

PAPER • OPEN ACCESS

Analysis of the Impact of Exchange Rate Changes on China-South Korea Bilateral Trade Balance

To cite this article: Yao Li and Xingshuai Wang 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **304** 032099

View the [article online](#) for updates and enhancements.

You may also like

- [Analysis of Influencing Factors of RMB Exchange Rate Trend Based on Least Square Method](#)

Lin Li, Fuchen Pan and Chaobo Wang

- [Research on impulse response and variance decomposition analysis of co-integrated systems](#)

Yang-Chao Wang, Jui-Jung Tsai and Yueying Dong

- [Urban expansion inferenced by ecosystem production on the Qinghai-Tibet plateau](#)

Li Tian and Jiquan Chen



ECS
The
Electrochemical
Society
Advancing solid state &
electrochemical science & technology

DISCOVER
how sustainability
intersects with
electrochemistry & solid
state science research

Analysis of the Impact of Exchange Rate Changes on China-South Korea Bilateral Trade Balance

Yao Li¹, Xingshuai Wang²

¹ College of Business Administration, Haikou University of Economics, Haikou, Hainan, 571127, China

² College of Business, Chungbuk National University, Cheongju, Chungbuk, 28644, South Korea

*Corresponding author's e-mail: liyao1005@163.com

Abstract. Though the relevant econometric analysis of the quarterly data from the “exchange reform” in 2005 to 2016, it is found that the real exchange rate changes of the RMB have limited effects on the improvement of the trade balance between China and South Korea. Meanwhile, the changes in political environment, the economic development levels of the two countries and the structure of export trade all have certain impact on the bilateral trade between China and South Korea. Based on the above-mentioned findings, it is proposed that the export enterprises be guided to enhance risk awareness of the exchange rate, change the import and export trade mode and structure, strengthen the cooperation in financial fields, such as currency swaps, and actively promote the internationalization of the RMB.

1. Introduction

Since the establishment of diplomatic relations between China and South Korea in 1992, the bilateral trade has developed rapidly. China has become South Korea's largest trading partner, import source, export destination and overseas investment target country. South Korea has also become China's largest source of imports for five consecutive years. In October 2016, the RMB officially entered the basket (SDR), marking the end of the era of unilateral volatility, and it is gradually transitioning to a free floating exchange rate system[1]. China's exchange rate mechanism is more flexible and the degree of marketization has also been significantly improved[2]. Recently, the central bank also said that it will not deal with trade disputes by the depreciating of RMB, which indicates that it bear a higher level of tolerance of the exchange rate fluctuations than before. Under the new normal, China's economic downward pressure is increasing. At the same time, with the challenges of the new trade protectionism of the United States, the following measures are of great practical significance for promoting the stable and healthy development of China's economy. For instance, analyzing the impact of RMB exchange rate changes on the import and export trade and actively exploring counter solutions.

2. Research Design

2.1. Model construction and explanation of variables

Since China and South Korea do not have a high degree of substitution in trade structure, this paper will develop a model based on the imperfect substitutes model of Goldstein and Khan (1985)[3].



- China's export function to South Korea: $EX = f(RKGDP, REEX)$
- China's import function from South Korea: $IM = f(RCGDP, REEX)$
- China-South Korea trade balance function: $TB = f(RCGDP, RKGDP, REEX)$

When empirically testing how exchange rate changes affect China-South Korea trade, it mainly analyzes the impact of China's exchange rate changes on China-South Korea trade in 2006-2016 after the reform of the exchange rate system in 2005. Models are developed on China's exports to South Korea, imports and trade balances respectively:

$$\bullet \ln REX_t = b_0 + b_1 \ln REEX_t + b_2 \ln RKGDP_t + \theta \quad (1)$$

$$\bullet \ln RIM_t = a_0 + a_1 \ln REEX_t + a_2 \ln RCGDP_t + \varepsilon \quad (2)$$

$$\bullet \ln RTB_t = c_0 + c_1 \ln REEX_t + c_2 \ln RCGDP_t + c_3 \ln RKGDP_t + \mu \quad (3)$$

In these equations, where $\ln REX_t$ represents the logarithm of China's exports to South Korea in millions of dollars; $\ln RIM_t$ represents the logarithm of China's imports to South Korea in millions of dollars; $\ln RTB_t$ denotes China's trade balance with South Korea, which is measured by the difference between exports and imports in millions of US dollars; $\ln REEX_t$ represents the logarithm of the bilateral real exchange rate of the RMB against the won; $\ln RCGDP_t$ represents the logarithm of China's actual gross national product which reflect China's domestic economic level; $\ln RKGDP_t$ denotes the logarithm of Korea's actual gross national product, which reflects South Korea's domestic economic level. a_0, b_0, c_0 are constant terms; ε, θ, μ are random disturbance terms.

2.2. Source and processing of sample data

The empirical test is carried out on the quarterly data of the selected sample period of 2006Q1-2016Q4, and each group of data is processed by natural logarithm, so that the growth rate can be analyzed during modeling. In order to eliminate the error caused by seasonal variation factors, seasonal adjustments are also made to the quarterly data sequence of each group[4]. In order to truly reflect the impact of RMB exchange rate changes on export trade, the real exchange rate and real GDP are selected for the empirical analysis. The data about the actual GDP of China and South Korea come from the OECD statistical network. The actual exchange rate of the RMB against the Korean won is based on the indirect price method and is compiled from the WIND database. The data about China's actual exports to South Korea, China's actual imports from South Korea and trade balance come from the Customs Data Network and the Korea Trade Association[5]. The statistical analysis tool is Eviews 8.0 software.

3. Empirical Results and Analysis

3.1. Data Stationary Test

Since the time series data are selected, the sequence has a non-stationary possibility. To carry out the stationarity test, the following estimation equation is used for each group of data with the application of the extended Dickie-Fuller (ADF) unit root test method.

$$\Delta y_t = \alpha + \gamma y_{t-1} + \sum_{s=1}^m a_s \Delta y_{t-s} + v_t$$

Where $\Delta y_{t-s} = y_{t-s} - y_{t-s-1}$, v_t is the error term, α is the intercept item, t denotes the time trend item.

Table 1. ADF unit root test results for each variable.

Variables	ADF Test Value	5% Critical Value	P- Value	Conclusion
$\ln REEX$	-2.6451	-3.5266	0.2637	Unstable
$\ln RIM$	-0.3136	-3.5298	0.9874	Unstable
$\ln REX$	-1.8328	-3.5181	0.6713	Unstable
$\ln RTB$	-2.8167	-2.9314	0.0643	Unstable

$\ln RCGDP$	0.8420	-3.5181	0.9997	Unstable
$\ln RKGDP$	-2.4928	-3.5208	0.3299	Unstable

The unit root test is performed on the original logarithmic data, and the test results are shown in Table 1. Under the 5% confidence condition, the test results of each variable are larger than the McKinnon critical value, so the stationary hypothesis proves not true and it is a non-stationary time series.

Table 2. ADF unit root test results after each variable difference.

Variables	ADF Test Value	5% Critical Value	P- Value	Conclusion
$\Delta \ln REEX$	-4.9955*	-3.5208	0.0011	Stable
$\Delta \ln RIM$	-4.1657*	-3.5298	0.0112	Stable
$\Delta \ln REX$	-6.2509*	-3.5208	0.0000	Stable
$\Delta \ln RTB$	-8.8891*	-2.9332	0.0000	Stable
$\Delta \ln RCGDP$	-4.9259*	-3.5208	0.0014	Stable
$\Delta \ln RKGDP$	-4.8052*	-3.5208	0.0019	Stable

Note: * indicates that the ADF test value is significant at a confidence level of 5%.

After the first-order difference is performed, the absolute values of the ADF test values of the variables are respectively greater than the absolute values of the corresponding 5% horizontal critical values, the sequence stationary hypothesis is applied, that is, the sequence obtained after the first-order difference, and the test results are shown in Table 2. The preliminary conclusions are that all variables satisfy the same order and single integer at the same time. And as a stationary time series of the same order, Granger causality test and cointegration test can be carried out to prove whether there is a long-term stable relationship between variables.

3.2. Granger Causality Test

The Granger test of causality defines the causal relationship between variables from the perspective of prediction. It is done by the test of a constrained F and statistically examines whether the relationship is one-way or two-way. That is: the past behavior of one variable affects the current behavior of another variable, or the past behavior of both parties affects each other's current behavior. The Granger causality test results of models (1), (2), and (3) are shown in Table 3.

Table 3. Granger causality test results of models (1), (2), and (3).

	The Null Hypothesis	F- statistic	Prob.	Conclusions
Model (1)	REEX Not Being the Granger Cause of REXPORT	3.5769	0.0380	Refuse
	REEXPORT Not Being the Granger Cause of REEX	0.5754	0.5674	Accept
	RKGDP Not Being the Granger Cause of REXPORT	6.6117	0.0035	Refuse
	REEXPORT Not Being the Granger Cause of RKGDP	0.0918	0.9125	Accept
	RKGDP Not Being the Granger Cause of REEX	2.0957	0.1373	Accept
	REEX Not Being the Granger Cause of RKGDP	0.1761	0.8392	Accept
Model (2)	Reasons For REEX Not Being the Granger Cause of REXPORT	3.8966	0.0291	Refuse
	RIMPORT Not Being the Granger Cause of REEX	0.9081	0.4121	Accept
	RCGDP Not Being the Granger Cause of RIMPORT	2.1308	0.1331	Accept
	RIMPORT Not Being the Granger Cause of RCGDP	2.9417	0.0652	Refuse
	RCGDP Not Being the Granger Cause of REEX	2.6147	0.0867	Refuse
	REEX Not Being the Granger Cause of RCGDP	2.2370	0.1210	Accept
Model (3)	REEX Not Being the Granger Cause of RTB	4.5975	0.0165	Refuse
	RTB Not Being the Granger Cause of REEX	1.4676	0.2436	Accept
	RCGDP Not Being the Granger Cause of RTB	3.2319	0.0509	Refuse
	RTB Not Being the Granger Cause of RCGDP	7.3173	0.0021	Refuse

RKGDP Not Being the Granger Cause of RTB	3.3513	0.0460	Refuse
RTB Not Being the Granger Cause of RKGDP	0.2087	0.8126	Accept
RKGDP Not Being the Granger Cause of RKGDP	3.0965	0.0571	Refuse
RCGDP Not Being the Granger Cause of RKGDP	1.0071	0.3751	Accept

As can be seen from Table 3, the Granger test results between the variables of models (1), (2), and (3) indicate that the real exchange rate of the RMB is the Granger cause of China's exports to South Korea, imports, and trade balances. That is, the changes in the RMB exchange rate in the short term have certain causal effect on the trade between China and South Korea. At the same time, China's exports to South Korea, imports and trade balance are not the Granger cause for exchange rates, and they further illustrate that changes in China-South Korea trade will not affect exchange rate fluctuations. The trade balance between China and South Korea is the Granger cause of China's real GDP. It also demonstrates that the growth of import and export trade has driven the improvement of China's economic level. China's real GDP is the Granger cause of China-South Korea trade balance, reflecting the growth of China's actual domestic demand and promoting the development of bilateral trade between China and South Korea.

3.3. Test of Cointegration Relationship

The Johansen Cointegration Test is a unit root test. Under the premise of each group data's passing the stationary test, it is verified whether there is a long-term equilibrium relationship between the variables, that is, the cointegration relationship. The variables of the set model are the same as the first-order single integer, and the Johansen cointegration test can be applied to further infer the long-term equilibrium relationship between the variables.

Table 4. Johansen cointegration test results for model (1).

Null Hypothesis	Alternative Hypothesis	Eigen value	Trace Statistic	5% Critical Value	Concomitant Probability
$r=0$	$r \geq 1$	0.3056	15.3171	21.1316	0.2673
$r \leq 1$	$r \geq 2$	0.1151	5.1356	14.2646	0.7246
$r \leq 2$	$r \geq 3$	0.0184	0.7808	3.8415	0.3769

From the test results, the cointegration equation between China's exports to South Korea and the real exchange rate of the RMB is derived:

$$\ln REEX_t = b_0 + 0.2079 \ln REEX_t + 2.5213 \ln RKGDP_t + \theta$$

(0.4996) (0.7745)

In Table 4, the Johansen test results for model (1) show that if the trace statistic values are less than the critical value at the 5% level, the null hypothesis of $r=0$ cannot be rejected, that is, there are 0 cointegration vectors. It can be inferred that the cointegration relationship between the real exchange rate of the RMB and the real GDP of South Korea and China's exports to South Korea is not established, that is, there is no long-term equilibrium relationship.

Table 5. Johansen cointegration test results for model (2).

Null Hypothesis	Alternative Hypothesis	Eigen value	Trace Statistic	5% Critical Value	Concomitant Probability
$r=0$	$r \geq 1$	0.4722	26.8385	25.8232	0.0366
$r \leq 1$	$r \geq 2$	0.2686	13.1355	19.3870	0.3172
$r \leq 2$	$r \geq 3$	0.1546	7.0542	12.5180	0.3389

From the test results, the cointegration equation between China's imports of South Korea and the real exchange rate of the RMB is derived:

$$\ln RIM_t = a_0 + 0.1781 \ln REEX_t + 0.6027 \ln RCGDP_t + \varepsilon$$

(0.2385) (0.2940)

In Table 5, the Johansen test results of model (2) can be concluded that the cointegration relationship between the real exchange rate of RMB and China's imports to South Korea is established, that is, there is a long-term equilibrium relationship.

Table 6. Johansen cointegration test results for model (3).

Null Hypothesis	Alternative Hypothesis	Eigen value	Trace Statistic	5% Critical Value	Concomitant Probability
$r=0$	$r \geq 1$	0.5098	29.9441	27.5843	0.0244
$r \leq 1$	$r \geq 2$	0.4311	23.6936	21.1316	0.0213
$r \leq 2$	$r \geq 3$	0.2080	9.7942	14.2646	0.2258
$r \leq 3$	$r \geq 4$	0.0868	3.8149	3.8415	0.0508

After the test, the cointegration equation between the bilateral trade balance between China and South Korea and the real exchange rate of the RMB is given:

$$\ln RTB_t = c_0 - 1.7724 \ln REEX_t + 5.6885 \ln RCGDP_t - 2.1115 \ln RKGDP_t + \mu$$

(-6.5579) (-2.1496) (-5.6887)

In Table 6, the Johansen test results of model (3) can be concluded that the cointegration relationship between the real exchange rate of the RMB and the trade balance between China and South Korea is established, that is, there is a long-term equilibrium relationship.

The cointegration test results of the above models (1), (2), and (3) indicate that there is a long-term stable cointegration relationship between the real exchange rate of the RMB and China's import trade volume from South Korea, China's income level, and trade balance. There is no long-term stable cointegration relationship between the export trade volume of South Korea. In the long run, the impact of the real exchange rate of the RMB and China's imports on South Korea is positive. The exchange rate elasticity is 0.1781, indicating that the appreciation of the RMB exchange rate can increase the import trade volume from South Korea, but the effect is not obvious due to the small elastic coefficient and it is less than the impact of China's economic development level. The real exchange rate between the RMB and the bilateral trade balance between China and South Korea has a negative correlation, which is also statistically significant and consistent with the expected results[6]. The exchange rate flexibility is -1.7724, as the exchange rate of the RMB to the Korean won rise by 1%, the China's trade balance with South Korea will be reduced by 1.77 %.

4. Conclusion

The empirical analysis shows that there is a stable cointegration relationship between the real exchange rate of the RMB and the trade balance between China and South Korea. The exchange rate appreciation has a certain restraining effect on the trade balance between China and South Korea, and the depreciation can improve the trade balance between China and South Korea. However, the exchange rate elasticity coefficient is small, which is -1.77, indicating that the real exchange rate change of the RMB has a limited effect on the improvement of China-South Korea trade balance in the long run; there is a theoretical J-curve effect, and in the short term, the trade balance will deteriorate, but on the whole, the impact is positive and there is no time lag. It is also demonstrated that exchange rate changes have little effect on China-South Korea trade balance and will not have a great impact on bilateral trade between the two countries. When the exchange rate rises, the accompanying trade balance may increase or decrease[7], which indicates that the factors affecting China-South Korea trade balance are not only limited to the changes in the RMB exchange rate, but also limited to some other factors such as, the economic development level of the two countries, the structure of import and export trade and changes in politics environment.

References

- [1] Yan Sun. (2017) The Choice of RMB Exchange Rate System-The Loss Function Based on Game Theory. J. Technical Economics and Management Research, pp. 72-77.

- [2] Shufang Lv. (2015) An Empirical Analysis of the Impact of RMB Exchange Rate Changes on China's Export Trade. *J. Economic Issues*, pp. 61-64.
- [3] Sauer C, A Bohara. (2001) Exchange rate volatility and exports: regional differences between developing and industrialized countries. *J. Review of International Economics*, pp. 133-152.
- [4] Baharumshah A Z. (2001) The effect of exchange rate on bilateral trade balance: New Evidence from Malaysia and Thailand. *J. Asian Economic Journal*, pp. 291-312.
- [5] Chit M. (2008) Exchange rate volatility and exports: evidence from the ASEAN-China free trade area. *J. Journal of Chinese Economic and Business Studies*, pp. 261-277.
- [6] Guobing Shen. (2004) An Empirical Analysis of Sino-Japanese Trade and RMB Exchange Rate. *J. International Economic and Trade Exploration*, pp. 11-16.
- [7] Shihong Dai. (2006) Empirical Study on RMB Exchange Rate and Sino-Japanese Trade Balance. *J. Financial Research*, pp. 150-158.