ANALYSIS ON THE INFLUENCE OF EXCHANGE RATE CHANGES ON CHINESE IMPORT AND EXPORT TRADE

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ABSTRACT

America has a dominant position in the international market economy, and each policy implementation will affect the economic development of other countries, among which the subprime crisis in 2008 was the most significant. This paper uses econometric analysis method to establish a Vector Autoregressive model，then empirically analyzes the impact of exchange rate changes on Chinese import and export trade. The result shows that the decline in exchange rate has a significant effect on imports, weak influence on export and put forward the corresponding countermeasures and Suggestions.

Key words：*exchange rate, Import and export trade, China, VAR model;*

I. INTRODUCTION

The establishment of theBretton Woods system in 1944 made the U.S. dollar a foreign currency reserve currency for other than the United States, and allowed the United States to borrow without restrictions in U.S. dollar terms. In August 2008, the US subprime mortgage crisis broke out. In November of the same year, in order to save the market,the United States decided to implement a quantitative easing policy, which means that the U.S. dollar relative to foreign currencies will drop sharply, which will cause a new round of resource prices to rise, or it will face a global inflation, and thus affect the economic development of each country. As a result of the crisis, Chinese foreign trade imports and exports have also been adversely affected. Therefore, the establishment of VAR model to study the impact of exchange rate changes on Chinese import and export trade, and take appropriate countermeasures to mitigate market volatility will be of great significance to China.

II. LITERATURE REVIEW

Zhong Xiaojun[1]based on the impulse response function and variance analysis of the VAR model, to explore the long-term dynamic relationship between import and export trade on FDI, it was found that export trade has a positive effect on FDI, and import trade has a negative effect on FDI. And FDI has a long-term role on import and export trade.YueYao[2]analyzed the impact of the US's six-year-long downtrend on China and found that the devaluation of the US will trigger import inflation in China, curb export trade, and reduce national wealth.Li Yiwen[3]separatelyanalyzed the positive and negative aspects of the devaluation of the U.S. dollar to the development of Chinese economy, the positive effects are: favorable forexpanding China foreign capital quota, improving trade conditions, expanding consumption, and promoting the optimization of the structure of imports and

exports. The negative effects include: slowing down export trade, aggravating trade friction with Europe, and impairing foreign exchangereserves. Zhao Yaming[4] furtherexplored the impact on the environment of Chinese import and export trade from the performance and causes of the depreciation of the U.S. dollar. The depreciation of the U.S. dollar will directly lead to a decrease in the cost of Chinese imported products, an increase in the cost of export products, and it is also conducive to the development of Chinese import industry for production factors, which is not conducive to Chinese export trade to the United States. Deng Bojun[5] analyzed and discussed the main influencing factors from the current status of Chinese import and export trade, including the contradiction between resource constraints and economic growth, Chinesemarket opening policy, exchange rate movements, export volume and FDI. In addition, the depreciation of the U.S. dollar has also limited the expansion of Chineseimport and export trade to some extent. Ding Zhengliang, Ji Chengjun[6] used the VAR model to conduct empirical research on the real exchange rate of RMB, import and export trade and economic growth, the results show that the real exchange rate depreciation boostedexports and economic growth, has a certain influence on imports, there is a long-term equilibrium relationship between the real exchange rate and economic growth. Yu Xiaoli[7] pointed out that the suppression of Chinese export trade, rising prices of raw material and house,which is because of Chinese macroeconomic affected by the value of the U.S. dollar, and the fundamental reason for the depreciation ofthe U.S. dollarwas the implementation of quantitative easing. Guo Jingkun[8] stated that due to the gradual integration of the global economy, the development of the U.S. economy has profoundly affected other countries, it has analyzed the positive impact on China from the devaluation of the U.S. dollar,it is conducive to the development of Chinese foreign exchange debt ,promote Chinese import trade and export trade to Europe.And also analyzed the negative influence of our country, reducing the actual value of foreign exchange reserves, detrimental to the export trade to the United States, and impeding the development offinancial markets, and made correspondingrecommendations. Li Zhenjiang[9] analyzed the long-term elasticity of exchange rate and import and export trade by establishing the VECM model, and used the error correction model to study the short-term adjustment rate after returning from the equilibrium path. The results show that the exchange rate and import and export trade have a very stable long-term equilibrium relationship, after deviating from the equilibrium path will adjust the recover very quickly, and the depreciation of the U.S. dollar will reduce Chinese exports. Li Zijie[10] explainedthe main reasons for exchange rate changes from economic revenue and expenditure and economic growth, analyzed the positive and negative effects on Chinese import and export trade, and proposed countermeasures and suggestions for dealing with exchange rate changes.

III. EMPIRICAL ANALYSIS OF EXCHANGE RATECHANGES AND IMPORT AND EXPORT TRADE

3.1. Sample data selection and processing

The article uses 2000-2017 asa sample interval, using monthly data, a total of 216 data, select the current value of exportsas an explanatory variable(C/100 million U.S. dollars), and the current value of imports as an explanatory variable (J/100 million U.S. dollars), the U.S. dollar against the RMB exchange rate as an explanatory variable(H/yuan). The data comes from the China National Bureau of Statistics, the People's Bank of China, and the Oriental Fortune Network.

3.2 Introduction ofVAR (Vector Autoregressive) model

The VAR model was put forward in 1980 at first. Based on multiple stationary time series variable, the lag value of all endogenous variables was regressed, and multiple equationswere established to observe the dynamic relationships among endogenous variables and then predict. Models are often used in macro-finance and other aspects.

3.3.Unit Root Test

Prior to the establishment of the VAR model, the unit root test for three time series variables (export value, import amount, exchange rate) was conducted using the ADF method. At the 0.05 level of significance, all three sequences are non-stationary within the0.95 confidence interval. Logarithmic difference processing was carried out for variables and converted to the growth rate. The results are shown in Table 1, indicating that all the three variables are stationary series after difference.

Table1 ADFtest results for lnc, lnj, and lnh

Variable	t-Statistic	0.01 Critical Value	0.05 Critical Value	0.1 Critical Value	Prob.
c	0.7963	-3.4627	-2.8757	-2.5744	0.8177
j	0.9442	-3.4627	-2.8757	-2.5744	0.7725
h	0.8364	-3.4609	-2.8749	-2.5740	0.8063
lnc	2.9028	-3.4627	-2.8757	-2.5744	0.0468
lnj	3.2231	-3.4627	-2.8757	-2.5744	0.0201
lnh	-10.6237	-3.4609	-2.8749	-2.5740	0.0000

3.4 Constructed Vector Autoregressive (VAR) model

3.4.1 Selected the lag order

As shown in Table 2, the SC and HQ of the five test indicators point to the second stagflation stage, and the LR, FPE and AICpoint to the seventh stagflation stage. According to the "majority principle",VAR (7) is selected for subsequent analysis.

Table2 determination of Vector Autoregressive model lag period

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1782.410	NA	6227.335	17.25033	17.29863	17.26987

1	-1730.532	101.7508	4115.185	16.83606	17.02926	16.91418
2	-1700.921	57.21849	3372.354	16.63692	16.97502*	16.77365*
3	-1692.035	16.91372	3376.567	16.63802	17.12102	16.83334
4	-1676.401	29.30485	3167.779	16.57392	17.20182	16.82784
5	-1670.837	10.26759	3276.123	16.60712	17.37992	16.91964
6	-1661.399	17.14395	3264.326	16.60289	17.52059	16.97400
7	-1639.596	38.97078*	2887.006*	16.47919*	17.54180	16.90890

* indicates lag order selected by the criterion

3.4.2 Diagram of the AR Root

To build a three-dimensional vector autoregressive model based on stationarity data, the stability of AR root needs to be tested, and the results are shown in Figure 1. Obviously, the roots of corresponding characteristic equations are all within the unit circle, that is, VAR model is stationary.

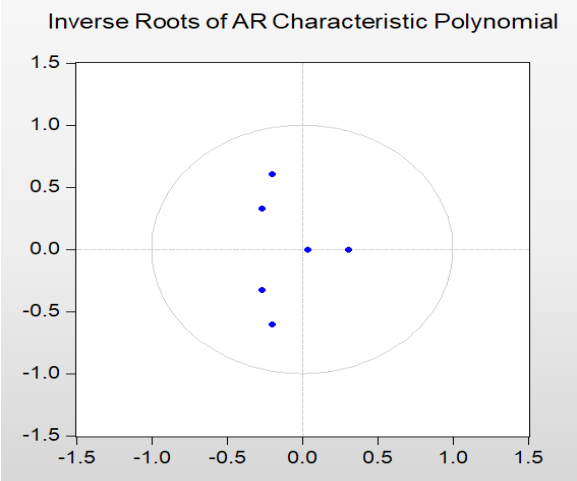

Figure 1 Roots of AR

3.5 Granger causality test

Table 3 shows that under 0.1 significance level, imports and exchange rates are the Granger causality of exports, exports and exchange rates are the Granger causality of imports, exports and imports are the Granger causality of the exchange rates.

Table3 Granger causality test results

Dependent variable	Excluded	Chi-sq	df	Prob.
lnc	lnj	39.59104	7	0.0000
	lnh	14.02228	7	0.0508
	All	57.07990	14	0.0000
lnj	lnc	25.61405	7	0.0006
	lnh	21.87544	7	0.0027
	All	43.77453	14	0.0001

	lnc	12.67696	7	0.0804
lnh	lnj	14.87856	7	0.0376
	All	17.77889	14	0.2170

3.6 Johansen cointegration test

From 2.3, the three variables of export value, import value and exchange rate are all I(1) sequences and satisfy the prerequisite of cointegration test. The cointegration test was used to determine whether there was a long-term equilibrium relationship among the variables. The results are shown in Table 4.

Table4 test results of maximum eigenvalue (max-eiggenvalue)

Hypothesized No. of CE（s）	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.1546	33.9350	21.1316	0.0005
At most 1 *	0.0609	12.6909	14.2646	0.0873
At most 2 *	0.0468	9.6801	3.8414	0.0019

Max-eigenvalue test indicates 3 cointegratingeqn(s) at the 0.05 level

The largest eigenvalue test result shows that rejecting the original hypothesis without cointegration relationship. The same is true for the feature trace test result. There is a cointegration relationship between the three variables of export volume, import volume, and exchange rate.

3.7 Analysis of Impulse Response

According to the impulse response function to obtain the dynamic effect between variables and variables, and then analyze the results of a variable after being impacted by another variable. Based on the Vector AutoregressionVAR(7) model, an impulse response function is established for the export amount, import amount, and exchange rate. The results are shown in Figure 2-4. The horizontal axis represents the number of lag periods after the variable was impacted.

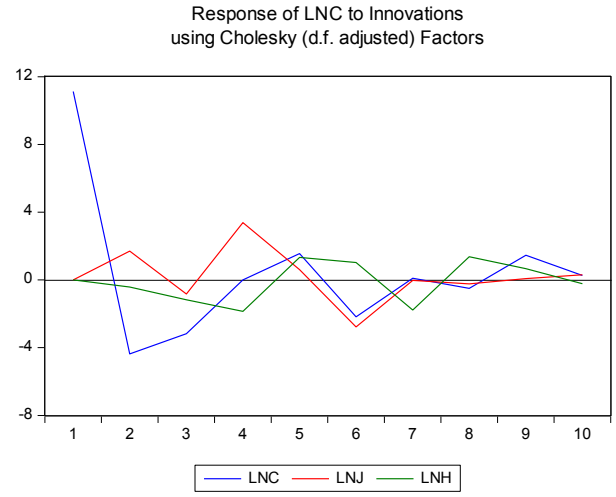

Figure 2 pulse effect of LNC on LNC, LNJ and LNH

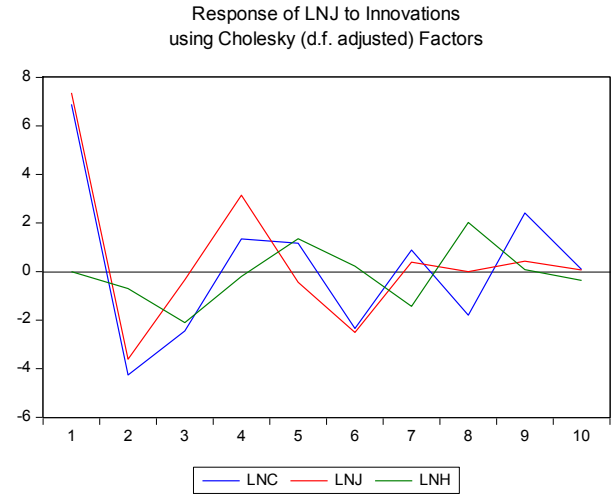

Figure 3 pulse effect of LNJ on LNC, LNJ and LNH

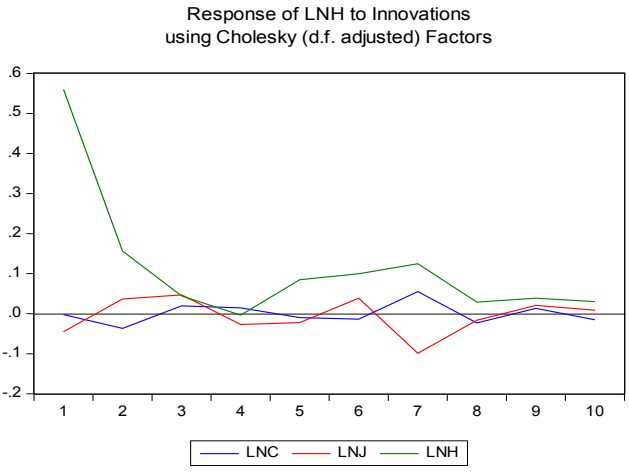

Figure 4 pulse effect of LNH on LNC, LNJ and LNH

According to Figure 2, after the export to the import of an impact, the first and second periods are positive effects, but the effect of the third to the sixth periods fluctuates greatly and gradually becomes stable at the seventh period. It

shows that the impact of exports on imports is initially a boost, but as time passes, imports are more affected by other factors, and the impact of exports gradually weakens. After the impact of export on the exchange rate, the negative effect of the first four periods on the exchange rate is more significant. The fourth period reaches a peak of -1.9, and then begins to fluctuate up and down, and the effect of the tenth period is converges to zero. It shows that the exchange rate was significantly affected by the export of 4 periods, which is affected by the outside world, but the final export is stable under the influence of the exchange rate.

According to Figure 3, after an import shock to the export, the volatility of the export before the 7th period is similar to that of the import. However, the fluctuations of exports between the 7th to the 9th period are greater than the import fluctuations. At the 10th period, the fluctuations are close to zero. Among the factors affecting imports, exports accounted for a relatively large amount, showing that the fluctuations in the first seven months are roughly the same. After the impact of import on the exchange rate, the negative effect continues from the first period to the third period. The negative effect of the fourth period converts to a positive effect, and the ninth phase begins to be stable. The entire fluctuation image is similar to the export fluctuation image of the lag phase 1. It shows that the impact of the exchange rate on import is delayed by one phase compared with the impact of exports on imports, which has hysteresis.

According to Figure 4, after the exchange rate gives the export an impact, the negative effect and the positive effect alternate, but the overall effect is still negative. The maximum negative effect is -0.04 and the maximum positive effect is 0.06. It shows that the effect of exchange rate on exports is not significant, and is affected by external factors. After the impact of the exchange rate on imports, after the negative effect lasts for one period, it turns into a positive effect. After that, the fluctuation situation is contrary to the export fluctuations affected by the exchange rate. The negative effect is most significant at -7 in the 7th period, and the 8th phase gradually becomes stable. It shows that foreign exchange has the opposite effect on exports and imports, and the overall fluctuation of imports is relatively large.

3.8 Variance decomposition

The variance decomposition can know the extent to which the variance of a variable's variance is affected by random disturbance terms of other variables. Based on the VAR(7) model, the variance of the export amount, import amount, and exchange rate is decomposed, and the variance decomposition results of each variable are shown in Figure 5-7.

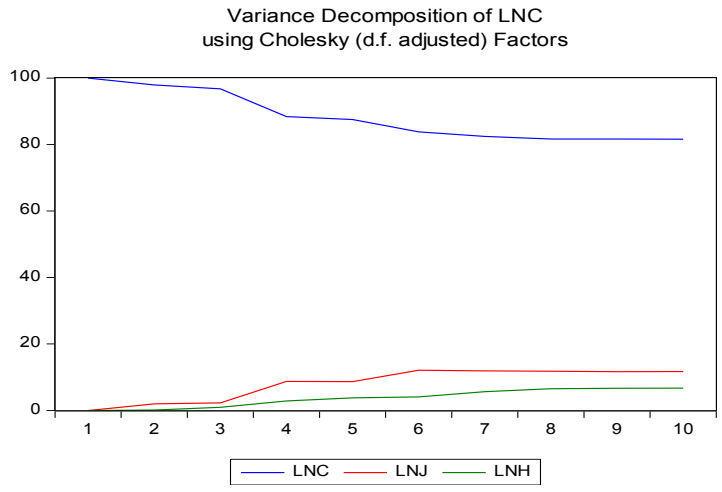

Figure 5 LNC variance decomposition

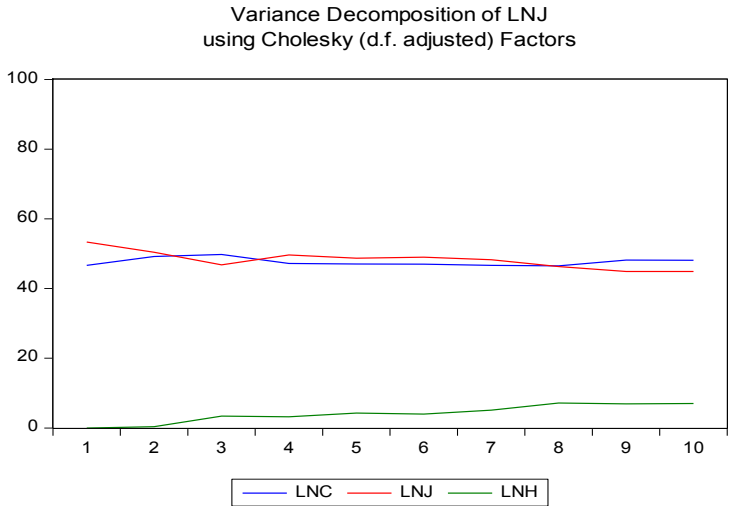

Figure 6 LNJ variance decomposition

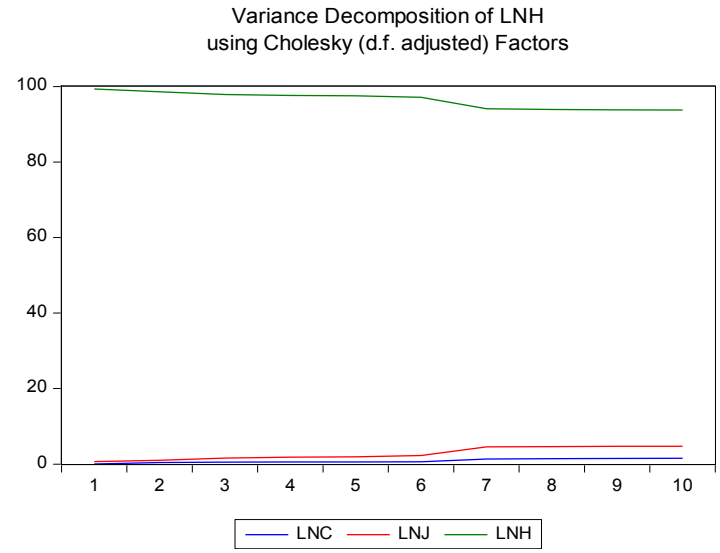

Figure 7 LNH variance decomposition

According to Figure 5 and the analysis of variance table, export fluctuations accounted for 81.60% of its own impact, 11.70% due to imports, and 6.70% due to exchange rates. Comprehensive Granger causality test, impulse response analysis, the export is the Granger cause of imports, indicating that exports are partly affected by imports. The impact of exchange rates on exports is small, the early performance is a negative effect, and the period is a positive effect, but overall there is a negative correlation between exchange rates and exports.

According to Figure 6 and the analysis of variance table, in the fluctuation of import trade, 7% is explained by exchange rate fluctuations, 44.88% is explained by own fluctuations, and 48.12% is explained by exports fluctuations. Combined with Figure 3, it shows that imports mainly depend on exports and their own inertia, and the exchange rate also has a positive effect on imports.

According to Figure 7 and the analysis of variance table, in the fluctuation of exchange rate trade, 93.74% is

explained by own fluctuations, 4.71% is explained by imports fluctuations, and 1.54% is explained by exports fluctuations. It shows that the exchange rate is less affected by endogenous variables and is more affected by its own inertia.

IV. CONCLUSIONS AND RECOMMENDATIONS

By constructing a VAR model, empirically analyzing the current value of imports and exports and the exchange rate of the US against the RMB, the following conclusions are drawn:

(1) Imports and exports are affected to a certain extent by exchange rate fluctuations. The decline in the real exchange rate has a stronger effect on imports and weaker on exports.

(2)There is a long-term equilibrium relationship between import，export, and the exchange rate, and the equilibrium deviation will be adjusted to equilibrium after a certain lag period.

(3) Imports and exports affect each other, especially after exports are affected by import shocks and the overall fluctuations are similar to imports. But the main influencing factors of both are still themselves.

Under the influence of exchange rates, in order to enable the import and export trade to better promote the healthy development of Chinese economy and maintain steady growth, there are six suggestions as follows:

(1) Reasonably adjusting foreign exchange reserves and reduce the risk of market value decline in China. With the depreciation of the U.S. dollar, the inflation rate will rise, which will further lead to a rapid rise in Chinese commodity prices, and the bubble price is particularly significant, which will cause the actual purchasing power of foreign exchange reserves to drop sharply, and have a serious impact on Chinese macro economy. Reasonably hold the amount of US foreign exchange, and gradually increase other stable foreign currency reserves.

(2) Optimizing the diversification strategy of import and export, and strengthen the import and export trade between China and other countries. When Sino-US trade is blocked, it can be converted into transactions with other countries, reducing Chinese dependence on US imports and exports, optimizing the structure of import and export trade, and strengthening Chinese competitiveness in the foreign trade market.

(3) Expanding domestic demand and reduce dependence on imports and exports. When Chinese self-sufficiency is insufficient, it will shift to external demand and demand will gradually increase. At this time, the decrease in foreign exchange rate will cause the appreciation of the renminbi, curb Chinese export trade, and it is not conducive to the development of foreign trade enterprises. Promoting productivity and accelerating the upgrading of industrial structure can reduce external demand, increase domestic demand, and stabilize economic development.

(4) Improving the exchange rate system and promote international balance of payments. Efforts to enhance national comprehensive strength and strengthen the right to speak, when the US implements a quantitative monetary easing policy and the RMB is greatly impacted, it can work together with other countries to solve problems, and promptly ease the impact on the market of economic and financial fluctuations.

(5) Paying close attention to the fluctuation of the U.S. dollar and make corresponding countermeasures in time. Optimize and improve the exchange rate management policy of the RMB peg to the US, effectively avoid foreign exchange risks and reduce the impact on the RMB.

(6) Balancing the balance of foreign trade revenue and expenditure to achieve a balance between internal and external development. Increasing the number of countries importing Chinese trade surplus and increasing market

supply will help Chinese long-term development.

REFERENCES

1. Bo-junDeng. (2011).Factors Affecting Chinese Import and Export Trade [J]. China Business, (05): 187-188.
2. Jun-KunGuo.(2015).Analysis of the Impact of the Depreciation of the US on Chinese Economy [J]. Finance and Economics (Academic Edition), (23): 15.
3. Yi-wen Li. (2009) .Rational View of the Impact of the Depreciation of the US on Chinese Economy [J]. Business Research, (10): 162-164.
4. Yao Yue. (2009) .Analysis of the Negative Impact of the Depreciation of the US on China[J].Management and Technology of SMEs (second edition), (08):79-80.
5. Xiao -li Yu.(2014) .The Impact of the Depreciation of the US on Chinese Macro Economy [J]. Era finance, (30): 7.
6. Xiao-junZhong. (2009) .Research on the Relationship between Foreign Direct Investment and the Import and Export Trade of our country——Analysis based on Impulse Response Function and Variance Decomposition Method of VAR Model [J].Statistical Education, (06):14-20.
7. Ya-mingZhao, Yan-hong Ma. (2009).Influence of US Weakness on Chinese Import and Export Trade [J].Economic Guide, (12): 46-47.
8. Zheng-lianDing g, Cheng-Jun Ding. (2014) .An Empirical Study of Chinese Import, Export, Real Exchange Rate and Economic Growth based on VAR Model [J]. International Trade Problem, (12): 91 - 101.
9. Zhen-qiang Li, Ting Zhang. (2015).An Empirical Analysis of the relationship between RMB exchange rate changes and import and export trade based on VAR model [J]. Journal of Hunan University of Arts and Science (NATURAL SCIENCE EDITION), 27 (04): 14-19.
10. Zi-jie Li. (2017).Impacts of Foreign Exchange Rate Movements on Imports and Exports and Countermeasures [J]. China International Finance and Economics (Chinese and English), (13): 4-5.