6848	0.0000	0 ***
	Cons, Trend	-2.4080	0.3725	0	Cons, Trend	-6.6719	0.0000	0 ***
Call Rate	None	-0.8585	0.3408	1	None	-6.7955	0.0000	0 ***
	Constant	-0.7255	0.8333	1	Constant	-6.9254	0.0000	0 ***
	Cons, Trend	-2.5448	0.3065	1	Cons, Trend	-6.8746	0.0000	0 ***
JGB Yield	None	-1.6115	0.1005	0	None	-8.5251	0.0000	0 ***
	Constant	-0.9243	0.7752	0	Constant	-8.8965	0.0000	0 ***
	Cons, Trend	-1.8147	0.6877	0	Cons, Trend	-8.8957	0.0000	0 ***
Share	None	0.6232	0.8488	0	None	-10.2108	0.0000	0 ***
	Constant	-1.8305	0.3632	0	Constant	-10.2410	0.0001	0 ***
	Cons, Trend	-2.8233	0.1939	0	Cons, Trend	-10.1749	0.0000	0 ***
Lend	None	-0.0441	0.6649	0	None	-7.7183	0.0000	0 ***
	Constant	-2.2644	0.1862	0	Constant	-7.6618	0.0000	0 ***
	Cons, Trend	-2.2072	0.4784	0	Cons, Trend	-7.6206	0.0000	0 ***
Production	None	0.5143	0.8245	1	None	-14.8902	0.0000	0 ***
	Constant	-2.1755	0.2169	1	Constant	-14.8212	0.0001	0 ***
	Cons, Trend	-2.5214	0.3173	1	Cons, Trend	-14.7424	0.0001	0 ***
[Nov.2014 - May.2019]								
IMB(log)	None	1.5504	0.9688	3	None	-1.8187	0.0660	10 *
	Constant	-3.9528	0.0037	10 ***	Constant	-1.1152	0.7015	10
	Cons, Trend	-1.3840	0.8523	10	Cons, Trend	-5.8921	0.0001	9 ***
BOJAC (log)	None	0.5888	0.8400	9	None	-2.0220	0.0425	10 **
	Constant	-3.9186	0.004	10 ***	Constant	-1.3284	0.6081	10
	Cons, Trend	-2.2191	0.4678	10	Cons, Trend	-5.3088	0.0004	9 ***
Fexresv (log)	None	2.1962	0.9926	1	None	-8.8880	0.0000	0 ***
	Constant	-0.9986	0.7476	1	Constant	-9.4678	0.0000	0 ***
	Cons, Trend	-4.2390	0.0075	0 ***	Cons, Trend	-9.3471	0.0000	0 ***
M2 (log)	None	4.4126	1	10	None	-0.4340	0.5205	10
	Constant	-1.9357	0.3135	10	Constant	-4.4742	0.0008	9 ***
	Cons, Trend	0.3849	0.9985	10	Cons, Trend	-5.0556	0.0009	9 ***
REER	None	0.6381	0.8512	0	None	-6.1895	0.0000	0 ***
	Constant	-1.7383	0.4068	0	Constant	-6.1966	0.0000	0 ***
	Cons, Trend	-1.6531	0.7586	0	Cons, Trend	-6.1818	0.0000	0 ***
CPI	None	-2.5398	0.0120	0 **	None	-6.1907	0.0000	0 ***
	Constant	-2.7263	0.0761	0 *	Constant	-6.1907	0.0000	0 ***
	Cons, Trend	-3.1339	0.1091	1	Cons, Trend	-6.3084	0.0000	0 ***
Call Rate	None	-0.8077	0.3616	0	None	-5.7761	0.0000	0 ***
	Constant	-1.2603	0.6417	0	Constant	-5.9169	0.0000	0 ***
	Cons, Trend	-1.2251	0.8952	0	Cons, Trend	-5.9181	0.0000	0 ***
JGB Yield	None	-2.0409	0.0405	0 **	None	-5.9164	0.0000	0 ***
	Constant	-1.5075	0.5225	0	Constant	-5.9885	0.0000	0 ***
	Cons, Trend	-1.6410	0.7635	0	Cons, Trend	-5.8983	0.0000	0 ***
Share	None	0.3174	0.7738	0	None	-8.2141	0.0000	0 ***
	Constant	-1.8675	0.3449	0	Constant	-8.1746	0.0000	0 ***
	Cons, Trend	-2.3206	0.416	0	Cons, Trend	-8.0987	0.0000	0 ***
Lend	None	-0.5911	0.4568	0	None	-6.6281	0.0000	0 ***
	Constant	-1.8147	0.3697	0	Constant	-6.5704	0.0000	0 ***
	Cons, Trend	-1.7592	0.7108	0	Cons, Trend	-6.4835	0.0000	0 ***
Production	None	0.3645	0.7864	1	None	-11.8698	0.0000	0 ***
	Constant	-1.7287	0.4113	1	Constant	-11.7776	0.0000	2 ***
	Cons, Trend	-2.7127	0.2359	1	Cons, Trend	-11.6553	0.0000	2 ***

Note: Significance at 1%; 5%, 10% shown as ***, **, *, respectively.

Sources: IMF IFS database, BIS, BOJ, Statistics Office (Japan), METI (JAPAN), Nikkei Profile,

Re-evaluation of the Bank of Japan's monetary easing policy after the Global Financial Crisis

[Apr.2013 - June.2019] QQE								
IMB(log)	None	-0.2377	0.5967	9	None	-3.8487	0.0002	11 ***
	Constant	-4.0376	0.0022	4 ***	Constant	-1.1657	0.6839	8
	Cons, Trend	-0.0702	0.9944	10	Cons, Trend	-2.4979	0.3282	9
BOJAC (log)	None	0.3170	0.7743	9	None	-4.9497	0.0000	11 ***
	Constant	-3.6134	0.0080	8 ***	Constant	-3.0994	0.0317	11 **
	Cons, Trend	-4.9681	0.0007	8 ***	Cons, Trend	-3.1188	0.1111	11
Fexresv (log)	None	3.3272	0.9997	0	None	-8.2584	0.0000	0 ***
	Constant	-3.5005	0.0106	0 **	Constant	-9.4594	0.0000	0 ***
	Cons, Trend	-3.2278	0.0871	0 *	Cons, Trend	-10.0514	0.0000	0 ***
M2 (dlog)	None	-0.8247	0.3548	11	None	-10.9883	0.0000	10 ***
	Constant	-0.7295	0.8313	11	Constant	-10.9622	0.0000	10 ***
	Cons, Trend	-1.0714	0.9255	11	Cons, Trend	-10.9159	0.0000	10 ***
REER	None	-0.2620	0.5885	0	None	-8.2579	0.0000	0 ***
	Constant	-2.1206	0.2373	0	Constant	-8.1990	0.0000	0 ***
	Cons, Trend	-2.0790	0.5487	0	Cons, Trend	-8.1643	0.0000	0 ***
CPI	None	-1.1665	0.2202	0	None	-6.7279	0.0000	0 ***
	Constant	-1.9363	0.3142	0	Constant	-6.6848	0.0000	0 ***
	Cons, Trend	-2.4080	0.3725	0	Cons, Trend	-6.6719	0.0000	0 ***
Call Rate	None	-0.8585	0.3408	1	None	-6.7955	0.0000	0 ***
	Constant	-0.7255	0.8333	1	Constant	-6.9254	0.0000	0 ***
	Cons, Trend	-2.5448	0.3065	1	Cons, Trend	-6.8746	0.0000	0 ***
JGB Yield	None	-1.6115	0.1005	0	None	-8.5251	0.0000	0 ***
	Constant	-0.9243	0.7752	0	Constant	-8.8965	0.0000	0 ***
	Cons, Trend	-1.8147	0.6877	0	Cons, Trend	-8.8957	0.0000	0 ***
Share	None	0.6232	0.8488	0	None	-10.2108	0.0000	0 ***
	Constant	-1.8305	0.3632	0	Constant	-10.2410	0.0001	0 ***
	Cons, Trend	-2.8233	0.1939	0	Cons, Trend	-10.1749	0.0000	0 ***
Lend	None	-0.0441	0.6649	0	None	-7.7183	0.0000	0 ***
	Constant	-2.2644	0.1862	0	Constant	-7.6618	0.0000	0 ***
	Cons, Trend	-2.2072	0.4784	0	Cons, Trend	-7.6206	0.0000	0 ***
Production	None	0.5143	0.8245	1	None	-14.8902	0.0000	0 ***
	Constant	-2.1755	0.2169	1	Constant	-14.8212	0.0001	0 ***
	Cons, Trend	-2.5214	0.3173	1	Cons, Trend	-14.7424	0.0001	0 ***
[Nov..2014 - June.2019]								
IMB(log)	None	1.5504	0.9688	3	None	-1.8187	0.0660	10 *
	Constant	-3.9528	0.0037	10 ***	Constant	-1.1152	0.7015	10
	Cons, Trend	-1.3840	0.8523	10	Cons, Trend	-5.8921	0.0001	9 ***
BOJAC (log)	None	0.5888	0.8400	9	None	-2.0220	0.0425	10 **
	Constant	-3.9186	0.004	10 ***	Constant	-1.3284	0.6081	10
	Cons, Trend	-2.2191	0.4678	10	Cons, Trend	-5.3088	0.0004	9 ***
Fexresv (log)	None	2.1962	0.9926	1	None	-8.8880	0.0000	0 ***
	Constant	-0.9986	0.7476	1	Constant	-9.4678	0.0000	0 ***
	Cons, Trend	-4.2390	0.0075	0 ***	Cons, Trend	-9.3471	0.0000	0 ***
M2 (log)	None	4.4126	1	10	None	-0.4340	0.5205	10
	Constant	-1.9357	0.3135	10	Constant	-4.4742	0.0008	9 ***
	Cons, Trend	0.3849	0.9985	10	Cons, Trend	-5.0556	0.0009	9 ***
REER	None	0.6381	0.8512	0	None	-6.1895	0.0000	0 ***
	Constant	-1.7383	0.4068	0	Constant	-6.1966	0.0000	0 ***
	Cons, Trend	-1.6531	0.7586	0	Cons, Trend	-6.1818	0.0000	0 ***
CPI	None	-2.5398	0.0120	0 **	None	-6.1907	0.0000	0 ***
	Constant	-2.7263	0.0761	0 *	Constant	-6.1907	0.0000	0 ***
	Cons, Trend	-3.1339	0.1091	1	Cons, Trend	-6.3084	0.0000	0 ***
Call Rate	None	-0.8077	0.3616	0	None	-5.7761	0.0000	0 ***
	Constant	-1.2603	0.6417	0	Constant	-5.9169	0.0000	0 ***
	Cons, Trend	-1.2251	0.8952	0	Cons, Trend	-5.9181	0.0000	0 ***
JGB Yield	None	-2.0409	0.0405	0 **	None	-5.9164	0.0000	0 ***
	Constant	-1.5075	0.5225	0	Constant	-5.9885	0.0000	0 ***
	Cons, Trend	-1.6410	0.7635	0	Cons, Trend	-5.8983	0.0000	0 ***
Share	None	0.3174	0.7738	0	None	-8.2141	0.0000	0 ***
	Constant	-1.8675	0.3449	0	Constant	-8.1746	0.0000	0 ***
	Cons, Trend	-2.3206	0.416	0	Cons, Trend	-8.0987	0.0000	0 ***
Lend	None	-0.5911	0.4568	0	None	-6.6281	0.0000	0 ***
	Constant	-1.8147	0.3697	0	Constant	-6.5704	0.0000	0 ***
	Cons, Trend	-1.7592	0.7108	0	Cons, Trend	-6.4835	0.0000	0 ***
Production	None	0.3645	0.7864	1	None	-11.8698	0.0000	0 ***
	Constant	-1.7287	0.4113	1	Constant	-11.7776	0.0000	2 ***
	Cons, Trend	-2.7127	0.2359	1	Cons, Trend	-11.6553	0.0000	2 ***

Note: Significance at 1%; 5%, 10% shown as ***, **, *, respectively.

Sources: IMF IFS database, BIS, BOJ, Statistics Office (Japan), METI (JAPAN), Nikkei Profile,

