



The Demand for Money: Recent Japanese Case

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Abstract

Demand for money has been discussed a lot from the past both in the theoretical and in the empirical fields of economics. In Japan, low or almost interest rates has been prevailed and there has been a strong demand for Japanese government bond, so there is possibility that money demand has been changed and been apart from traditional one. Also, exchange rates against Japanese currency and stock prices have fluctuated largely recently due to the introducing unprecedented financial policy from the 2000s. They might have affect macroeconomic variables and money demand function. Empirical evidence show that demand for money is affected by real GDP, prices, and exchange rates, and is also stable, however, stock prices have not impacts on demand for money.

Keywords: Demand for money, Exchange rate, Financial policy, Japan, Stock.



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1. Introduction

Demand for money has been discussed a lot from the past both in the theoretical and in the empirical fields of economics. In Japan, low or almost interest rates to combat deflationary pressure has been ongoing from the end of 1990s, also, exchange rates against main foreign currencies and stock prices have fluctuated largely, and there has been a strong demand for Japanese government bond, so there is possibility that money demand has been changed dramatically and has been a different one from a traditional one.

The Bank of Japan (BOJ), as the central bank of Japan, conducts financial policy with the goal of keeping price stable from the past. Price stability is thought to be important because it is considered to be the foundation of economic activity. The main operating target of the BOJ's financial policy changed from the uncollateralized overnight call rate (interbank interest rate) to the outstanding balance of the current account held at the BOJ as the interest rates in Japanese financial markets have been almost zero from the beginning of the 2000s.

At the end of 2001, the BOJ raised the outstanding balance of the current account at the BOJ. This objective can be perceived from the one that the holding a level of reserves at the BOJ would transmit into lending capital to the economy and removal of deflationary pressures. Under this quantitative easing policy, the BOJ purchased government bonds to reach its target of current account balances held by financial institutions. The BOJ, as interest rates were at the lower bound of zero, set a goal to purchase government securities from the financial institutions and to raise the level of cash reserves held by private banks. This was called *unconventional financial policy*. Since then, Japanese financial policy has received much attention from the world because this unconventional financial policy was unprecedented all over the world and much drastic. However, only a few studies have examined this policy. One and serious reason is that only a short time has passed since this unprecedented policy was adopted.

In April, 2013, the policy board of the BOJ decided to introduce quantitative and qualitative monetary easing, more aggressive financial policy. The BOJ decided to achieve the price target of 2% in terms of the year-on-year rate of change in the consumer price. It was said that the BOJ did a new phase of monetary easing both in terms of quantity and quality. The BOJ would double the monetary base and the amounts outstanding of Japanese government bonds as well as exchange-traded funds (ETFs) in two years and would more than double the maturity of Japanese government bond purchases. To achieve quantitative monetary easing, the main target of financial policy instruments was changed from the uncollateralized overnight call (interbank interest) rate to the monetary base as mentioned above again.

Could the demand for money function be affected by economic uncertainty in addition to monetary uncertainty? [Choi and Oh \(2013\)](#) showed that economic uncertainty can affect public's decision in allocating their wealth among different assets. They found that output uncertainty had negative effect and monetary uncertainty had positive effect on the money demand in the US. [Kumari and Mahakud \(2012\)](#) indicated that the long elasticity of demand is sensitive to stock prices, inflation, and economic activity. [Dogru and Recepoglu \(2013\)](#) examined that the real money demand in Turkey is related with income positively and is related with nominal interest rate negatively. [Khan and Hve \(2013\)](#) demonstrated that GDP and real deposit rate have impact positively the demand for money both in the long-run and in short-run. [Jiranyakul and Opiela \(2014\)](#) showed that in the short-run, only a change in real GDP affects M1 money holdings. Also, in the long-run, both real GDP and an interest rate determine money demand. As many developed countries are under deflationary pressures and people hold holding money instead of investing risky assets, demand for money, which has been very traditional field of economics, should be paid to a lot of attention ([Bahmani-Oskooee and Xi, 2011; 2014](#)).

Japan has monetary sovereignty, which gives the Japanese government the ability to finance its debt, and enables the Bank of Japan to keep JGB's nominal yields low by ensuring that short-term interest rates are low, and by conducting various other tools of financial policy. Debt to GDP in Japan is illustrated in [Figure 1](#). The ratio is extraordinary high among developed countries.

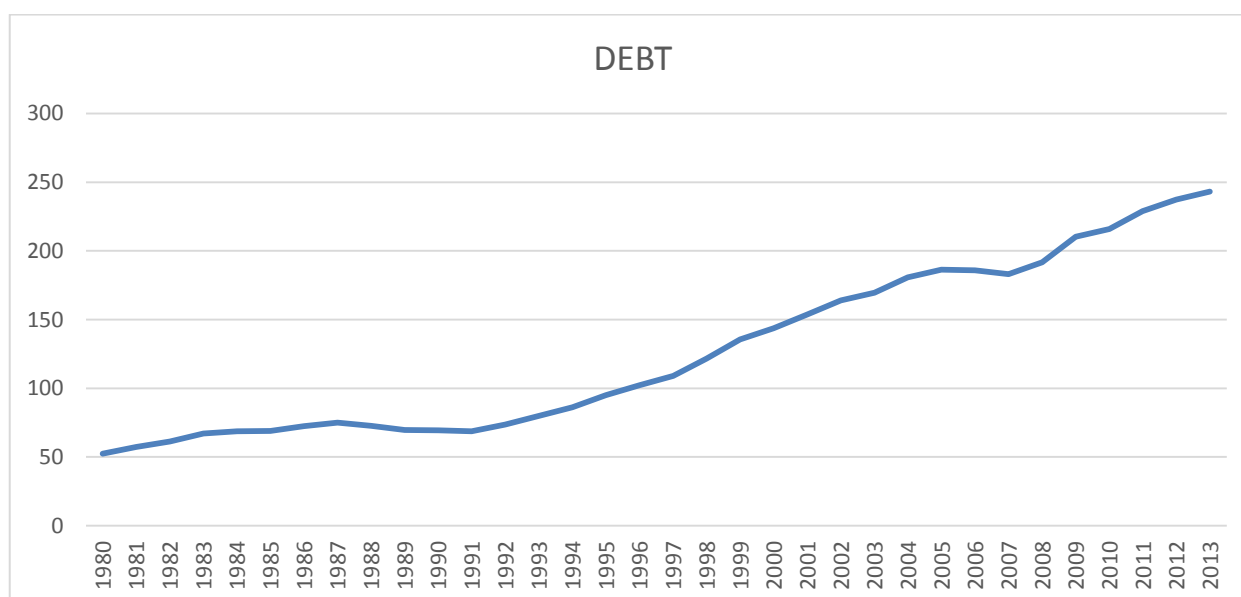


Figure-1. Japanese public debt to GDP ratio (%)

Note: Data are from International Financial Statistics (IMF)

Exchange rates have not been paid much attention from the past in analyzing demand for money. [Craig \(1982\)](#) found that exchange rate in West Germany is related with demand for money. [Bahmani-Oskooee and Malixi \(1991\)](#) indicated that depreciation of domestic currency promotes a decrease in the demand for domestic currency in many less developing countries. [Bahmani-Oskooee et al. \(1998\)](#) demonstrated that demand for money including the

effective exchange rate were shown to be stable. [Hueng \(1988\)](#) showed that changes in the foreign interest rate and exchange rate affect the demand for money in Canada. [Gunnar \(2001\)](#) argued that shocks to the nominal exchange rate have impacts on domestic prices in the short-run but have no impact on real output, while shocks to money have a temporary impact on real output before causing inflationary. [Dreger et al. \(2007\)](#) showed that for new entrants EU member States, against US exchange rate is significantly related with demand for money. [Tang \(2007\)](#) demonstrated that real M2 aggregate, real expenditure components, exchange rate, and inflation have cointegration relationship in Malaysia, Philippines, and Singapore. [Yu \(2008\)](#) showed that the demand for real M1 in Argentina had a positive relationship with real income and peso depreciation in Argentine. [Abdullah et al. \(2010\)](#) found that depreciation of domestic currency increases the demand for money. [Arize and Nam \(2012\)](#) showed that increases in the exchange rate, has a significant and positive effect on money demand. [Abdulkheir \(2013\)](#) showed the existence of a long-run cointegration relationship between the demand for money and its explanatory variables, namely, real GDP, interest rate, inflation rate, and exchange rate. Moreover, along with the changing of economic circumstances, demand for money, which is not necessarily a new topic of economics, has been discussed and examined again recently.

This paper examines recent Japanese demand for money function. It has been discussed a lot, however, the exchange rate has not been included for empirical analysis in many cases. Also, recent Japanese economic and financial condition, namely, drastic financial policy and almost zero interest rate could have changed the demand function for money greatly. Changing of stock prices is one of them to be examined.

This paper is structured as follows. Section 2 provides theoretical background for empirical analysis. Following this section, section 3 conducts empirical analyses. Section 4 reviews the results and performs additional analyses to examine the problems which cause from previous section. Finally, this paper ends with a brief summary.

2. Theoretical Backgrounds

Few studies have examined the impact of economic and monetary uncertainty on the demand for money of Japanese case. This paper firstly examines this equation.

$$\ln Mt = a + b\ln RGDPt + c\ln(Pt/Pt-1) + d\ln EXCt + \epsilon t \tag{1}$$

t means time. M denotes M2 (seasonally adjusted). A measure of economic activity is real income (RGDP), which indicates transaction demand for money. b is an estimate of income elastic and is expected to be positive. The measure of opportunity cost of holding money against financial assets, the inflation rate, namely, $\ln(Pt/Pt-1)$ measures the opportunity cost against real assets. It is expected to be negative. To explain the degree of each currency substitution between domestic and foreign currency, the exchange rate, EXC, is included in the regression analysis. This variable has been regarded as unimportant or not affective variable against money supply. The exchange rate is the effective exchange rate. Hence, a decline reflects depreciation. Since the depreciation of domestic currency promotes domestic currency value of foreign assets held by domestic residents, the demand for money could rise due to perceived increase in wealth [Arango and Ishaq Nadiri \(1981\)](#). However, [Bahmani-Oskooee and Pourheydarian \(1990\)](#) demonstrated that if depreciation of domestic currency causes an increase in expectation of more depreciation, domestic residents have less of domestic currency and more of foreign currency. Therefore, an estimate of d could be negative or positive. It would be inconclusive.

Finally, interest rates are not included in the estimation as they are almost zero, so instead of these variables, exchange rate is estimated for demand for money. For preliminary estimation, interest rates were checked empirically, however, there were not significant.

3. Empirical Analysis

Sample period is from 2002Q1 to the latest 2014Q1. At the end of 2001, the BOJ raised the outstanding balance of the current account at the BOJ. It is the beginning of unprecedented financial policy. Such policy has been changing, however, basic stances to boost the economy has not been changing.

Empirical methods are OLS (Ordinary Least Squares), GMM (Generalized Method of Monument), and Robust Estimation.

One problem in equations that use the OLS method is the existence of unobservable specific effects and also lagged dependent variables. This problem can be overcome with the use of the GMM. This method requires a decision on which variables to use as instrumental variables. J-test is also performed. This test checks whether the models moment contains match the data or not. In a GMM context, when there are more moment conditions than parameters to be estimated, this chi-square test can be used to test the over-identifying restrictions. In this analysis, the lagged values of the dependent variables are used as instrumental variables.

Robust estimation is a robust estimator, unlike maximum likelihood estimation. OLS estimates for regression models are highly sensitive to outliers. Outliers are observations which do not follow the pattern of the other observations. This is not a problem if the outlier is simply an extreme observation from the tail of a normal distribution, however, if the outlier are from non-normal measurement error or some other violation of standard OLS, it compromises the validity of the regression results if a non-robust regression method is employed.

Table-1. Demand for money in Japan

| | OLS | GMM | Robust estimation |
|-------|-----------------------|----------------------|-----------------------|
| C | -1.464*** (-5.391) | -1.704** (-3.209) | -1.939*** (-8.666) |
| RGDP | 2.022*** (35.468) | 2.075*** (19.975) | 2.108*** (44.909) |
| PRICE | 0.328*** (4.750) | 0.558*** (4.669) | 0.440*** (7.724) |
| | | | <i>Continue</i> |

| | | | |
|--------------------|---------------------|--------------------|--------------------|
| EXC | -0.058* (-1.708) | -0.035 (-0.473) | -0.015 (-0.584) |
| Adj.R2 | 0.984 | 0.982 | |
| Rw-squared | | | 0.994 |
| F-statistic (Prob) | 2829.440 (0.000) | | |
| J-statistic(Prob) | | 8.057(0.005) | |
| Rn-squared (Prob) | | | 12067.21(0.000) |
| Durbin-Watson | 0.209 | 0.257 | |

Note: Parentheses are t-statistic (OLS and GMM) and z-statistic (Robust estimation). ***, **, and * denote significant at 1, 5, 10%.

Almost all the results are clear and expected. However, only the results of exchange rate are not conclusive confirmly. The results of OLS could understand that depreciation of domestic currency (minus means depreciation of the yen) promotes domestic currency value of foreign assets held by domestic people, so the demand for money could rise due to perceived increase in wealth, however, it is significant at 10% level and for the cases of other methods, the coefficients are not significant. However, all of the coefficients are minus in spite of the employed empirical methods.

To understand the relationship among variables, VAR (Vector Autoregression Estimation) is employed. Stock prices are includes in this analysis. The results are in Table 2.

Table-2. Vector Autoregression Estimation for Japanese demand for money

| | MS | RGDP | PRICE | EXC | STOCK |
|-------------|-----------------------|---------------------|-----------------------|----------------------|-----------------------|
| MS(-1) | 1.624*** (22.798) | 0.060 (0.334) | 0.012 (0.028) | 0.150 (0.164) | -0.315 (-0.201) |
| MS(-2) | -0.609*** (-8.011) | 0.018 (0.094) | 0.079 (0.162) | -0.026 (-0.230) | 0.386 (0.237) |
| RGDP(-1) | -0.012 (-0.321) | 0.858*** (9.371) | 0.126 (0.542) | -0.327 (-0.704) | -0.281 (-0.362) |
| RGDP(-2) | -0.039 (-1.132) | -0.048 (-0.559) | -0.353* (-1.616) | 0.368 (0.841) | -0.003 (-0.004) |
| PRICE(-1) | -0.007 (-0.584) | 0.029 (0.907) | 1.153*** (14.157) | -0.078 (0.476) | -0.093 (-0.343) |
| PRICE(-2) | 0.008 (0.686) | -0.015 (-0.488) | -0.378*** (-4.888) | 0.073 (0.474) | 0.114 (0.442) |
| EXC(-1) | 0.011 (1.594) | 0.008 (0.473) | -0.028 (-0.639) | 1.191*** (13.633) | -0.129 (-0.882) |
| EXC(-2) | -0.014** (-2.105) | -0.010 (-0.600) | 0.013 (0.307) | -0.285** (-3.245) | 0.068 (0.464) |
| STOCK(-1) | 0.002 (0.523) | 0.019* (1.839) | 0.018 (0.702) | 0.002 (0.031) | 1.319*** (15.174) |
| STOCK(-2) | 0.001 (0.280) | -0.006 (-0.587) | -0.036 (-1.332) | -0.014 (-0.268) | -0.348*** (-3.890) |
| C | 0.098** (3.289) | 0.221 (2.935) | 0.364 (1.910) | 0.507 (1.327) | 0.813 (1.275) |
| Adj.R2 | 0.999 | 0.997 | 0.890 | 0.976 | 0.958 |
| F-statistic | 147293.3 | 5331.013 | 109.036 | 540.370 | 303.532 |
| Akaike AIC | -9.887 | -8.033 | -6.172 | -4.781 | -3.757 |

Note: Parentheses are t-statistic (OLS and GMM) and z-statistic (Robust estimation). ***, **, and * denote significant at 1, 5, 10%. Time lag is selected according to Akaike AIC.

A few results are not conclusive, other results are almost as expected and are not contrary to previous analyses. Traditional money demand function (Table 1) is rather stable and accountable than the results of this one (Table2). In general, setting time lag for explanatory variables is not adequate to explain demand for money except the case of exchange rate. Exchange rate plays a role to determine demand for money.

4. Further Analysis

Almost all the results conducted in the previous section are as expected. They are very ‘traditional’ results. Exchange rates, which are not usually included in the money demand function, have not significantly impacts on money supply at 1% or 5% level, however, significant at 10% level (Table 1). On the other hand, Japanese economic and financial circumstances have been changing greatly from the beginning of 2000s. The BOJ continuously has conducted financial policy to boost the economy, the BOJ did a new phase of monetary easing both in terms of quantity and quality from 2013. The BOJ decided to increase the monetary base and the amounts outstanding of Japanese government bonds as well as ETFs. To achieve quantitative monetary easing, the main target of monetary policy instruments was changed from the uncollateralized overnight call (interbank interest) rate to the monetary base. Before that, similar policies like quantitative easing policy and zero interest rate policies have been adopted as mentioned before.

Two more empirical analyses are conducted in this section. First, stock price (indexes data are from IFS) is included in the estimation (1). The estimated equation is as (2).

$$\ln Mt = a + b \ln RGDP_t + c \ln (Pt/Pt-1) + d \ln EXC_t + e \ln STOCK_t + \varepsilon_t \quad (1)$$

Table-3. Demand for money in Japan, Including stock prices

| | OLS | GMM | Robust estimation |
|--------------------|----------------------|--------------------|----------------------|
| C | 0.693 (0.524) | 1.828 (0.636) | 4.547*** (6.365) |
| RGDP | 1.572*** (5.045) | 1.257* (1.694) | 0.548*** (2.957) |
| PRICE | 0.044 (0.579) | 0.027 (0.188) | -0.032 (0.477) |
| EXC | -0.176** (-2.100) | -0.227 (-1.426) | -0.345*** (0.000) |
| STOCK | -0.090 (-1.523) | -0.062 (-0.728) | -0.003 (-0.082) |
| Adj.R2 | 0.790 | 0.767 | |
| Rw-squared | | | 0.931 |
| F-statistic (Prob) | 47.126(0.000) | | |
| J-statistic(Prob) | | 6.044(0.014) | |
| Rn-squared (Prob) | | | 402.905(0.000) |
| Durbin-Watson | 0.349 | 0.252 | |

Note: Parentheses are t-statistic (OLS and GMM) and z-statistic (Robust estimation). ***, **, and * denote significant at 1, 5, 10%.

In addition, impulse responses are analyzed according to the VAR analysis in the previous section (Table 2). The results are in Figure 1.

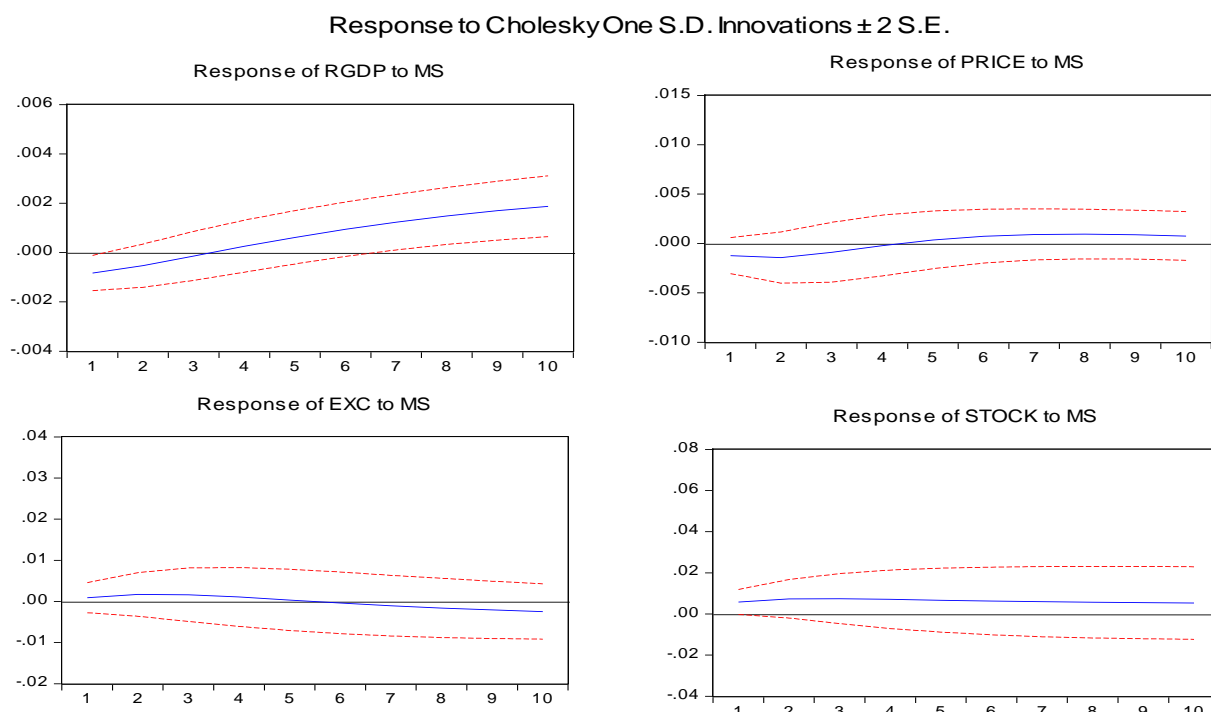


Figure-1. Impulse responses to demand for money.

The results seem to be clear. The results are expected. Stock prices do not influence demand for money. However, it should be noted that drastic financial policy has been adopted recently. From 2013, stock prices has been rising greatly, so much more time is needed to analyze the effect. On the other hand, shocks of exchange rates affect demand for money, however, the impact is not so long. The results are seem to be predictable.

Secondly, the relationship between monetary base and money supply is regressed as follows (3). The results of OLS is reported here.

$$\ln Mt = a + b \ln MBt + \varepsilon t \quad (3)$$

MB denotes monetary base (from IFS). The regression method is OLD. The results are in Table 4.

Table-4. Money supply and monetary base

| | |
|--------------------|-------------------|
| C | 5.302*** (68.511) |
| MB | 0.277*** (7.328) |
| Adj.R2 | 0.518 |
| F-statistic (Prob) | 53.691(0.000) |
| Durbin-Watson | 0.094 |

Note: Parentheses are t-statistic. ***, **, and * denote significant at 1, 5, 10%.

The results are very clear. Financial policy has been effective to promote the economy although the effect is not so large. So much more time to do research would be necessary as there is some possibility that demand for money function would change.

5. Conclusions

In Japan, low or almost interest rates has been prevailed and there has been a strong demand for Japanese government bond, so there is possibility that money demand has been changed. This paper examined recent Japanese

case. Despite recent dramatic changing of the economy, money demand function is very stable and accountable mostly according to the traditional money demand function presented by traditional economic theory. Empirical evidence shows that demand for money is affected by real GDP, prices, and exchange rates, however, stock prices have not impacts on demand for money clearly. Also, financial policy to combat the deflation and to boost the economy can be judged adequately. It can be said that market participants can believe policies because demand for money is stable and predictable.

Finally, Japanese government not only conducted drastic economic policy but also took measures to strengthen competitiveness and economic growth. These measures included possible policy actions to reform the economic structure, such as concentrating resources on innovative research and development, strengthening the foundation for innovation, performing regulatory and institutional reforms, and changing the tax system. Moreover, by strengthening coordination between the BOJ and the government, the Japanese government implements measures to achieve a new fiscal structure to ensure the credibility of the fiscal condition from 2013. This approach is called *Abenomics*. Abe is from the name of Japan's current prime minister. So much more time to do research would be necessary as there is some possibility that demand for money function would change.

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