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MONEY DEMAND AND ZERO-INTEREST RATE POLICY: A LESSON FROM JAPAN

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Abstract: *The objective of this paper is to evaluate how the Japanese quantitative easing monetary policy affects the sensitivity of money demand with respect to the opportunity cost of holding money in Japan. For the analysis, we divide the sample period into a normal interest rate period and a zero interest rate period, and quantify the sensitivity of money demand by applying Multivariate co-integration method. The results reveal that the sensitivity of money demand with respect to the opportunity cost of holding money is five times higher in the near-zero interest rate period than in the normal interest rate period.*

JEL Classifications*: C32, E41, E50*

Keywords*: Quantitative easing monetary policy, Multivariate structural vector autoregression, Money demand, Liquidity trap*

1. INTRODUCTION

This paper analyses the role of money demand and the effect of an ultra-low interest rate policy on money demand by quantifying the sensitivity of money demand with respect to the opportunity cost of holding money. We begin by stating Eggertsson and Woodford's argument that

> "The spectre of a "Liquidity Trap" originally proposed as a theoretical possibility by John Maynard Keynes (1936) has recently created alarm among the world's central banks. The fact that the federal funds rate has now been reduced to only one percent in the United States, while signs of recovery remain exceedingly fragile,…where interest rate policy would no longer be available as a tool for macroeconomic stabilisation." (Eggertsson and Woodford, 2004).

Since the credit crunch triggered by the burst in the US housing market, namely the sub-prime crisis, the US economy is in a similar situation to the liquidity trap, whereby the nominal interest rate has reached the lower bound constraint and therefore central banks have almost lost the ability to stimulate the economy, meaning that signs of recovery remain exceedingly fragile. Thus, as Eggertsson and Woodford (2004) argue, the liquidity trap originally proposed as a theoretical possibility by Keynes (1936) is not just a theoretical possibility anymore, and has triggered further fiscal imbalances and financial instability in the country.

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Japan has been experiencing a serious liquidity trap for more than ten years. Since the bursting of the bubble in the late 1980s, Japan has experienced a recession caused by a dramatic fall in share prices and land prices, which ultimately led to the creation of huge non-performing loans in the financial market. Therefore, to boost the economy and climb out of the recession, the Bank of Japan has implemented a low interest rate policy since the late 1990s.

The purpose of this paper is to analyse how a change from a standard monetary policy to an ultra-low interest rate policy affects money demand and other economic activities, by examining the real-life example of the liquidity trap in Japan. These analyses may be considered to be important not only for Japan, but also for those countries which are in a similar situation, as they will help them to control money supply and inflation rates, as well as other economic activities such as unemployment rates and GDP growth.

In the literature, there are a number of studies about money demand. Representative papers include Tobin (1956), Lucas (1988), and Hendry and Ericsson (1991). The general consensus is that money demand is extremely interest-elastic when the nominal interest rate hits the zero bound. In terms of quantifying Japan's money demand, there are a limited number of studies and the arguments are slightly scattered (see Miyao (2004), Fujiki and Watanabe (2004), Bae *et al.* (2006), and Nakashima and Saito (2009)). For example, some research avoids using money data since 2000 because of the instability of money demand or because the data was not available at the time. Also, some of the studies suffer from spurious relationships due to the integlation of order 2 (i.e., I(2)) or non-linearity of money growth in the co-integration framework. In these cases, it is difficult to rely on the determined co-integration rank, as well as other statistical inferences and estimators, when making an economic analysis and drawing conclusions. For example, in the Engle-Granger framework, all the variables must be I(1). On the other hand, Johansen's method which is used in this paper as the multivariate co-integration method is robust and flexible with respect to the above issue since Johansen's theorem looks at the whole multivariate system rather than each single variable. Thus, what matters is whether the system is I(1) or not in Johansen's frame-work (Johansen (1996)). By exploiting the above property of Johansen's theorem with the money data, this paper attempts to construct a stable money demand relationship and quantify the sensitivity of money demand with respect to the opportunity cost of holding money. We also compare the sensitivity of money demand during the normal monetary policy period and during the zero interest rate period, shedding light on the economic implications of the quantitative monetary easing policy.

The structure of this paper is as follows. Chapter 2 presents the basic design and concept of the model. Chapter 3 explains the econometric theory of the multivariate vector autoregressive structural model used in this paper, namely Johansen's theorem. Chapter 4 carries out the co-integration analyses for the two periods, and attempts to construct consistent and stable money demand relationships and quantify the sensitivity of money demand with respect to the nominal interest rate. The overall conclusions are summarised in Chapter 5. All empirical analyses and graphics use OxMetrics5 (Doornik and Hendry 2006) unless otherwise stated.

2. BASIC CONCEPTS AND VARIABLES

2.1. Money demand under the zero lower bound interest rate

This subsection analyses the monetary transmission mechanism under the zero lower bound interest rate, then gives a definition of the quantity theory of money. As mentioned in the introduction, a significant change was made in Japanese monetary policy at the end of the 1990s to boost the economy and help it climb out of recession. This change positioned the Japanese short-term nominal interest at zero. Taking this into consideration, the monetary transmission mechanism under the zero lower bound constraint can be explained as follows:

$$\varepsilon_{Md} = \frac{\partial M_d}{M_d} \frac{i}{\partial i}$$

where ε_{Md} denotes the elasticity of money demand against the nominal interest rate, while M_d and i denote money demand and the nominal interest rate. As the nominal interest rates approaches zero, agents will be indifferent to holding money and bonds. Moreover, because buying bonds is unprofitable at i=0 (but rather involves some transaction costs in buying and selling bonds) and we also assume that money gives us some transaction value, the demand for money will be infinite (∞) at $i = 0$. Consequently, once the nominal interest rate reaches zero, monetary expansion cannot affect income since the elasticity of money demand against the nominal interest rate becomes infinite.

2.2. Variables and the design of sample periods

We first define the following variables based on Hendry and Ericsson (1991) and Hendry and Nielsen (2007), which we then use for the analysis of money demand. Velocity, inflation and spread are used for modelling:

y: the logarithm of real GDP, in billions of yen in 1995;

p: the logarithm of the GDP deflator, 1995=100 where p=ln(deflator/100);

m: the logarithm of nominal, narrow money, M1, in billions of yen; M0 includes cash and bank reserves, while M1 includes elements and other liquid balances such as deposits in interest-paying cheque accounts;

Velocity: $v_t = y_t + p_t - m_t$;

Δp_t: quarterly inflation (percentage term);

Cost of holding money (spread$_t$): long-term interest rate$_t$ – short-term interest rate$_t$;

Long-term interest rate: the logarithm of the 10-year government bond yield (quarterly yield);

Short-term interest rate: the logarithm of the overnight call rate (quarterly yield)

$$\ln(1+\frac{I}{100}) \approx \frac{I}{100} \Rightarrow 100 \times \ln(1+\frac{I}{100}) \approx I$$ where I is a percentage term interest rate.

The effect of a zero rate of interest accrued on all M1s (short-term interest rates) is negligible for cash, and we assume that all M1s receive a return at the Bank of Japan's call money rate. Thus, the opportunity cost of M1 means that such wealth cannot accrue the interest paid on a less liquid long-term asset, such as a ten-year government bond, so the spread defines the opportunity cost of M1.

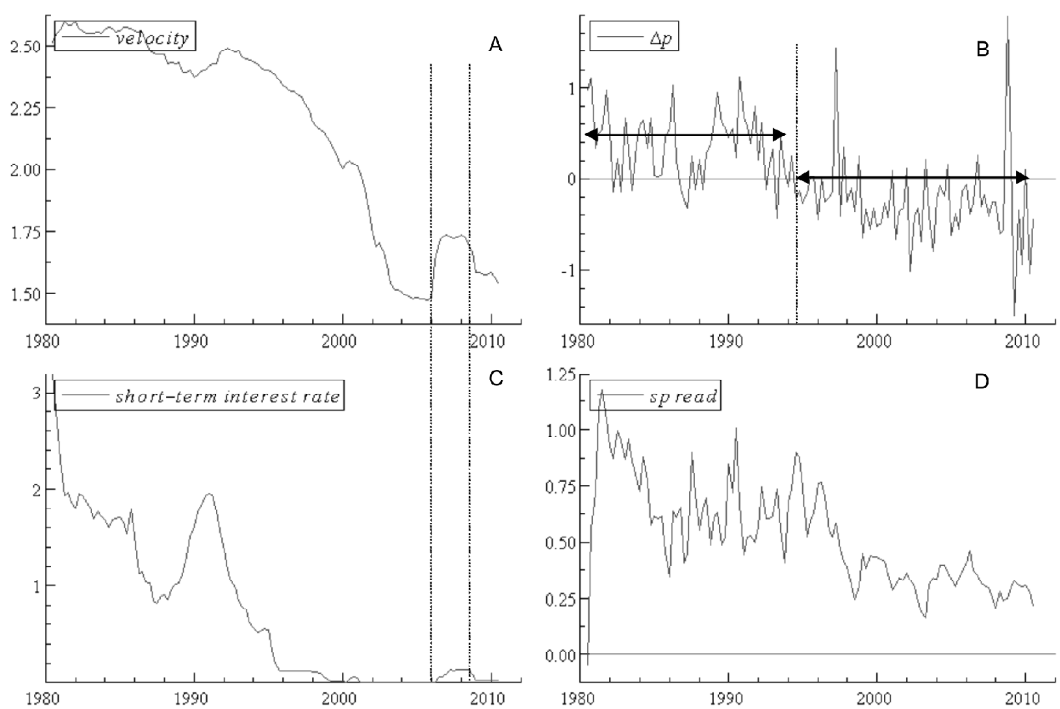
We next carry out graphical inspections of these variables before undertaking econometric modelling. Figure 1 shows the basic variables and design of the sample period. As shown in Figure 1-B, the level of inflation seems to have shifted downward since 1994, which reflects the deflation period. Furthermore, the overall trend of spread is downward (Figure 1-D), while velocity also shows a downward trend, although a steep decline is observed around 2000 (Figure 1-A). Thus, one may expect that these two variables share a common stochastic trend in this period.

Moreover, we observe a large jump in velocity due to the termination of the quantitative monetary easing policy in 2006Q2, and velocity falls again owing to the onset of an expansionary monetary policy corresponding to the recent credit crisis.

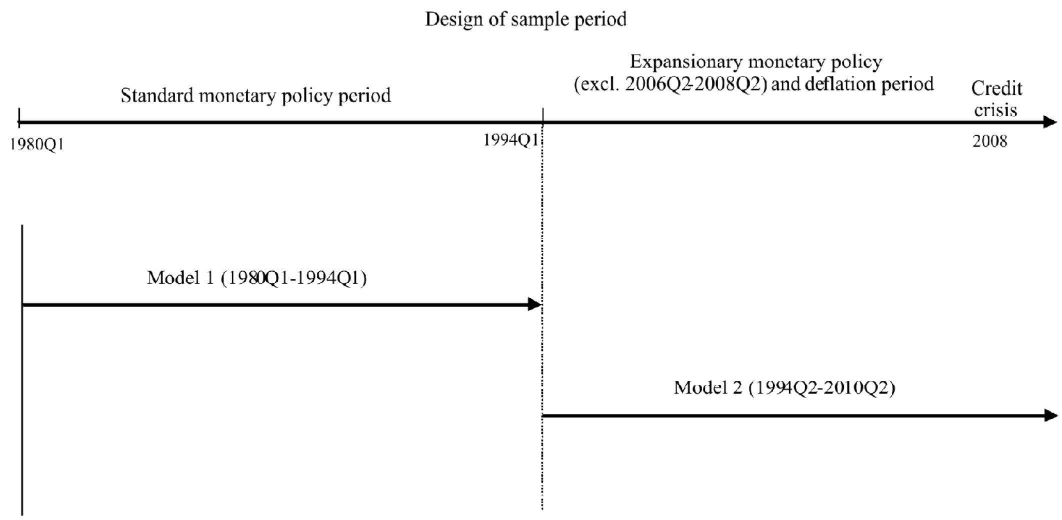
Similarly, the short-term interest rate also clearly shows different behaviour before and after 1994 due to the expansionary monetary policy (Figure 1-C). Therefore, it is reasonable to divide the sample period into two periods and analyse the difference in the results for each of these periods. The sample periods for the analysis are as follows:

Model 1 {1980Q1-1994Q1}, Model 2 {1994Q2-2010Q2}.

Figure 1: Basic variables and design of the sample period



Design of sample period



3. ECONOMETRIC THEORY

We now move on to implementing a co-integrated VAR model. This paper exploits the multivariate vector autoregressive structure as the main mechanism of empirical analysis. Specifically, we use Multivariate co-integration method, which is applicable for co-integration relationships in the multivariate vector autoregressive structure described in Johansen (1988, 1996). First, we assume the following multivariate vector autoregressive model:

$$\Delta \mathrm{x}_t = (\Pi, \Pi_l)\begin{pmatrix} \mathrm{x}_{t-1} \\ c \end{pmatrix} + \sum_{i=1}^{k-1} \Gamma_i \Delta \mathrm{x}_{t-i} + \Phi D_t + \varepsilon_t , \qquad \forall t = 1,....,T \tag{3.1}$$

for fixed values $\mathrm{x}_{1-k},......\mathrm{x}_0$ and a Gaussian error vector (i.e. $\mu_t \sim niidN_p(0,\Omega)$). Π and Γ_i are $p \times p$ matrices, c is a restricted constant with a parameter vector Π_l, and D_t is a dummy vector, which may include impulse and/or seasonal dummies.

Assuming that $(\Pi, \Pi_l) = \alpha \begin{pmatrix} \beta \\ \gamma_l \end{pmatrix}'$, the above expression can be written as follows:

$$\Delta \mathrm{x}_t = \alpha \begin{pmatrix} \beta \\ \gamma_l \end{pmatrix}' \begin{pmatrix} \mathrm{x}_{t-1} \\ c \end{pmatrix} + \sum_{i=1}^{k-1} \Gamma_i \Delta \mathrm{x}_{t-i} + \Phi D_t + \varepsilon_t , \qquad \forall t = 1,....,T \tag{3.2}$$

where $\mathrm{x}_t = [v_t, \Delta p_t, spread_t]'$

Similarly, we also assume the following three conditions: 1) rank $\Pi = r$; 2) the number of unit roots is p-r; 3) the remaining characteristic roots are stationary. In this case, the solution for x_t is given by Johansen's representation theorem.

Therefore, the number of co-integrating relationships r ($r<p$) is given by the reduced rank condition:

$$(\Pi, \Pi_l) = \alpha(\beta', \beta_l') \tag{3.3}$$

Consequently, the rank condition of the I(1) process with r co-integrating vectors can be defined as follows:

$$\text{Rank}(\alpha'_{\perp} \Gamma \beta_{\perp}) = p - r \tag{3.4}$$

where $\alpha_{\perp,} \beta_{\perp} \in \tilde{N}^{p\times(p-r)}$ are orthogonal complements (that is, $\alpha' \alpha_{\perp} = 0$, $\beta' \beta_{\perp} = 0$ and $(\alpha, \alpha_{\perp})$, $(\beta, \beta_{\perp})$ are full rank) and $\Gamma = \text{I}_p - \sum_{i=1}^{k-1} \Gamma_i$.

If these conditions are satisfied, the multivariate model is regarded as an I(1) process (Engle and Granger, 1987; Johansen, 1996).

Hence, the co-integration rank hypothesis is defined as

$$H_l(r): \ \text{rank}(\Pi, \Pi_l) \le r \tag{3.5}$$

To determine the co-integrating rank, the following log-likelihood test statistic is used:

$$-2 \log Q(\text{H}(r) \mid \text{H}(p)) \tag{3.6}$$

where we test the null hypothesis of r co-integration ranks H(r) against the alternative hypothesis H(p). The log-likelihood test statistic is asymptotically distributed as

$$-2 \log Q(\text{H}(r) \mid \text{H}(p)) \xrightarrow{w} tr\left[\int_0^1 (dB)F' \left(\int_0^1 FF' du\right)^{-1} \int_0^1 F(dB)'\right] \tag{3.7}$$

where B is a (p-r) Brownian motion and F is a (p-r+1) dimensional process

(3.8)

The asymptotic quantiles are provided by Johansen (§15, 1996).

4. ECONOMETRIC MODELLING AND ANALYSIS

This section first estimates unrestricted VAR models based on the three endogenous variables. Second, we attempt to estimate the long-run co-integrating relationships between velocity, inflation and the cost of holding money. Interpretations and analyses of the co-integrating vectors are then discussed.

4.1. Unconditional VAR model estimation and co-integration analysis

As discussed above, we divide the sample period into two periods and carry out separate co-integration analyses (Model 1 and Model 2). The three endogenous variables in our model are

$$\text{x}_t = [v_t, \Delta p_t, spread_t\ ]'.$$

The first sample period runs from 1980Q1 to 1994Q1 and the second from 1994Q2 to 2010Q2. Owing to seasonal regularities in inflation, seasonal dummies are introduced into the model. Moreover, a restricted constant term is introduced to account for the constant state of velocity and inflation in each period. With reference to lag length, the initial model has two lags (one lag in I(0) space).

Under the above condition, we first estimate the unrestricted initial VAR model, which is purely a statistical model. The following figures show the estimation and diagnostic test results.

Table 1
Diagnostic tests for the unrestricted VAR: Model 1

Single equation tests		*velocity*	*Δp*	*spread*
Autocorr.	F(4,36)	0.43 (0.79)	0.50 (0.73)	1.03 (0.41)
Normality	Chi^ 2(2)	3.12 (0.21)	0.20 (0.91)	1.87 (0.39)
ARCH	F (4,32)	0.72 (0.59)	0.60 (0.67)	0.67 (0.62)
Hetero.	F(12,27)	0.44 (0.93)	0.64 (0.79)	0.96 (0.50)
Vector tests				
Autocorr.	F(36, 77)	1.14 (0.31)		
Normality	Chi ^ 2(6)	61.4 (0.41)		
Hetero.	F (72, 125)	0.49 (1.00		

Table 2
Diagnostic tests for the unrestricted VAR: Model 2

Single equation tests		*velocity*	*Δp*	*spread*
Autocorr.	F (4,42)	0.79 (0.54)	2.72 (0.04)	0.15 (0.96)
Normality	Chi^ 2(2)	5.79 (0.06)	0.43 (0.80)	2.35 (0.31)
ARCH	F (4,38)	3.25 (0.02)	0.70 (0.60)	3.18 (0.02)
Hetero.	F (12,33)	2.58 (0.02)	0.82 (0.63)	1.20 (0.32)
Vector tests				
Autocorr.	F (36,95)	0.88 (0.66)		
Normality	Chi ^2(6)	6.17 (0.40)		
Hetero.	F (72,158)	1.01 (0.47)		

Table 1 and Table 2 show the results of the diagnostic tests for the unrestricted VAR Models 1 and 2, respectively. To test the condition of the error term, we use the following test criteria: k^{th}-order serial correlation (Godfrey, 1978), chi-square test for normality (Kilian and Demiroglu, 2000), k^{th}-order autoregression (Nielsen, 2006) and heteroscedasticity (White, 1980). The tests are based on an F-test, Fj (k,T-l), against alternative hypothesis j (Hendry, 2001). As evidenced by the figures, all test statistics are insignificant at the 1% significance level.

Furthermore, the recursive estimation constancy test statistics in Table 3 and Table 4 show no significant evidence of structural breaks, and the models satisfy the overall system constancy test. (The one-step residuals lie within their approximate 95% confidence bands with constant standard errors [the first three plots in each model], and no break-point Chow test is anywhere significant [the 1% line is the top of each of the last four plots]. The last plot is the overall system consistency test) Hence, constancy cannot be rejected, and it can therefore be confirmed that this unrestricted VAR specification has potential benefits for the subsequent modelling process.

Table 3
Recursive estimation constancy statistics: Model 1
one-step residuals +/-2SE and break-point Chow test with a 1% significance level

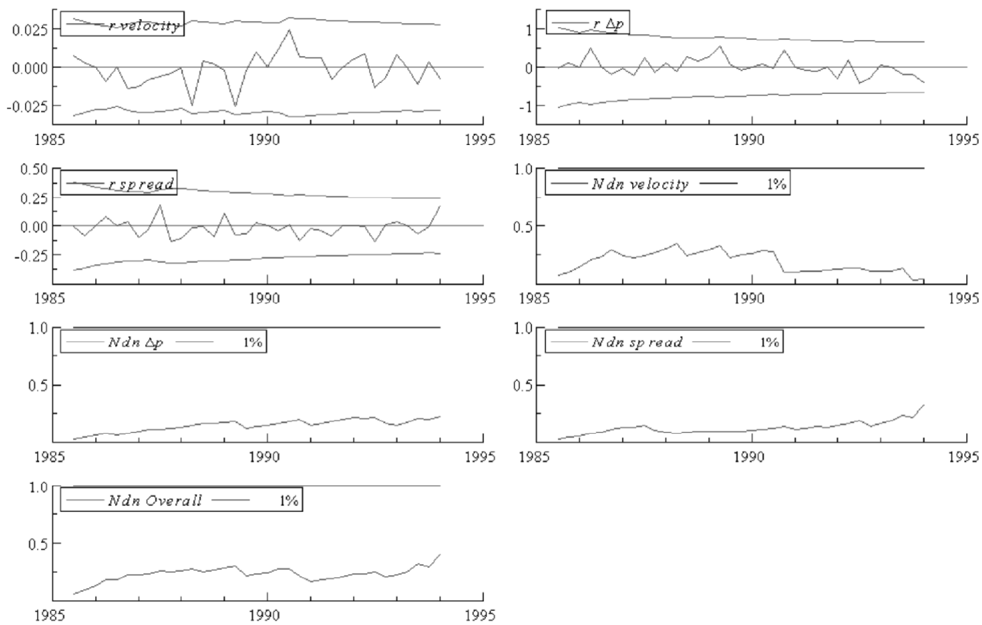
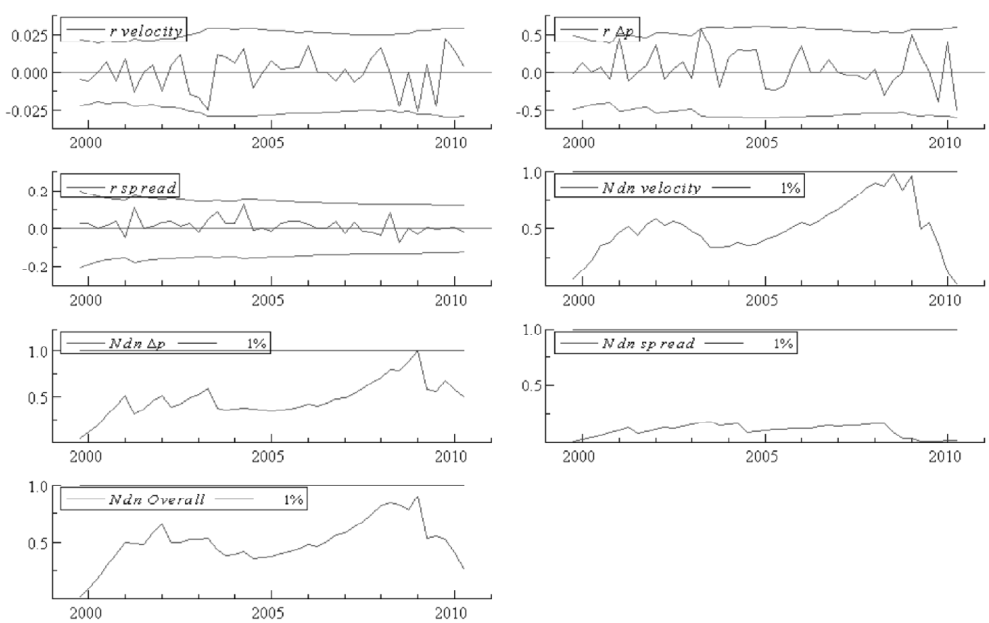


Table 4
Recursive estimation constancy statistics: Model 2
one-step residuals +/-2SE and break-point Chow test with a 1% significance level



4.2. Hypothesis of the co-integrating relationship

Before proceeding to the co-integration analysis, we define the hypothesis for the co-integrating relationships between the variables.

Assumptions

1: The spread is the opportunity cost of holding money.

2: $V \propto 1/M_d$: The velocity of money is inversely proportional to money demand.

Hypothesis: There is a positive long-run relationship between the velocity of money and the opportunity cost of holding money:

$$velocity_t = \gamma_1 spread_t + \gamma_2 + \varepsilon_t \tag{4.1}$$

where γ_1>0 and γ_2 is a constant

The argument is clear. If the opportunity cost of holding money increases, people will want to place their cash into long-term assets, so they will hold less money by putting it into long-term assets (for example, gilts or a well-diversified portfolio), which means that, by definition, velocity must go up.

Therefore, the opportunity cost of holding money and velocity should be positively correlated, which means that the opportunity cost of holding money is negatively correlated with money demand.

4.3. Co-integration analysis

This subsection reports the number of co-integrating ranks and attempts to specify co-integrating vectors. First, following a co-integrating rank test based on the likelihood test, we examine the number of co-integrating ranks for each model. Table 5 to Table 8 show the test results.

In all models, we accept the null hypothesis that there exist at least two co-integrating vectors against the alternative hypothesis of the existence of more than two co-integrating vectors, so r=2 is the first hypothesis we accept at the 5% significance level. Additionally, the four largest eigenvalues for the companion matrix show no statistical evidence of explosive roots. Furthermore, the I(2) tests confirm that there is no evidence for I(2) components in the model. Hence, the rank is 2.

Table 5
I(1) co-integration analysis: Model 1

r	*168.3*	*193.5*	*206.6*	*206.8*
λ		0.60	0.38	0.01
	r = 0	r ≤ 1	r ≤ 2	r ≤ 3
Q(r)	77.11	26.60	0.46	
p-values	(0.00)	(0.01)	(0.99)	
mod.	0.98	0.65	0.42	0.42

Table 6
I(2) co-integration analysis: Model 1

r	*S(r,s 1)*							
0	272.7	(0.00)	183.8	(0.00)	116.8	(0.00)	77.11	(0.00)
1			150.5	(0.00)	68.95	(0.00)	26.60	(0.01)
2					36.84	(0.00)	0.46	(0.99)
p-r-s1	3		2		1		0	

Table 7
I(1) co-integration analysis: Model 2

r	*0*	*1*	*2*	*3*
l	258.8	270.4	279.3	283.5
l		0.31	0.25	0.12
	r = 0	r ≤ 1	r ≤ 2	r ≤ 3
Q(r)	49.34	26.12	8.30	
p-values	(0.00)	(0.01)	(0.07)	
mod.	0.98	0.74	0.53	0.45

Table 8
I(2) co-integration analysis: Model 2

r	*S(r,s1)*							
0	320.1	(0.00)	142.6	(0.00)	91.31	(0.00)	49.34	(0.00)
1			172.8	(0.00)	75.17	(0.00)	26.12	(0.01)
2					41.65	(0.00)	8.30	(0.07)
p-r-s1	3		2		1		0	

We do not impose any restriction initially. Instead, we look carefully at the significance of each coefficient and impose restrictions according to the significance of each variable. Based on this procedure, we estimate and carefully specify structural representations of the co-integrating space as follows.

Fully specified adjustment space

$$\tilde{y}_t = \begin{pmatrix} v_t \\ \Delta p_t \\ spread_t \\ c \end{pmatrix} : \alpha = \begin{pmatrix} * & * \\ * & 0 \\ * & * \end{pmatrix} : \beta = \begin{pmatrix} 0 & 1 \\ 1 & 0 \\ 0 & \beta_2 \\ \beta_1 & \beta_3 \end{pmatrix}$$

$$ecm1 = \Delta p_t + \beta_1$$
$$ecm2 = v_t + \beta_2 spread_t + \beta_3$$

where $\{\beta_{1,} \beta_3\}$ are sign free and $\beta_2 < 0$

Figure 2: Fully specified adjustment space estimation results: Model 1 and 2

Model 1: $\chi^2(2) = 1.13\,(0.57)$

$$\hat{\alpha}' = \begin{bmatrix} v_t & \Delta p_t & spread_t \\ \underset{[0.005]}{0.02} & \underset{[0.11]}{-0.52} & \underset{[0.04]}{-0.03} \\ \underset{[0.017]}{0.01} & 0 & \underset{[0.14]}{0.92} \end{bmatrix}$$

$$\hat{\beta}' = \begin{bmatrix} v_t & \Delta p_t & spread_t & c \\ 0 & 1 & 0 & \underset{[0.13]}{-0.45} \\ 1 & 0 & \underset{[0.09]}{-0.59} & \underset{[0.07]}{-2.17} \end{bmatrix}$$

Standard errors are in parentheses

$ecm1 = \Delta p_t - 0.45$

$ecm2 = v_t - 0.59 spread_t - 2.17$

Model 2: $\chi^2(2) = 0.50\,(0.78)$

$$\hat{\alpha}' = \begin{bmatrix} v_t & \Delta p_t & spread_t \\ \underset{[0.01]}{0.01} & \underset{[0.12]}{-0.46} & \underset{[0.03]}{0.04} \\ \underset{[0.01]}{-0.02} & 0 & \underset{[0.03]}{0.08} \end{bmatrix}$$

$$\hat{\beta}' = \begin{bmatrix} v_t & \Delta p_t & spread_t & c \\ 0 & 1 & 0 & \underset{[0.16]}{-0.10} \\ 1 & 0 & \underset{[0.45]}{-3.08} & \underset{[0.25]}{-0.36} \end{bmatrix}$$

Standard errors are in parentheses

$ecm1 = \Delta p_t - 0.1$

$ecm2 = v_t - 3.08 spread_t - 0.36$

Figure 3: Recursive unrestricted cointegration coefficient: Model 1

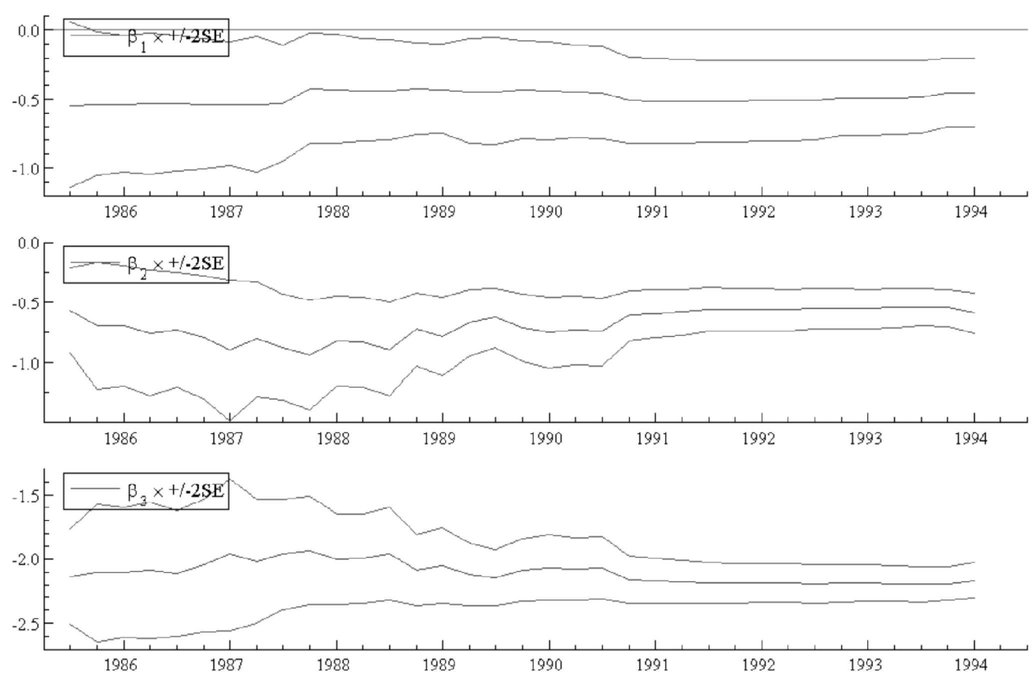
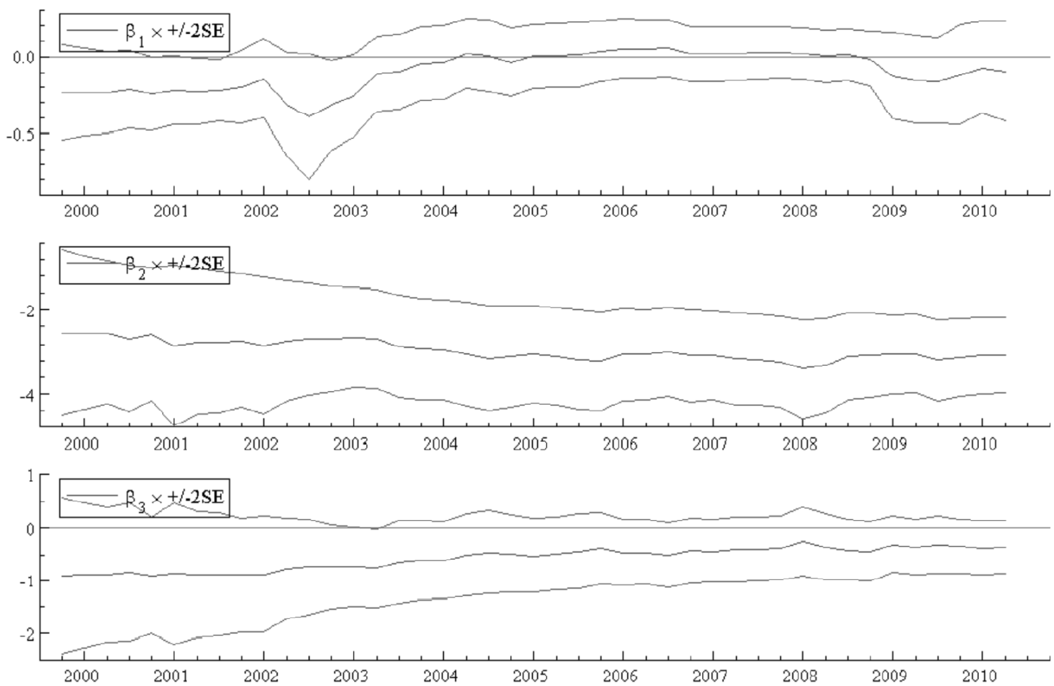


Figure 4: Recursive unrestricted cointegration coefficient: Model 2



As can be seen from Figure 3 and Figure 4, we can confirm the stability of the freely estimated co-integration coefficients. β_1 in Model 2 shows some fluctuation, but this simply reflects the fluctuation of inflation over time. The unique specification is accepted against the hypothesis that no restriction is imposed at the 5% significance level in all periods (Figure 2), which allows us to carry out a horizontal analysis.

Interpretation and analysis of the long-run relationship:

ECM1:

$$ecm1 = \Delta p_t + \beta_1$$

This indicates that inflation is stationary during the period specified, a result supported by inspecting the earlier graphs (Figure 1-B). Inflation in Japan was positive until the mid-1990s, but after this time the Japanese economy experienced long-lasting deflation (ecm1 from Model 2 indicates slight positive inflation, but this may be upwardly biased by a large positive spike in 2008 due the aftermath of the credit crisis).

ECM2:

$$ecm2 = v_t + \beta_2 spread_t + \beta_3$$
where $\beta_2 < 0$

As discussed in the previous section, we can see a positive association between velocity and spread, which highlights a negative association between the opportunity cost of holding money and money demand. From the above estimation, we can establish the sensitivity of money demand with respect to the opportunity cost of holding money as follows.

Normal interest rate period

$$v_t = 0.59 spread_t + c_1$$

$$\frac{\partial v_t}{\partial spread_t} = 0.59$$

Zero interest rate period

$$v_t = 3.08 spread_t + c_2$$

$$\frac{\partial v_t}{\partial spread_t} = 3.08$$

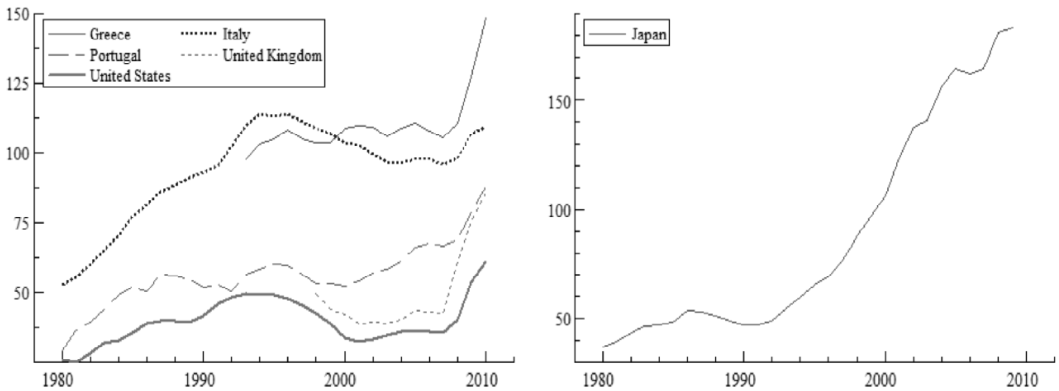
Thus, the sensitivity of money demand with respect to the opportunity cost of holding money under a zero interest rate is approximately five times higher than that for the normal interest rate period (assuming $v \propto 1/M_d$). This makes sense, because under the zero lower bound interest rate, money demand will be very large (it will be infinite if cash is defined as money, as convention dictates). Therefore, money demand will be more sensitive under a zero lower bound interest rate than in a normal period. This is consistent with the slope of a standard money demand curve approaching infinity at the lower bound, given that money is defined as M1 and not cash. In our case, because we use M1, we effectively have the spread on the vertical axis in the money demand diagram, whereas in a conventional money demand diagram that uses cash, one would simply have the interest rate on the vertical axis. Conventionally, money would be narrowly defined as cash, and cash would pay a zero yield. Thus, it can be argued that, in effect, when the spread approaches zero, liquid M1 and illiquid long-term assets are perfect substitutes in terms of yield, and therefore the demand for liquidity could potentially be unbounded as there is no disadvantage to holding a liquid as opposed to an illiquid asset. Note that under the zero interest rate policy, we do not quite have the same spread (the average is around 30 basis points). Hence, we would expect a larger but finite $\partial v / \partial spread$ during the very low interest rate period.

Another possible explanation for the small coefficient for spread in the pre-1994 model is the limited range of financial instruments available to households. As argued in much of the literature (e.g. Hendry, 2001), modern economies experienced a number of financial innovations in the 1980s, and it has been posited that these financial innovations significantly reduced the cost of transactions, therefore increasing the efficiency of the financial market and accessibility to a variety of financial instruments. It is plausible that, if consumers face such high switching costs between asset classes, then the elasticity of money demand with respect to the opportunity cost of holding money would be low. This is consistent with our finding that money demand sensitivity was smaller before 1994 than after 1994.

5. CONCLUSION AND POLICY ANALYSIS

In this paper, we have estimated the long-run co-integrating relationships between velocity, inflation and the opportunity cost of holding money, and we have quantified the sensitivity of money demand. The results reveal that the sensitivity of money demand with respect to the opportunity cost of holding money is higher in the zero interest rate period than in the normal interest rate period, which is consistent with economic theory. The possible effect of holding excess money on the Japanese economy is excess liquidity (e.g. savings) of Japanese M1 flowing into Japan Post, which finances Japanese debts, instead of lending this money to the private sector to stimulate economic activities and increase the money multiplier. This places downward pressure on bond yields, which helps the Japanese government to roll over debts they have issued.

Figure 5: Total government debt as a % of GDP



Dada source: OECD stats, 2012

With the above in mind, a similar phenomenon has recently been observed in the United States and several European countries. As can be seen from Figure 5, rapid increases in total government debt as a percentage of GDP coincide with the onset of monetary easing policies implemented by the Federal Reserve and the ECB. Greece has hit a total government debt of 150% of GDP, and other countries have also faced a similar problem. In terms of the application of this paper, one could see how similar or different results could be seen depending on the nature of the economy.

Discussion of the relationship between fiscal imbalances and monetary expansion may be beyond of the scope of this paper, but we would nevertheless like to reiterate the maxim of ‘treat the cause, not the symptom’. Quantitative easing policies may be a necessary condition, but they are not sufficient to escape a liquidity trap. What is needed may be a fundamental structural change in the economy that induces policies that address long-term sustainable growth and increase productivity.

Notes

1. Data source: International Financial Statistics 2012, IMF.
2. We include dummy variables as a standard way of taking outliers into account.
3. There are some insignificant parameters, but we retain them so as to gain a unique specification.

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