BioTechnology

An Indian Journal

FULL PAPER

Effect of external shocks on domestic prices based on monetary theory

Li Zhou
School of Management, Minzu University of China, Beijing, (CHINA)

ABSTRACT

China's foreign exchange reserve scale began to growth rapidly in resent years. At the same time, the fast growth of foreign exchange reserve also has brought some negative influences as inflation. In this paper, we use VAR model to analyze how China's excessive foreign exchange reserves effect on monetary policy. From the result, we find that the foreign exchange reserves will lead the price level sustained growth in the later several months. While once inflation happened, it will push prices continually rise, so it is much more difficult to control the inflation after it begin, so that China government should pay more attention to foreign exchange system reform, enlarge open market operations, and use sterilization or other policy instruments to reduce China's huge foreign exchange reserves.

KEYWORDS

© **Trade Science Inc.**

INTRODUCTION

After China's foreign exchange system reform in 1994, China's foreign exchange reserve scale began to growth rapidly; the trade export increase from $165.574 billion by the end of 2000, up to $3.181148 trillion in 2011. At the same time, China has been experiencing a rapid sustained accumulated foreign exchange reserve, the fast growth of foreign exchange reserve also has brought some negative influences to Our country's economic development as the Central Bank must put more currency into economy[1], this will increase the amount of the base currency putted into entire economy and finally weak the independence monetary policy. The 2008 global financial crisis slow down the inflation rate and the investment enthusiasm[2], however, it doesn't deny the inherent relation between the foreign exchange reserve and the monetary policy, the growth of foreign exchange reserves has also imposed pressure to expected inflation rate[3-4]. As China use fixed exchange rate, the central bank will issue more domestic currency to buy the foreign exchange in order to maintain the exchange rate stable, and that will finally influence the monetary policy and promote inflation. So, it is still extremely important to study how China's excessive foreign exchange reserves effect on monetary policy and try to reduce the negative influence of excessive foreign exchange reserves.

Guillermo A.Calvo and Mervyn King (1997) pointed out that when Central banks offsetting foreign exchange reserves by increasing issuance of bills, the government must pay a higher interest to these notes, this make the cost of sterilization policy higher, therefore the sterilization policy doesn't have feasibility in a long time[5]. Rogers and Siklo (2000) established many models to analyze how sterilized intervention effects on independence of money supply and monetary policy under fixed exchange rate system, and use the response function to measure the influence and effectiveness that sterilized intervention effects on money supply[6]. Kumhof (2004) established a theoretical model about fixed exchange rate, capital controls and mandatory settlement, and use this model to analyze the relationship between foreign exchange reserves and monetary supply[7]. Terada-Hagiwara (2000) analyzed the problems after foreign exchange reserve grows quickly in Asian, he pointed out that foreign exchange reserves growth influence the money supply and monetary policy[8]. Many Chinese scholars also did a lot of researches about the influences caused by China's increasing foreign exchange reserves, such as Fan D.Jun & Zhang C.Zheng (2007) used VAR model to analyze how foreign exchange reserves effect on monetary supply, and find out that foreign exchange reserve growth is the reason to money supply increase.

EXPERIMENTAL SECTION

I use STATA 12.0 software and make a statistical analysis of foreign exchange reserve (FER) and consumer price index (CPI). The monthly data is from Jan.2008 to Dec.2011, and we undertook log processing to data, noted as LnFER and LnCPI. All data was collected form Caixin database.

ADF unit root test

In order to analyze each variable's stationary, we use ADF unit root test to inspect LnFER and LnCPI, the result as is shown in TABLE 1. Through the test results we can see that LnFER and LnCPI are non-stationary. Then I calculate the difference of LnFER and LnCPI, and denoted as d.LnFER and d.LnCPI, results show that the two variable d.LnFER and d.LnCPI are stable, and then we can use granger test and cointegration test.

TABLE 1: ADF test

variable	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value	result
LnFER	-1.788	-3.709	-2.983	-2.623	unstable
LnCPI	1.305	-3.709	-2.983	-2.623	unstable
D. LnFER	-4.821	-3.709	-2.983	-2.623	stable
D. LnCPI	-3.065	-3.709	-2.983	-2.623	stable

VAR model

Vector auto regression (VAR) model is the simultaneous form of autoregressive model, A VAR (p) model of a time series y (t) has the form:

$$A_0 y_{(t)} = A_1 y_{(t-1)} + \cdots + A_p y_{(t-p)} + \varepsilon_{(t)}$$

Lag length selection have great influence for VAR model, if we establish two models, it is unable to determine the relationship between variables without the lag length. Therefore, the structure of VAR model is determined by the variables and lag length. I use Stata to measure the lag length; the result is shown in TABLE 2:

TABLE 2: Related data of VAR model order

lag	LR	df	p	FPE	AIC	HQIC	SBIC
0				.000012	-5.68778	-5.65825	-5.59348
1	195.58	4	0	1.8e-08	-12.1559	-12.0673	-11.873
2	24.042	4	0	1.0e-08	-12.7091	-12.5614	-12.2376*
3	12.57*	4	0.014	9.0e-09*	-12.8667*	-12.6599*	-12.2066
4	7.3742	4	0.117	9.4e-09	-12.8451	-12.5793	-11.9964

In this paper, I use AIC, SC criterion to identify the lag length. From TABLE 2, we can get that the minimum AIC is -7.22551 in lag 3, so I choose 3 lag as the lag length. According to the analysis above, we construct the VAR regression model of LnFER and LnCPI, and choose lag length as 3. Through the STATA 12.0, we get the formula of LnCPI as:

$$LnCPI = 0.392 + 1.51 LnCPI_{t-1} - 0.67 LnCPI_{t-2} + 0.11 LnCPI_{t-3}$$
$$+ 0.14 LnFER_{t-1} + 0.02 LnFER_{t-2} - 0.07 LnFER_{t-3}$$

According to this formula, we can get that the foreign exchange reserves growth will promote consumer price index increase. LnFER at lag 1 period increased one percentage points can drive LnCPI increased by 0.14 percentage points, so the effect of foreign exchange reserves to CPI is obvious.

Granger causality test and Co-integration test

Granger test is put forward by Granger (1969) and Sims (1972), Grainger test can be used to analyze the direct causal relation of a variable with another variable in VAR model. We assume a VAR model as:

$$y_t = \sum_{i=1}^{k} a_i y_{t-i} + \sum_{i=1}^{k} \beta_i x_{t-i} + u_t$$

So the null hypothesis will be:

$$H_0 : \beta_1 = \beta_2 = \cdots = \beta_k = 0$$

If all the parameter estimates of x are not significant, then the null hypothesis will not be rejected. In other words, if there is any parameter estimate of x significant, that means x is the granger reason to y. This test can be shown by F statistics:

$$F = \frac{(SSE_r - SSE_u)/k}{SSE_u/(T - kN)}$$

In this formula, SSE_r represents the residual sum of squares when null hypotheses was passed, and SSE_u represents the residual sum of squares when null hypotheses was not passed, k represents the lag length, N represents the number of variables. To analyze the relations between foreign exchange reserves and consumer price index. I use granger causality test to analyze this VAR model, the result is shown in TABLE 3.

TABLE 3: Granger causality test

Equation	Excluded	chi2	df	Prob > chi2
LnCPI	LnFER	19.294	2	0.000
LnFER	LnCPI	10.988	2	0.575

From TABLE 3, we can get that LnFER is the reason to LnCPI, which means foreign exchange reserves growth is the reason of consumer price index increase. However, LnCPI is not the reason for LnFER, so that CPI increase is not the reason of foreign exchange reserves change, this is also same to the conclusion above. At the same time, we take Johnson co-integration test to analyze the long-term relations between FER and CPI, the results is shown in TABLE 4:

TABLE 4: Johnson Co-integration test

Rank	Parms	LL	Characteristic Value	Statistic	5% Significant level
0	6	205.19511		6.1601*	15.41
1	9	206.86566	0.10217	2.8190	3.76

According to the results, there exist at least one direct co-integration relationship between FER and CPI, which means that there exist a long-term equilibrium relationship between foreign exchange reserves and consumer price index.

Impulse-response function and cholesky variance decomposition

According to the results above, we can get that there exist a long-term equilibrium relationship between foreign exchange reserves and consumer price index, and foreign exchange reserves is the reason to consumer price index, also the VAR model is stable. There are two methods to analyze the VAR model: impulse-response function and cholesky variance decomposition. Impulse-response function describes the response of endogenous variable to random error, and we can get the endogenous variable's change trend from the graph. In order to analyze the VAR model, I use Impulse-response function and cholesky variance decomposition, the results is shown in Figure 1 and Figure 2.
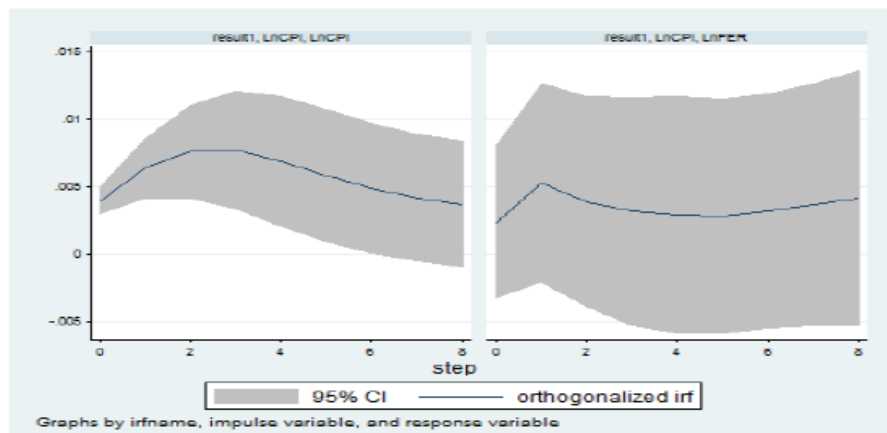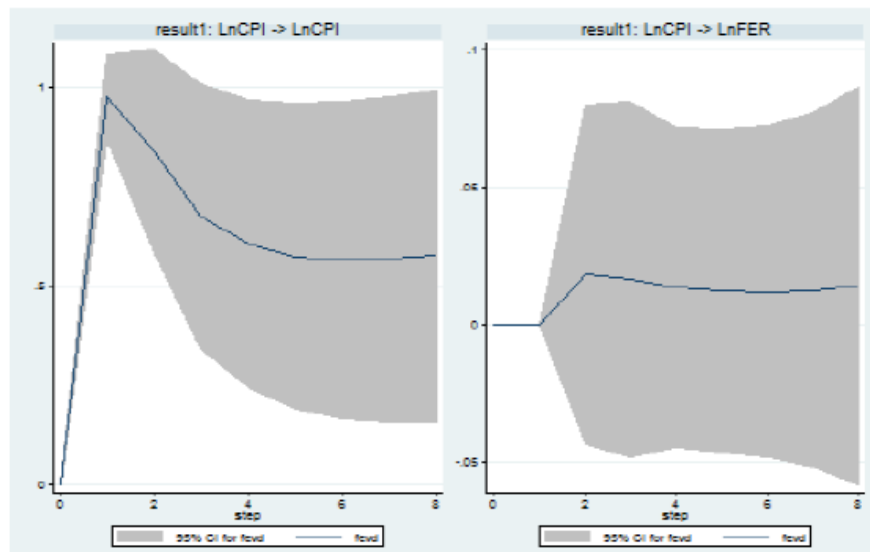

Figure 1: Impulse-response analysis

Figure 2: Cholesky variance decomposition

From Figure 1, we can get that when LnFER received one unit impact, it will lead LnCPI increase currently, LnCPI will reach the max at t=1 period and begin to stable then. It illustrates there is long-term effect between foreign exchange reserves and consumer price index increase; If give LnCPI one unit impact, LnCPI will continue increasing and reach the maximum at t=2 period, this means that when inflation is appear, it will promote prices level continually rise. According to the impulse analysis results, we can get that foreign exchange reserves growth will significant influence CPI increase, and once inflation happened, it will continue to promote inflation increasing, so that it is important to deal with the inflation. The cholesky variance decomposition also show the same result, the contribution degree of LnCPI to LnCPI is gradually reduced while the contribution degree of LnCPI to LnFER is gradually increased.

CONCLUSION

To sum up, according to the test results we can get that China's foreign exchange reserves growth will promote consumer price index increase, foreign exchange reserves will influence the monetary policy by increase money supply. So that, the excessive foreign exchange reserves is the reason to CPI increase, also we find that the contribution degree of foreign exchange reserves to CPI is more that 20%, that means the influence of foreign exchange reserves is obvious. From the result of impulse-response analysis, we find that the foreign exchange reserves will lead the price level sustained growth in the later several months. While once inflation happened, it will push prices continually rise, so it is much more difficult to control the inflation after it begin, so that China government should pay more attention to foreign exchange system reform, enlarge open market operations, and use sterilization or other policy instruments to reduce China's huge foreign exchange reserves.

According to the empirical analysis, I want to propose some advises to better reduce the excessive foreign exchange reserves. First, the government should reform the system of foreign exchange, change the compulsory settlement policy and broaden the flexibility range of exchange rate of RMB. Second, the central bank expands the base money supply channels and offers a variety of sterilization methods. Third, strengthen coordination of monetary policy and fiscal policy, and adopt comprehensive measures to promote the international payments balance. As China's foreign exchange reserves still growth and the inflation is an urgent issue too, it is till important to reduce the negative influence of the excessive foreign exchange reserves.

ACKNOWLEDGMENTS

REFERENCES

[1] H.Shou-feng, C.Lang-nan; Journal of Management sciences in China, **14(3)**, 61-69 **(2011)**.
[2] X.Tai-feng; Research on Economics and Management, **3**,101-104 **(2012)**.
[3] F.Desheng; Social Sciences in Nanjing, **7**, 17-21 **(2012)**.
[4] C.Lian-xiang; Journal On Economic Problems, **3**, 87-89 **(2012)**.
[5] C.Guillermo, K.Mervyn; Palgrave Macmullian,**11**,181-207 **(1997)**.
[6] J.M.Rogers, P.L.Siklos; Journal of International Money and Finance,**6**,112-115 **(2003)**.
[7] M.Kumhof; Journal of International Money and Finance, **23**,167-170 **(2004)**.
[8] A.Terada-Hagiwara; Foreign Exchange Reserves, Exchange Rate Regimes and Monetary Policy: Issues in Asia, ERD Working Paper No.61, 202-205 **(2005)**.