Research on the Interactive Relationship between China's Foreign Exchange Reserves, CPI, Money Supply, and Foreign Investment Based on VAR Model

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Abstract: Based on the study of foreign exchange reserves at home and abroad, this paper selects the monthly sample data of China's foreign exchange reserves, CPI, money supply, and foreign investment from 2008/1- 2018/3 (data from the National Bureau of Statistics of China).In order to analyze the potential interaction between China's foreign exchange reserves and CPI, money supply, and foreign investment, we try to use ADF unit root test, explore the co-integration relationship between data, and establish VAR models.

Keywords: Foreign Exchange Reserve, CPI, ADF Unit Root, VAR Model, Impulse Response Function.

I. INTRODUCTION

Foreign exchange reserves refer to the foreign currency portion of international reserve assets owned by a country (bonds held in foreign currency).Representing a country's international debt repayment ability and international status has the effect of stabilizing the balance of payments and exchange rate; foreign investment, also known as foreign investment, refers to non-Chinese nationals making private investment in China. As China's economic development has continued in recent years, China has become the largest concentration of foreign investment in the world. The CPI represents the consumer price index, which reflects the macro reference data of the residents' level of commodity consumption and service price; the money supply amount is equal to the base currency multiplied by the currency multiplier.

II. EMPIRICAL ANALYZES

Empirical analysis steps: first perform unit root test, co-integration analysis and establish VAR model and test and impulse response function and variance decomposition. (Note: In the following data analysis, x represents CPI, y represents foreign exchange reserves, z represents foreign investment, and z1 represents money supply). 1.1 ADF inspection.

Table 1 ADF Roots of Variable Sequences

variable	ADF statistics	5% threshold	P value	Smooth or not
y	0.457372	-1.943540	0.8118	unstable
D(y)	-3.303400	-2.885863	0.0169	unstable
D(y,2)	-14.03159	-3.448021	0.0000	smooth
x	0.081075	-1.943768	0.7065	unstable
D(x)	-6.110488	-2.887909	0.0000	smooth
D(x,2)	-10.77295	-3.448328	0.0000	smooth
z	1.573489	-1.943796	0.9712	unstable
D(z)	-5.429176	-2.888157	0.0000	smooth
D(z,2)	-8.442825	-3.451959	0.0000	smooth
z1	-0.989033	-1.943471	0.2877	unstable
D(z1)	-10.95695	-2.885450	0.0000	smooth
D(z1,2)	-9.225015	-3.448681	0.0000	smooth

Note: D(y): y takes a first-order difference; D(y,2); y takes a second-order difference.

The test results in Table 1 show that the unit root test was performed on the raw data y, x, z, and z1, and the ADF test T statistics were 0.457372 and 0.081075, 1.573489, and -0.989033 at the 5% significant level, respectively, and both were larger than the criticality. Values, so the original hypothesis cannot be rejected, there is a unit root and it is not smooth. After the first-order difference processing, the result obtained by the variable y is still unstable. After the second-order difference, P=0.0000<0.05, and it is significant at the 5% level. The variable y is a stable with trend and interception data. The same data as above are used to perform the same-upper test analysis on the original data x, z, z1. After the first-order difference, the data is stable. At this point, the whole data can be considered as a second-order monotonous sequence.

2.1. Johansen Co-Integration Test Analysis

In order to prevent spurious regression between sequence variables, this paper analyzes the Johansen co-integration relationship of variables to explore whether there is a co-integration relationship between foreign exchange reserves and CPI, foreign investment, and money supply.

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**Table 2 Variable Co-Integration Relationship Test**

The original hypothesis does not have a co-integration equation	Eigen values	T value of trace	0.05 threshold	P value
No	0.389939	96.26284	47.85613	0.0000
at least one	0.185128	39.92455	29.79707	0.0025
At least two	0.104513	16.58595	15.49471	0.0341
At least three	0.034494	4.001785	3.841466	0.0454
The original hypothesis does not have a co-integration equation	Eigen values	Maximum Eigen value	0.05 threshold	P value
No	0.389939	56.33829	27.58434	0.0000
at least one	0.185128	23.33860	21.13162	0.0241
At least two	0.104513	12.58417	14.26460	0.0906
At least three	0.034494	4.001785	3.841466	0.0454

Table 2 shows that the statistical value of the trace of the variable is greater than the critical value of 5% of the significance level. The fact shows that there is a certain co-integration relationship between the four sequence variables, and secondly, the maximum Eigen value of the variable group is also higher than 5%. The level of sexuality, the results show that there are at least two co-integration relationships between data variables exist.

2.2. VAR model

After the unit root test is completed, a lag order is arbitrarily selected and a VAR model is established for regression. After repeated experiments, the optimal lag order is determined as 8, and the model is regressed and analyzed accordingly.
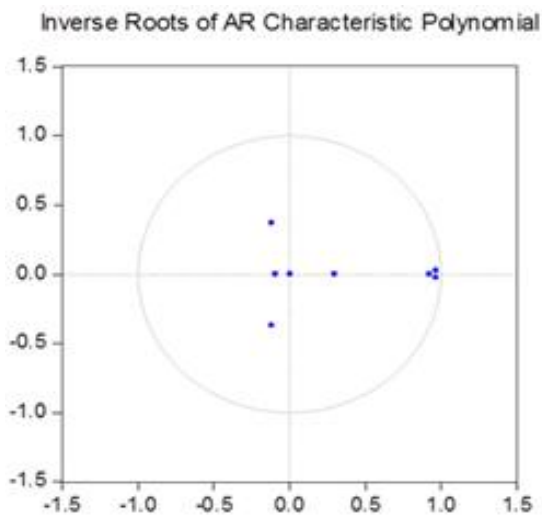
Figure 1 Model Stationarity Test

Fig. 1 is the unit circle of the model test. Obviously, the unit root falls within the unit circle, so the model can be considered as valid and the model can successfully pass the stability test. Next to the list of unit roots, it can be seen that the unit roots are all less than one, so it can be said that the model is also stable and passed the test.

2.3. Impulse Response Function

The impulse response function can analyze the relationship between endogenous variables on themselves or other endogenous variables. The impulse response function indicates that the impact of a shock on a certain variable is not in 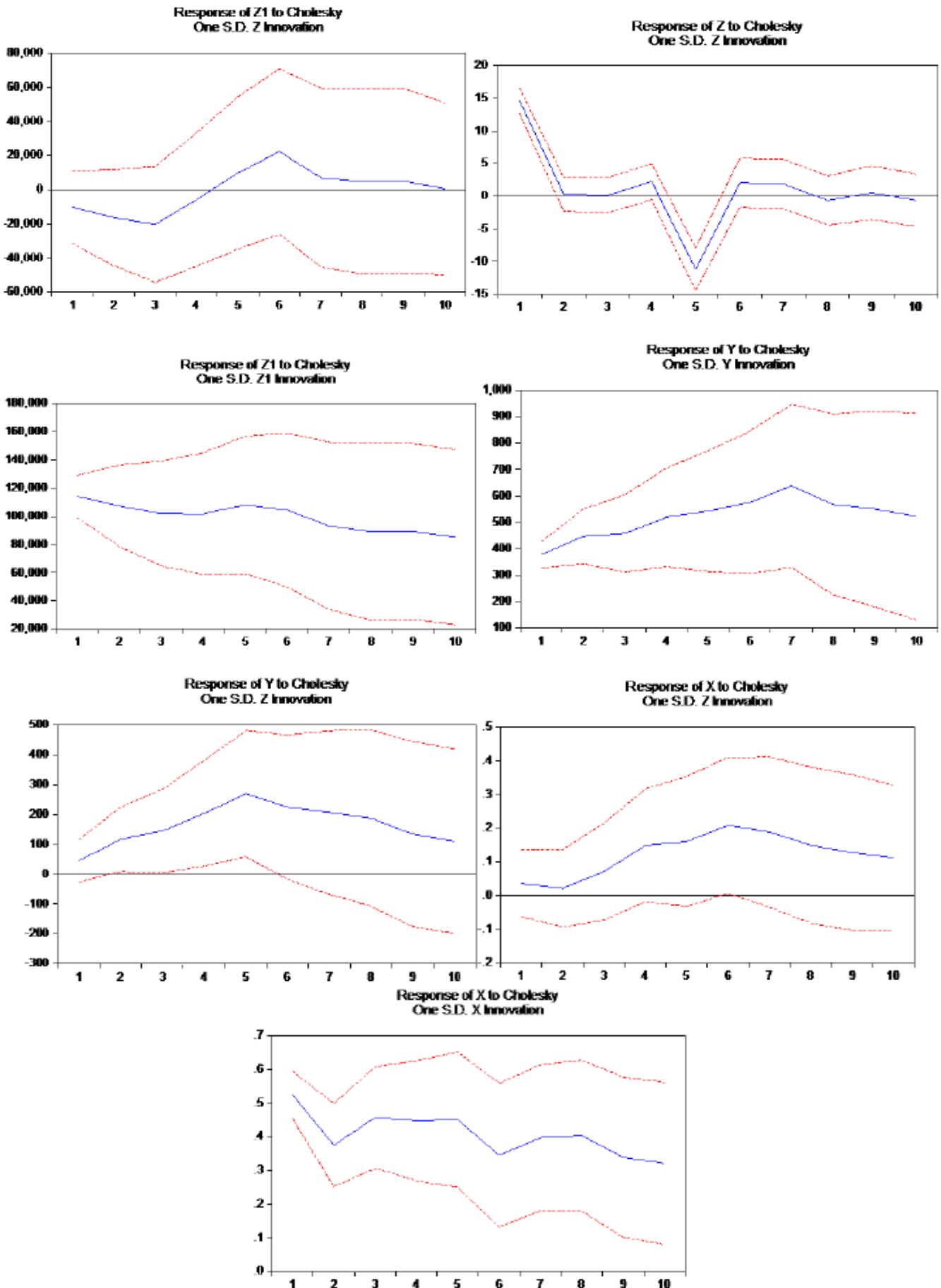the same period. We think that if this effect is stable in the long term, then the shock effect can be regarded as basically unchanged.

Figure 2 Analysis of Impulse Response Function

Fig 2 is the impulse response function graph The z-response to z has a positive impact in the first 4 period, and a reverse impact in the 5th to 6th stages, with the most significant effect in the 5th stage, and the 10th stage response. Basically zero. The autocorrelation coefficient plot of z1 vs. z1 vs. x vs. x gradually decreases as the lag period increases. The impact of y on y in the 7th period is most obvious to itself, and it is still stable afterwards. The impact of y to z from the 1st to 5th pulses is positive and rising, with the impact on the 5th reaching maximum. The response of x to a standard deviation of z and z1 to z reaches the maximum in the third phase, and reaches the maximum in the sixth phase.

2.4. Variance Decomposition Analysis

The variance decomposition is different from the impulse response function. The degree of influence of each disturbance factor on other variables in the VAR model is provided by variance decomposition. Figure 3 shows that the reserves of foreign exchange reserves are affected most by themselves, and with the increase of the lag period, the effect of this effect is gradually reduced. In the first period, the effect reached 97.63962%, the most significant decrease in the 4, 5, and 6 periods. The impact of CPI on foreign exchange reserves is basically maintained at about 1.5% from the 3rd to the 9th period, and the effect is not significant. The impact of foreign investment on foreign exchange reserves is not stable, showing a wave trend that increases first and then decreases. The money supply is the largest impact on foreign exchange reserve, and with the increase of the lag period, the more significant the impact, the impact of money supply in the tenth period of the contribution rate is 18.81994%.

Period	S.E.	Y	X	Z	Z1
1	380.2832	100.0000	0.000000	0.000000	0.000000
2	602.4724	97.63962	0.263918	1.018101	1.078363
3	781.1090	94.67839	1.044652	1.748776	2.528178
4	981.7827	90.31496	1.216055	3.006663	5.462325
5	1174.813	86.77583	1.135747	4.966674	7.121746
6	1356.183	84.69143	1.413099	4.896529	8.998940
7	1539.670	84.10205	1.304346	4.447931	10.14567
8	1693.934	81.54855	1.626279	4.086516	12.73866
9	1840.169	78.53607	1.996623	3.553938	15.91337
10	1972.281	75.70537	2.350437	3.124707	18.81948

Cholesky Ordering: Y X Z Z1

Figure 3 Variance Decomposition Analysis Results of y

III. CONCLUSIONS AND RECOMMENDATIONS

3.1 Conclusions: Foreign exchange reserves, foreign investment, money supply, and CPI sequence data are not stable. After unit root testing, the data is obtained by second-order consolidation; Johansen co-integration test analysis can be obtained foreign exchange reserves, foreign investments. There is indeed a co-integration relationship between the money supply and the CPI, which is also consistent with reality. The establishment of the VAR model is also stable. The facts show that the model passed the test and the model is effective; the impulse response function yields the correlation coefficient of the data to itself. Both decreased with the increase of the lag period, and the influence of foreign investment and money supply increased

with the lag period. The contribution rate of money supply was nearly 20% in the 10th period.

3.2 Suggestions: (1) Perfecting the RMB Exchange Rate Mechanism: At present, China's exchange rate mechanism lacks flexibility and flexibility. This is a relatively monotonous market with passive intervention. It is appropriate to increase the floating range of the exchange rate, increase the variety of foreign exchange trading market, and improve the trading system. (2) Increase the form of foreign exchange reserves: The structural forms of foreign exchange reserves mainly include cash bank reserves, gold reserves, and marketable securities, etc. Foreign exchange commodities and items expressed in the form of foreign exchange can be used as foreign exchange reserves, as well as education and entertainment. It can increase investment in foreign exchange reserves. (3) Appropriately liberalizing the exchange rate policy: China's foreign exchange reserves have been increasing year by year. Although a huge amount of foreign exchange reserves can stimulate China's economic growth, it will bring high opportunity costs and increase the pressure of appreciation of foreign currencies. But still we must encourage exports. We can appropriately reduce the country's foreign exchange reserves, increase the stock of private foreign exchange reserves, properly open the foreign exchange accounts of high-quality enterprises, and implement independent accounting for foreign exchange, which can increase the flexibility of the foreign exchange market, but we must maintain a high degree of strict supervision.

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