

Article**Monetary Policy under the Zero Lower Bound Interest:
Japan's Experience***

Shigeyoshi Miyagawa and Yoji Morita

Department of Economics

Kyoto Gakuen University

E-mail: miyagawa@kyotogakuen.ac.jp

Abstract

This paper quantifies the effect of non-traditional monetary easing at the zero lower bound on interest rate, so called “quantitative easing monetary policy” which the BOJ adopted from March 2001 through June 2006, by changing operating target for money market from the uncollateralized call rate to the outstanding current account balances held by financial institutes at the BOJ. The paper confirms that the monetary policy has contributed to the recovery of the prolonged deflation.

First we estimate a minimal VAR model, which consists of the current account balances at the BOJ (CABs) as a policy variable, real GDP, and inflation rate. Next we decompose money stock into transaction money and precautionary money to evaluate the transmission mechanism of the effect of CABs on the real economy by taking into account the financial anxiety. We have found a quantitative easing shock firstly increases transaction money and then raises output and price, which dispels the anxiety. We also confirm that a liquidity trap did not exist during the period of quantitative easing monetary policy.

Keywords: Quantitative easing, Financial anxiety, Transaction money,
Precautionary money

JEL Classification: E41, E52

* The original paper of the paper was written when the first author stayed at Helsinki Center of Economic Research (HECER), University of Helsinki, Finland, in the summer of 2013. See <https://helda.helsinki.fi/handle/10138/40710>. He wishes to thank Professor Hannu Varitainen, Professor Liisa Laakso, and Professor Antti Ripattiand for their useful suggestions and warm hospitality. He also would like to thank Ms.Hanne Kauppila and Ms. Jenni Ryttonen for their kind secretary service.

Introduction

Many central banks implemented the unconventional monetary policy in response to the turmoil of the financial market triggered by the collapse of Lehman Brothers in September 2008. The unconventional policy of expanding the central bank's balance sheet is usually referred to as quantitative easing monetary policy (QEMP). The Federal Reserve conducted QEMP¹ by purchasing a large quantity of assets in December 2008. The Bank of England also started the unconventional easy monetary policy by reducing the bank rate from 1% to 0.5% and announcing to purchase £ 75 billion of assets over the three months funded by central bank money in March 2009. It was Bank of Japan which firstly adopted the QEMP in the intensified recession. The BOJ implemented the policy from March 2001 through June 2006. The BOJ restarted the QEMP again after the Lehman Brothers' shock in 2008.

Whether or not does the unconventional policy has really an effect on the improvement of economy is the subject of a lot of debate. Many empirical researches have been done on the first QEMP's effect in Japan. Most of the researches show the negative results on the effect of QEMP². However several researches confirm the effectiveness by the sample period contains the whole period of the first QEMP.

The aim of the paper is to statistically quantify the effect of the Quantitative Easing Monetary Policy from March 2001 through June 2006 implemented by the BOJ on the Japan's prolonged recession. We estimate the effect of the QEMP focusing on the role of expectation. The QEMP is supposed to foster the expectation that there would not be the financial uncertainty in the future.

1 Overview

Japan's economy had experienced the prolonged recession after the bust of bubble in the early 1990s. The BOJ gradually reduced its policy target, uncollateralized overnight call rate to overcome the deteriorated economy. The BOJ lowered the rate to 0.02% in February 1999 after the financial crisis in 1997 and 1998, when several Japan's major financial institutes collapsed and the Japan premium surged in the overseas markets. The BOJ literally took the "zero-interest rate policy". However the economy rapidly deteriorated when BOJ lifted the zero-interest rate policy by raising the call rate to 0.25% in 2000. In response to the difficult situation, the BOJ adopted the "quantitative easy monetary policy" by changing operating target for money market from the uncollateralized call rate to the outstanding current

¹ FRB named officially the program with the large-scale asset purchases (LSAPs).

² Ugai (2006) surveys the empirical researches on the QEMP. Many researches denied the effect of QEMP, or showed the very limited effect, if any, according to his survey.

account balances held by financial institutes at the BOJ³. The Target change of the CAB during the QEMP period is shown in Table 1. The BOJ started its new policy with 5 trillion yen in March 2001 and increased the reserves to reach 10 to 15 trillion yen in December 2001. The BOJ set the reserve at the most, 35 trillion yen in January 2004. The required reserve is 4 trillion yen. The new policy ceased in March 2006, when the BOJ judged that further easing would trigger the inflation because CPI inflation rate has been slightly positive and the economy showed the signal of the recovery.

However the role of money stock in the monetary policy has been graded down in the process of deflation. BOJ (2003) shows that there is not any close relationship among money stock and the real economy by performing the cointegration analysis among M2, real GDP and opportunity cost based on the data extending the period to 2002.

Table 1 Target change of the CAB during the QEMP

Date	Targets of the CAB
March 19, 2001	From 4 trillion yen to around 5 trillion yen
August 14, 2001	From 5 trillion yen to around 6 trillion yen
September 18, 2001	From 5 trillion yen to above 5 trillion yen
December 19, 2001	From above 6 trillion yen to 10-15 trillion yen
October 30, 2002	From 10-15 trillion yen to 15-20 trillion yen
March 25, 2003	From 15-20 trillion yen to 17-22 trillion yen
April 30, 2003	From 17-22 trillion yen to 22-27 trillion yen
May 20, 2003	From 22-27 trillion yen to 27-30 trillion yen
October 10, 2003	From 27-30 trillion yen to 27-32 trillion yen
January 20, 2004	From 27-32 trillion yen to 30-35 trillion yen
March 9, 2006	Lift of QEMP

2 Review of literatures on the QEMP

The channels through which QEMP affects the economy are very controversial subjects. Monetary policy works through the interest rate channel in the normal situation. Monetary easing will increase monetary base which reduce the short-term interest rate. The lower interest rate affects the longer interest rates of financial assets, which will stimulate the investment and consumption, and finally contribute to the boost of economy. However monetary policy does not work through this channel when the interest rate reaches at zero or close zero per cent. A liquidity trap appears because money and bond becomes a perfect substitute when interest rate is at the zero lower bound.

³ The quantitative easing framework which the BOJ adopted in March 2001 consists of the following three characteristics. (1) The changing of the main operating target for money-market operations from the uncollateralized overnight call rate to the outstanding balance of the current accounts at the Bank (CABs). (2) The commitment by the Bank to keep the new procedures for money-market operations in place until the CPI registers either zero per cent year-on-year growth or an increase. (3) Increases in the Bank's outright purchases of long-term government bonds, in case it considers the increase necessary for providing liquidity smoothly.

Michael Joyce, Matthew Tong and Robert Woods (2011) briefly showed the channels through which asset purchase financed by central bank might affect the economy with a picture shown in Figure 1. They classified the channels into five: Confidence, Policy signaling, Portfolio rebalancing, Market Liquidity, Bank lending (Money). 1 confidence channel: the policy improves economic outlook and boosts consumer confidence, 2 Policy signaling channel: people believe that interest rates remain low for a long period, 3 Portfolio rebalancing channel: People who sell the assets to central bank will buy another assets, ie rebalance their portfolios, which raise the price of the asset and reduce the yields, which reduced the borrowing cost and stimulate the spending⁴, 4 Market liquidity channel: asset purchase provides the financial market with lots of liquidity, which would contribute the improvement of market functioning, especially in the turmoil of financial crisis, 5 money channel: Increased reserve would encourage the banks to extend the loans.

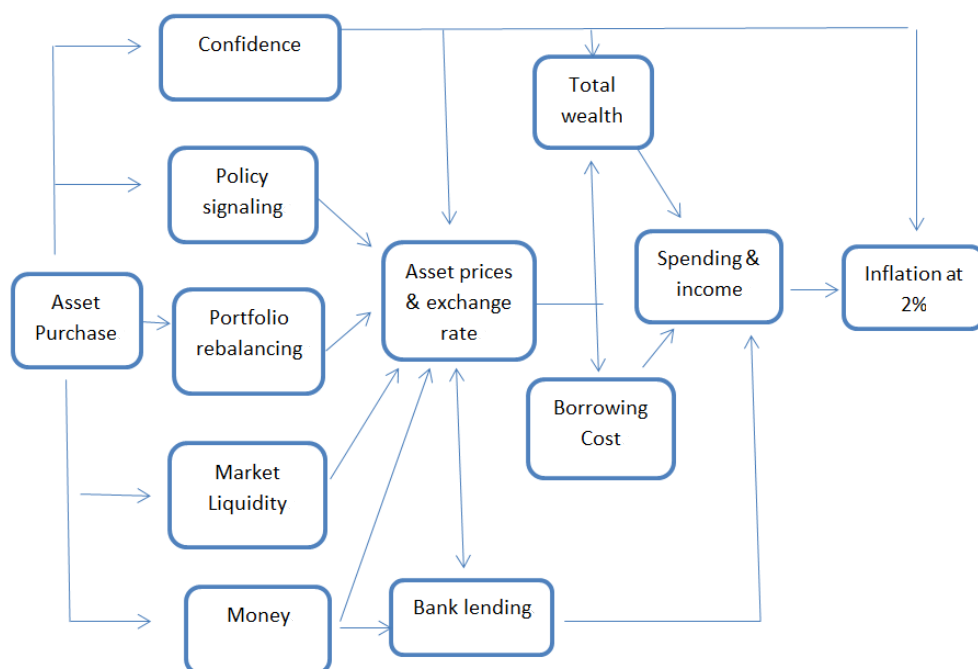


Figure 1 Transmission Mechanisms of Asset Purchase by Central Bank

Source: Joyce, Michael, M.Tong and R.Woods (2011) p.201.

Several empirical works have been done on the effectiveness of monetary policy under the zero bound constraint of the interest rate. Baig (2002) shows that monetary policy still work well even at the zero interest rate by using VAR model. He points that expansion of monetary base has a positive effect on the prices and output. However his sample period from 1980 to 2001 includes the period when Japan's economy is very sound and interest rate is far from zero. His result is not satisfactory because it does not reflect the effect of the

⁴ It is Tobin (1958) which firstly suggested the rebalance channel.

monetary base in the period of zero interest rate. Taking the problem into consideration, Kimura et al. (2002) estimated by using a time-varying VAR. A time-varying VAR can capture the changes in the policy that varies over time. Their result is that the effect of the increase in the monetary base at the zero interest rate period is very limited, if any, suggesting the inept of monetary policy. Fujiwara (2006) also showed the same result by using a Markov switching VAR model. Their problem in common is that their sample period covers only the former period of the zero interest rate and quantitative easy monetary policy.

Honda et al. (2007, 2010) and Harada and Masuda (2010) estimated the effectiveness of monetary easing by the sample period covers the whole implementation period of QEMP. Honda et al. (2007, 2010) estimated the effect of the QEMP on the Japan's economy by the Vector auto regressing model composing of industrial production, CPI, and the current account balances at the BOJ. In addition, they used several financial data including share price to identify the transmission mechanism of monetary policy. They concluded that the QEMP had a positive effect on the economy and the effectiveness worked through share price channel.

Harada and Masuda (2010) also conducted the same VAR analysis in the period of the QEMP. They estimated based on the Honda et al (2007, 2010). They increased the number of variables to focus on the transmission mechanism. They basically confirmed the results of the Honda et al. They newly found the transmission mechanism through the bank's balance sheet channel in addition to share price channel.

Nakazawa and Yoshikawa (2011) estimated the effect of the QEMP by the VAR model composed of three variables; the current account balances, nominal GDP, and share price. They focus on the BOJ's asset composition which expanded through the purchases of government bonds (JGB). They reconfirm the results of Honda et al. (2007, 2010) and Harada and Masuda (2010). However they indicate that the JGBs' maturity which BOJ purchased in the QEMP is mainly from one to three years, suggesting that it would have a stronger effect if the BOJ purchased JGBs with the longer-term maturity.

These new researches show that BOJ's non-traditional monetary easing from 2001 through 2006 had a positive effect on Japan's economy, suggesting the BOJ should continue the monetary easing to conquer Japan's deflationary economy. However they do not analyse the role of the anxiety in the deflationary economy. Under the severe deflation, people tend to stick to cash because they had the cash-flow constraints.

Krugman (1998, 2000) indicated that additional monetary easing would not have a positive effect on the economy, because monetary base and bonds became a perfect substitute at the almost zero interest rate. Japan's economy had fallen into "a liquidity trap." He argued that natural rate of interest rate became negative in the deflation, while nominal interest rate could not be reduced below zero. He insisted to take the policy to foster the inflation expectation to exempt from the deflation trap. Inflation expectation will raise the natural rate of interest rate in the future, which will stimulate the consumption and

investment⁵.

Several researches have been done on the change of the future expectation in the period of the QEMP. Okina and Shiratuka (2004) and Shiratuka et al. (2010) focus on the effect of the BOJ's commitment to maintain the QEMP until core CPI registers stably zero per cent or an increase year on year. The longer term interest rate would decline even if the short term interest rate already reached at the zero interest rate, as far as the private sector confirms the BOJ's commitment. The decline of the longer-term interest rate is expected to stimulate the investment and consumption⁶. They estimate the relationship between the future expectation and the economic variables (inflation rate, output and interest rates) by time-varying parameter vector autoregression model with stochastic volatility (TVP-VAR). They conclude that the BOJ's commitment does not have a positive effect on the dynamic relationship of prices and production, though it has succeeded in changing the future expectation of the financial market, firms, and household, only in the first year when the QEMP was adopted.

We also investigate the role of expectation in the QEMP period from the different view point. We focus on the role of a kind of expectation, financial anxiety in the deflationary economy. We will clear why the BOJ should continue the quantity easing policy. People are afraid of the risk they cannot get money from the financial institute in the deflation. They tend to hold money as much as possible in order to avoid the cash-flow constrains. Such a financial behaviour of the people in the deflation rapidly increases the precautionary money demand. Money will not have a positive effect on the economy even if the central bank increases the money stock, because additional money will be absorbed as precautionary demand. The precautionary demand for money will decline if people confirm the BOJ's strong commitment to continue the QEMP until the economy get rid of the deflation.

The QEMP is supposed to have a positive effect on the economy, as far as the BOJ keeps to provide more money than the money which the firms and households need to make an economic activity smoothly in the deflationary economy. Thus, we estimate the effect of quantitative easing policy on the economy by decomposing money stock into the transaction and the precautionary money. The former money will contribute to the improvement of the economy, while the latter will not. The monetary easing would lose its effectiveness if additional money is absorbed as precautionary money.

⁵ Krugman insisted the importance of inflation expectation in the recovery of the great Depression, citing the Romer (1992). He mentioned that the real expansion of the economy - and the rise in prices associated with that expansion - was the result of a rise in inflation expectations, which reduced real interest rates when nominal rates were already at the floor. Without this expected inflation, the expansion of monetary base that she stresses would have been ineffectual. See Krugman (1998) p.61.

⁶ Ueda (2002) called the effect of monetary easing on the yield curve "the policy duration effect."

3 VAR model

3.1 The Data Property

Variables and their symbolic notations are given below. The data we estimate here are the Current Account Balances at the BOJ (CAB), Money Stock (M2+CD), Business Cycle of Tankan Diffusion Index, the uncollateralized overnight call rate, real GDP, and the core Consumer Price Index (CPI). These data are symbolized, respectively, $dpst$, $m2$, $tankan$, $call$, y , and p . All data except for the core CPI are obtained from Website of Bank of Japan. The core CPI is obtained from Website of Ministry of Internal Affairs and Communications.

The new variable has to capture the psychological change of people due to the financial anxieties. We used the Diffusion Index issued quarterly by Bank of Japan known as TANKAN in order to qualify the unobservable variable. We display the behaviour of each variable in Figure 2.

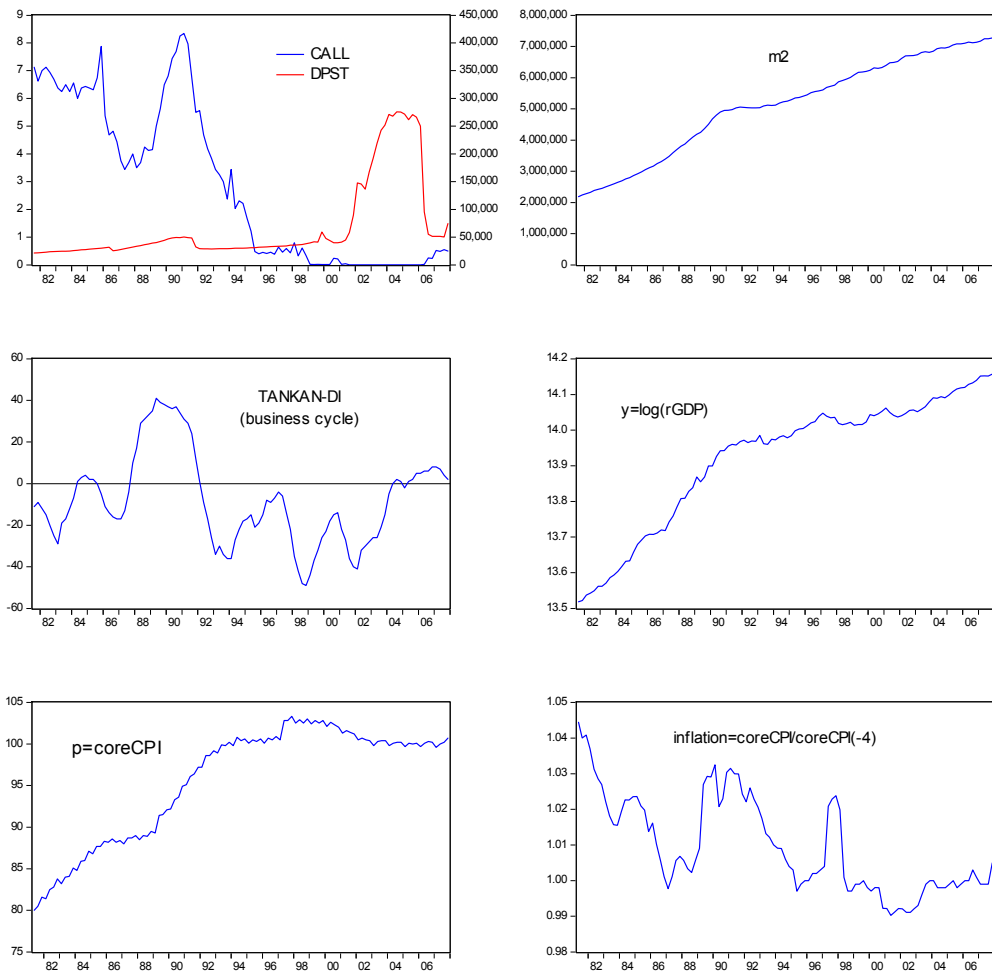


Figure 2 the behaviour of each variable

We apply two conventional unit-root tests, DF-GLS (ERS) and KPSS test to the logs of the time series for each variable. ERS tests the unit root of the time series as the null hypothesis, while KPSS test the stationarity as the null hypothesis. The results are shown in table 2. *Tankan* is shown to be stationary, while *call*, *y* and *p* are nonstationary. We assume that *dpst* is nonstationary and that *inflation* ($=p(t)/p(t-4)$) is stationary, though these data cannot be strictly judged to be nonstationary or stationary by both tests.

Table 2 Unit root test (1981q3, 2007q4)

var.	ERS(t-stats)	lag	KPSS(LM-stats)	trend
<i>dpst</i>	-1.75526*	1	0.60521**	const.
<i>tankan</i>	-2.83677**	1	0.20946	const.
<i>call</i>	-0.02444	0	0.98470***	const.
$y=\log(\text{realGDP})$	0.84268	3	1.04898***	const.
$p=\text{coreCPI}$	0.45950	4	0.983331***	const.
$\text{inflation}=p(t)/p(t-4)$	-1.46771	1	0.060818	trend+const.

***, ** and,* denote significance levels of 1%, 5%, and 10%, respectively

3.2 Modell

We first estimate the simple three-variable VAR that consists of the Current Account Balances at the BOJ (*dpst*), real GDP(*y*), and the core Consumer Price Index ($p=\text{core CPI}$) where *p* is changed into $\text{inflation}=p(t)/p(t-4)$. All variables are estimated, following the result of unit-root test. The sample period is from Q2 2001 through Q4 2005.

Letting $x(t) = (\Delta dpst, \Delta y, \text{inflation})'$, we consider a growth rate system described by VAR (Vector Auto Regression) model of the form:

$$x(t) = A_0 + A_1x(t-1) + A_2x(t-2) + \varepsilon(t)$$

The dynamic impulse response functions are shown in Figure 2. The first to third column show the dynamic responses of each variable to policy shock (CAB shock), an output shock, and price change shock, respectively. The solid line shows the point estimate of impulse response function, while the dotted lines imply 95 % confidential interval.

The interesting findings which the simple model gives are as follows. The first column shows that policy shock has a positive effect on real output. Output starts to increase with a lag of three quarters after CAB rises. The positive response is statistically significant at 5 % level at third quarter. Quantity easing monetary policy surely contributes to the recovery of Japan's recession. The second column displays that an output shock has an immediate effect on the price change. The third column also shows that price change has a positive shock on the real output. Thus, we can summarize the effect of monetary easing policy during the QEMP starting at March 2001 as follows.

Quantitative easing monetary policy has a positive effect on Japan's deflationary economy. The policy effect starts at the increase of current account balances at the BOJ. The effect has a positive effect on the economy, though it takes time for its effect to exert. Easing policy does not have an effect on the deflation. However, it has indirectly the effect on the price

change, through the effect on the real output. Increase of real output tends to improve the deflation. Improvement of deflation has a positive effect on the real output.

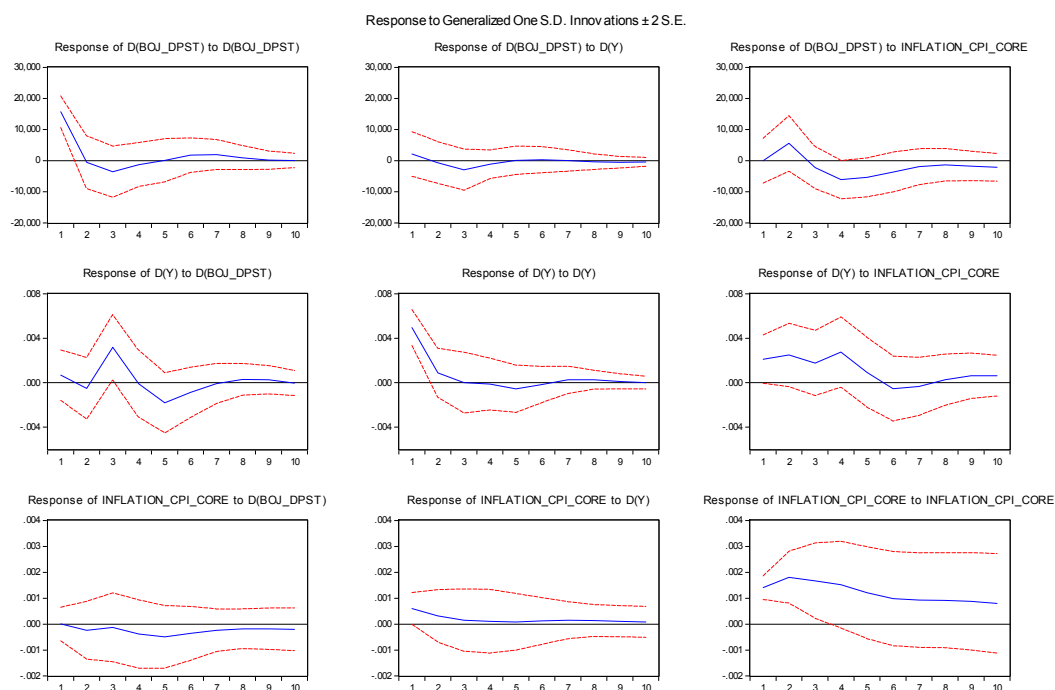


Figure 3 Impulse Response Functions for 3 variables ($\Delta(dpst), \Delta(y), inflation$)

3.3 Model 2

Next we statistically quantify how much money contributed to the recovery of the economy when the BOJ increased the current account balances at the BOJ. We would decompose the money stock into the transaction money and the precautionary money.

Precautionary demand will increase when the liquidity concern among the private sector intensify in the depression, while its demand will decrease when the concern dispels in the boom. We use here the Corporate Financial Position Diffusion Index issued quarterly by Bank of Japan known as TANKAN⁷ in order to quantify the unobservable variable, which would affect the precautionary demand.

We assume the precautionary money demand as follows.

⁷ The Tankan is a statistical survey data by the BOJ, conducted quarterly every year. The survey is done to provide an accurate of business trends of enterprises. Business Condition asked ; 1 Favourable, 2 Not so favourable, 3 Unfavourable. Responses are aggregated into Diffusion Index (DI) as follows;

DI = percentage share of enterprises responding choice 1 minus percentage share of enterprises responding choice 3

$$\begin{aligned} prec. demand = trend + c_1 * tankan * \frac{m2}{100000} \\ + c_2 * dpst * dummy_{dpst} + c_3 * call * dummy_{call} * 1000, \end{aligned} \quad (1)$$

where the 2nd term on the RHS means that the precautionary money demand is a function of $tankan * m2$, because people try to hold more money when financial anxiety intensifies, it also depends on the level of $m2$, the 3rd term and 4th term represents the effect of the BOJ' monetary policy. We take into the consideration the policy change by adding the dummy variables. The BOJ adopts the zero interest rate policy in February 1999 and temporarily lifts its policy in August 2000. It implements the QEMP from March 2001 through March 2006. Thus, the dummy variables are set as follows.

$$\begin{aligned} dummy_{call} &= 1 \quad \text{for } call \\ &\neq 0, \quad 1980q1 - 1998q4, 2000q3 - 2000q4, 2006q3 - 2007q4 \\ dummy_{call} &= 0 \quad \text{for } call = 0, \quad 1999q1 - 2000q2, 2001q1 - 2006q2 \\ \text{and} \\ dummy_{dpst} &= 1 \quad \text{for } call = 0, \quad 1999q1 - 2000q2, 2001q1 - 2007q4 \\ dummy_{dpst} &= 0 \quad \text{for } call \neq 0, \quad 1980q1 - 1998q4, 2000q3 - 2000q4 \\ \text{and} \\ dummy_{dpst} &= 1 \quad dummy_{call} = 1, \quad \text{after } 2006 \text{ } q3 \end{aligned}$$

”trend” in equation (1) is defined by using dummy variables in each year:

$$trend(t) = 1000 * \{c(81) + c(82) * d_{82}(t) + c(83) * d_{83}(t) + \dots + c(107) * d_{107}(t)\},$$

where $c(81)$ is constant during the whole interval (1981q3, 2007q4), and where dummy variables $d_{82}, d_{83}, d_{84}, \dots, d_{107}$ are of the form:

$$\begin{aligned} d_{82}(t) &= 1 \quad \text{for } t = 1982q1, q2, q3, q4 \\ &= 0 \quad \text{otherwise,} \\ d_{83}(t) &= 1 \quad \text{for } t = 1983q1, q2, q3, q4 \\ &= 0 \quad \text{otherwise,} \\ \dots \dots \dots \\ d_{107}(t) &= 1 \quad \text{for } t = 2007q1, q2, q3, q4 \\ &= 0 \quad \text{otherwise} \end{aligned}$$

Instead of $y = \log(realGDP)$, nominal output denoted by $\log(nGDP)$ is taken into consideration. $\Delta \log(nGDP(t))$ is expressed by the following equation and the log-likelihood function of $\Delta \log(nGDP(t))$ should be maximized with respect to every parameter containing precautionary demand.

$$\begin{aligned}
 \Delta \log(nGDP(t)) &= d_0 + d_1 * \Delta \log(nGDP(t - 1)) \\
 &+ d_2 * \Delta \log(m2(t - 1) - prec. demand(t - 1)) \\
 &+ d_3 * \Delta \log(m2(t - 2) - prec. demand(t - 2)) + \varepsilon(t) \quad (2)
 \end{aligned}$$

Estimation results of equations (1) and (2) are given in Tables 3 and 4.

Table 3 Estimation results in equation(1)

	Coefficient	Std. Error	z-Statistic	Prob.
c_1	-77.68188	44.26587	-1.754893	0.0793
c_2	0.483055	1.107827	0.436038	0.6628
c_3	-23.15774	23.21498	-0.997534	0.1668

Table 4 Estimation results in equation(2)

	Coefficient	Std. Error	z-Statistic	Prob.
d_0	0.001158	0.001485	0.779713	0.4356
d_1	-0.095937	0.112673	-0.851458	0.3945
d_2	0.293503	0.180195	1.628803	0.1034
d_3	0.166242	0.120239	1.382588	0.1668

Estimation results of trend in equation (1)

$$\begin{aligned}
 trend(t) = & 1000*(822.88+29.41*d_{82}(t)-4.89*d_{83}(t)-52.82*d_{84}(t)-130.89*d_{85}(t) \\
 & -168.33*d_{86}(t)-262.48*d_{87}(t)-138.34*d_{88}(t)-28.43*d_{89}(t)-200.30*d_{90}(t) \\
 & -352.35*d_{91}(t)-479.80*d_{92}(t)-222.58*d_{93}(t)-265.89*d_{94}(t)-343.69*d_{95}(t) \\
 & -314.50*d_{96}(t)-204.76*d_{97}(t)-37.08*d_{98}(t)+172.48*d_{99}(t) \\
 & +357.81*d_{100}(t)+707.43*d_{101}(t)+811.72*d_{102}(t)+722.53*d_{103}(t) \\
 & +854.93*d_{104}(t)+808.67*d_{105}(t)+794.73*d_{106}(t)+936.65*d_{107}(t)
 \end{aligned}$$

For space of economy, estimation of trend is given with only coefficients values.

Figure 4 shows the nominal money stock and the transaction money. The difference between the two kinds of money measures the precautionary demand. We find that the difference begins to expand rapidly around 1990 when the bubble economy busted and gradually turns to shrink around 2001 when the QEMP has been introduced. The actual development of the transaction demand and precautionary demand is shown in Figure 5.

The transaction money demand increases in 1980s when Japan's economy is very sound and bullish, and declines in 1990 when the bubble economy busts. On the contrary, the precautionary money demand stays at low level in 1980s and gradually increases in response to the deteriorating economy. It rapidly increases in the period of financial crisis, 1998-

1999⁸. The deflationary concerns intensified in the private sector. It is the further deterioration of financial system and the liquidity constraints of financial institutions that sharply increased precautionary demand during this period.

The QEMP contributed to expel the people's anxiety caused by the financial system uncertainty, which destabilize the economy. The Figure 4 clearly shows the increase of transaction money demand and decline of the precautionary demand money after the introduction of the QEMP in 2001.

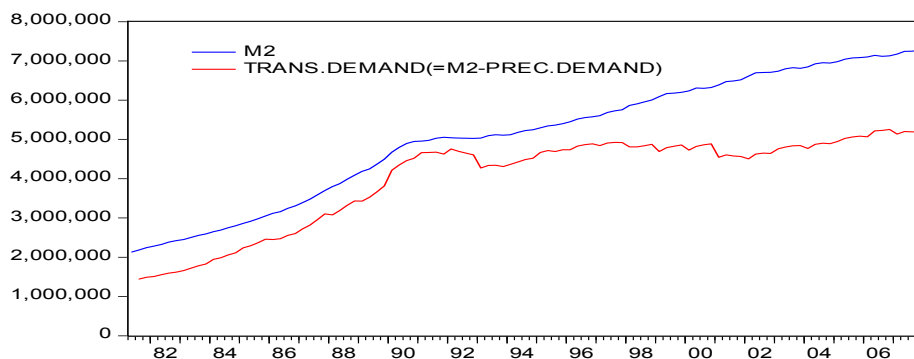


Figure 4 money stock (M2) and transaction money

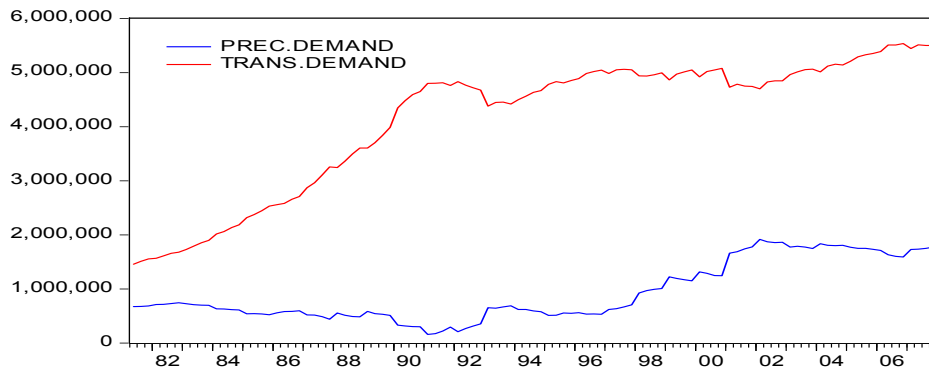


Figure 5 precautionary money and transaction money

⁸ Hokkaido Takushoku Bank, one of Japan's city banks (largest twenty banks), and Yamaichi Securities Company, one of Japan's four largest security companies, failed in November 1997. The failure of two big financial institutions sent the sign that the government gave up the "too big to fail" policy. People thought no financial institutions were immune from failures. Rumors about the other banks' failure had spread out through Japan. The stock prices of many financial institutions sharply declined and "Japan premium" in the international money market jumped by around 100 basis points. Japanese banks were obliged to pay the additional basis points for raising funds in the overseas financial markets. The premium is calculated as the difference between the quoted rates of TIBOR in the Tokyo offshore market and LIBOR in the London offshore market. Bonds issued not only by Japanese financial institutions but also by Japanese government were downgraded at the investment grade ratings by international credit-rating agencies, such as Moody's.

Next we estimate the five variables VAR model that consists of CABs, Tankan, transaction money, real GDP, and inflation rate (core cpi). We focus on role of Tankan in the transmission mechanism of easing monetary policy.

Figure 6 shows the estimated impulse response to a one standard deviation shock to five variables. The first column shows that policy shock has a positive impulse on the transaction money at the second quarter, though it has a negative effect on the transaction money at the first quarter. The first negative shock is triggered by the increase of the precautionary money. It also has a positive impact on the real output at third quarter. The second column shows that Tankan immediately affects the transaction money. Transaction money increases as soon as anxiety is dispelled. Tankan also has a positive effect on both output and inflation rate. Price response is much delayed than output response. The positive response of inflation rate is statistically different from zero at fifth quarter.

The third column shows that transaction money shock has a positive effect on the Tankan. Transaction money also has a positive effect on both output and price change. Increase of transaction money immediately increases real output, while it has a delayed effect on price change. The effect of transaction money on the price is statistically significant at fifth quarter. The fourth column indicates that real output has a positive effect on Tankan. Output shock has a positive effect on the transaction demand, though its shock on the price change is not statistically significant. The last column shows that price change has a positive effect on Tankan with five quarters delay. Price change has a positive effect on the real output at third quarter. Real output response is statistically significant at the third quarter. The estimation results are summarized as follows.

A quantitative monetary easing has a positive effect on Japan's prolonged deflation. The transmission of the policy effect is through its effect on the transaction money. In response to an increase of CABs, transaction money increase first. Transaction money contribute to the rise of real output and dispel of the anxiety in the future. Increase of transaction money also raises price in the five or six quarters. The rise of output and price changes people's mind from negative to the positive. The increase of transaction money indicates that there is not a liquidity trap in the period of the QEMP.

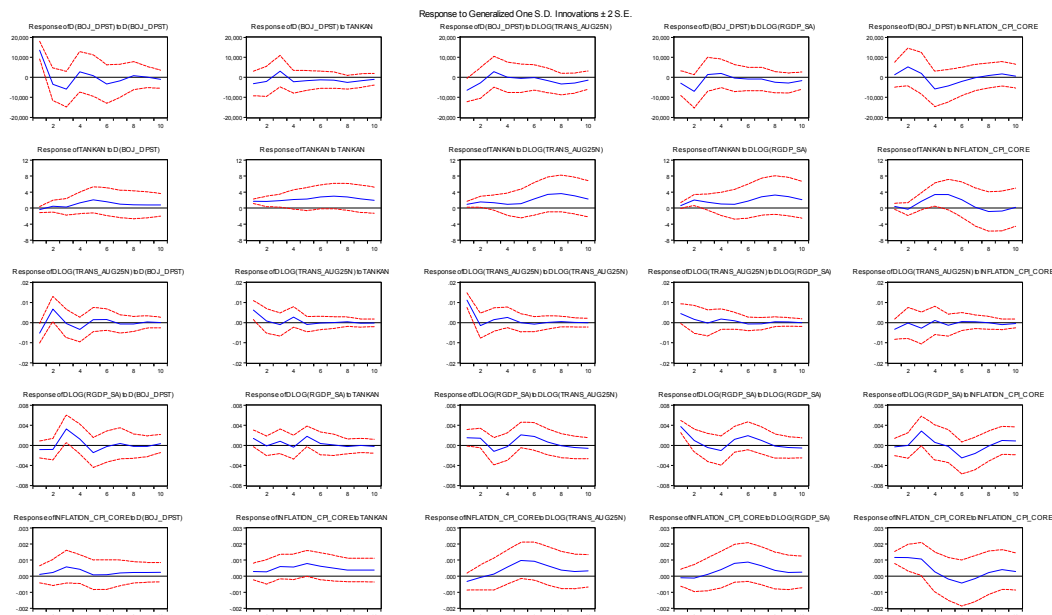


Figure 6 Impulse Response Functions for 5 variables
 $(\Delta(dpst), Tankan, \Delta \log(trans. money), \Delta(y), inflation)$

4 Concluding remarks

Many macroeconomist and policy makers have discussed on the effectiveness of non-traditional monetary easing which the BOJ adopted at the zero lower bound on interest rate. Some blamed the BOJ by arguing the prolonged deflation of Japan's economy attributed to the Bank of Japan's past monetary policies. The other defend the BOJ's policy by insisting that expanding unlimitedly the assets of the BOJ's balance sheet without any favourable effect on the economy would risk the financial position of the Bank.

The paper challenged the policy issues by quantifying statistically the effect of the monetary easing, during the period of QEMP. We have found monetary easing has a positive effect on the output and prices by estimating the simple VAR model composed of three variables; CABs, real GDP, and price change. Next we have estimated the transmission mechanism of the effect of monetary easing by decomposing money stock into transaction money and precautionary money, using the same VAR approach. Some argued that Japan's economy already fall into a liquidity trap in which additional monetary easing would lose its effectiveness, because the monetary base and bonds became perfect substitutes. They insisted that additional money would be absorbed as a precautionary demand even if central bank increased the base money. The money stock would not have any effect on the economy if people hold additional money stock by the precautionary motivation.

We quantified statistically how much money was absorbed into precautionary money by adding the expectation variable (Tankan). People tend to increase the precautionary demand

if the deflation is expected to continue. We found that the precautionary money gradually declines after the QEMP has been introduced in 2001. The increased transaction money firmly contributed to the recovery of the economy. The new policy seems to mitigate the cash-flow constrain of firms and households. Thus, we conclude that the QEMP has the positive effect on the economy by dispelling future deflationary concerns. We also confirm the non-existence of a liquidity trap in the QEMP period.

References

- Ahearne, A., J. Gagnon, J. Haltmair, and S. Kamin (2002), Preventing Deflation: Lessons from Japan's Experience in the 1990s," *International Finance Discussion Papers* Board of Governors of Federal Reserve System No. 729.
- Bank of Japan (1997), "M2+CD to Keizaikankei ni tuite (On the Relationship between M2+CD and Economic Activity in Japan," *Bank of Japan Monthly Review*, 101-123. (in Japanese)
- Bank of Japan (2003), "The Role of the Money Stock in Conducting Monetary Policy," *Bank of Japan Research Papers*, Policy Planning Office.
- Fujiwara, Ippei (2006), "Evaluating Monetary Policy when Nominal Interest Rates Are Almost Zero," *Journal of the Japanese and International Economy* 20, pp. 434-453.
- Hamilton, J.D. 1994, *Time Series Analysis*, Princeton, NJ: Princeton University Press.
- Harada, T. and M. Masujima (2010), "Effectiveness and transmission Mechanism of the Quantitative Monetary Easing Policy," in H. Yoshikawa ed., *Deflationary Economy and Monetary Policy*, Keio Univ. Press. (in Japanese)
- Honda, Yuzou, Y. Kuroki, and M. Tachibana (2007), "An Injection of Base money at Zero Interest Rates: Empirical Evidence from the Japanese Experience 2001-2006," Osaka University, *Discussion Papers in Economics and Business*, No.07-08.
- Honda, Yuzou, Y. Kuroki, and M. Tachibana (2010), "Quantitative Monetary Policy: An empirical analysis on Japan's experience, 2001-2006," *Financial Review*, No. 99, Ministry of Finance.
- Joyce, Michael, M. Tong and R. Woods (2011), "The United Kingdom's Quantitative Easing Policy : Design, Operation and Impact," *Quarterly Bulletin* Q3, pp.200-212.
- Kimura, T, H. Kobayashi, J. Muranaga, and H. Ugai (2002), "The Effect of the Increase in Monetary Base on Japan's Economy at Zero Interest Rates: An Empirical analysis," BOJ, *IMES Discussion Paper series*, No. 2002-E-22.
- Kuroda, Haruhiko (2013), Quantitative and Quality Monetary Easing, *Speech at a meeting Held by the Yomiuri International Economic Society in Tokyo*, April 12.

- Krugman, P.(1988), “It’s Baaack: Japan’s Slump and the Return of the Liquidity Trap,” *Brooking Papers on Economic Activity* 2, pp.137-187.
(<http://web.mit.edu/krugman/www/>)
- Krugman,P. (2000), “Thinking About the Liquidity Trap,” *Journal of the Japanese and International Economies*, Vol.14, no.4, pp.221-237.
- Morita Yohji and S. Miyagawa (2012), *On the Liquidity Trap in the Interval (2001-2006) with Zero Interest Rate*, Proceedings on SSS11.
- Nakazawa, Masahiko and H.Yoshikawa (2011) “Monetary Policy in the deflation; Empirical Test of Quantity Easy Monetary Policy,” *PRI Discussion Paper Series*, No. 11A-03. (In Japanese)
- Okina and Shiratuka (2004), “Policy Commitment and Expectation Formation: Japan’s Experience under Zero Interest Rates,” *North American Journal of Economics and Finances*, 15-1, pp.75-100.
- Romer, Christina. (1992), “What ended the Great Depression,” *Journal of Economic History* 52, pp.757-84.
- Shiratuka, Shigenori, Y. Teranishi, and J. Nakajima (2010), “The effect of monetary policy commitment: Japan’s experience,” *Monetary and Economic Studies*, Vol.29, No. pp. 239-259.
- Shirakawa, Masaaki (2012), *Torward Sustainable Growth with Price Stability*, Speeches at the Kisaragi-kai Meeting in Tokyo, Bank of Japan.
- Tobin, James (1958), “Liquidity Preference as Behaviour towards Risk,” *Review of Economic Studies*, Vol.25, No.2, pp.65-86.
- Ugai Hiroshi (2006), Effects of the Quantitative Easing Policy: A Survey of Empirical Analysis, *BOJ, Working Paper Series*, No.06-E-10.