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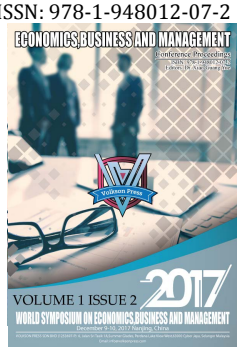

FINANCIAL LIBERALIZATION AND MONEY DEMAND STABILITY IN CHINA

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ABSTRACT

The existing literatures have identified many channels through which financial liberalization may influence money demand. There are evidences of stability as well as instability of demand for money due to financial development for developing economies. The main objective of the current study is to evaluate the effect of financial liberalization on money demand in China for a period of 27 years (1990-2016), i.e. whether financial liberalization has affected the demand for money or not. The issue is important as stable demand for money function is a precondition for formulating and operating monetary policy. To achieve the objective Johansen co-integration and vector error correction techniques are employed to estimate the long and short run relationship between broad money M2 and our measure of financial liberalization with other determinants of demand for money like gross domestic product, inflation, foreign interest rate and exchange rate. In order to verify the stability of the model, the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squires of recursive residuals CUSUMSQ tests have been applied. The empirical results indicated that for broad money, there exists long-run money demand function.

1. INTRODUCTION

In the past decades, financial activities have experienced immense modifications in the World economies; attributed largely to full existence of indirect financing in which the development of capital markets has led to increased competition in the banking systems. This has led to the emergence of new institutional investors and the growth of transactions using financial derivatives. The drivers of these developments have been financial deregulation, innovations and advancement in technology. Not to mention the fact that financial liberalization plays an important role in economic development by allowing market forces to be determined by the financial markets. These have culminated into changes in the demand for money away from currency and towards other substitutes. This phenomenon has been well documented in the existing literature [1].

In the case of china, a handful of research has been carried out on money demand stability [2-6]. On a broad-spectrum, the previous literature has employed standard estimation technique or cointegration techniques to estimate money demand in China from different aspects such as the definition of monetary aggregate, the variables that should be included in the money demand function, the effects of economic reform on money demand, and the causal relationship between monetary aggregate and some other macroeconomic indicators.

These studies have helped us understand money demand in China. However, there are several limitations from the previous studies. Firstly, most previous studies have focused on a time prior to certain reforms in China as China was under fixed exchange regime before 2005. Secondly, the stability of money demand is vital for effective monetary policies for the economy. As demonstrated by some researcher which cointegration does not imply stability [1]. The CUSUM and CUSUMQ stability test can be used to test the stability of demand for money. This debate makes it even more important to test the long-run stability of money demand, especially when the exchange rate is included into the model. Third, the data used in most of the previous studies cover from 1980 and up to 2000s. However, Chinese reform has been undertaken for more than 40 years now and major changes have continued to take place in Chinese economy after 2000 [7]. The properties of money demand stability in China based on the most recent data might be different.

Our empirical analysis to investigate the impact of financial liberalization on money demand stability is different from the previous studies particularly the following points. So researcher used the composite financial liberalization index as a major determinant of demand for money [8]. We will use M2/M1 as a proxy of financial innovation to capture the impact of banking sector reforms as a measure of financial liberalization on demand for money. From the methodological point of view, we will employ Johansen-Juselius cointegration approach for long-run implication and the error correction model for short-run implication. We will also employ the CUSUM and CUSUMQ to test the stability of the money demand function for China for the period 1990-2016.

2. METHODOLOGY

2.1 Empirical Model Specification

Following the existing literature of the theories of money demand, two key factors determine money vis-à-vis an inventory to smooth variations between income and expenditure patterns and as various assets in a portfolio [9]. Hence, the general specification of the long-run money demand model that has been adopted in most emerging economies takes the following functional representation:

$$[M/P]_t = f\,(Y, r) \qquad (1)$$

Where M/P is demand for real balances that denotes function of a chosen scale variable Y and the opportunity cost variable r. M is the chosen monetary aggregate in nominal terms and P is the price level. Following the works the study augments equation (1) with other variables that are assumed to influence the relationship among real balances, and financial liberation is given by equation (2) [1,7].

$$[M/P]_t = f\,(Y, inf, f, \ exr) \qquad (2)$$

Where *f* denotes foreign interest rate, *inf* is inflation rate and *exr* is real effective exchange rate. Y is as previously defined. Transforming equation (2) into log linear form in order to reduce the errors and variances, the following empirical model is formulated as shown by equations (3).

$$\ln(M\text{-}P)_t = \beta_0 + \beta_1 \ln Y_t + \beta_2 inf_t + \beta_3 f_t + \beta_4 \ln exr_t + \varepsilon_t \quad (3)$$

Assuming ln(M-P) = lnRM2, lnY= lnRGDP, equation (3) can be rewritten as follows:

$$\ln RM2_t = \beta_0 + \beta_1 \ln RGDP_t + \beta_2 inf_t + \beta_3 f_t + \beta_4 \ln exr_t + \varepsilon_t \quad (4)$$

Where lnRM2 is natural log of real broad money balances (M2), lnRGDP is natural log of real gross domestic product (GDP), *f* is foreign interest rate, *inf* is inflation rate and ln*exr* natural log of real effective exchange rate.

3. ESTIMATION PROCEDURE AND EMPIRICAL RESULTS

3.1 Unit Root Tests

The first step in our analysis is to check for unit root. This test was done to determine the order of integration for each variable in the model. A variable is said to have a unit root if it is non-stationary at level but can became stationary after first differencing-integrated of order one. The order of integration of each series was established using the Augmented Dickey-Fuller (ADF) tests [10]. The ADF test equation is given as:

$$\Delta x_t = \alpha + \delta x_{t-1} + \ldots \sum \delta_i \Delta x_{t-1} + \ldots \delta_m \Delta x_{t-m} + \varepsilon_t \quad (5)$$

$$\Delta x_t = \alpha + \beta_t + \delta x_{t-1} + \ldots \sum \delta_i \Delta x_{t-1} + \ldots \delta_m \Delta x_{t-m} + \varepsilon_t \quad (6)$$

Equation (5) includes an intercept and no trend, while equation (6) includes intercept and time trend. α_0 is a constant, δ is a coefficient of autoregressive process, Δ is the difference operator, t is a time trend, x_t is the variable under consideration, m is the number of lags and ε_t is the stochastic error term. The lagged differences of the variables are augmented to the test model in order to mitigate autocorrelation problems in the disturbance term. The Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) are used to determine the optimal lag length m in the above equations.

The tests rely on rejecting the null hypothesis of a unit root (the series are non-stationary) in favor of the alternative hypothesis of no unit root (the series are stationary). If the absolute values of the ADF test statistics are greater than the critical values, we reject the null hypothesis of non-stationary and conclude that the series is stationary. On the other hand, if the absolute values of the ADF statistics are less than the critical values, we fail to reject the null hypothesis and conclude that the series is non-stationary. These tests results are presented in table 1

Table 1: Augmented Dickey-Fuller Test

Variables	Level/ ΔLevel	Calculated ADF	ADF critical value 5%	Probability Values	Inference
LnM2	Level	-2.028904	-2.986225	0.2734	I(1)
	ΔLevel	-5.379183	-2.991878	0.0002	
lnGDP	Level	1.440646	-2.986225	0.9986	I(1)
	ΔLevel	-6.261156	-2.998064	0.0000	
INF	Level	-2.747895	-2.998064	0.0815	I(1)
	ΔLevel	-3.173759	-2.998064	0.0349	
FI	Level	-2.674126	-2.981038	0.0920	I(1)
	ΔLevel	-4.327720	-2.991878	0.0026	
lnExr	Level	-2.674126	-2.981038	0.0920	I(1)
	ΔLevel	-4.327720	-2.991878	0.0026	

Source: computed by authors using E-views software

The unit root test result reveal that all the variables in the model were non-stationary at their level but became stationary after differencing. Thus the variables are integrated of order one, denoted as I (1). This suggests the use of co-integration analysis since the concept of co-integration requires variables must be integrated of same order.

3.2 Co integration Test

Given that the variables are integrated of the same order, the co-integration analysis is appropriate to estimate the long run model. Thus, the significant issue is to determine the number of co-integrating vectors. Johansen and Juselius (1988, 1990) suggested the use of two statistical tests which are the trace test ($\boldsymbol{\lambda}_{trace}$) and the maximum eigen value test ($\boldsymbol{\lambda}_{max}$). These two tests are estimated with the aid of the following equations:

$$\lambda_{trace}(r) = -T \sum_{j=i+1}^{n} \ln(1 - \hat{\lambda}_i) \quad (7)$$

$$\lambda_{max}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1}) \quad (8)$$

Where

$\boldsymbol{\lambda}_{trace}$ test the null hypothesis r = 0 against the alternative of r > 0

T = number of usable observations

$\boldsymbol{\lambda}_i$ = Eigen values or estimated characteristics root

$\boldsymbol{\lambda}_{max}$ test the null hypothesis r = 0 against the alternative of r =1

If the null hypothesis of no co-integrating vector is rejected, it indicates that there is a long-run relationship among the variables in the model. These test results are presented in table 2 and 3.

Table 2: Unrestricted Co-integration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.967895	195.9954	69.81889	0.0000
At most 1 *	0.923937	113.4657	47.85613	0.0000
At most 2 *	0.667267	51.63710	29.79707	0.0000
At most 3 *	0.511677	25.22714	15.49471	0.0013
At most 4 *	0.284199	8.024488	3.841466	0.0046

Source: E-views output

Table 3: Unrestricted Co-integration Rank Test Result (Maximum Eigen value)

Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.967895	82.52971	33.87687	0.0000
At most 1 *	0.923937	61.82862	27.58434	0.0000
At most 2 *	0.667267	26.40995	21.13162	0.0082
At most 3 *	0.511677	17.20266	14.26460	0.0167
At most 4 *	0.284199	8.024488	3.841466	0.0046

Source: E-views output

The co-integration test results for both the trace and maximum Eigen tests show five co-integrating equations at the 5% level of significance. Consequently, there exists co-integrating relationship between money demand stability and the explanatory variables. The presence of co-integration implies that long run equilibrium relationship exists between the dependent variables and the explanatory variables. Hence the hypothesis that long-run equilibrium relationship between money demand and financial liberalization exits in China is supported. The long run relationship is presented in table 4 below.

Table 4: Normalized long run co-integrating equation

lnM2	lnGDP	INF	FI	lnExr
1.0000	-1.3886 (0.0453)	-0.0857 (0.0137)	0.2558(0.0335)	-2.5835 (0.1566)

Note: Values in Parenthesis are standard errors

The result of the normalized long-run money demand equation shows that

foreign interest rate has positive effects on money demand stability in China whereas inflation rate, GDP and exchange rate have negative effect on money demand stability. The money demand elasticity for GDP, inflation rate, foreign interest rate and exchange rate are -1.38, -0.08, 0.25, and -2.58 respectively (Table 4).

3.3 Estimation of Error Correction Model (ECM)

The Vector Error Correction Model (VECM) is a restrictive auto regressive model that can be used to estimate non-stationary time series that were identified to be co-integrated. It is designed in such a way that it restricts the long-run behavior of the independent variables to meet to their co-integrating relationship and at the same time allow for short-run correction. This can also be explained with the help of the following equation:

$$\Delta X_t = \gamma_0 + \gamma_1 + \Delta Y_t + \lambda V_{t-1} + \varepsilon_t \quad (9)$$

Substituting equation (3) into equation (9) to incorporate the error correction term to reflect the short-run dynamics gives:

$$\Delta \ln M2_t = \alpha_0 + \sum_{i-1}^{q} \beta_1 \Delta \ln RGDP_{t-j} + \sum_{i-1}^{q} \beta_2 \Delta f_{t-j} + \sum_{i-1}^{q} \beta_3 \Delta inf + \sum_{i-1}^{q} \beta_4 \ln exe_{t-j} + \lambda ECM_{t-1} + \varepsilon_t \quad (10)$$

Where Δ is the first difference operator, q is the lag length, **λ** is the speed of adjustment and ECM_{t-1} is the lagged error term and all other variables are as previously defined.

Given that the series are integrated of order one I(1) and co-integrated, justifies the use of the Error Correction Model to capture the short-run dynamics of the model. The short-run relationship among the variables is tested and the result is presented in table 5 below:

Table 5: Result of the Error Correction Model

Dependent Variable: $\Delta \ln M2_t$				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
ECT_{t-1}	-0.089271	0.016648	-5.362357	0.0002
$\Delta \ln M2_{t-1}$	0.288127	0.191588	1.503890	0.1585
$\Delta \ln M2_{t-2}$	0.112443	0.230891	0.486996	0.6350
$\Delta \ln GDP_{t-1}$	0.881628	0.334434	2.636182	0.0217
$\Delta \ln GDP_{t-2}$	1.104605	0.326148	3.386820	0.0054
ΔINF_{t-1}	-0.016988	0.005068	-3.352251	0.0058
ΔINF_{t-2}	0.015193	0.004094	3.710719	0.0030
ΔFI_{t-1}	-0.032840	0.005946	-5.522916	0.0001
ΔFI_{t-2}	0.002985	0.002900	1.029425	0.3236
$\Delta \ln Exr_{t-1}$	0.177286	0.092212	1.922590	0.0786
$\Delta \ln Exr_{t-2}$	-0.199401	0.094597	-2.107900	0.0567
C	-0.186901	0.042039	-4.445854	0.0008

R-squared	0.940872	Mean dependent var	0.170707
Adjusted R-squared	0.886671	S.D. dependent var	0.058105
S.E. of regression	0.019561	Akaike info criterion	-4.723732
Sum squared resid	0.004591	Schwarz criterion	-4.134705
Log likelihood	68.68478	Hannan-Quinn criter.	-4.567463
F-statistic	17.35897	Durbin-Watson stat	2.392353
Prob(F-statistic)	0.000011		

Source: E-views output

The short run vector error correction result confirms that there is a direct positive and highly significant relationship between gross domestic product lag 1 and lag 2, and money demand. This means, by considering the period under study, GDP is found to be a determinant factor of money demand.

Results from the short run money demand model reveal that one period lag of inflation rate has an inverse relationship with money demand in the case of China. The coefficient was found to be negative and significant at the 1 percent level of significance suggesting that a 1 percent increase in inflation rate in one lag period leads to approximately 0.016 percent decrease in money demand on average in the short run. The degree of responsiveness of money demand with respect to inflation rate is -0.0169.

Similarly, the result reveals that foreign interest rate has an inverse relationship with money demand in the case of China. The coefficient was found to be negative and significant at the 1 percent level of significance suggesting that a 1 percent increase in foreign interest rate in one lag period leads to approximately 0.032 percent fall in money demand on average in the short run. The degree of responsiveness of money demand with respect to foreign interest rate is -0.0328. Exchange rate was also found to be significant at the 10% levels for both the one period lag two period lag with varying signs.

In summary, the short run result is in conformity with the long run result. The coefficient of the error correction term indicates the speed of adjustment in eliminating deviation from the long run equilibrium. The coefficient has the expected negative sign (-0.349953) and it is statistically significant at the 1% level. The significance of the coefficient further confirms the existence of the long run relationship between money demand and the I(1) variables under consideration. The magnitude of the coefficient implies that nearly 8.9% of the disequilibrium in the previous year's shock adjusts back to long run equilibrium in the current year. The value of the DW statistic d=2.39 is within the appropriate range (1.95≤d≤2.5) indicating no autocorrelation.

The Adjusted R- squared value is 0.886671, implying that approximately 88% of the variation in the money demand is explained by the independent variables, which is an indication of a very good fit. The overall equation is highly statistically significant as shown by the probability value of the F-statistic (0.000011).

3.4 Stability Test

With regards stability test, the results of both the CUSUM and CUSUMQ plots lie within the 5% critical band width which confirm the stability of the coefficients and the correct specification of the model and also reveal that the demand for money is stable in China

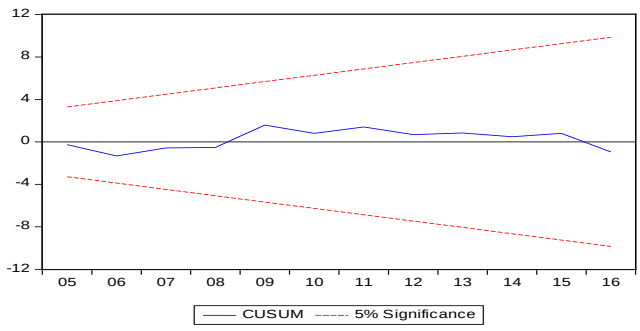

Figure 1: Plot of Cumulative Sum (CUSUM)

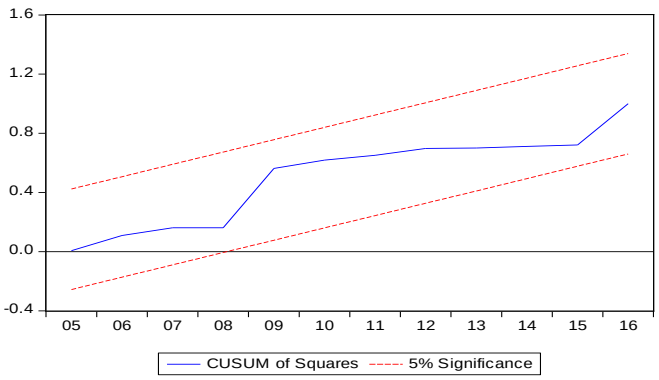

Figure 2: Plot of Cumulative Sum of Squares (CUSUMQ)

4. CONCLUDING REMARKS

The study has presented an investigation on financial liberalization and money demand stability in China for a period of 37-year (1980-2016). The study followed an econometric approach where various tests were conducted in order to avoid spurious regression results. Our measure of money demand has been used as the dependent variable and GDP, inflation, interest rate, and exchange rate as independent variables. All the variables were found to be stationary after differencing. The Johansen co integration technique is adopted to estimate the long run relationship. The test suggests that there exists a unique co-integrating relationship between money

demand and our measure of financial liberalization, which is further confirmed by the negative and statistically significant coefficient of the lagged error correction term in the parsimonious ECM.

The magnitude of the coefficient implies that 8.9% of the disequilibrium caused by previous year's shocks converges back to the long run equilibrium in the current year. The plots of both the CUSUM (Figure 1) and CUSUMSQ (Figure 2) tests suggest the existence of a stable relationship between money demand and financial liberalization. Our major finding is consistent with a study, i.e. money demand function has been fairly stable in many Asian countries (including China). It is also consistent with the findings for 14 Asian countries.

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