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# Does Currency Wealth or Substitiution Effect Matters?

# Recent Evidence from Money Demand in China

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## ABSTRACT

This study investigates the stability of money demand function for China, using an innovation ARDL framework for co-integration test for the time period 1986-2018. Specifically, this study used narrow money (M1) and broad money (M2) as a measurement of money. To consider currency wealth and substitution effects, the estimated money demand model includes the real effective exchange rate in addition to income and interest rate. By incorporating the CUSUM and CUSUMSQ tests for stability in conjunction with co-integration analysis, the results confirm that there exists a stable long-run relationship for narrow money demand function. Importantly, the finding also discovers that real effective exchange rate appears to have a significant substitution effect on narrow money demand, which its omission can lead to biased result and misspecifications in the money demand function. This further corroborates that narrow money, (M1) act as a better measurement, which may have systematic influence on the trend of monetary aggregates.

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## INTRODUCTION

In the new era of global economy, the money demand issues remained a major concern throughout the economic circle. The rising interest in this area of research stem from the importance role played by the money demand function (MDF hereafter) in the transmission mechanism of monetary policy and also coincides with the money demand elasticities, which have been considered as critical inputs to monitor monetary policy (Friedman, 1959; Laidler, 1993; Lucas, 1988). Indeed, the success of the policy reliant on whether the monetary authority able to achieve steady-state relationship between money demand and its determinants. This reflects that a stable relationship between money and its determinants is prerequisite in controlling and targeting of monetary aggregates. Basically, the relationship between MDF and its determinants is underlying by the fundamental block of the theories of monetary economics, which comprises of a series of economic activities, scale variable and cost variable. This poses number of questions and challenges on the alternative route through which response of monetary can be transmitted to the economic progress.

In view of the importance of a stable MDF, has led to an extensive research across countries and regions. In addition, the development of co-integration technique as established by Engle and Granger (1987) or Johansen (1988) or Johansen and Juselius (1990) have diverted the intention of many empirical studies to re-investigate the demand for money relationship. For example, Hafer and Jansen (1991), Hoffman and Rasche (1991), McNown and Wallace (1992) Choudhry, (1996) for the U.S.; Adams (1991), Johansen (1992) for the U.K.; Frenkel and Taylor (1993) for Yugoslavia; Bahmani-Oskooee and Shabsigh (1996) for Japan and Bahmani-Oskooee (1996) for Iran. The findings of these studies support the presence of co-integration relationship between money demand and its elected determinants, which highlighted as evidence of a stable demand for money.

In line with the literature, several countries have been identified in MDF in the developing areas. Sriram (2001), for instance stressed that due to globalization of capital markets, financial liberalization and particularly the country specific events on the demand for money, have led to a great deal about the issue of money demand in developing and emerging economies, particularly among the monetary authorities and policymakers. One of a typical transition and emerging economy that has received growing interest of attention is China, which has undergone a range of economic reforms throughout number of changes in institutional and regulatory framework since the end of 1970. This marks a strong benchmark that in order to conduct monetary policy entails to establish the stability of the combination of money stock, the price level and the level of output. In the interim, numerous studies on money demand in China have also focused on the co-integration relationship between money demand with its relevant economic variables. Chen (1989), Burton and Ha (1990), Hafer and Kutan (1994), Huang (1994), Qin (1994), Chen (1997) and Huang (2000), among others, found a stable demand for money with M2 monetary aggregate is co-integrated with its selected main determinants (i.e. income and interest rate).

However, Akinlo (2006), Bahmani-Oskooee and Bohl (2000), among others, have argued that the estimated long-run parameters could be unstable, albeit, variables included in the function are co-integrated. In the context of China, Bahmani-Oskooee and Wang (2007) who examined for the case of China found that the function of money demand in China appeared to be co-integrated for both definition of money between M1 and M2. Nonetheless, the results which is based on the technique developed by Brown et al. (1975) discovered that only M1 found to be stable. In the same vein, Lee and Chien (2008), using data over the period 1977–2002, illustrates that the stability of M1 and M2 in China are affected by economic and financial reforms. The results raised an important concern on whether the stability of the China's MDF appear to be stable or else. In addition, Baharumshah et al. (2009) who used M2 to investigate the stability of China's MDF, found that not only the variables included in the function are co-integrated but also the parameters of the model appear to be stable. Therefore, accentuates doubt on the effectiveness role played by the M2 as a monetary target in the case of China's money demand.

In addition, Wu et al. (2005) have also stressed that missing variables may have led to explain the lack of support for the stable money demand function. In recent study, Dou (2018) and Wang (2017) have argued that the stability of money demand, particularly for China may due to the currency substitution effect. Basically, the idea is that a gain in wealth, which may exert a systematic influence on demand for money through the two important channels, substitution-and-wealth effect. Arango and Nadiri (1981), Bahmani Oskooee and Malixi (1991) Mcgibany and Nourzad (1995) Marashdeh (1997) Bahmani-Oskooee (2002) and Azim, Ahmed, Sami,

Zakaria (2010) among other that found substitution effect of exchange rate on money demand. The argument shows, if the exchange rate is likely to fall, the wealth holders that measure their assets in terms of their domestic currency may attempt to increase the value of foreign assets by holding more foreign currency. That means as depreciation of exchange rate, the lower the demand for domestic currency. This indicates that currency substitution effect act as a key hedging tool against such risk, signifying higher opportunity cost of holding domestic money. Unlike the above studies mentioned above, Bahmani-Oskooee and Pourheydarian (1990), Renani and Hosein (2007) and Azali et al. (2001) discovered wealth effect of exchange rate on demand for money. This shows that any depereciation of exchange rate may also lead wealth holders to increase the value of their foreign assets and thereby contribute to wealth-enhancing process. In order to further sustain the value of the wealth, they will repatriate part of their foreign assets to domestic currency. Thus, increase demand for domestic currency as depreciation of exchange rate. Nevertheless, this issue has been long ignored as China was under fixed exchange rate before 2005. This highlights that while many studies have concentrated on the matters concerning the function of money demand for China, which results to be assorted and far from conclusion, only limited studies have engaged with wealth effect of exchange rate in searching for the stability of the China's money demand model.

In light with the progress of China's financial market development and its economic reform, this study exclusively concentrates on the demand for money with currency wealth effect in China that span from 1986 to 2018. Despite the fact that the narrow money (*M1*) seems to be well-known proxy to be used in the money demand analysis, there is also growing interest that underlined the importance function of the broad money (*M2*), which accommodates the latest invented financial instruments as a result of the ensuing progress of institutional and financial structures, leading *M2* to be a relevant measurement to be considered in order to proceed with the money demand analysis (see Pradhan and Subramanian, 2003 and Lee and Chang, 2012). Therefore, this study aims to examine both the demand for broad money (*M2*) and narrow money (*M1*) in China throughout the episodes of its economic reform to provide better understanding on the stability of money demand function. It is also worth mentioning here that this study emphasises on the real effective exchange rate (*REER*) to measure the exchange rate as compared to the real bilateral rate against the dollar as accentuated in Dou (2018) and Wang (2017). Essentially, the REER plays a pivotal role in the adjustment of macroeconomic indicators as each country having trade with the rest of the world while having the US alone as proxy does not reflect the real value of trading transactions (Rhomberg, 1976; Lipschitz and Sumdrajan, 1980). This allows REER to measure the competitiveness level of a country at the international market while reducing the risk of erroneous generalizations that may result from changes that is peculiar only to a specific currency (Yusoff, 2010; Naseem and Hamizah, 2013). Hence, the influence of REER on the stability of money demand function is the central concern in order to stimulate effective monetary policies and thereby contribute for a better economic progress of an open economies, namely China.

Moreover, this study takes into account a more comprehensive analysis on the stability of China's money demand function using latest data for the country, which span from 1986 to 2018. This highlights the continuous episodes of economic and financial reforms, particularly the efforts taken by the China monetary authorities in 1993, which have been on-going process. This sample is also seemed to be sufficiently large and allowed to draw robust results. Also, the relatively small sample size (1986-2018), this study employs a widely used method, namely an ARDL approach, which out performs the Engle and Granger (1987) and Johansen and Juselius (1990). Instead of been well known in incorporating small sample size (Ghatak and Siddiki, 2001; Pesaran et al., 2001) as well as the irrespective of integrated order either $I(0)$, $I(1)$ or mutually integrated, this technique also incorporated to correct the potential problem of endogenous in the money demand function. Hence, the findings obtained from this study seem to be timely in order to bridge the gap as well as to shed some light, which contribute a fresh look to the development of the literature of money demand function, especially for the case of developing economies like China.

To this end, the outlined of the paper is as follows: Section 2 provides the money demand model and Section 3 briefly discusses an innovative co-integration technique applied in this study. In Section 4 reports the empirical results while the conclusion and policy implication are delivered in Section 5.

## THE MONEY DEMAND MODEL

In favour of this study, the standard MDF is employed, which broadly similar to Friedman (1988) and Bahmani-Oskooee and Wang (2007). Therefore, the specification of money demand model comprises of real economics transaction, opportunity cost of holding money and exchange rate can be derived as follows:

$$M_t = \delta_0 + \delta_1 Y_t + \delta_2 ir_t + \delta_2 REER_t + \varepsilon_t \quad (1)$$

where, M donates real money balance and presented by monetary aggregates in China (M1 or M2), Y represents real income measured by the real GDP, which refers as a scale variable, ir is the domestic deposit rate of interest, which measures for the opportunity cost of holding money, REER represents the real effective exchange rate (a decline in value indicates RMB yuan appreciation and an increase indicates depreciation), $\varepsilon_t$ is the error term and *t* refers to time period. The estimated coefficient of $\delta_1$ and $\delta_3$ refers to the elasticity of income and exchange rate while $\delta_2$ denotes semi-elasticity of the interest rate. The uppercase letters represent that the fundamental variables are in natural log form.

Typically, following the macro theory, the estimates parameter of income elasticity of money demand ($\delta_1$) is expected to be positive and the domestic semi-interest elasticity of money demand ($\delta_2$) the expected to be negative. While the exchange rate elasticity of money demand ($\delta_3$) is expected to be positive of negative. For example, if the depreciation of domestic currency leads to increase the value of foreign securities held by domestic residents, the demand for the domestic currency will increase. This is an agreement with the wealth effect. However, under the market uncertainty, currency depreciation may also cause further depreciation, in which the demand for the domestic currency will decrease (Bahmani-Oskooee and Poorheydarian, 1990). This is in line with the speculative motive as highlighted by the Keynesian approach – Liquidity Preference, which supports the substitution effect.

## DATA AND METHODOLOGY

This study employs time series data commenced from 1986 to 2018 for the case of China. The real money balance is measured through the monetary aggregates of narrow money (M1) and broad money (M2) and the real effective exchange rate (REER) is used to measure the rate of exchange. For the real income is gauged by the real GDP while the opportunity cost of holding money is proxied by the one-year domestic deposit rate. All the variables are extracted from various report of China Statistical Yearbook, published by the National Bureau of Statistics of China, while REER is extracted from International Financial Statistics, International Monetary Fund (IFS, IMF).

For the purpose of this study. the autoregressive distributed lag (ARDL) bound test proposed by Pesaran et al. (2001) is utilized to estimate the money demand model in China. The main advantage of using ARDL is that it able to bypass the pre-testing of the integration order, which avoid the potential biased associated with the unit root. This means that it is applicable irrespective of whether the regressors in the money demand equation are purely *I*(0) or *I*(1), or mutually co-integrated. In the meantime, the endogeneity problem seems to be non-existent on condition that the model is not suffered from the residual correlation. The brief description of the ARDL technique is as follows:

$$\begin{aligned} \Delta M_t = {} & \lambda_0 + \lambda_1 M_{t-1} + \lambda_2 Y_{t-1} + \lambda_3 ir_{t-1} + \lambda_4 nER_{t-1} \\ & + \sum_{k=1}^{n} \delta_1 \Delta nM_{t-k} + \sum_{k=0}^{n} \delta_2 \Delta nY_{t-k} + \sum_{k=0}^{n} \delta_3 \Delta ir_{t-k} \\ & + \sum_{k=0}^{n} \delta_4 \Delta ER_{t-k} + \varepsilon_t \end{aligned} \quad (2)$$

where $\Delta$ is the first difference operator and $\varepsilon_t$ is a white-noise disturbance error term. In this case, the long-run elasticity can be derived by normalizing each of the one lagged explanatory ($\lambda_2$ *to* $\lambda_4$) variable by the coefficient of the lagged dependent variable ($\lambda_1$). Next, the Wald test (*F*-statistic) for the joint significance of lagged variables is applied to determine the existence of co-integration as recommended by Pesaran et al.

(2001). The *F*-statistic is provided with two sets of critical values, in which the first set of all variables is assumed to be *I*(0) while the other set is assumed to be *I*(1). By imposing restriction on the estimated long-run coefficients the null hypothesis can be set against the alternative hypothesis as follows:

$Ho: \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$ (no long-run relationship)
$H_A: \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq 0$ (a long-run relationship exists)

Then, the null hypothesis of co-integration can be rejected if the calculated *F*-test exceeds the upper bound value, *I*(1) then it is concluded that real money balances and its determinants are moving together to a long-run equilibrium. Conversely, if computed *F*-statistic falls below the lower bound value, *I*(0) or within the bound values, the null hypothesis of no co-integration cannot be rejected or a conclusive inference cannot be made. Given that the sample size for this research is less than 80, the Narayan (2005) critical value for the lower and upper bound will be used.

## EMPIRICAL RESULTS

Since the ARDL technique allows the pre-testing of the integration order, which associated with the unit root tests to be bypassed. The variables, however, cannot be *I*(2). For that reason, it is necessary to display the unit root tests in order to confirm the time series variables involved in this analysis are either integrated at *I*(0), *I*(1) or mutually co-integrated. And so, two tests of unit root are used, which are the Augmented Dickey Fuller (ADF) test and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test as shown in Table 1. The results of unit root tests show that all the selected variables are found to be stationary at first difference, validating the money demand and its determinants are co-integrated. This confirms with the nature of the most macroeconomic variables which seem to follow an *I*(1) process (Baharumshah et al., 2003; Naseem et al., 2010).

Table 1 Unit root test results

| | ADF test results | | KPPS test results | |
|---|---|---|---|---|
| Variables | Without trend | With trend | Without trend | With trend |
| | Level | | | |
| M1 | -2.03 (0) | -2.53 (0) | 0.67 (4) [b] | 0.16 (4) [b] |
| M2 | -1.86 (2) | -3.60 (0) | 0.68 (4) [b] | 0.14 (8) [b] |
| Y | -0.87 (4) | -0.94 (4) | 0.68 (4) [b] | 0.16 (4) [b] |
| ir | -1.39 (1) | -2.02 (2) | 0.51 (4) [b] | 0.12 (3) [c] |
| REER | -2.59 (4) | -1.57 (0) | 0.36 (4) [c] | 0.17 (4) [b] |
| | First difference | | | |
| ΔM1 | -6.88 (0) [a] | -6.53 (0) [a] | 0.28 (1) | 0.07 (1) |
| ΔM2 | -4.78 (0) [a] | -6.76 (1) [a] | 0.17 (8) | 0.11 (8) |
| ΔY | -3.45 (3) [b] | -3.84 (3) [b] | 0.29 (3) | 0.09 (1) |
| Δir | -4.36 (0) [a] | -4.27 (0) [b] | 0.12 (8) | 0.11 (7) |
| ΔREER | -4.25 (0) [a] | -5.39 (0) [a] | 0.25 (3) | 0.11 (3) |

Notes: ADF is the Augmented Dicker-Fuller and KPPS is the Kwiatkowski-Phillips-Schmidt-Shin unit root tests. [a, b] and [c] indicates 1%, 5% and 10% significance level respectively. For the ADF test, numbers inside parentheses are the optimum lag order in the ADF test selected by the Schwarz Information Criterion (SIC). As for the KPSS test, numbers in parentheses are the selection of bandwidth based on the Newey-West nonparametric plug-in method.

Once the integration order has been established, the next step is to proceed with the investigation to verify the presence of a long-run relationship between the variables in both money demand functions. Using the Wald test of joint significance of lagged variables to perform the ARDL bound test, the results are presented in Table 2. The results indicate that in each cases the estimated *F*-statistic found to be greater than the upper bound the critical values, implying that the restricted null hypothesis of the long-run coefficient is rejected ($Ho: \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$) at 1 percent significant level. This supports that both money demand functions (i.e. M1 and M2) in China for the period under investigation exists a long-run relationship among the variables. In addition, a relatively more efficient way of establishing co-integration relationship is through a negative and statistically significant lagged error-correction term ($ecm_{t-1}$) as recommended by Kremers et al. (1992), Bahmani-Oskooee (2001) and Bahmani-Oskooee and Wang (2007). Indeed, the results as shown in Table 4 further confirm the presence of co-integration relationship among the variables as the $ecm_{t-1}$ appeared to be significant with negative coefficients.

Table 2 The Bounds Test Results

| | *F*- statistics | | | | | |
|---|---|---|---|---|---|---|
| $F_M$(M1\| Y, ir, REER) | 7.96 | | | | | |
| $F_M$(M2\|Y, ir, REER) | 9.38 | | | | | |
| | 90 % | | 95 % | | 99 % | |
| Critical Value | *I*(0) | *I*(1) | *I*(0) | *I*(1) | *I*(0) | *I*(1) |
| Pesaran *et al.* (2001) | 2.37 | 3.20 | 2.79 | 3.67 | 3.65 | 4.66 |
| Narayan (2005) | 2.67 | 3.58 | 3.27 | 4.31 | 4.61 | 5.97 |

Notes: Critical values are extracted based on Pesaran *et al.* (2001) and Narayan (2005), Table (C1.iii), Case III: unrestricted intercept and no trend. The structural lags are determined by using minimum Schwartz–Bayesian Criterion (SBC).

Given the bound test found to be satisfactory, the long-run relationship of the money demand function is then estimated. Using the standard rule of the Schwarz Bayesian Criterion (Schwarz, 1978; SBC), the selected specification of MDF for M1 and M2 are itemized as those of an ARDL (1, 1, 1, 1) and an ARDL (1, 0, 1, 1). The coefficients of the long run relationship of narrow money demand (M1) function and broad money demand (M2) are displayed in Panel A and Panel B of Table 3. First and foremost, exchange rate appeared to be significant at 1 percent conventional level on M1 while found to be an insignificant impact on real M2. The exchange rate elasticity of money demand is elastic (= 1.1457), presenting that one percent change in exchange rate leads money demand to decrease by around 1.15 percent in the long-run. This implies that a depreciation of exchange rate may lead to decrease the demand for domestic currency, which supports the substitution effect. The finding seems with an agreement of earlier studies such as Dou (2018) and Wang (2017), which corroborate currency substitution hypothesis in China money demand. This signifies that wealth holder in China may hedge against risk due to higher opportunity cost of holding domestic money as depreciation of exchange rate. In other words, currency substitution effect may act as hedging instrument in order to protect their assets through the increase the value of foreign assets by holding more foreign currency.

In addition, real income found to be positively significant on real narrow money (M1), which the effect seems to be similar for the case of real M2. This indicates that one percent increase in real income raises the real money by approximately 1.9 – 1.5 percent. Meaning that the significant of long-run income elasticity plays an important role in money demand function, in which is accordance with the quantity theory of money. This finding is also not surprising as the magnitude of the coefficient of the scale variable appear to be comparable with respect of previous studies (see for example, Deng and Liu, 1999, 1.80; Arize and Malindretos, 2000, 1.51; Mehrotra, 2008, 1.73).

For the interest rate, the result found to be negative and statistically significant effect on M1. The result also shows that the semi-elasticity of interest rate appeared to be 0.23 in the long-run of real M1 equation. This implies that a one percentage-point increase in the interest rate leads to approximately 0.23 percentage-point decrease in the real money balances of M1. However, the interest rate turns out to be insignificant for real M2. This suggests that the money demand for M1 is merely sensitive to interest rate, demonstrating cost of holding money seems to be challenging to be formulated (Dreger et al., 2007).

Table 3 Results for Long-Run Relationship

| M | Y | ir | REER | Intercept |
|---|---|---|---|---|
| Panel A: Narrow Money Demand Function (M1) | | | | |
| -1.000 | 1.9156 (0.0878) [a] | -0.2396 (0.01742) [a] | 1.1457 (0.1935) [a] | -4.6073 (0.7208) [a] |
| Panel B: Broad Money Demand Function (M2) | | | | |
| -1.000 | 1.5787 (0.1585) [a] | -0.0482 (0.0294) | 0.5537 (0.2868) | -6.0417 (0.9242) [a] |

Notes: Standard errors in parentheses. The superscripts [a,] and [c] denote statistical significance at the 1% and 10% levels, respectively.

Next, the adequacy of the estimated money demand models in China are measured through a battery of diagnostic tests such as Breusch-Godfrey serial correlation LM test, ARCH test and Jacque-Bera normality test. The result of diagnostic tests exhibits in Table 4 reveal that the estimated models are serially uncorrelated while the residual has a constant variance and normally distributed. This indicates that the specification of money demand in China is adequately estimated, despite the analysis is based on the short-run span of data. Finally, the statistical fit of the model that gauge through the values adjusted *R*-squared ($\bar{R}^2$) , suggests that over 88 percent and 22 percent of the variation in real money M1 and M2 are explained by the demand function for

money in China. Hence, the estimated demand for money models for real money M1 and M2 are sufficient and can be used to construct the subsequent explanation on the behaviour of demand for real balances in China.

Following a stable long-run money demand function leads to a subsequent estimation procedure of a dynamic short-run model. The estimated error correction model ($ecm_{t-1}$) of money demand model is displayed in Table 4. As mentioned earlier, the results present that the $ecm_{t-1}$ carry its expected statistically negative effect at one percent significant level, signifying the co-integration and the long run equilibrium are further confirmed to be attainable for the real money M1 and M2. The magnitude and the significance of the error correction term implies that each variable in each equation tend to reinstate the equilibrium point in the money market. Indeed, the $ecm_{t-1}$ coefficients term for real money M1 appeared to be –0.88 (real money M2 is –0.27), which portrays that the speed of adjustment of the money demand in perceiving changes in its determinants is very rapid (slow) before converging to its equilibrium level. This means that around 88 percent (27 percent) of the disequilibria of the previous period's shock of M1 (M2) is corrected back to its long-run equilibrium path in the current year. The results for the individual coefficient show significant impact on M1, while an insignificant impact on real M2. The sign of real income appears to be positive and statistically significant at conventional significance levels for the current lag ($\Delta Y_t$) and first lagged ($\Delta Y_{t-1}$) as displayed in Table 4. Meanwhile, the coefficient of real cost of holding money also pointed out to be significant for the current lag ($\Delta ir_t$) and first lagged ($\Delta ir_{t-1}$) at negative effect. For the real exchange rate the sign found to be positively significant at conventional level. This means that the sign of coefficients found to justified as discussed earlier in this study.

Table 4 ARDL Model ECM Results

| | Summary Statistics | | | |
|---|---|---|---|---|
| Estimated Coefficients | $\bar{R}^2$ | *ARCH* | *JB* | *AR(2)* |
| Panel A: Narrow Money Demand (M1) | | | | |
| $\Delta M1_t = -12.952 - 0.8869\ \Delta M1_{t-1} + 0.8578\ \Delta Y_t + 1.6991\ \Delta Y_{t-1}$ | 0.887 | 0.849 | 0.808 | 0.445 |
| (2.2622) (0.1002) [a] (1.1142) [a] (0.2339) | | | | |
| $-0.1441\ \Delta ir_t - 0.2125\ \Delta ir_{t-1} + 1.0902\ \Delta REER_t$ | | | | |
| (0.0242) [a] (0.0254) [a] (0.4306) [b] | | | | |
| $+1.0163\ \Delta REER_{t-1} - 0.8869\ ecm_{t-1}$ | | | | |
| (0.2487) [a] (0.0685) [a] | | | | |
| Panel A: Broad Money Demand (M2) | | | | |
| $\Delta M2_t = -12.952 - 0.7213\ \Delta M2_{t-1} + 0.4399\ \Delta Y_t - 0.0110\ \Delta ir_t$ | 0.215 | 0.000 | 0.061 | 0.564 |
| (2.2622) (0.3339) [b] (0.5597) (0.0079) | | | | |
| $-0.0024\ \Delta ir_{t-1} + 0.1267\ \Delta REER_t$ | | | | |
| (0.0204) (0.1220) | | | | |
| $+0.0274\ \Delta REER_{t-1} - 0.2787\ ecm_{t-1}$ | | | | |
| (0.1862) (0.0251) [a] | | | | |

Notes: $\Delta$ indicates the first difference and $ecm_{t-1}$ is the error correction term. Standard errors in parentheses. The superscripts [a,] and [b] denote statistical significance at the 1% and 5% levels, respectively. The statistic tests are: ARCH is the autoregressive conditional heteroscedasticity; AR(*i*) is the LM-type Breusch-Godfrey Serial Correlation test at lag *i*, where i = 2; JB refer to Jarque-Bera test for normality residual.

At this point the, the stability of the long-run relationship between money demand and its determinants is assessed. For instance, Lee et al., (2007) underlined that the stability tests are important as unstable parameters may lead to a misspecification, which lead to bias results. Following a standard procedure as applied by Bahmani-Oskooee and Bohl (2000) and Bahmani-Oskooee (2001), this study employs the cumulative sum (CUSUM) and the cumulative sum of square (CUSUMSQ) test as established by Brown, Durbin and Evans (1975) to the residuals of these models in order to confirm the constancy of the long-run parameters. Based on the CUSUM test the cumulative sum of recursive residuals is established on the first set of n observations. Then, the CUSUM test is updated recursively and is plotted against the break points. The similar process applies for the CUSUMSQ statistics, in which are based on the squared recursive residuals. This reflects that if the plot of CUSUM and CUSUMSQ stay within the margin of 5 percent significance level, the estimated regression appears to be stable throughout the study period sample.

The plot of CUSUM and CUSUMSQ is provided in terms of graphical presentation as illustrated in panel A and Panel B of Figure 1. As can be seen the CUSUM and CUSUMSQ statistics in the M1 money demand found to be within the 5 percent critical bounds as represented by two straight lines. This indicates the stability in the M1 money demand function. However, Panel B of Figure 1 reveals that M2 money demand has experienced some instability through the CUSUM and CUSUMSQ tests. This shows the existence of statistically significant breaks as indicated by the two statistics. Yi (2004) and Jiang et al., (2005), among other, stated that one possible explanation affecting the stability of M2 may due to the weakening monetization commencing from the middle of 1990s while the development of stock market progress. Overall, these findings clarified that the stability of error correction model of the narrow money (M1). Therefore, confirms the absence of any stability in the coefficients in the real broad money demand model (M2). In other words, the findings appear to corroborate the inventory approach and the Keynesian speculative demand for China based on narrow money demand (M1) model.

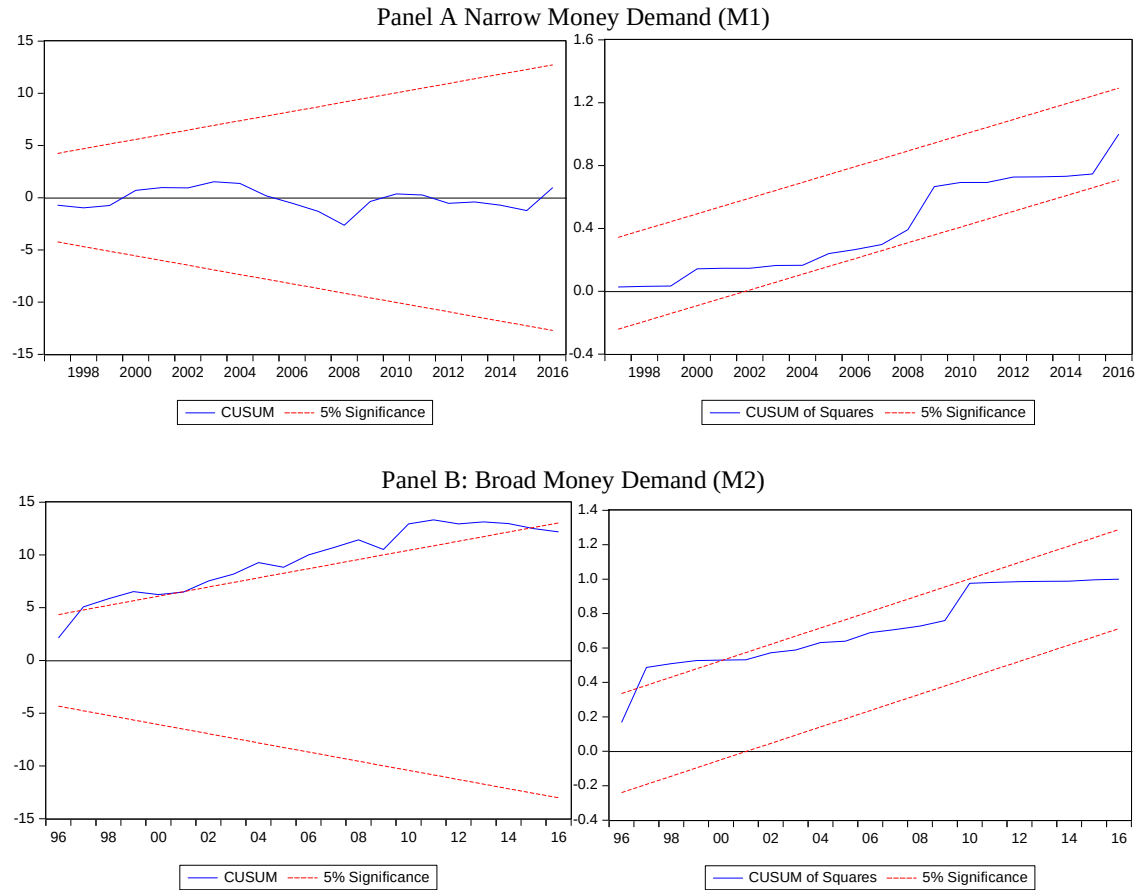


Figure 1 Stability Test Results for M1 and M2 Money Demand

## CONCLUSION

Based on an innovative ARDL co-integration technique, this study explores the money demand function in China using data that covers from 1986 to 2018. The empirical results show that the estimated real money balance in China, supports the existence of long-run co-integration relationship. The finding highlights the exchange rate matter in real money balance in China. This also suggests the presence of currency substitution effect in order to protect risk against greater opportunity cost of holding domestic money due to depreciation of exchange rate. That means the exchange rate and its fluctuations act as a key driver in determining money demand in China.

In addition, the evidence from the CUSUM and CUSUMSQ tests to the models also demonstrated that the long-run M1 money demand model is more stable than the long-run M2 money demand model. It is worth mentioning that Bahmani-Oskooee and Wang (2007) also discovered that M1 is co-integrated with income,

interest rates and exchange rates while a stable relationship in the broad MDF (M2) seems to be doubtful. As such, the policies under consideration should include the effects of exchange rate as the omission of such variables could result omitted variables misspecification. The formulation of monetary policy in China should target M1 rather than M2 as M1 seems to serve as better money aggregate in China. In a nutshell, one may suggest that a monetary policy at stabilizing the China's domestic economy seems to be generated from the M1 money demand function as well as to pay attention to the currency substitution effect phenomena.

## REFERENCES


Adam, CS 1991, 'Financial Innovation and the Demand for M3 in the U.K. 1975-86', *Oxford Bulletin of Economics and Statistics*, vol. 53, pp. 401- 423.

Akinlo AE 2006, 'The stability of money demand in Nigeria: An autoregressive distributed lag approach', *Journal of Policy Modelling*, vol. 28, pp. 445-452.

Arango, S & Nadiri 1981, 'Demand for Money in Open Economies', *Journal of Monetary Economics*, vol. 7, no. l, pp. 69-83.

Arize, AC, Malindretos, J 2000, 'Does Inflation Variability Affect the Demand for Money in China? Evidence from Error-Correction Models', *International Economics Journal*, vol. 4, no. 1, pp. 47–60.

Azali, M, Baharumshah, AZ & Habibullah, MS (2001), 'Exchange Rate and the Demand for Money in Malaysia', *Pertanika Journal of Social Science and Humanities*, vol. 8, no. 2, pp. 71-75.

Azim, P, Ahmed, N, Sami U & Zakaria, M 2010, 'Demand for Money in Pakistan: An ARDL Approach', *Global Journal of Management and Business Research*, vol. 10, no. 9, pp. 76-79.

Baharumshah, AZ, Mohd, SH, Masih, AMM 2009, 'The stability of money demand in China: Evidence from the ARDL model', *Economic Systems*, vol. 33, pp. 231-244.

Baharumshah, AZ, Thanoon, MA & Rashid, S 2003, 'Savings Dynamic in the Asian Countries', *Journal of Asian Economic*, vol. 13, pp. 827-845.

Bahmani- Oskooee & Pourhydarian 1990, 'Exchange Rate Sensitivity of Demand for Money and Effectiveness of Fiscal and Monetary Policies', *Applied Economics*, vol. 22, no. 7, pp. 917-925.

Bahmani-Oskooee 2001, 'How Stable is M2 Money Demand Function in Japan?', *Japan and the World Economy*, vol. 13, pp. 455-461.

Bahmani-Oskooee, M 2002, 'Long-Run Demand for Money in Hong Kong: An Application of the ARDL Model', *International Journal of Business and Economics*, vol. 1, no. 2, pp. 147-155.

Bahmani-Oskooee, M 1996, 'The Black Market Exchange Rate and Demand for Money in Iran', *Journal of Macroeconomics*, vol. 18, pp. 171-176.

Bahmani-Oskooee, M & Wang, Y 2007, 'How stable is the demand for money in China?', *Journal of Economic Development*, vol. 32, pp. 21-33.

Bahmani-Oskooee, M & G. Shabsigh 1996, 'The Demand for Money in Japan: Evidence from Cointegration Analysis', *Japan and the World Economy*, vol. 8, pp. 1-10.

Bahmani-Oskooee, M & M. Bohl 2000, 'German Monetary Unification and the Stability of Long-Run German Money Demand Function', *Economics Letters*, vol. 66, 203-208.

Bahmani-Oskooee, M & Malixi, M 1991, 'Exchange Rate Sensitivity of the Demand for Money in Developing Countries', *Applied Economics*, vol. 23, no. 8, pp. 1377-1383.

Brown, RL, Durbin, J &Evans, JM 1975, 'Techniques for testing the constancy of regression relationships over time', *Journal of the Royal Statistical Society*, vol. B37, pp.149-192.

Burton, D & J. Ha 1990, 'Economic Reform and the Demand for Money in China', vol. 21, *IMF Working Paper*, 90/42.

Chen, B 1997, 'Long-Run Money Demand and Inflation in China', *Journal of Macroeconomics*, Summer, pp. 609-617.

Chen, CH 1989, 'Monetary Aggregates and Macroeconomic Performance in Mainland China', *Journal of Comparative Economics*, vol. 13, pp. 314-324.

Choudhry, T 1996, 'Real Stock Prices and the Long-Run Money Demand Function: Evidence from Canada and USA', *Journal of International Money and Finance*, vol. 15, pp. 5051-17.

Deng, S & Liu, B 1999, 'Modelling and forecasting the money demand in China: Cointegration and nonlinear analysis', *Annals of Operations Research*, vol. 87, pp. 177-189

Dou, X 2018, 'The Determinants of Money Demand in China', *Cogent Economics and Finance*, vol. 6, pp. 1564-422.

Dreger, C, Reimers, HE & Roffia, B 2007, 'Long-Run Money Demand in the New EU Member States with Exchange Rate Effects. *Eastern European Economics*, 45(2), pp. 75-94.

Engle, RF & Granger, CWJ 1987, 'Co-integration and Error-correction: Representation, Estimation and Testing', *Econometrica*, vol. 55, pp. 251-276.

Frenkel, JA & Taylor MP 1993, 'Money Demand and Inflation in Yugoslavia, 1980-1989', *Journal of Macroeconomics*, vol. 15, pp. 455-481.

Friedman, M 1959, 'The Demand for Money: Some Theoretical and Empirical Results', *Journal of political economy*, vol. August, pp. 327-351.

Ghatak, S, Siddiki, J 2001, 'The use of the ARDL Approach in Estimating Virtual Exchange Rates in India', *Journal of Applied Statistics*, vol. 28, pp. 573-583.

Hafer, RW & Kutan, AM 1994, 'Economic Reforms and Long-Run Money Demand in China: Implications for Momentary policy', *Southern Economic Journal*, vol. 60, no. 4, pp. 936-945.

Hafer, RW & Jansen DW 1991, 'The Demand for Money in the United States: Evidence from Cointegration Tests', *Journal of Money, Credit, and Banking*, vol. 23, pp. 155-168.

Hoffman, DL & Rasche RH 1991, 'Long-Run Income and Interest Elasticities of Money Demand in the United States', *The Review of Economics and Statistics*, vol. 73, pp. 665-674.

Huang, C 2000, 'Economic Reform and the Stability of Long-Run Demand for Money in China: Some Results from Co-Integration Tests', *The Chinese Economy under Transition*, pp. 276-296.

Huang, G 1994, 'Money Demand in China in the Reform Period: An Error Correction Model', *Applied Economics*, vol. 29, pp. 713-719.

Jiang YK, Zhao, Z & Liu Y 2005, 'Empirical Analysis for Chinese Money Demand Function: based on two stages 1978-1993 and 1994-2004', *China Soft Science* (in Chinese), vol. 2, pp. 24-33.

Johansen, S 1988, 'Statistical Analysis of Cointegration Vectors', *Journal of Economic Dynamics and Control*, vol. 12, pp. 231-254.

Johansen, S 1992, Testing Weak Exogeneity and the Order of Cointegration in UK Money.

Johansen, S & Juselius, K 1990, 'Maximum Likelihood Estimation and Inference on Cointegration, with Applocation for demand for Money', *Oxford bulletin of Economics and statistics*, vol. 52, pp. 169-210.

Kremers, JJ, Ericson NR & Dolado JJ 1992, 'The Power of Cointegration Tests', O*xford Bulletin of Economics and Statistics*, vol. 54, pp. 325-347.

Laidler, DEW 1993. *The Demand for Money: Theory, Evidence and Problems*, 4th ed., HarperCollins College Publishers.

Lee, CC & Chang, AC 2012, 'The Demand for Money in China: A Reassessment Using the Bounds Testing Approach', *Romanian Journal of Economic Forecasting*, pp. 74-94.

Lee, CC, Chen, PF, Chang, CP 2007, 'Testing Linearity in A Cointegrating STR Model for the Money Demand Function: International evidence from G7 Countries', *Mathematics and Computers in Simulation*, vol. 76, pp. 293-302.

Lee, CC & Chien, MS 2008, 'Stability of Money Demand Function Revisited in China', *Applied Economics*, vol. 40, pp. 3185-3197.

Lipschitz, L & Sumdrarajan, V 1980, 'The Optimal Basket of the World Generalized Floating.', *IMF Staff Papers*, vol. 27, pp. 80-100.

Lucas, RE Jr 1988, 'Money Demand in the United States: A Quantitative Review', *Carnegie-Rochester Conference Series on Public Policy*, vol. 29, pp. 137-168.

Marashdeh, O 1997, The Demand for Money in an Open Economy: The Case of Malaysia, presented at the Southern Finance Association Annual Meeting, 19-22 November 1997, Baltimore, Maryland, USA.

Mcgibany, JM & Nourzad, F 1995, 'Exchange Rate Volatility and the Demand for Money in the U.S', *International Review of Economics and Finance*, pp. 411-425,

McNown, RMS & Wallace 1992, 'Cointegration Tests of a Long-Run Relationship between Money Demand and the Effective Exchange Rate', *Journal of International Money and Finance*, vol. 11, pp. 107-114.

Mehrotra, AN 2008, 'Demand for Money in Transition: Evidence from China's disinflation', *International Advances in Economic Research*, vol. 14, pp. 36-47.

Naseem, NAM & Hamizah, MS 2013, 'Exchange rate Misalignment And Economic Growth', *Recent Evidence in Malaysia, Pertanika Journal of Social Sciences and Humanities*, vol. 21S, pp. 47-66.

Naseem, NAM, Tan HB & Mohd, SH 2010, 'Exchange Rate Regime, Exchange Rate Variability and Flows of Malaysian Foreign Trade', *Jurnal Ekonomi Malaysia*, vol. 44, pp. 35-49.

Pesaran, MH, Shin, Y & Smith, RJ 2001, 'Bounds Testing Approaches to The Analysis of Level Relationships', *Journal of Applied Econometrics*, vol. 16, pp. 289-326

Pradhan, BK, Subramanian, A 2003, 'On the stability of demand for money in a developing economy: Some empirical issues', *Journal of Development Economics*, vol. 72, pp. 335-351.

Qin, D 1994, 'Money Demand in China: The Effect of Economic Reform', *Journal of Asian Economics*, vol. 5, pp. 253-271.

Renani, S & Hosein 2002, Demand for money in Iran: An ARDL approach. Online at http://mpra.ub.uni-muenchen.de/8224MPRA Paper No. 8224.

Rhomberg, RR 1976, 'Indices of Effective Exchange Rates', *IMF Staff Papers*, vol. 27, pp. 80-100.

Sriram, S 2001, A Survey of Recent Empirical Money Demand Studies, *IMF Staff Paper*, vol. 47, no. 3.

Wang, YQ 2017, 'Demand for Money in China with Currency Substitution: Evidence from the Recent Data', *Modern Economy*, vol. 8, pp. 484-493.

Wu, CH, Lin, JL, Tiao, GC & Cho, DC 2005, 'Is Money Demand in Taiwan Stable?', *Economic Model*, vol. 22, pp. 327-346.

Yi Xingjian 2004, 'Impact of Stock Market on Money Aggregate and Structure', *Economic Science* (in Chinese), vol. 6, pp. 38-47.

Yusoff, MB 2010, 'The Effects of Real Exchange Rate on Trade Balance and Domestic Output: A Case of Malaysia', *The International Trade Journal*, vol. 24, no. 2, pp. 209-226.