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## Estimation of RMB Stock Outside Mainland China and Empirical Research on Its Influencing Factors

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### Abstract

After selecting new estimated caliber and data from 1978 to 2003, we estimate the domestic money demand function. And then the indirect estimation method is used to estimate the RMB stock outside mainland China from 2004 to 2013, meanwhile we make an empirical research on the influencing factors of RMB stock outside mainland China. The outcome shows that the RMB stock outside mainland China increases from 288.3 billion yuan of 2004 to 2270.6 billion yuan of 2013 and the number increases to the maximum in 2010. The main factors influencing the RMB stock outside mainland are the fluctuation of exchange rate, the developed degree of financial market, the degree of dependence on foreign trade, per capita GDP and the inflation rate. Finally the article puts forward some conclusions and suggestions on enlarging the scale of the RMB stock outside mainland China and then internationalizing the RMB.

**Key words:** RMB stock outside mainland China; Money demand function; Influencing factors; The developed degree of financial market

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### INTRODUCTION

Since the reform and opening up, the economy of China

has developed rapidly and its influence in the world has been gradually increased. In 1980, China's total exports were \$18.1 billion, which is the 26<sup>th</sup> in the world's total export. By 2009, China's total exports reached \$1.20161 trillion which was the first in the world's total exports, since then China's total exports kept the first in the world's total exports. In 2010, with 40.15 trillion yuan of China's GDP which is more than Japan, China became the world's second largest economy and has remained the world's second place to now. Along with the improvement of China's foreign trade and economic capacity, RMB's status in the international arena is becoming more and more important and the call about the internationalization of RMB is becoming higher. Following this trend, our country launched a series of initiatives to promote the internationalization of RMB. With the expansion of the scope and scale of currency swap agreements and the development of Hong Kong offshore RMB market, the pace of the internationalization of RMB gradually accelerates and the size of the RMB stock outside mainland China keeps improving. RMB moving out of our country, serving as means of hoard, medium of exchange and unit of account, can bring our country huge international seigniorage income and enhance the international influence of our country in the world. However, if the large-scale RMB stock outside mainland China suddenly returns to our country, this must give an impact to our financial stability. In addition, there is no official statistics about RMB stock outside mainland China, so it is very important to estimate the RMB stock outside mainland China and analyze the factors of influencing the RMB stock outside mainland China.

### 1. LITERATURE REVIEW

Now, there are two main methods which are direct and indirect estimation method to estimate the overseas currency stock in the academic circles.

Direct estimation method mainly estimates the overseas stock of RMB caused by border trade, tourism, consumption and so on. Based on the stock of 500 million yuan in 1998, Li (2002) estimated the RMB stock staying in Mongolia through the field survey. He got the estimated value of RMB inflows and outflows between China and Mongolia from the trade and non-trade aspects, and the amount of RMB currently staying in Mongolia was about 300 million yuan in 2002. Ba (2002) estimated the stock of RMB in Hong Kong that was carried from China to Hong Kong by the travel of residents. He thought that the stock of RMB was at least about 57 billion yuan between 1996 and 2001 in Hong Kong market. RMB cross-border investigation group of cash flow (2005) had a survey of RMB cash flow in Hong Kong, Macao and the neighboring countries of China. The findings showed that RMB cash flow staying in Hong Kong, Macao and the neighboring countries of China was about 21.6 billion yuan, and the total annual flow of cross-border RMB cash inflows and outflows was about 771.3 billion yuan, and the net outflows was about 9.9 billion yuan (RMB Cross-border Investigation Group of Cash Flow, 2005).

The indirect estimation method mainly estimates the stock of overseas currency by econometric or statistical methods. These methods firstly fits out the money demand function of the country through some sample data, and then uses the money demand function to forecast the money demand in a certain period of time. So the difference between the actual money supply and the forecasted money demand is the stock of overseas currency. There are some important research literatures using these methods to estimate the stock of overseas currency. The maximum likelihood estimation was used by Pen and Shi (2003) to estimate the Hong Kong dollar outside the Hong Kong, and the Hong Kong dollar in circulation outside the Hong Kong was about 15-25 percent of the total circulation of Hong Kong. The value of the maximum likelihood estimation was 16 percent. Ma and Rao (2006) estimated the RMB stock outside the mainland China from 1995 to 2005 using the data from 1958 to 2005 and the method of deducting local demand. The result suggested that the size of RMB stock outside mainland China had raised from -16.2 billion of 1995 to 31.1 billion of 2005. Xu and Liu (2006) used  $M_1$  and gap estimation method to analyze the RMB stock in Hong Kong from 2000 to 2005, which showed that the error caused by conditional gap estimation method was smaller than that caused by unconditional gap estimation method when the interval of estimation was longer. Dong (2008) used the quarterly data from 1990 to 1998 and the method of deducting local demand to value the size of RMB stock outside mainland China in every quarter. It showed that the scale of RMB stock outside mainland China, approximately -6.5 billion in the first quarter of 1999, had gradually increased to more than 25 billion of 2005, and also it was negative in 2000 and the first quarter of 2005. Ba and

Yan (2010) estimated the stock of overseas RMB from 1999 to 2008 using gap estimation method. The paper showed that the average ratio of the overseas demand for RMB and the total RMB cash was 7.62% in the period of 1999 to 2008, and the scale of overseas RMB circulation had increased year by year. Li (2011) estimated RMB stock outside mainland China from 2001 to 2008 by the method of deducting domestic demand. The result showed that the scale of RMB stock outside mainland China had an increasing fluctuation trend, and at the end of each quarter, the average value had risen from 11.68 billion of 2001 to 92.65 billion of 2008, and the maximum value had risen from 38.96 billion of 2001 to 178.16 billion of 2007. In addition, the RMB stock outside mainland China was negative in some quarters.

The direct estimation requires the statistic data of RMB inflows and outflows in every aspect, which is limited to the actual statistics and surveys. At the same time, the subjectivity is inevitable in some parts, so this article estimates the RMB stock outside mainland China by the indirect estimation method.

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## 2. THE ESTIMATION OF RMB STOCK OUTSIDE MAINLAND CHINA FROM 2004 TO 2013

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### 2.1 The Description for the Estimation Method

This paper uses the method of Ma and Rao (2006) to estimate the stock of overseas RMB. By choosing the data from 1978 to 2013 and dividing the data into two periods of 1978 to 2003 and 2004 to 2013, providing the RMB circulating only in the domestic in the period of 1978 to 2003, we can estimate the money demand function of our country using the data of the period of 1978 to 2003 and then test the stability of parameters of the money demand function. It is assumed that there is little change about the structure of money demand in our country, and then we can take use of the stable money demand function to forecast the domestic money demand of the period of 2004 to 2013. Finally the difference of the predicted value and the actual money issued by central bank can be as the estimation value of RMB stock outside mainland China.

About the data selection, because the era of China's planned economy and chaotic social situation had seriously distorted the economy before 1978, which caused lots of data distortion and the whole economic system functioning unreasonably, so this paper chooses the data after 1978 as sample data. About the division of the two periods, every academician's opinion is different. For example, Ma and Rao (2006) take the 1997 as a demarcation point, Dong (2008) and Ba and Yan (2010) take the 1999 as a demarcation point, and Li (2011) takes the 2001 as a demarcation point. This is mainly because Li, Guan, and He (2004) think that RMB began to flow abroad after the

Asian financial crisis in 1998, but some academicians' results were negative, and they explained the reasons using the currency substitution. However, this is not fully in line with China's actual situation. On one hand, there are always strict exchange controls in our country, and the currency substitution is not feasible. On the other hand, currency substitution will not exist for only a short time and it must exist for a period of time. Meanwhile, the tough policy for RMB not depreciated winning a good reputation for RMB in the international community will not immediately cause massive foreign holdings of RMB after the Asian financial crisis in 1998, so we postpone the demarcation point. Owing to the overseas RMB before 2004 mainly caused by border trade and tourism consumption, the stock outside the mainland China is not great and mainly concentrates in Hong Kong and Macao. And also because the mainland and Hong Kong signed the "Mainland and Hong Kong Closer Economic Partnership Arrangement" (CEPA) in June 2003, the agreement was formally implemented in January 1<sup>st</sup>, 2004. So the RMB inflows in Hong Kong accelerated from the beginning of 2004, and so it is assumed that the RMB stock outside mainland China before 2004 is negligible.

This paper analyzes the RMB stock outside mainland China taking  $M_1$  as the caliber. Many academicians analyze the RMB stock outside mainland China taking  $M_0$  as the caliber, this is because Yi (2004) thought that RMB mainly existed outside the bank system in the form of cash. This is reasonable to some extent, because  $M_0$  is easy to statistic as the cash in circulation, and also  $M_0$  reflects the residents' money demand in a certain extent. But this paper argues that it is unreasonable taking  $M_0$  as the caliber. Firstly, the caliber  $M_0$  is too small to really reflect the situation of our domestic money demand. Secondly, in essence, the majority of RMB stock outside mainland China will return to domestic bank system except for a very few saved in hands in the form of cash. Take the Hong Kong for example, the RMB is either accumulated in the hands of merchants or deposited in the bank, and the RMB deposited in the bank will eventually enter into the bank system in our country, so in essence the RMB outside mainland China also circulates in the bank system. At the same time, this article does not choose  $M_2$  to analyze the stock of overseas RMB. Because the statistical standards are always changing and it is difficult to ensure the accuracy of data, and also  $M_2$  is the stock index, which does not match the flow index of GDP. Although the flow index and the stock index can be transformed into each other, the two are quite different on scale. Thus this paper estimates the scale of RMB stock outside mainland China using  $M_1$  as the caliber.

## 2.2 The Estimation of Money Demand Function

### 2.2.1 The Establishment of Econometric Model, Variable Declarations and Data Selection

According to the economic theory of money demand,

we know that the money demand of a country is related to interest rate, income and inflation of the country (Yi & Wu, 1999). Considering the actual situation of our country, our economic system gradually transits to the market economy from the planned economy, and the government always plays a very important role in our country's economy, this causes the serious financial repression of our country and a huge scale of underground economy which influences the money demand of our country. Moreover, with the development of our economy, the gradually improved degree of monetization also causes the impact of our residents' money demand. So our money demand function can be expressed as:

$$\frac{M^d}{P} = f(RGDP, MC, MTAX, Rr, u) \quad (1)$$

Where  $\frac{M^d}{P}$  is real money demand of our residents,  $P$

is the price index and can be denoted by consumer price index (CPI). In eq. (1), RGDP, MC, MTAX and Rr are four independent variables. RGDP is the actual national income, which denotes the real income level of our country and can be gained with the normal GDP divided by CPI. MC is the degree of monetization, which denotes a country's currency proportion of economic activities. Mackinnon (1996) thought that  $M_2/GNP$  was the best indicator to measure a country's degree of monetization, but in this paper,  $M_2/GDP$  replaces  $M_2/GNP$ . MTAX denotes the scale of underground economy. According to the analysis of Kenneth (1998), the scale of underground economy in a country has a significant positive correlation with the country's tax rate, thus the paper uses this indicator to reflect the relationship between the scale of underground economy and the tax and the indicator can be denoted by the ratio of fiscal revenue and GDP. Rr denotes the real interest rate, which reflects the opportunity cost of currency and can be gained by normal interest rate minus inflation rate. We use the one-year deposit interest rate to denote the normal interest rate and use  $INF = \frac{CPI_t - CPI_{t-1}}{CPI_{t-1}}$  to denote the inflation rate. Other factors influencing the money demand are denoted by  $u$ , and  $u$  is a random disturbance.

In order to weaken the influence of multi-collinearity, we use the logarithm of  $M_1/P$ , RGDP and MC, so our country's money demand function is as follows:

$$\ln(M_1/P)_t = C + \partial_1 \ln(RGDP)_t + \partial_2 \ln MC_t + \partial_3 MTAX_t + \partial_4 Rr_t + u_t \quad (2)$$

The data of narrow currency  $M_1$ , broad currency  $M_2$ , consumer price index (CPI), national fiscal revenue and the gross domestic product (GDP) is gained from the central bank's website, "The new China statistic compilation of sixty years" and the website of national statistical bureau. The normal interest rate can be gained from the data center of eastern wealth network and the central bank's website. During to so many times of changing some years' interest rate, we adjust these years' interest rate by the weighted average method.

### 3.2.2 The Estimation of Domestic Money Demand Function from 1978 to 2003

We estimate the parameter using the data from 1978 to 2003 in Eq. (2). Because this paper uses time-series

data of long period of time, we make the unit root test (ADF test) in order to avoid “spurious regression” and to improve the effectiveness of estimation. The test results are shown in Table 1.

**Table 1**  
**The ADF Test Results of Every Variable**

Variables	(c, t, n)	ADF value	Mackinnon threshold (significance level)	P value	Conclusion
Ln(M1/P)	(c, t, 5)	-2.208726	-3.23805(10%)	0.4647	Non-stationary
Ln(RGDP)	(c, t, 5)	-4.717536	-3.243079(10%)	0.0050	Stationary
Ln(MC)	(c, t, 3)	-3.394603	-3.238054(10%)	0.0748	Stationary
MTAX	(c, t, 1)	-0.707261	-3.243079(10%)	0.9608	Non-stationary
Rr	(c, t, 2)	-3.905522	-3.243079(10%)	0.0278	Stationary
$\Delta$ ln(M1/P)	(c, t, 3)	-4.216716	-3.612199(5%)	0.0146	Stationary
$\Delta$ ln(RGDP)	(c, t, 1)	-3.674462	-3.622033(5%)	0.0452	Stationary
$\Delta$ ln(MC)	(c, t, 3)	-4.464246	-3.612199(5%)	0.0086	Stationary
$\Delta$ MTAX	(0, 0, 1)	-2.428452	-1.955681(5%)	0.0175	Stationary
$\Delta$ Rr	(c, t, 1)	-4.791466	-3.622033(5%)	0.0045	Stationary

Note.  $\Delta$  is a first-order differential operator. And c represents the intercept items, t represents trend items, n represents the lag order of a variable in the type of test.

So we can have some results. The variables of ln(M1/P) and MTAX can not pass the unit root test at the 10% significance level, which suggests that both variables are non-stationary sequence, but their corresponding first-order differential sequences pass the unit root test at 5% significance level. In addition, the variables of ln(RGDP), ln(MC) and Rr are stationary sequences at the level value, and their first-order differential

sequences are still stationary. Thus all variables obey the first-order single process, and we can use E-G two-step method to determine whether there is a cointegration relationship between the dependent variable and the independent variables.

In the first step, we use OLS to estimate the eq. (2), and the regression result is as follows:

$$\ln(M/P) = 1.188139 + 0.517420\ln(RGDP) + 1.419669\ln MC + 2.598523MTAX - 0.735230Rr \quad (3)$$

S.E = 0.561902      0.120912      0.202982      0.489415      0.289758  
 t = (2.114496)      (4.279324)      (6.994050)      (5.309442)      (-2.537392)  
 R-squared=0.996932    Adjusted R-squared=0.996348    F-statistic=1706.088    Prob=0.000000  
 S.E. of regression=0.052819

In the second step, we make the unit root test for the residual and the test results as shown in Table 2

**Table 2**  
**The Unit Root Test Results of Residual  $u_t$**

T-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.144160    0.0030
Test critical values: 1%	-2.660720
5%	-1.955020
10%	-1.609070

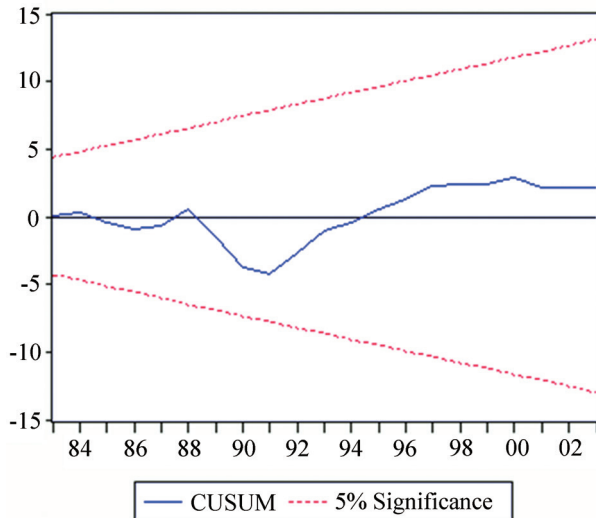
Note. Mackinnon (1996) one-sided p-values.

The test results show that the residual sequence rejects the hypothesis of existing the unit root. So there is a cointegration relationship among ln(M<sub>1</sub>/P), ln(RGDP), ln(MC), MTAX and Rr, which shows that there is a long-term equilibrium relationship between the dependent

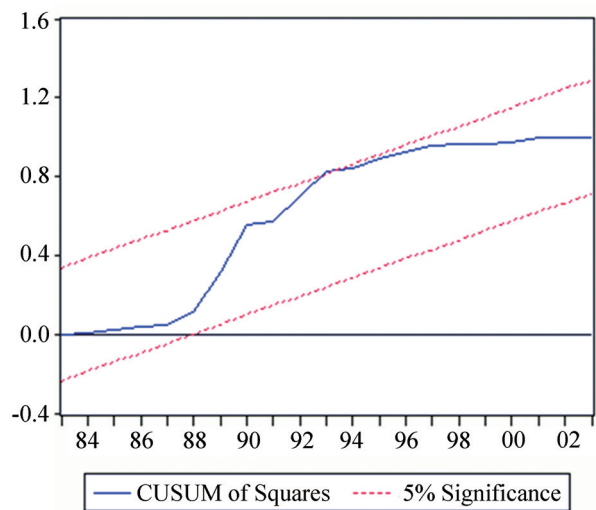
variable and the independent variables. Then we can get our country’s money demand function of 1978 to 2003, as in eq. (3). In eq. (3), the signs of estimated parameters are in line with economic theory. The results tell us that our country’s money demand will increase 0.52% if RGDP and MC increases 1%, the money demand will increase 2.60% if MTAX increases one unit, and the money demand will decrease 0.74% if Rr increases one unit.

Moreover, since the foundation of China, the economic system and economic structure have changed so much and the supply and demand have also been affected. Thus the stability of the model structure is likely to be affected and then the money demand function may be unstable. So we need to test the parameters’ stability of the model. In this paper, the sum of cumulative residuals and the sum of cumulative residuals’ square are used to

test the parameters' stability and the results show that the parameters of model have good stability, which suggests that eq. (3) can be used to forecast the money demand of next period. The results of parameters' stability test are shown in Figure 1 and Figure 2.



**Figure 1**  
The Results of Parameters' Stability Test



**Figure 2**  
The Results of Parameters' Stability Test

In order to have further understand the short-term dynamic adjustment of money demand function, having  $ECM_t = u_t$ , we establish the ECM model as follows:

$$\Delta \ln(M_1 / P)_t = c + \sum_{i=0}^l \beta_i \Delta \ln(RGDP)_{t-i} + \sum_{i=0}^l \delta_i \Delta \ln MC_{t-i} + \sum_{i=0}^l \lambda_i \Delta MTAX_{t-i} + \sum_{i=0}^l \eta_i \Delta Rr_{t-i} + \mu ECM_{t-1} + v_t \quad (4)$$

Where  $l$  is lag order,  $\Delta$  denotes the difference and  $\sum$  represents the summation. According to the method from the general to the specific, starting from  $l=3$ , though removing the non-stationary lags, we have the results of ECM model:

**Table 3**  
The Estimation Results of ECM Model

Variables	Coefficient	Standard deviation	T-statistics	P-value
C	-0.046398	0.027444	-1.690659	0.1072
$\Delta \ln(\text{rgdp})$	0.937250	0.238773	3.925271	0.0009
$\Delta \ln(\text{mc})$	1.528954	0.271824	5.624791	0.0000
$\Delta \text{mtax}$	1.689597	0.896576	1.884499	0.0749
$\Delta r$	-0.721940	0.266693	-2.707012	0.0140
$\text{Ecm}(-1)$	-0.440200	0.219337	-2.006958	0.0592
Adjusted R-squared=0.750624 Prob(F-statistic)=0.000004				

From the estimation results of ECM model, we see that model gets through the F-statistics and every variable gets through the T-statistics, and the sign of non-equilibrium error term is negative, which is in line with the reverse correction mechanism. The regression results indicate that if the previous money demand deviates from the equilibrium level, though putting it back 44%, the current error correction term  $\text{ecm}(-1)$  will make it back to the equilibrium level. So in the long term the dependent variable has a stable equilibrium relationship with the independent variables, but in the short term the relationship between them will fluctuate around the equilibrium level.

**2.2.3 The Estimation About RMB Stock Outside Mainland China from 2004 to 2013**

Using the data of 2004 to 2013 and the eq. (3), we estimate the domestic money demand from 2004 to 2013, comparing the forecast value of money and the actual money issued by the central bank, the stock of overseas RMB can be got as shown in Table 4:

**Table 4**  
The Estimation Value of RMB Stock Outside Mainland China

Variables	Ln(M <sub>1</sub> /P)		Stock of overseas RMB (one hundred million yuan)	The proportion of the total issued RMB of overseas RMB stock
	actual value	forecast value		
Years				
2004	5.349745	5.319240	2,883.441	0.030045
2005	5.443301	5.408539	3,665.163	0.034165
2006	5.589458	5.483169	12,708.76	0.100835
2007	5.733588	5.548009	25,840.20	0.169377
2008	5.762043	5.606113	23,998.53	0.144381
2009	6.049486	5.862659	37,491.09	0.170413
2010	6.209264	5.998547	50,657.05	0.189996
2011	6.240285	6.091114	40,166.65	0.138578
2012	6.277527	6.180013	28,679.05	0.092911
2013	6.340476	6.270786	22,705.64	0.067318

The results show that the current stock of RMB stock outside mainland China, a huge number, is over one trillion yuan. The whole scale of RMB stock outside mainland China increases from 288.3 billion yuan of 2004 to 2270.6 billion yuan of 2013, of which the stock reaches the maximum in 2010 and the proportion of RMB stock outside mainland China and the total RMB issued by the central bank increases from 3% of 2004 to 6.7% of 2013.

### 3. THE EMPIRICAL STUDY ON FACTORS OF AFFECTING THE RMB STOCK OUTSIDE MAINLAND CHINA

Currently there is very few quantitative literatures which study the factors of affecting the RMB stock outside mainland China. Zhang (2011) estimated the RMB stock circulating in Russia and analyzed the factors of

affecting the stock. He made a quantitative analysis though choosing gross domestic product, consumer price index, exchange rate, the total of border trade and the number of outbound as explanatory variables, but the results of estimation were non-stationary. On this basis, this paper improves some relevant indicators and introduces a few new variables to make a empirical research which studies the factors of affecting the RMB stock outside mainland China.

#### 3.1 Indicator Selection and Theoretical Explanation

The paper chooses five factors of exchange rate, the development degree of financial market, the degree of dependence on foreign trade, per capita GDP, and inflation rate to analyze the affection to the RMB stock outside mainland China. The explanatory variables are described in Table 5:

**Table 5**  
**The Explanatory of the Variables**

Variables	Explanatory
RO	The RMB stock outside mainland China
EX	Exchange rate, denoted by the dollar amount of per RMB. This indicator is directly related to the stability of our currency value, and the higher the degree of appreciation, the stronger our currency, and then there will be more foreign residents and non-residents who have the motivation to hold RMB.
FM	The development degree of financial market, denoted by the ratio of our country's total stock market value and the GDP. We know that the developed financial market can increase the desire of foreign invertors to hold our currency, and meanwhile when facing the impact of foreign speculators' capital, well-developed financial market will be as a good buffer.
EW	The degree of dependence on foreign trade, denoted by the degree of dependence on export. This indicator reflects the degree of dependence on our economic growth to the export trade, which is an important indicator determining the degree of our openness, and has a positive correlation with the RMB stock outside mainland China.
AGDP	Per capita GDP. The higher a country's per capital GDP, the stronger the country's economic strength and this country will have a stronger external capacity to pay, which is positively related to the RMB stock outside mainland China.
CPI	Consumer price index, used to represent the inflation rate. The higher a country's inflation rate, the more the trend of depreciation of the country's currency, which is negative with foreign holding our currency.

#### 3.2 The Establishment of Econometric Model on Factors of RMB Stock Outside Mainland China and Data Description

In order to weaken the multi-collinearity and the heteroskedasticity, we use the logarithm of RO, EX, FM, EW, and AGDP to establish the econometric model on the factors of affecting the RMB stock outside mainland China:

$$\ln(RO)_t = c + \lambda_1 \ln(EX)_t + \lambda_2 \ln(FM)_t + \lambda_3 \ln(EW)_t + \lambda_4 \ln(AGDP)_t + \lambda_5 \ln(CPI)_t + e_t \quad (5)$$

We choose the data of the period of 2004 to 2013, and the RMB stock outside mainland China is from the above results, and other data comes from the website of national statistic bureau.

#### 3.3 The Test for Model and the Estimation Results

In order to avoid "spurious regression" caused by the non-stationary time series, it is necessary to make the unit root test for each variable. At the level value,  $\ln(RO)$  and  $\ln(RGDP)$  are non-stationary, and other time series are stationary. After first-order difference,  $\ln(EX)$  is non-stationary and other variables are stationary. After making the second-order difference, all variables are stationary at the 5% significance level. The test results are as shown in Table 6.

**Table 6**  
**The Test Results of ADF**

Variables	(c, t, n)	ADF value	Mackinnon threshold (significance level)	P-Value	Conclusion
Ln(RO)	(0, 0, 1)	1.094762	-1.600140(10%)	0.9132	Non-stationary
Ln(EX)	(0, 0, 1)	-3.790991	-1.600140(10%)	0.0018	Stationary
Ln(FM)	(0, 0, 1)	-2.276156	-1.599088(10%)	0.0302	Stationary
Ln(EW)	(0, 0, 1)	-6.234022	-1.600140(10%)	0.0001	Stationary
Ln(AGDP)	(c, t, 1)	-0.757073	-3.515047(10%)	0.9261	Non-stationary
Ln(CPI)	(c, t, 1)	-5.890828	-3.590496(10%)	0.0095	Stationary
$\Delta(\Delta\ln(\text{RO}))$	(c, t, 1)	-11.00218	-4.773194(5%)	0.0013	Stationary
$\Delta(\Delta\ln(\text{EX}))$	(0, 0, 1)	-2.957644	-2.021193(5%)	0.0108	Stationary
$\Delta(\Delta\ln(\text{FW}))$	(c, t, 1)	-5.799982	-4.773194(5%)	0.0242	Stationary
$\Delta(\delta\ln(\text{ew}))$	(0, 0, 1)	-3.100889	-2.021193(5%)	0.0086	Stationary
$\Delta(\Delta\ln(\text{AGDP}))$	(c, t, 1)	-4.843177	-4.773194(5%)	0.0490	Stationary
$\Delta(\Delta\ln(\text{CPI}))$	(c, 0, 1)	-4.278779	-3.519595(5%)	0.0226	Stationary

Note.  $\Delta$  is a first-order differential operator. And c represents the intercept items, t represents trend items, n represents the lag order of a variable in the type of test.

All variables obey second-order single process, so we can use E-G two-step method to make the cointegration

test. Firstly, we use OLS method to estimate eq. (5) and have following equation:

$$\ln(RO) = 206.7773 + 19.70162\ln(EX) + 0.507816\ln(FM) + 3.107574\ln(EW) + 3.782867\ln(AGDP) - 30.68904\ln(CPI) \quad (6)$$

S.E = 27.59563	3.123067	0.143011	0.511072	1.301149	5.337440
T = (7.493118)	(6.308421)	(3.550895)	(6.080503)	(2.907328)	(-5.749768)

Adjusted R-squared=0.985490 Prob(F-statistic)=0.000181

Secondly, we make the unit root test for residual and the test results as shown in Table 7.

**Table 7**  
**The Unit Root Test Results of Residual  $e_t$**

	T-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.336995	0.0260
Test critical values:	1%	-2.847250
	5%	-1.988198
	10%	-1.600140

Note. Mackinnon (1996) one-sided p-values.

So the residual gets through the unit root test, which shows that there is a long-term equilibrium relationship among  $\ln(RO)$ ,  $\ln(EX)$ ,  $\ln(FM)$ ,  $\ln(EW)$ ,  $\ln(AGDP)$  and  $\ln(CPI)$ .

From the eq. (6), we see that the sign of each variable is in line with the economic theory, which is consistent with our previous analysis. Currently the upmost factor of affecting the RMB stock outside mainland China is inflation rate and exchange rate, and inflation rate decreases 1%, the RMB stock outside mainland China will increase about 30.7%, and every 1% appreciation of RMB, the RMB stock outside mainland China will increase about 19.7%. The impact of the degree of dependence on export trade and per capita GDP to the overseas RMB

stock can not be ignored, and also we can see that there is a positive relationship between the development degree of financial market and the overseas RMB stock, every 1% of the development degree of financial market increases, the overseas RMB stock will increase about 0.51%.

## CONCLUSIONS AND POLICY RECOMMENDATIONS

From the estimation results of RMB stock outside mainland China of 2004 to 2013, we can see that since 2004, the RMB stock outside mainland China has gradually increased and has a significant growth at the beginning of 2005 and the stock has reached the maximum in 2010. This may be due to the reform of the exchange rate system in 2005, which causes the significant appreciation of RMB and then to promote an increase of RMB stock outside mainland China. This result is corresponding with the analysis on the factors of RMB stock outside mainland China, which shows that there a positive relationship between the exchange rate (indirect quotation) and the RMB stock outside mainland China. However, the stock scale begins to decrease from 2011, because at the beginning of 2011 the inflation rate raised rapidly, GDP growth had began to slow, and meanwhile

the development of our stock market developed slowly, which directly decreased the scale of overseas RMB stock. In addition, export has been always one of “three carriages” of the economic growth in our country, but our export mainly relies on cheap labor and abundant natural resources, since the beginning of 2010, this comparative advantage encounters the challenges caused by the increase of labor cost and the limited natural resources and challenges of the cost advantage of neighboring countries, which decreases the exports and also the RMB stock outside mainland China.

It is a natural process on the demand of foreign residents and non-residents for RMB. And it's beneficial for our country or other countries when RMB is held by overseas. In the future, the impact of RMB to the world may be gradually expanded, so we should conform to the needs of the world economy and promote the RMB to go to the overseas, expand the scale of overseas residents and non-residents holding RMB, and establish some effective return mechanisms for RMB. So we put forward the following suggestions:

Firstly, we need increase the technological innovation of export products and the added value. There are some limitations for previous export strategy relying on the cheap labor and natural resources, which is unsustainable. Only technological innovation, industrial upgrading and high value-added models can further increase our country's export and can promote the association between RMB and the world economy, and then further expand the scale of the RMB stock outside mainland China.

Secondly, we should accelerate the construction of the offshore RMB market and actively promote the swap agreements of RMB with foreign currencies. On the one hand, under not full convertibility of capital account and not free flexibility of exchange rate, the construction of offshore RMB market is in favor of the effective return of the RMB stock outside mainland China, which can prevent the sudden impact of large-scale RMB return to the stability of our financial market. On the other hand, the swap agreements of RMB with foreign currencies will help the RMB as other countries' official reserve currency and increase the influence of RMB in the international arena. At the same time, other countries can import our products using the RMB by the swap and this will increase our export and then expand the scale of overseas RMB stock.

Thirdly, deepening the reform of financial market, which is a necessary step to expand the scale of overseas RMB and thereby to internationalize RMB. At present, the internationalization of RMB is still in the initial stage and has a trend of surrounding and regionalization,

so there is a long way to go for internationalizing the RMB. We need continue to deepen the financial reform, because a financial market with depth and breadth can play a good buffer role in financial crisis, and it also helps foreign holders of RMB to find some suitable investment channels. Meanwhile it is also the main growth potential for expanding future scale of overseas RMB.

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