The Demand for Money in China: Evidence from Half a Century

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Abstract

This paper employs real money balances, real GDP, inflation rate, and price level to study money demand in China in three periods of time: pro-reform (1952-1978), post-reform (1979-2003), and the whole period (1952-2003). We test stationarity of the time series and examine the consistency of the long-run money demand in the emerging economy of China. There is a stable long-run money demand function for China during pro-reform period and post-reform period respectively. However, because of the inconsistent monetary policy and ongoing economic reform, a long-run equilibrium money demand function does not exist in China throughout the half-century sample period from 1952 to 2003.

Keywords: money demand; economic reform, cointegration

1. Introduction

China has experienced a transition from the central planning economy towards the market-based economy since the late 1970's. Issues concerning the implementation of monetary instruments in the management of macro-economy have arisen since economic reform started. The purpose of this paper is to compare the money demand function before and after the economic reform, and to determine whether there exists a long-run, equilibrium relationship between real money balances, real GDP, price level, and inflation in China.

Prior to the 1978 economic reform, almost all financial institutions in China had merged into the People's Bank of China (PBC), which was both the administration headquarter and business center of China's financial and banking system. It had sole responsibility of controlling money supply and also served as government treasury. From1978 to 1984, the Chinese government set up a few state-owned specialized banks to meet the growing demand for financial services. These banks are the so-called "big-four" state-owned banks: Agriculture Bank of China, China Construction Bank, China Investment Bank and the Industrial and Commercial Bank of China. However, their operations were limited to special areas and they served individual functions. For example, the Industrial and Commercial Bank of China mainly supplied funds to China's urban areas and manufacturing sector, while the China Construction Bank specialized in financing infrastructure projects and urban housing development.

After 1985, the PBC was transformed to the central bank of China to conduct independent monetary policy. The administrative functions and commercial functions of the banking system were finally separated. Some of its functions were taken over by state-owned commercial banks that were transformed from state-owned specialized banks. In the 1990s, the focus of the reform was to create an efficient banking system to formulate and implement monetary policy and issue loans which was not controlled by political orders. In 1995, the Commercial Bank Law was passed to commercialize and regulate the operations of the "big four". Chinese government then established three policy banks to perform government-directed spending functions. Eight years later, PBC's responsibilities for implementing monetary policies and supervising the banking system were eventually separated with the creation of the China Banking Regulatory Commission (CBRC). By 2009, a total number of 140 city commercial banks have been founded in China. Garcı´a-Herrero et al (2006) present the features of China's banking system and the ongoing reform during China's economic transition.

Burton and Ha (1990) estimate the money demand function in China from 1983 to 1988 when China experienced substantial inflation. Hafer and Kutan (1994) use data from 1952 to 1988 to examine whether there is a long-run equilibrium money demand relation for China. Our research extends the period of study to 2003, and we compare the pro-reform, post-reform, and the whole period to examine the long-run demand for money in China. We find that both currency in circulation and broad money may provide a reliable money demand function, but Hafer and Kutan (1994) suggest that broad money (M2) is more preferred.

Chen (1997) studies the stability of long-run money demand functions for three definitions of money in China and calculates the income elasticity of real money demand. Budina et al. (2006) investigate the money demand in Romania from 1992 to 2000 and test the stationarity of money, inflation and output. They also test the cointegration between these factors. Wang (2001) evaluates the causes of changes in monetary policy effectiveness in China during the late 1990's. Gu (2005) uses the Johansen Maximum likelihood procedure and the dynamic OLS procedure to estimate long-run equilibrium relationships between real money balances and their determinants. He also examines the possible structural breaks in money demand functions. Baharumshah et al. (2009) use the autoregressive distributed lag (ARDL) cointegration framework to examine money demand in China. They choose real income, inflation, foreign interest rates, and stock indexes as determinants of the money demand function. Bahmani-Oskooee and Wang (2007) report that the M1 money demand function is stable in China but the M2 one is not.

There is a growing amount of research on money demand in China. We are interested in studying whether the economic reform process beginning in 1978 led to structural changes in money demand in China. Due to limitations on data collection, our research is conducted over a half-century period from 1952 to 2003.In order to investigate differences of money demand in China during its transition from the planned economy to the market economy, three periods are studied in detail in the present paper: 1952-2003 (whole period), 1952-1978 (pro-reform period), and 1979-2003 (post-reform period).During the whole research period from 1952 to 2003, there is not a unique long-term, equilibrium relationship among variables due to the innovations, institutional changes, and the inconsistent monetary policy.

The remainder of this paper is organized as follows. Section 2 reports sources and construction of data. Section 3 describes the methodology and proposed models. Section 4 provides details of empirical results, and Section 5 concludes.

2. Data

We use annual data of money balances (M0 and M2), GDP, interest rates and retail price index (RPI) from Comprehensive Statistical Data and Materials of 50 years of New China (1952-1999) and we update the data to year 2003 with IFS CD-ROM. GDP, M0 and M2 are all in billions of national currency (RMB). The whole period of study is from 1952 to 2003. The pro-reform period is from 1952 to 1978, and the post-reform period is from 1979 to 2003.

Following Hafer and Kutan (1994), we also use two monetary aggregates, M0 and M2: M0 is the currency in circulation, or bills and coins held by the public; and M2 is the broad money, which equals M0 plus demand deposits and time deposits. In China, M0 accounted for up to 80 percent of M2 before the 1970's, and the central bank mainly targeted at M0 before the 1978 reform began. Since the 1990s, a broad monetary aggregate has become much more important in setting targets for monetary policy. The use of two monetary aggregates better represents for changes of the monetary policy in China. Real variables are obtained by deflating nominal variables with RPI. The RPI in 1950 is normalized to one. All variables, except the inflation rate and interest rates, are in natural logarithmic form. As usual, lower case letters denote the logarithms of upper case letters.

3. Methodology

The primary interest of the present paper is whether there exists a long-run equilibrium relationship or cointegrating vector between real money balances, real GDP, the price level and the opportunity cost of holding real money balances, indicated by the inflation rate and/or interest rates in China. First we use the Augmented Dickey-Fuller unit root test to check the stationarity of the time series data.

Unit root test are performed on univariate time series.

$$\Delta x_t = a + \delta x_{t-1} + \sum_{i=1}^{n} \Delta x_{t-i} + \varepsilon_t \quad (1)$$

where Δ is the first difference operator, α is the constant term, x is the logarithm of the variable, and ε is the error term. We estimate (1) and test the null hypothesis that δ=0, which means that there is a unit root and the time series is not stationary. It the null hypothesis is rejected, the time series is stationary.

Although the time series are non-stationary individually, their one or more linear combinations might be stationary. If individual time series are found to be integrated of the same order after the unit root tests, then these variables may be cointegrated.

The Johansen multivariate cointegration procedure is based on the kth order vector auto regression (VAR) model:

$$X_t = \prod_1 X_{t-1} + \ldots + \prod_k X_{t-k} + \epsilon_t \quad (t = 1, 2, \ldots, T) \ (2)$$

where $X_t$is a sequence of p×1 random vectors (X_{1t},…, X_{pt}), $\prod_i$ is a p×pmatrices of parameters, and ϵ_t is a p×1 random disturbance vector.

The Johansen method applies the maximum likelihood to determine the presence of cointegrating vectors in non-stationary time series. The trace test and maximal-eigenvalue test are used to test the null hypothesis that there are at most r cointegrating vectors, and then determine the number of cointegrating vectors. Variables will be cointegrated, which means $\beta x \sim I(0)$, where β is cointegration vector. As a result, we will be able to show that there is a long-run equilibrium relationship between variables in study.

4. Empirical Results

We first present graphical descriptions of our data. The selected annual time series, in levels are displayed graphically in Figure 1to Figure 5. They are real GDP, inflation rates, realM0, real M2, and real interest rates.

Figure 1: Real GDP

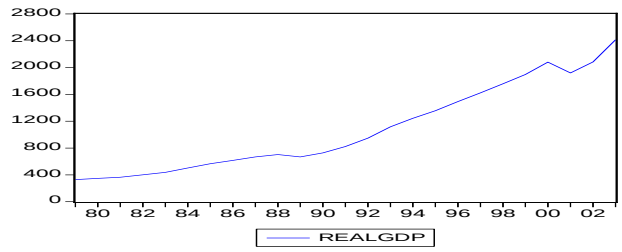


Figure 2: Inflation Rates

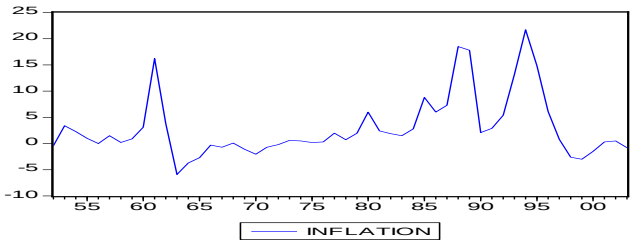


Figure 3: Real M0

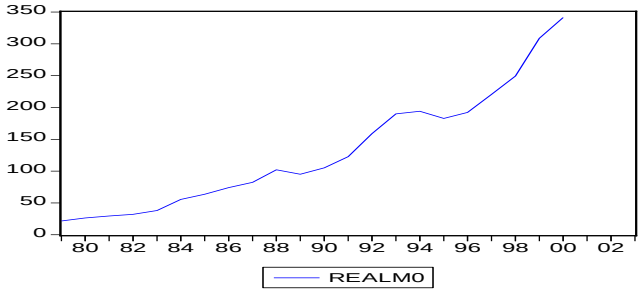


Figure 4: Real M2

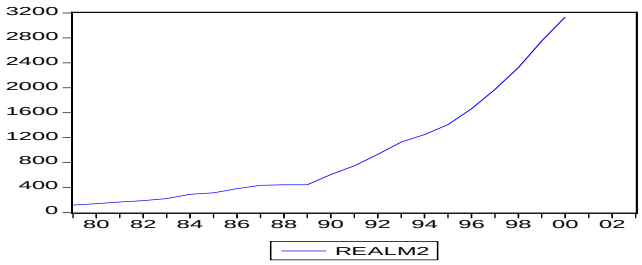
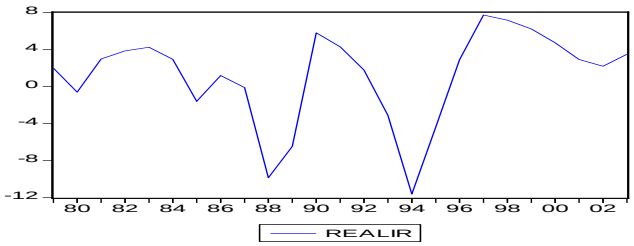


Figure 5: Real Interest Rates



The time series of Real GDP, Real M0and Real M2 demonstrate an upward trend. Figure 2 shows that during the sample period China economy was characterized by significant inflation around 1960 and 1993 and deflation during late 60's and early 2000's, and this process was accompanied by high growth of GDP. We also check the pairwise correlation coefficient of these variables, which are0.98 between Real M0 and Real GDP, and 0.997 between Real M2 and Real GDP. Furthermore, the pair wise correlation between Real M0and RPI is 0.95, and the pairwise correlation between Real M2 and RPI is 0.97.These results suggest that level variables might be constrained to a stable relationship over long time.

Table 1 presents the augmented Dickey-Fuller (ADF) unit root tests for the inflation rate, interest rates and all other variables in natural logarithmic form.

Table 1: ADF Unit Root Test Results

Variable	Level	First-Difference
1952-2003		
Real gdp	1.327	-5.835*
Real m0	1.262	-6.144*
Real m2	1.446	-4.66*
Inflation Rate	-2.696	-5.77*
rpi	0.30	-4.362*
Interest Rates	-4.439*	-5.089*
Pro-Reform 1952-1978		
Real gdp	-0.068	-4.4*
Real m0	-0.748	-4.951*
Real m2	-2.198	-5.611*
Inflation Rates	-3.406**	-3.895*
rpi	-2.451	-3.895*
Interest Rates	-2.99**	-4.97*
Post-Reform 1979-2003		
Real gdp	-0.571	-3.843*
Real m0	-1.259	-4.151*
Real m2	0.118	-4.564*
Inflation Rates	-2.988	-4.886*
rpi	-0.716	-3.04**
Interest Rates	-3.807*	-5.089*

*denotes rejection at all 1%critical values; ** denotes rejection at 5%critical values

Table 1 shows that the log of real currency in circulation (Real m0), the log of real broad money(Real m2), the log of real gdp (Real gdp), and the log of retail price index (rpi) are not stationary. For inflation rates, only when we test the unit root during the pro-reform period, the null hypothesis is rejected at 5% and 10% critical values. However, interest rates are stationary in all periods of time because they have been regulated by the Chinese government and central bank. The results are significant and are consistent with the graphical description of the time series.

When the first-difference of each time series is estimated, the unit root hypothesis is rejected in all cases. This non-stationarity of our levels and stationarity of the first-difference of variables suggest that our variables, real gdp, real m0, real m2, rpi and the inflation rate, might be integrated of order one or I (1). Because the unit root test suggests that interest rates are stationary[i] and then they do not have long-run effect on the money demand in China. We will only use the inflation rate as the opportunity cost of holding money.

The cointegration test results are found in the following tables (Table 2, Table 3, and Table 4) for different sample periods.

Table 2: Cointegration Test Results (1952-2003)

	Trace Test Statistic			
Monetary Aggregate	r=0	r≤1	r≤2	r≤3
M0	48.348*	24.722	10.104	2.521
M2	39.504	14.336	4.612	0.623
	Maximum Eigenvalue Test Statistic			
Monetary Aggregate	r=0	r≤1	r≤2	r≤3
M0	23.627	14.618	7.583	2.521
M2	25.169	9.724	3.990	0.623

Note: The cointegration tests are conducted using a maximum lag of 2. Johansen's trace and maximal-eigenvalue statistics are used for testing the null hypothesis of r cointegrating vectors under the assumption of the presence of a linear deterministic trend in the data.

* denotes rejection of the hypothesis at the 5% level

Table 2 shows that when using M0for the whole period, the null hypothesis of $r = 0$ cointegrating vectors is not rejected at5% level for maximum eigenvalue test statistic but not for trace test statistic. When using M2 instead, the null hypothesis of at most $r = 0$ cointegrating vectors is supported by the data at the 5% significance level for both maximum eigenvalue test and trace test statistics. Overall, there is no cointegration relationship among these variables when we use M2 for the whole sample period from year 1952 to 2003.

Table 3: Cointegration Test Results (1952-1978)

	Trace Test Statistic			
Monetary Aggregate	r=0	r≤1	r≤2	r≤3
M0	100.412*	24.182	7.186	1.347
M2	71.052*	22.211	8.233	0.013
	Maximum Eigenvalue Test Statistic			
Monetary Aggregate	r=0	r≤1	r≤2	r≤3
M0	76.231*	16.996	5.839	1.347
M2	48.841*	13.978	8.220	0.013

Note: The cointegration tests are conducted using a maximum lag of 2. Johansen's trace and maximal-eigenvalue statistics are used for testing the null hypothesis of r cointegrating vectors under the assumption of the presence of a linear deterministic trend in the data.

* denotes rejection of the hypothesis at the 5% level

Table 3 shows that during the pro-reform period(1952 to 1978)when using M0, the null hypothesis of at most r = 0 cointegrating vectors is rejected at the 5% level for both trace and maximum eigenvalue statistics.

When using M2,the null hypothesis of r = 0 cointegrating vectors is rejected at the 5% level for both trace and maximum eigenvalue statistics. Therefore, there is a cointegration relationship among these variables during the pro-reform sample period.

Table 4: Cointegration Test Results (1979-2003)

	Trace Test Statistic			
Monetary Aggregate	r=0	r≤1	r≤2	r≤3
M0	86.158*	40.151*	18.920*	3.244
M2	88.012*	35.486*	11.102	2.594
	Maximum Eigenvalue Test Statistic			
Monetary Aggregate	r=0	r≤1	r≤2	r≤3
M0	46.008*	21.231*	15.676*	3.244
M2	52.526*	24.384*	8.509	2.594

Note: The cointegration tests are conducted using a maximum lag of 2. Johansen's trace and maximal-eigenvalue statistics are used for testing the null hypothesis of r cointegrating vectors under the assumption of the presence of a linear deterministic trend in the data.
* denotes rejection of the hypothesis at the 5% level

Table 4 shows that during the post-reform period (1979 to 2003) when using M0, the null hypotheses of at most r = 0, r=1 and r=2 cointegrating vectors are rejected at the 5% level for both trace and maximum eigenvalue statistics. When using M2,the null hypotheses of at most r = 0 and r=1 cointegrating vectors are rejected at the 5% level for both trace and maximum eigenvalue statistics. Therefore, there is more than one cointegration relationship among these variables during the post-reform sample period.

The above analyses indicate that we cannot reject the hypothesis that there is a long-term, equilibrium money demand function for both measures of money during pro-reform and post- reform periods. Currency in circulation (M0) and broader money (M2) are both efficient policy measures. However, during the whole half-century research period from 1952 to 2003, there is not a unique long-term equilibrium relationship among variables. This is due to the innovations, institutional changes, and the inconsistent monetary policy during the sample period as explained in the Introduction. Gu (2005) find that during the post-reform period, there exists a long-run money demand function for broad money holdings, but not for narrow money holdings, which is different from our results.

5. Conclusion

The economic reform in China has introduced greater changes to its monetary policies. The half century in our study has been extraordinary and brought decentralization and diversification to China's macroeconomic management and banking system. Broad money supply (M2) in China reached 2,000 billion RMB in 2003 and 120,960 billion RMB in July 2014. It is interesting and important to explore whether there exists a stable long-run money demand function for China under this transitional circumstance. The empirical results show that during the whole sample period from 1952 to 2003 there is not a long-term equilibrium money demand function due to substantial changes of monetary policies in China. Our paper also investigates money demand in China before and after the economic reform, and a long-run equilibrium relationship is found in each episode. All variables in the money demand equation are individually significant. In our future studies, we are interested in extending the research to a more recent period and also including other variables, such as M1, stock prices, and/or exchange rates to our discussions.

References

Baharumshah, A., et al. (2009).The Stability of Money Demand in China: Evidence from the ARDL Model. Economic Systems, 33 (3), 231-244.

Bahmani-Oskooee, M. and Wang, Y. (2007). How Stable is the Demand for Money in China? Journal of Economic Development, 32 (1), 21-33.

Budina, N. et al. (2006). Money, Inflation and Output in Romania, 1992-2000. Journal of International Money and Finance, 25, 330-347.

Burton, D. and Ha, J. (1990).Economic Reform and the Demand for Money in China. IMF Working Paper, April 1990, 1-26.

Cargill, T. and Parker, E. Price Deflation, Money Demand and Monetary Policy Discontinuity: a Comparative View of Japan, China and United States. North American Journal of Economics and Finance, 15, 125-147.

Chen, B., (1997). Long-Run Money Demand and Inflation in China. Journal of Macroeconomics, 19(3), 609-617.

Engle, R. and Granger, C. (1987).Co-integration and Error Correction: Representation, Estimation and Testing. Econometrica, 55, 251-276.

Garcı´a-Herrero, A. et al. (2006). China's Banking Reform: An Assessment of its Evolution and Possible Impact. CESifo Economic Studies, 52 (2), 304–363.

Gu, C. (2005). Empirical Analysis of Money Demand in China: A Cointegration Approach. Working Paper.

Hafer, R. and Kutan, A. (1994). Economic Reforms and Long-Run Money Demand in China: Implications for Monetary Policy. Southern Economic Journal, 60 (4), 936-945.

Johansen, S. (1988). Statistical Analysis of Cointegration Vectors. Journal of Economic Dynamics and Control, 12, 231-254.

Johansen, S. and Juselius, K. (1990).Maximum Likelihood Estimation and Inference on Cointegration- With Applications to the Demand for Money. Oxford Bulletin of Economics and Statistics, 52, 169-210.

Wang, R. (2001). Effectiveness of Monetary Policy in Post-Reform China: Some Empirical Evidence, Working Paper.

Sriram, S. (2001).A Survey of Recent Money Demand Studies. IMF Staff Papers, 47 (3).

[i] τ=-4.871, and the critical values at 1%, 5% and 10% are -4.152511, -3.502373 and -3.180699 respectively. We can reject the null hypothesis at all levels.