An Empirical Analysis of the Relationship between Foreign Exchange Reserves and Money Supply

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Abstract: Based on the fact that China's current money supply and foreign exchange reserves are in a state of extraordinary growth, based on theoretical analysis, empirical analysis of foreign exchange reserves and money supply data from April 2008 to April 2018 was carried out by establishing a VAR model. The results show that there are two-way Granger reasons for foreign exchange reserves and money supply, and there is a long-term equilibrium relationship. Foreign exchange reserves and money supply have lagging effects on each other for two to three periods, and then make recommendations based on China's current foreign exchange reserves and monetary policy. To reasonably control the growth of China's foreign exchange reserves and money supply, and promote the stable operation of the macro economy.
Keywords: Money Supply, Foreign Exchange Reserve, VAR Model

Introduction

Foreign exchange reserves refer to the foreign exchange portion of international reserve assets held by the government of a country. Under the general trend of economic globalization, foreign exchange reserves are important indicators for measuring the macroeconomic operating conditions and the results of international payments. According to monetary theory, foreign exchange reserves .It is one of the important factors affecting the money supply. The impact mechanism can be expressed as: international balance of payments surplus -> foreign exchange reserves increase -> foreign exchange increase -> increase in base money supply -> increase in money supply. Under the background of reform and opening up, China's trade surplus and capital account surplus have increased year by year, resulting in rapid growth in foreign exchange reserves; as of February 2017, China's foreign exchange reserves ranked first in the world, more than twice as high as second place, high foreign exchange Reserves have both beneficial and disadvantageous aspects to economic development, which is conducive to strengthening the international ability to pay off debts, effectively preventing financial risks, and also facing losses in exchange rate risks and opportunity costs; therefore, this paper starts with the mechanism of the influence of foreign exchange and money supply. The interactive relationship between China's rapidly growing foreign exchange reserves and money supply, and on the basis of empirical analysis, proposes the development of foreign exchange reserves and monetary policy in light of China's actual situation.

Literature Review

The price-coin theory and international analysis are the two basic theories that study the relationship between foreign exchange reserves and money supply. As early as the middle of the 18th century, an English economy first proposed the interaction between foreign exchange reserves and money supply. He pointed out that under the gold standard system, imbalances in the balance of payments will cause changes in the money supply, and on this basis, a price-coin theory is proposed, that is, when the international balance of payments

surplus decreases, export goods decrease and foreign exchange rates rise. , Output gold; By the middle of the 20th century, based on the previous studies, economists proposed a new international balance of payments theory, which pointed out that the balance of payments will automatically adjust to a balanced state with money supply and demand, when there is a surplus of international payments At that time, the inflow of foreign capital will increase the supply of money in the country. When there is a balance of payments deficit, the outflow of funds abroad will reduce the supply of money in the country. When the supply and demand of domestic currency reach a balance, the balance of payments will also return to equilibrium.

With regard to the study of the relationship between foreign exchange reserves and money supply, most scholars analyzed the growth of foreign exchange reserves from both theoretical and empirical perspectives and have a greater impact on money supply. Ding Wenli (2000) analyzed the internal influence mechanisms and related relations of China's international balance of payments on China's money supply from both theoretical and empirical perspectives. The conclusion points out that China's international balance of payments and domestic currency supply and demand balance has a negative domestic effect [1]. Weiyi Jun (2005) empirically analyzed data from 1985 to 2004 and found that foreign exchange reserves are the main factors affecting the change of money supply [2]; Zhao Dongliang (2011) empirically analyzed changes and differences in China's foreign exchange reserves by using econometric methods. Balanced relationship between levels of money supply. [3]

Empirical Analysis

The money supply uses the broad money supply M2, and the foreign exchange reserve (FR) is converted to RMB using the exchange rate of the RMB against the U.S. dollar. The sample range for this article is April 2008 to April 2018, and 120 monthly time series data are selected. The VAR model was established through Eviews. The data comes from Eastern Wealth and the State Administration of Foreign Exchange.

1、 Unit Root Test

The ADF test method was used to test the stationary of the variables. The results are shown in Table 1, which shows that at the 10% significance level, both variables reject the stationary hypothesis, so both variables are unstable, and therefore their A first-order difference was performed and the results showed that the difference sequence was smooth.

Table 1 ADF unit root test results

variable	Inspection type	ADF statistics	Critical value			Smoothness
			1%	5%	10%	
FR	（c,t,0)	-0.712746	-4.037668	-3.448348	-3.149326	Non-stationary
M2	（c,t,0)	-1.008379	-4.046072	-3.452358	-3.151673	Non-stationary
Ln(FR(-1))	（c,t,0)	-3.880688	-4.039075	-3.449020	-3.149720	smooth
Ln(M2(-1)	（c,t,0)	-6.790344	-4.042819	-3.450807	-3.150766	smooth

2、 Create a VAR model

(1) Determination of the number of lag periods

As shown in Table 2, four out of the five inspection indicators determine that the lag period is the optimal lag period, so a VAR model with a lag period of four periods, VAR(4), is established.

Table 2 VAR Model Lag Order Selection Criteria						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	657.7412	NA	3.12e-08	-11.60604	-11.55777	-11.58645
1	671.0600	25.93036	2.65e-08	-11.77097	-11.62616*	-11.71221
3	688.9483	23.86757	2.22e-08	-11.94599	-11.60808	-11.80887
4	695.9006	12.79715*	2.11e-08*	-11.99824*	-11.56379	-11.82194*

(2) Inspection of the stationary of the model

The stability of the model was tested to ensure the validity of the results of the impulse response analysis and variance decomposition analysis. The test results are shown in Table 3 below. All the eigenvalues were less than one, so the established VAR (4) model was stable.

Table 3 Model ADF test results	
Root	Modulus
0.846926	0.846926
-0.509508 - 0.660680i	0.834324
-0.509508 + 0.660680i	0.834324
0.535186 - 0.332891i	0.630270
0.535186 + 0.332891i	0.630270
-0.166402 - 0.497142i	0.524252
-0.166402 + 0.497142i	0.524252
-0.264880	0.264880

(3) Johansen cointegration test

LNM2 and LNFR are all single time sequences and satisfy the preconditions of cointegration test. In the established VAR(4) model, Johansen test is used to test each variable to determine whether the long-term equilibrium relationship exists. The test results are as follows:.

Table 4. Johansen cointegration test results				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.
None *	0.235230	36.75841	15.49471	0.0000
At most 1 *	0.052816	6.185912	3.841466	0.0129

Note: In the selection of lag period, four periods of lag are used for testing.

The test results show that rejecting the null hypothesis with no cointegration within the 95% confidence interval indicates that there is at least one cointegration relationship between LNM2 and LNFR at the 0.05 significance level; in addition, at most 95% of the confidence intervals are rejected at most. There is an original hypothesis of a co-integration relationship, indicating that there is more than one cointegration relationship between the two, so we think they have two long-term equilibrium relationships.

(4) Granger Causality test

According to Table 5, FR is the Granger cause of M2 at the level of significance of 10%, and M2 is the Granger cause of FR (at 10% significance). Therefore, we believe that FR and M2 are causally related to each other.

Table 5 Granger Causality Test Results

Granger Causality	F value	Probability value	in conclusion
R2 does not Granger Cause R1	2.56347	0.0816	accept
R1 does not Granger Cause R2	2.45003	0.0909	accept

(5) Impulse response analysis

The impulse response function analyzes the impact of a standard deviation of the random disturbance term on the endogenous variables. The abscissa indicates the number of impact hysteresis periods (units: months). The solid line indicates the degree of response to the corresponding endogenous variables and the dashed line indicates positive and negative. Two standard deviations deviate from the band; the results are shown below.

From Figure 1, we can analyze that the impact of FR on M2 is not obvious in the first phase, and there is a large positive effect in the second phase.

From Figure 2, we can see that M2's impact on FR's impact has a negative and positive trend. FR is not affected by M2 in the first phase, and the second phase has a negative impact. The third phase reaches A positive impact has a peak, and then the impact gradually becomes zero. The reason for this phenomenon can be explained as follows: In the short term, when the money supply is greater than the production needs, it will accelerate the outflow of money and reduce foreign exchange reserves; in the long run , The increase in money supply, the devaluation of the RMB, the increase in exports, and the increase in foreign exchange reserves.

To sum up, there is a two-way influence relationship between the money supply and foreign exchange reserves, and the effect is significant in the second and third periods.
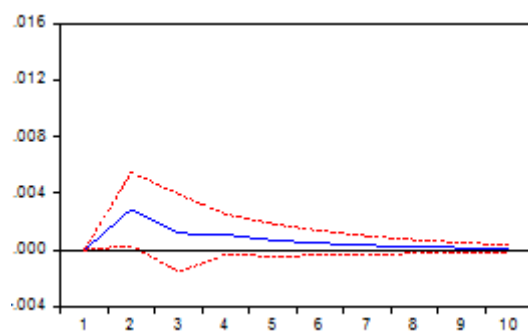
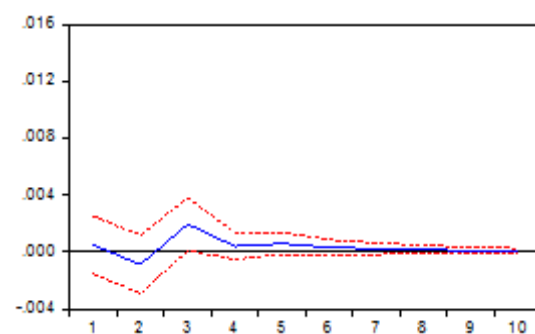

Figure 1 response of M2 to FR

Figure 2 response of FR to M2

Summary and Suggestions

The empirical analysis can be concluded that foreign exchange reserves and money supply have a mutual influence, and that the effect is most significant in the second and third periods; therefore, reasonable and effective control of foreign exchange reserves and money supply, and money supply and foreign exchange reserves It is of great significance; combined with the above analysis, it proposes corresponding policy

recommendations on foreign exchange reserves and money supply development respectively.

(1) Appropriately relax the exchange rate system and convert foreign exchange reserves

The reason for the high growth of China's foreign exchange reserves is due to the double surpluses of capital items and current trade items. Therefore, the exchange rate system should be appropriately relaxed, and its foreign exchange reserves should be automatically adjusted to the stable international balance of payments to reduce the impact on the money supply.

China's current high foreign exchange reserves face currency exchange rate and opportunity cost risks. Under the reasonable control of the scale of foreign exchange reserves, it can appropriately convert foreign exchange reserves into reserves of scarce resources, such as gold and oil, as a hedging and preservation value. Appreciation tools help offset the impact of money supply.

(2) Broaden the supply of money

According to the currency theory, foreign exchange reserves affect the foreign exchange purchases, which in turn affect the supply of base money, resulting in an increase in money supply; broadening open market operations, enriching the variety of government bonds, and reducing the proportion of foreign exchange receipts in the open market in China, effectively reducing foreign exchange reserves The impact on the money supply; at the same time, in the absence of foreign exchange liquidity in some financial institutions, the central bank may consider using part of the foreign exchange reserves to carry out currency swaps with financial institutions, which can not only reduce the delivery of base currency, but also Increase the foreign exchange liquidity of financial institutions.

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