Impact of China's Real Exchange Rate Volatility on Sino-US Commodity Trade

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Abstract

Constructing the imperfect substitute trade models of commodity goods between USA and China, this paper uses FGLS and GMM estimation to show whether fluctuation of the real China's exchange rate has any implication on the Sino-US commodity trade flows. Using two alternative measures of "real" China's exchange rates are discussed, export and import trade flows of 9 industries under 1-digit-SITC-category, we find the fluctuation of China's real effective exchange rate has significant impact on both export and import trade between two countries, however, the fluctuation of China's real exchange rate of Sino-US has no influence on it. The conclusion is China should maintain and loose the fluctuation in limited floating range to improve the structure and balance of international trade.

Key Words: *real exchange rate fluctuation; Sino-US commodity trade; FGLS, GMM,SITC*

1 Introduction

1.1 Summary

Since 2005, China has been launching a further reform of its exchange rate forming mechanism. On July 21, 2005, China ended the long-term fixed nominal exchange rate of the RMB vis-a-vis the US dollar, and began to managed "with reference to a basket of currencies" rather than pegged to the dollar. The measures which China was taking to establish a market-oriented exchange rate formation mechanism was effective, including the launch of risk-hedging tools like forwards and swaps. The stable exchange rate of the RMB is conducive to the economic stability and development of China, even though the world. However, it is also critical for China to move to a flexible currency because one sure way to build in adjustment problems in an economy is to have open capital flows and a rigid exchange rate.

The economic literature has paid important attention to the impact of exchange rate fluctuation on trade flows, both theoretically and empirically. The current article attempts to justify the direction of the relationship between the fluctuation of RMB exchange rate on international trade. The use of different measurement on exchange rate fluctuation could shed

some light on the effect to trade. In our empirical exercise, we consider two real exchange rate fluctuation: fluctuation of Sino-US bilateral real exchange rate (Sino-US-RER) and fluctuation of RMB real effective exchange rate(RMB-REER).

1.2 Literature review

There are at least two different streams of literature relevant to this study. The first stream of literature relevant about our work focuses on the correlativity between fluctuation of RMB-REER and China's international trade with other countries (see, in particular, Lu and Dai ,2005[1];Ronald Mckinnon, 2006[2]). The second view concentrates on the relationship between the fluctuation of Sino-US-RER and the trade flow between two countries (Liu,2007[3];Jin,2007[4];Hu,2012[5]). Consequently, the conclusions are ambiguous.Yuan (2011)[6]finds no evidence that the fluctuation of Sino-US-RER would affect China's international trade. While others find remarkable effect caused by fluctuation (JaewooLee ,1998[7]; Qiao, 2007[8]; Lu, 2005[9]).

Although there are a large body of literature on our study, we still find some blank need to be filled. Firstly, most researchers use general data, such as total export or import flow between China and other country, which fails to capture the different situations within different industries. In line with our research question, we focus on the studies that provide difference from industries. Secondly, few of researchers provide a comparative investigation of the impact of the fluctuation of Sino-US-RER and RMB-REER, analyzing the different roles they may play in China's trade. Since RMB-REER reflects the competitiveness of China in international trade, while Sino-US-RER represents the purchasing power parity of RMB against US dollars, they provide different information.

2 Experimental

2.1 The mathematical analysis of the adjustment effect of exchange rate fluctuation

We construct the model on the relative purchasing power parity. Firstly, we focus on China's export to USA. Domestic and foreign real income have the considerable influence on it. We use the YC and YU to respectively represent the China's and USA's real income. From the export perspective, we calculate Sino-US-REER by the following formation :

$$\text{PEX}_{it} = \frac{E_t \cdot PX_{it}^U}{PX_{it}^C}$$,where PEX_{it} represents the Sino-US-REER and E_t represents the

Sino-US-nominal exchange rate, PX_{it}^U represents the USA's domestic price of ith industry in t month, PX_{it}^C represents China's export price of ith industry in t month. Fluctuation of RMB's real exchange rate has the distinct influence on it. For exploring the effect of China's the export to USA, we decomposed it into fluctuation of RMB-REER and fluctuation of Sino-US-REER. CVX_{it} represents the fluctuation of RMB-REER in t year, and $CVREER_t$ represents the fluctuation of Sino-US-REER in t year. The $EX_{i,t-1}$ represents the export. The model is described as follow.

$$EX_{it} = \beta_0 + \beta_1 YU_t + \beta_2 PEX_{it} + \beta_3 CVX_{it} + \beta_4 CVREER_t + \beta_5 EX_{i,t-1} + u_i + \varepsilon_{it} \qquad (1)$$

where u_i represents the individual effect and ε_{it} is stochastic error term.

Then, we focus on China's import from USA. In formation $PIM_{it} = \dfrac{E_t \cdot PI_{it}^U}{PI_{it}^C}$, where E_t represents the Sino-US-nominal exchange rate, PI_{it}^U represents the USA's import price of ith industry in t month, PI_{it}^C represents China's domestic price of ith industry in t month. In order to explore the effect of that on the import from US, $CVIM_{it}$ represents the fluctuation of RMB-REER in t month, and $CVREER_t$ represents the fluctuation of Sino-US-RER in t month. The $IM_{i,t-1}$ represents the import. The model is described as follow.

$$IM_{it} = \beta_0 + \beta_1 YC_t + \beta_2 PIM_{it} + \beta_3 CVX_{it} + \beta_4 CVREER_t + \beta_5 IM_{i,t-1} + u_i + \varepsilon_{it} \quad (2)$$

where u_i represents the individual effect and ε_{it} is stochastic error term.

We select the monthly data of the Sino-US international trade of 9 industries under 1-digit-SITC-category from January, 2005 to December, 2015. Refer to Baumetal(2004) , we use GARCH to conduct the high frequency data. We get all data from WIND database, and use the STATA to estimate models. The correlation matrix for the variables is reported in Table 1, which suggests that multi-collinearity problems among variables do not exist.

Table 1

Variable	lnYU	lnYC	lnEX	lnIM	lnPEX	lnPIM	CVX	CVIM	CVREER
lnYU	1.0000								
lnYC	0.3251 0.0000	1.0000							
lnEX	0.0510 0.0789	0.1992 0.0000	1.0000						
lnIM	0.0312 0.2821	0.0525 0.0702	0.7916 0.0000	1.0000					
lnPEX	-0.0392 0.1830	-0.4548 0.0000	-0.0948 0.0012	-0.0234 0.4269	1.0000				
lnPIM	-0.0167 0.5713	-0.2817 0.0000	-0.0862 0.0033	0.0006 0.9836	0.7256 0.0000	1.0000			
CVX	0.0492 0.0899	0.0146 0.6143	-0.4342 0.0000	-0.4538 0.0000	0.1953 0.0000	0.1499 0.0000	1.0000		
CVIM	0.0714 0.0139	0.1036 0.0003	0.0031 0.9138	0.0081 0.7794	0.1018 0.0005	0.1377 0.0000	0.1550 0.0000	1.0000	
CVREER	-0.3767 0.0000	0.0808 0.0053	-0.0164 0.5733	-0.0097 0.7396	0.0278 0.3447	-0.0097 0.7396	0.0114 0.6935	0.0300 0.3016	1.0000

3 Result and discussion

3.1 The effect of fluctuation of exchange rate on Sino-US international trade : FGLS estimation

After GLS estimation, we test the group-wise heteroscedasticity, autocorrelation and contemporaneous correlation which will appeared in the panel, estimate the export and import

model though the FGLS analysis , the results are presented in Table 2.

Model (1) reflects the effect of CVX, which suggestes that CVX and YU do not play a significant role in the export, however, the result shows the important role play by Sino-US-RER which describe with export price. The coefficient related to the Sino-US-RER is negative and highly significant. The marginal effect of this variable on the export is 0.236. That means that a 1% increase in Sino-US-RER is associated with a decrease in export at 0.236%. The coefficient related to the export is positive. And the effect of different industries from 0 to 8 are significant. The effects of industries 1,3 and 4 are negative while the effects of industries 2,5,6,7 and 8 are positive. Model (2) shown the important role played by

*Table 2-*The export and import model of USA ad China:result of FGLS estimation

	EX				IM		
	(1)	(2)	(3)		(4)	(5)	(6)
CVX	0.0205 (0.0721)		0.0155 (0.0712)	CVIM	-0.002 (0.0046)		-0.0023 (0.0046)
CVREER		-0.0836*** (0.0175)	-0.0836*** (0.0175)	CVREER		-0.0377*** (0.0115)	-0.0380*** (0.0117)
lnYU	-0.0082 (0.169)	-0.366** (0.182)	-0.367** (0.182)	lnYC	0.0691 (0.0753)	0.0739 (0.0731)	0.0717 (0.0742)
LnPEX	-0.236** (0.0918)	-0.190** (0.0893)	-0.194** (0.0908)	lnPIM	-0.109*** (0.0353)	-0.0934*** (0.0344)	-0.0916*** (0.0353)
L.lnEX	0.523*** (0.0256)	0.513*** (0.0257)	0.513*** (0.0257)	L.lnIM	0.581*** (0.0246)	0.586*** (0.0241)	0.580*** (0.0244)
1.industry	-1.728*** (0.127)	-1.760*** (0.126)	-1.765*** (0.128)	1.industry	-1.931*** (0.118)	-1.903*** (0.115)	-1.935*** (0.117)
2.industry	0.903*** (0.0661)	0.921*** (0.0666)	0.921*** (0.0666)	2.industry	-0.421*** (0.0337)	-0.413*** (0.0312)	-0.423*** (0.0335)
3.industry	-0.713*** (0.0829)	-0.718*** (0.0723)	-0.727*** (0.0817)	3.industry	-0.969*** (0.0812)	-0.954*** (0.0804)	-0.970*** (0.0811)
4.industry	-1.973*** (0.148)	-2.013*** (0.147)	-2.017*** (0.148)	4.industry	-2.008*** (0.121)	-1.977*** (0.118)	-2.011*** (0.121)
5.industry	0.538*** (0.0451)	0.548*** (0.0441)	0.549*** (0.0442)	5.industry	0.341*** (0.0333)	0.340*** (0.0316)	0.341*** (0.0334)
6.industry	0.162*** (0.0473)	0.163*** (0.0472)	0.164*** (0.0474)	6.industry	0.908*** (0.0571)	0.900*** (0.0556)	0.909*** (0.0567)
7.industry	1.095*** (0.0677)	1.115*** (0.0675)	1.115*** (0.0676)	7.industry	1.522*** (0.0915)	1.505*** (0.0897)	1.523*** (0.0909)
8.industry	0.257*** (0.0340)	0.262*** (0.0336)	0.262*** (0.0337)	8.industry	1.368*** (0.0834)	1.350*** (0.0818)	1.368*** (0.0828)
mon	0.0041*** (0.0004)	0.0045*** (0.0004)	0.0045*** (0.0004)	mon	0.0013 (0.0008)	0.0013 (0.0008)	0.0014* (0.0008)
Constant	4.057** (1.969)	8.265*** (2.130)	8.283*** (2.132)	Constant	4.578*** (0.383)	4.528*** (0.375)	4.576*** (0.380)
Wald chi2	21695***	21770***	21742***	Wald chi2	232420***	247453***	239602***

Standard errors in parentheses；$^{*}p<0.1$, $^{**}p<0.05$, $^{***}p<0.01$

CVREER in the export from China to USA. The coefficient related to the CVREER is negative and highly significant. Considering the CVX and CVREER simultaneously, the results in model (3) are quite consistent with those in model(1) and model(2). In model (3),

the CVX do not play the significant role in export; the CVREER also have the negative coefficient relation with high signification.

The model (4) shows that CVIM do not play a significant role in the import, however, the result reflects the important role play by Sino-US-RER. The coefficient of Sino-US-RER is negative and highly significant. The marginal effect on the import was 0.109. And the effect of different industries from 0 to 8 are different with high signification. The effect of industries 1,2,3,4 are negative and which of industries 5,6,7,8 are positive.The model (5) shown the important role played by CVREER in the import. The coefficient related to the CVREER is negative and highly significant. Considering the CVIM and CVREER simultaneously, the results in model (6) are quite consistent with those in model (4) and model (5).

AS the consequence, the CVX(CVIM) do not play the significant role in export,and the CVREER play the significant and important role in the international trade. And the effect of different industries are significant.

3.2 The effect of fluctuation of exchange rate on Sino-US international trade : GMM estimation

Because of the endogeneity problem in the estimation, we use the GMM estimation on the sampled data, after deleted the CVX(CVIM). The estimation results are shown in table 3.

Table3-The export and import model of USA and China:result of GMM estimation

EX	（7）	IM	（8）
L.lnEX	-0.206	L.lnIM	-0.882***
	(0.333)		(0.274)
L2.lnEX	-1.021		
	(0.657)		
lnYU	-69.73**	lnYC	1.437***
	(35.16)		(0.389)
lnPEX	6.481*	lnPIM	-1.121*
	(3.881)		(0.621)
CVREER	1.565*	CVREER	-0.136*
	(0.831)		(0.0746)
Constant	854.3**	Constant	21.18***
	(427.3)		(3.527)
Wald chi2	9.07*		15.39***
N	1113	N	1122

Standard errors in parentheses. $^{*}p< 0.1$, $^{**}p< 0.05$, $^{***}p< 0.01$.Instruments for differenced equation,GMM-type: L(2/3).lnim; Standard: D.lnychinaD.lnpimD.cvreer

Model (7)shows that 1-month-lag of export and 2-month-lag of export do not play the important role in the export from USA to China, and the real income of USA have the negative effect on it. And the evidence indicates that the effect of Sino-US-RER is positive.

The coefficient related to this variable is 6.481. And CVREER play the important and significant role on export. The coefficient with this variable is positive. The effect of this variable on export is 1.565.

Model (8)shows that 1-month-lag of import and real income of USA play the important role in the import from USA to China. And the evidence indicated that the effect of Sino-US-RER describe with export price is negative and important. The coefficient related to this variable is 1.121. And CVREER play the important and significant role on export. The coefficient with this variable is negative.

4 Conclusion

The result shows that the fluctuation of Sino-US-RER has no impact on the export (import) trade between China and USA, and the more fluctuated RMB-REER is, the more greater negative impact is. So the government should give up pegging to the dollar and take a basket of currencies as reference. The regime is more an outcome propelled by supply and demand of the market under the existing managing float regime with reference to the dollar, than a managing float regime "with reference to a basket of currencies" . Refer to the basket currency not merely accelerating the level of RMB internalization, but also benefiting the government management on international trade. Simultaneously, the fallen of Sino-US-RER has an adverse effect on imbalance of Sino-US international trade; as mentioned, the CVREER can adjust the structure of industry.

The effect of CVREER is negligibly weakness. So the exchange rate policy of China that releasing the regulation is reasonable and effective. This policy not only can rise the level of market-oriented exchange rate mechanism, but also make the resource allocation more reasonable, make the rest of state foreign exchange reserves more powerful.

This paper complemented and developed the current theory on international trade and give a different conclusion to reference. The conclusion is keep and releasing the regulation of FRR not only cannot deteriorate the international trade, but also can make the resource allocation more reasonable, adjust the structure of international trade industry.

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