



Analysis of the relationship between China's exports to the world and Korea's export to China

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Abstract

Background/Objectives: The purpose of this study is to examine the relationship between China's exports to the world and Korea's exports to China, and to suggest directions for future Korea's exports.

Methods/Statistical analysis: The analysis period was using total 213 monthly data from January 2000 to September 2017. As a analysis result, there is a harmonization phenomenon between China's export to world and Korea's export to China and showed a very high correlation.

Findings: The correlation coefficient between China's exports to the world and Korea's exports to China by year was calculated as 0.9055. The correlation is showing very high harmonization phenomenon. In a regression analysis in which Korea's exports to China are dependent variables, the coefficient of China's exports to the world was 0.3040. We can recognize that KOEX increases by one unit when CNEX increases by 0.3040. In CNEX included with KOEX, CNEX and KOEX are interpreted as moving without time lag. As of 2016, Korea's exports to China account for 25.11%(1st) of total exports, but China's exports to Korea account for 4.48%(4th). It is also confirmed that China's exports to world and Korea's exports to China show high mutual harmonization phenomenon. In the Korean economy, China

accounts for a large portion of exports and trade balance. Therefore, it is expected to be influenced greatly by the economic trend of China in the future.

Improvements/Applications: In order for Korea's exports to grow steadily in the future, First, China's export to world should continue to increase. Second, Korea should establish an export diversification strategy to other countries including China.

Key Words : China's exports to the World, Korea's exports to China, Exports, Imports, Trade Balance

1 Introduction

Aircraft As of September 2017, Korea's exports are in the order of China(24.0%), the United States(12.3%), Vietnam(8.3%), Hong Kong(6.4%) and Japan(4.8%). Korea's total exports are ranked 6th in the world following China, US, Germany, Japan and Netherlands. Among Korea's exports to China, intermediate goods account for more than 70%, and cyclical sensitive products such as steel, petrochemicals and auto parts are made up of major exports. The proportion of exports to China, Korea's largest export country, is declining from \$145.8 billion in 2013. The share of the trade balance also fell sharply from 189% in 2012 to below 50% in 2016. China's economic growth has been declining and the industrial structure has been restructuring. China's exports to the world have been declining and Korea's exports to China are also falling. In recent years, exports to China have been declining as exports products to China have moved to Southeast Asia including Vietnam. There is a harmonization phenomenon between China's exports to the world and Korea's exports to China, so Korea's exports to China are expected to decline in the future[1]; The purpose of this study is to examine the relationship between China's exports to the world and Korea's exports to China, and to suggest directions for future Korea's exports.

2 Precedent Research

Choi (2017) analyzed the relationship between China's exports to the world and Korea's exports to China, with a cointegration relationship and a long-term elasticity of 0.933. In addition, it is analyzed that the two relations have a positive effect in the short term, and it is claimed that there is strong interoperability[2]. Park (2013) analyzed that when the Yuan rises 1% from the trading partner, exports decrease by 0.768% and imports increase by 0.255%[3]. Choi (2016) analyzed that the effect of the Chinese economy on the real economy in Korea was that the rise in the yuan would reduce Korea's exports to China and lower Korea's growth rate. This is because processing trade accounts for most of the exports, and China's exports to the world are declining due to the appreciation of the yuan[4]. Kang.ete.2. (2014) studied Korea's Foreign Direct Investment(FDI) and determinants of import and export. The results of the analysis are as follows. First, Korea's FDI to China is directly proportional to its exports to China, and is inversely proportional to its imports. Second, the greater the international competitiveness of Korean products, the greater the exports to China[5].

Hwang & Cho (2013) analyzed that China's exports and consumption have a positive(+) impact on Korea's exports by item[6]. Choi&Kang (2016) analyzed that China has secured diversified export products in order to cope with falling export prices in research on China's economic growth and export prices[7]. Aketc. 2(2017) analyzed that Technical Barriers to Trade(TBT) regulations and economic variables could affect Chinese exports in the impact of US TBT on Chinese exports[8]. Seo&Kang (2016) estimated the export competitiveness of Korea and China in the US market using alternative elasticity[9]. Hong & Kim (2014) analyzed the effect of changes in China's trade-related policy on corporate export performance, and suggested that exchange rate policies and labor policies affect corporate performance[10]. Jeong&Lee(2015) suggested that the use of electronic trade by Chinese exporting companies can realize a competitive advantage and maximize the efficiency and effectiveness of enterprises[11]. Son(2014) is expected to benefit from the manufacturing of electronic products, textiles, machinery, and auto parts due to the Korea-China FTA. On the other hand, the agricultural, forestry and fishery industries were expected to suffer

damage[12].

Kim(2017) assessed Korea's ICT export function to China, Japan and the United States. The ICT prices rise negatively affects Chinese and Japanese exports, while the effect of foreign direct investment on China and the US positively affects, and the decline in the value of the Chinese Yuan increases Korea's exports to China[13]. Kim (2016) analyzed the competitiveness of the Korean automobile industry in China, suggesting that the market share index(MSI) of the Korean automobile industry declined every year to 6.42% in 2014. He also analyzed that TSI(Trade Specialization Index) showed a competitive advantage for Chinese automobile exports[14]. Kim (2017) argued that the Korean consumer electronics industry should focus on expanding intra-industry trade to enhance export competitiveness in China, focusing on high-quality, convergence consumer electronics and technology development and premium items reinforce[15].Choi(2014) analyzed that although Korea's exports to China increased on electronic parts and oil painting industry, there were some insecurities in terms of diversity[16]. Choi&Nam (2014) argued that the Korean steel industry faces 'Sandwich Crisis' due to Japan's high value-added products and China's technological improvement in the competitiveness analysis of Korea, China and Japan[17].

Lee &Kwon(2015) suggested maintaining an agricultural product export support system, eliminating barriers to non-tariffs on agricultural products, fostering small and medium enterprises for exporting agri-food products, and expanding investments for foreign agricultural products for expand the export of Korean agricultural products to China[18]. Baek&Lee (2016) suggested exports through online shopping malls in China, utilization of large domestic retailers, diversity of payment methods and organic linkage with local joint logistics centers in order to revitalize online exports of Korean food to China[19].Na (2014) suggested that proper location, economic utilization of scope, market concentration strategy and product brand awareness of consumers are needed to encourage Korean companies to export bottled water to China[20]. Jang & Park (2015) suggested that understanding of the legislation related to mineral water is necessary to advance into the Chinese mineral water market[21].

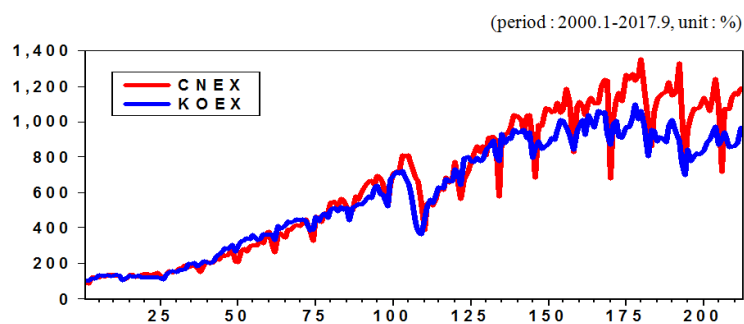
3 Data Collection and Indicator Analysis

3.1 Data Collection

Korea's exports, imports, trade balance data to China used in this study were collected from Trade Statistics of the Korea Customs Service. The analysis period was from January 2000 to September 2017 for a total of 213 months (17 years 9 months). For the sake of convenience, we want to mark KOEX for Korea's exports to China and CNEX for China's exports to the world. Monthly growth rate and change rate were analyzed using SPSS, Excel and E-views. In addition, descriptive statistics, correlation analysis, regression analysis, normal distribution, quantile-quantile and scatter analysis were conducted to examine Korea's exports to China and China's exports to world.

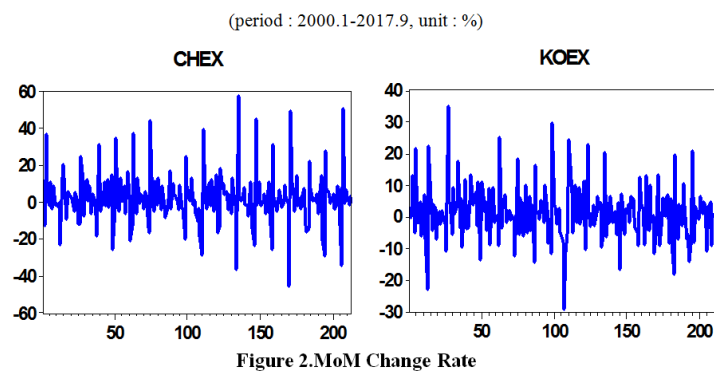
3.2 Indicator Analysis

As based of January 2000(=100), the rate of growth of CNEX and KOEX represents in [Figure 1]. In the past 213 months, the growth rates of CNEX and KOEX have been 1,190% and 960%, respectively. In December 2014, the highest growth rates of CNEX and KOEX recorded 1,354% and 1,064%, respectively. CNEX and KOEX show a highly harmonization phenomenon with almost similar repeats of rise and fall.



As based of January 2000(=0), MoM change rates for CNEX

and KOEX expressed in [Figure 2]. The rate of change is between -40% and +60% for CNEX and between -30% and +30% for KOEX. CNEX and KOEX have been equally increasing at the end of the year and decreasing at the beginning of the year.



4 Empirical Analysis

4.1 Numerical Analysis

Table 1 : Descriptive Statistics

	CNEX	KOEX
Mean	2.1184	1.4367
Median	1.1562	1.2052
Maximum	57.3342	35.1285
Minimum	-44.9174	-29.0775
Std. Dev.	14.0282	8.7028
Skewness	0.6560	0.4687
Kurtosis	6.0666	4.8828
Jarque-Bera	98.7415	39.2607
Probability	0	0
Observations	213	213

< Table1 > shows the descriptive statistics of China's exports to the world(CNEX) and Korea's exports to China(KOEX) over the last 213 months. The average is 2.118% for CNEX and 1.436% for KOEX, with standard deviations of 14.028 and 8.702, respectively. CNEX and KOEX have all positive(+) value in Skewness

and Kurtosis. Both indicators are tilted to the right axis with left tail and mean well centered around the mean.

Table 2 :Regression Analysis : KOEX - Dependent Variables

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.7926	0.5269	1.5041	0.134
CNEX	0.3040	0.0372	8.1665	0
R-squared	0.2401	Mean dependent var		1.4366
Adjusted R-squared	0.2365	S.D. dependent var		8.7028
S.E. of regression	7.6040	Akaike info criterion		6.9045
Sum squared resid	12200.43	Schwarz criterion		6.9361
Log likelihood	-733.339	Hannan-Quinn criter.		6.9173
F-statistic	66.6917	Durbin-Watson stat		2.4879
Prob (F-statistic)	0			

< Table2 > shows the least squares regression analysis, in which KOEX is dependent variables and CNEX is independent variables. In the simple regression model, Least Squares defines the mean by the distribution score that the sum of the squared deviations becomes minimum. The coefficient of CNEX for KOEX is 0.304. Therefore CNEX and KOEX show the same direction, and when KOEX increases by 1 unit, CNEX increases by 0.304. The adjusted R-squared was calculated as 0.236, and the change of the dependent variable KOEX in the regression model shows the explanatory power of 23.65%. CNEX calculated statistically significant at t-statistic and p-value(≤ 0.001). The Durbin-Watson stat is 2.4879, which is close to 2, so the error terms are independent.

4.2 China's exports to the world and Korea's export to China

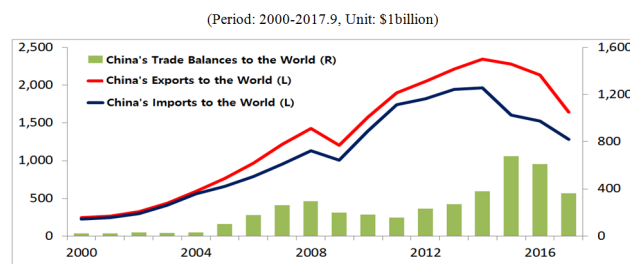


Figure 3. China's exports, imports, trade balance to the world (yearly)

Since 2000, China's exports, imports and trade balance to the world by year in [Figure 3]. China's exports increased by more than

10% during the past decade except for 2001 and 2009 from 2000 to 2011. It is decreasing since the export amount of \$2.34 trillion and the import amount of \$1.96 trillion in 2014. The trade balance is declining since it hit \$0.67 trillion in 2015.

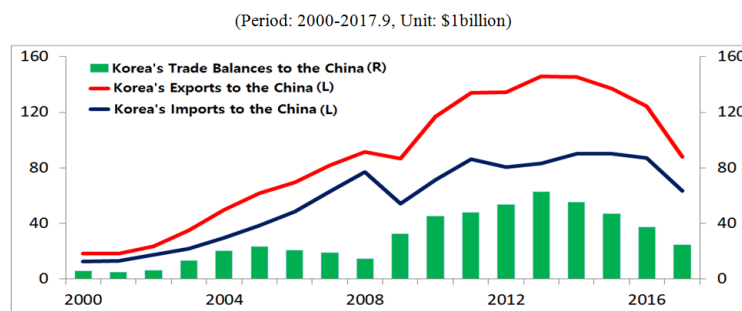


Figure 4. Korea's exports, imports, trade balance to China (yearly)

Since 2000, Korea's exports, imports, trade balance to China appears in [Figure 4]. Korea's exports to China have been declining year by year, peaking at \$145.8 billion in 2013. Imports to China are decreasing year by year, peaking at \$90.2 billion in 2015. Trade balance to China is decreasing year by year, peaking at \$62.8 billion in 2013. Korea's trade balance to China is rapidly shrinking as exports decline compared to imports. In the figure above, data for 2017 are included from January to September.

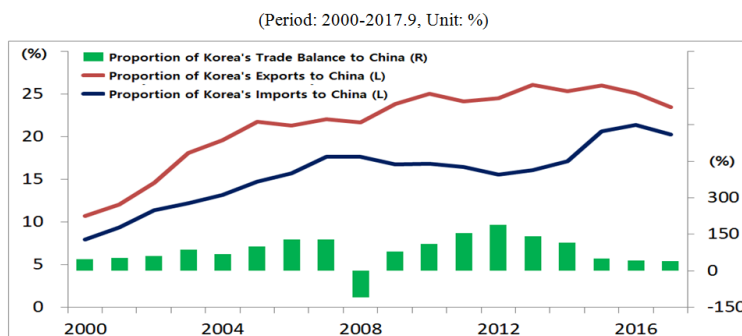


Figure 5. Proportion of Korea's exports, imports, trade balance to China (yearly)

Since 2000, proportion of Korea's exports, imports and trade balance to China appeared in [Figure 5]. The ratio of exports to China has declined modestly from 26.07% in 2013, but the ratio

of imports has remained at 20% since 20.68% in 2015. The share of trade balance in China has fallen sharply since 189% in 2012 and fell to less than 50% in 2016. In order for Korea's exports to increase continuously, it is necessary to diversify its exporting countries including China.

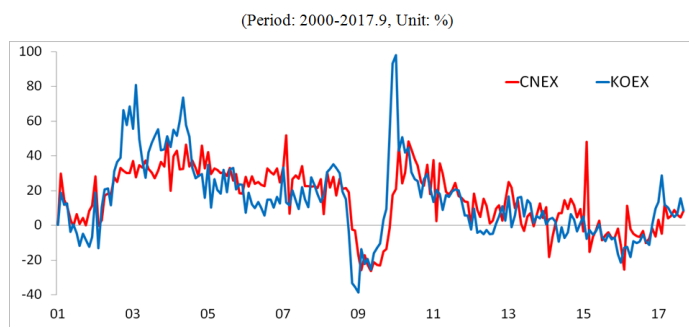


Figure 6. MoM Monthly Change rate of China's exports to the world & Korea's exports to China

Table 3 : Correlation Analysis (monthly)

	CNEX	KOEX
CNEX	1	
KOEX	0.5678**	1

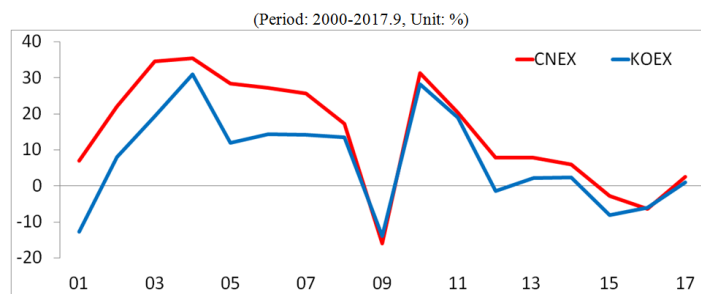
Note) **: Correlation coefficient is significant at 0.05 level.

From January 2001 to September 2017, the YoY monthly change rate of CNEX and KOEX is shown in [Figure 6] and the correlation analysis is shown in < Table3 > . There is a harmonization phenomenon between China's exports to the world and Korea's exports to China. The monthly correlation between China's exports to the world and Korea's exports to China is 0.5678, showing a high degree of harmonization.

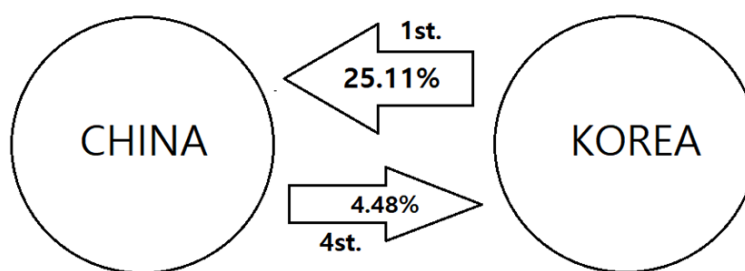
Table 4 :Correlation Analysis (yearly)

	CNEX	EXPO
CNEX	1	
EXPO	0.9055**	1

Note) **: Correlation coefficient is significant at 0.05level.

**Figure 7.YoY Change rate of China's exports to the world & Korea's exports to China (yearly)**

From January 2001 to September 2017, the YoY change rate of CNEX and KOEX is shown in [Figure 7] and the correlation analysis is shown in < Table4 > . There is a high harmonization phenomenon between China's exports to the world and Korea's exports to China. The yearly correlation between China's exports to the world and Korea's exports to China is 0.9055, showing a high degree of harmonization.

**Figure 8.The proportion & ranking of CNEX and KOEX (by 2016)**

As of the year of 2016, Korea has exported \$124.2 billion to

China, accounting for 25.11% of total exports, ranking first among exporting countries. On the other hand, China exported \$95.7 billion to Korea and ranked fourth among exporting countries with 4.48% of exports in [Figure 8]. From China's point of view, Korea does not have a large portion of exports. But in terms of Korea, China accounts for a large portion. Therefore, Korea is expected to be influenced by the economic trend of China. Korea needs to diversify its exports in order to continuously expand its exports in the future.

4.3 Model Analysis

Since January 2000, the monthly growth rate normal distribution for CNEX & KOEX is shown in [Figure 9]. The monthly average for the rate of increase is 2.12% for CNEX, 1.44% for KOEX and the standard deviation is CNEX 14.03 & KOEX 8.70. The average and standard deviation of CNEX were larger than KOEX. As a result, China's exports to the world are relatively more active and increasing.

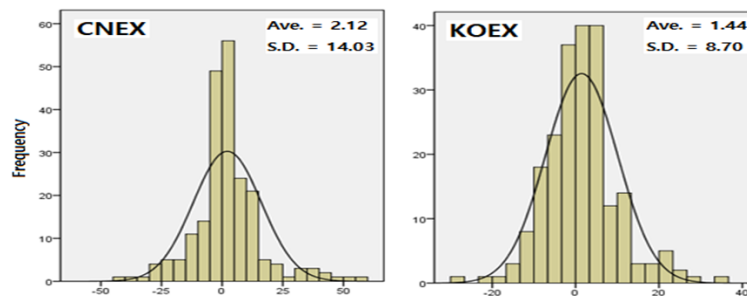


Figure 9. Normal Distribution

[Figure 10] shows the monthly Scatter Charts of Korea's exports to China versus China's exports to the world over the last 210 months. The X axis is the variation rate of CNEX, and the Y axis is the variation rates of KOEX. Compared with CNEX, the distribution of KOEX is slightly upward, showing a positive(+) relationship with each other.

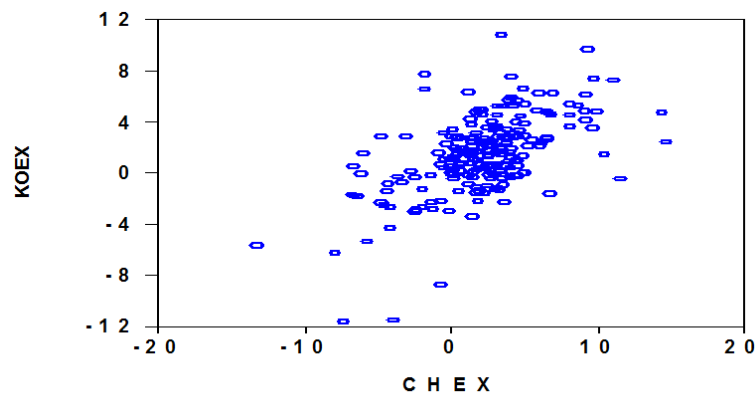


Figure 10. Scatter Charts

The periodicity of CNEX & KOEX according to the frequency is shown in [Figure 11]. In the figure, the X axis represents the frequency from 0.0 to 0.5, and the Y axis represents the periodicity. As the overall frequency increases, the periodicity also increases at the same time, indicating that exports of China and Korea are actively progress.

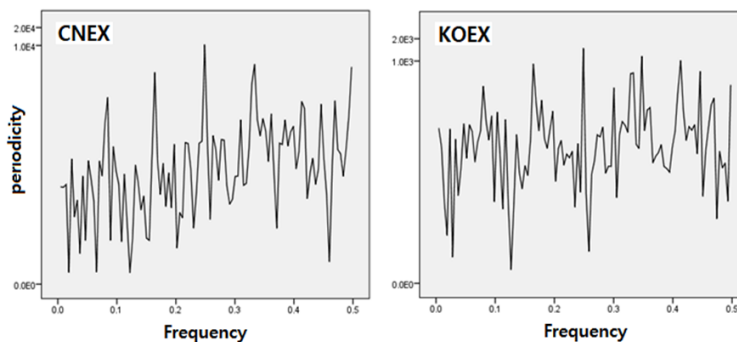


Figure 11. Periodicity according to Frequency

Table 5 :Auto Correlation Function - CNEX

Parallax	Auto Correlation	Standard Error	Box-Ljung Statistic		
			Value	Degree of freedom	Probability of significance
1	-.250	.068	13.477	1	.000
2	-.264	.068	28.642	2	.000

3	.054	.068	29.279	3	.000
4	.126	.068	32.763	4	.000
5	-.104	.067	35.134	5	.000
6	-.016	.067	35.187	6	.000
7	-.124	.067	38.609	7	.000
8	.126	.067	42.144	8	.000
9	.052	.067	42.755	9	.000
10	-.293	.067	62.095	10	.000
11	-.085	.066	63.738	11	.000
12	.636	.066	155.952	12	.000
13	-.088	.066	157.708	13	.000
14	-.273	.066	174.810	14	.000
15	.049	.066	175.361	15	.000
16	.100	.066	177.703	16	.000

Table 6 :Auto Correlation Function - KOEX

Parallax	Auto Correlation	Standard error	Box-Ljung statistic		
			Value	Degree of freedom	Probability of significance
1	-.181	.068	7.090	1	.008
2	-.082	.068	8.543	2	.014
3	.049	.068	9.058	3	.029
4	-.095	.068	11.032	4	.026
5	.000	.067	11.032	5	.051
6	.027	.067	11.194	6	.083
7	-.021	.067	11.292	7	.126
8	-.142	.067	15.774	8	.046
9	.096	.067	17.834	9	.037
10	-.165	.067	23.957	10	.008
11	.042	.066	24.362	11	.011
12	.352	.066	52.565	12	.000
13	-.087	.066	54.289	13	.000
14	-.094	.066	56.337	14	.000
15	.009	.066	56.355	15	.000
16	-.082	.066	57.903	16	.000

< Table5 >, < Table6 > and [Figure 12] show the Auto Correlation Function for CNEX and KOEX. The autocorrelation function represents the expected value $M[f(t)f(t+\tau_0)]$ of the product of the function at the other two points t and $t+\tau_0$, where the function $f(t)$ fluctuates with time or space. The ACF is a diagram(corogram) with a time difference that can be used to determine the existence and period of the cyclic fluctuation. In CNEX and KOEX, there was no parallax number and cycle.

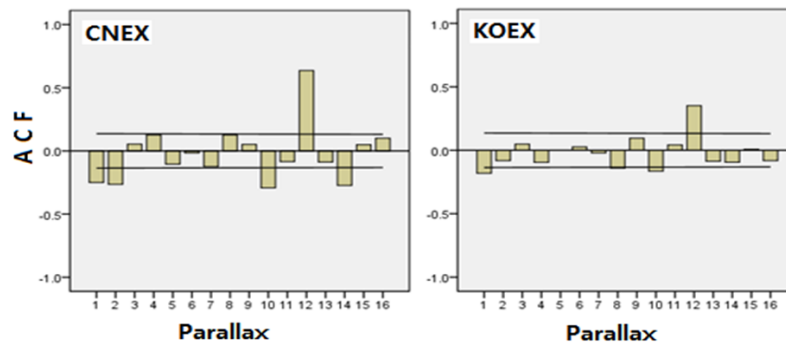


Figure 12. Auto Correlation Function : CNEX, KOEX

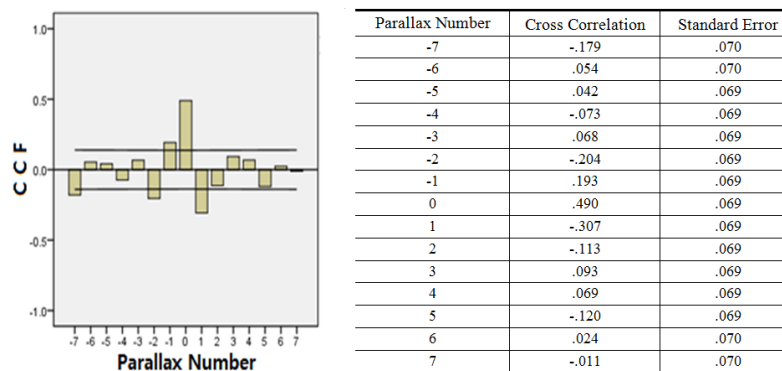


Figure 13. CNEX included with KOEX

[Figure 13] represents CNEX included with KOEX. In the figure, the X axis indicates the Parallax number, the Y axis indicates the CCF(Cross Correlation Function), the bar graph indicates the coefficient, the upper line indicates the confidence limit and the lower line indicates the confidence interval lower limit. CCF shows the correlation between two variables according to time lag. In the case of CNEX and KOEX, it is frequently switched from negative (-) to positive (+) and positive (+) to negative (-). CNEX and KOEX are interpreted as moving without time lag.

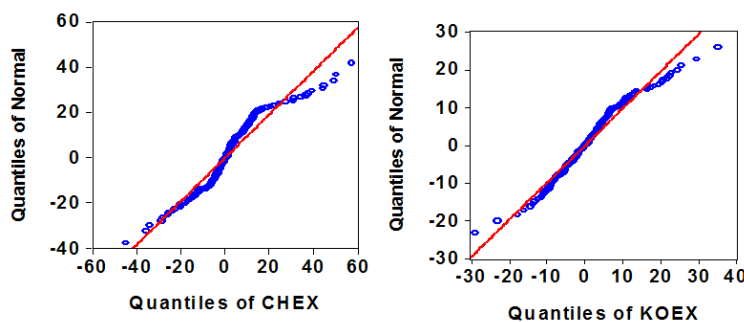


Figure 14. Quantile-Quantile Plot

Monthly Quantile-Quantile Plot over the last 210 months for CNEX and KOEX is shown in [Figure 14]. The figure shows CNEX and KOEX output data centered on 1: 1 line (red line). KOEX is moving closer to 1: 1 line relative to CNEX, showing a more stable flow. CNEX has shown large fluctuations in a relatively broader range.

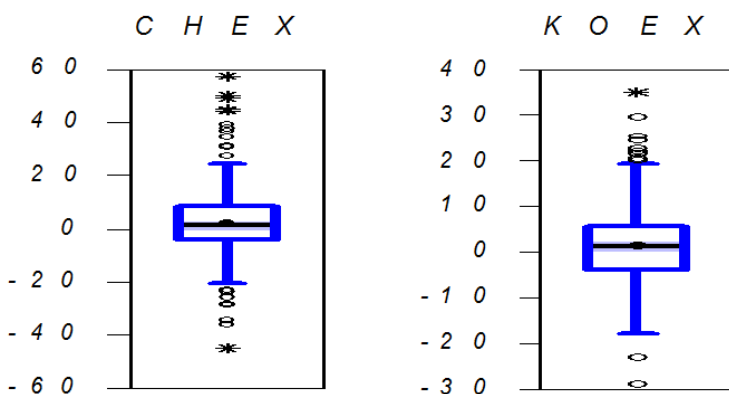


Figure 15. Box-Box Plot

Monthly Box-Box Plots for the last 210 months for CNEX and KOEX show in [Figure 15]. In the figure, CNEX has a relatively longer body and a topbottom longer tail than the KOEX, so showing a large variation. It can be seen that there is a lot of temporary abnormality(*) in the top and bottom of CNEX and KOEX.

5 Conclusion

The purpose of this study is to examine the relationship between China's exports to the world and Korea's exports to China, and to suggest directions for future Korea's exports. The analysis period was a total of 213 months from January 2000 to September 2017. We used Excel, e-views and SPSS for numerical analysis, indicator analysis and model analysis. As a result, China's exports to world have decreased since reaching US \$2.34 trillion in 2014. Korea's exports to China are declining to \$145.8 billion in 2013. The proportion of Korea's exports to China is falling since it recorded 26.07% in 2013. The share of trade balance also fell from 189% in 2012 to below 50% in 2016.

The correlation coefficient between China's exports to the world and Korea's exports to China by year was calculated as 0.9055. The correlation is showing very high harmonization phenomenon. In a regression analysis in which Korea's exports to China (KOEX) are dependent variables, the coefficient of China's exports to the world (CNEX) was 0.3040. We can recognize that KOEX increases by one unit when CNEX increases by 0.3040. In CNEX included with KOEX, CNEX and KOEX are interpreted as moving without time lag. As of 2016, Korea's exports to China account for 25.11% (1st) of total exports, but China's exports to Korea account for 4.48% (4th). It is also confirmed that China's exports to world and Korea's exports to China show high mutual harmonization phenomenon. In the Korean economy, China accounts for a large portion of exports and trade balance. Therefore, it is expected to be influenced greatly by the economic trend of China in the future. In order for Korea's exports to grow steadily in the future First, China's export to world should continue to increase Second, Korea should establish an export diversification strategy to other countries including China.

References

- [1] Yang, S. Y. (2016). Causes and countermeasures of recent decline in exports to China, *Korea International Trade Association*, Issue Brief, 11-12.

- [2] Choi, M. S. (2017). China's Export to World and Korea's Export to China : ARDL Bound Testing Approach, ***Journal of international trade and insurance***, 18(1), 277-296.
- [3] Park, J. J. (2013). China's Trade Elasticities to Real Effective Exchange Rate and Real Exchange Rate of RMB, ***Korea trade review***, 38(2), 229-254.
- [4] Choi, N. J. (2016). Effect of China Economy on the Korea Real Economy, ***A Study on the Northeast Asia***, 28(2), 95-125.
- [5] Kang, D. Y. etc. 2 (2014). An Analysis on the Economic Effects between Korean FDI in China and the KoreaChina Trade, ***Sino-Soviet Affairs***, 38(2), 79-115.
- [6] Hwang, S. O. &Cho, H. H. (2013). China and the Exports of Korea: Evidence from Industry Data, ***Korea Economic Review***, 31(1), 43-68.
- [7] Choi, J. I. &Kang, G. C. (2016). China's economic growth and export prices, ***China and sinology***, 28, 69-83.
- [8] Ak, D. etc. 2 (2017). The Effect of the American TBT on China's Export and the Countermeasures, ***Journal of Korea research association of international commerce***, 17(2), 99-120.
- [9] Seo, D. G. &Kang, S. J. (2016). Study of Korea and China's export competitiveness in the US market, ***Journal of Industrial Economics and Business***, 29(4), 1325-1344.
- [10] Hong, J. S. &Kim, G. N. (2014). An Empirical Study on the Relationship between China's Trade-related Policy Changes and Export Performance, ***The journal of Korea research society for customs***, 15(3), 135-152.
- [11] Jung, H. E. &Lee, S. C. (2015). A Study on Utilization and Performance E-Trading for Chinese Exporters, ***The journal of Korea research society for customs***, 16(2), 247-266.
- [12] Son, S. S. (2014). International Trade : A Study on the Economic Effects and Policy Implications of Korea-China FTA in Korea, ***International Area Studies***, 18(1), 381-405.

- [13] Kim, W. J. (2017). Korean ICT Export to China, Japan, and the United States, ***Korea China Social Science Research***, 15(1), 117-143.
- [14] Kim, H. C. (2016). Export Competitiveness of the Korean Automotive Industry in China, ***Journal of international trade & commerce***, 12(3), 293-310.
- [15] Kim, S. C. (2017). A Study on the Intra-Industry Trade and Implications for Korean Electric Home Appliances Industry in China, ***A Study on the Northeast Asia***, 27(4), 35-58.
- [16] Choi, E. H. (2014). Fluctuation of the Korean Export to China and Industrial Characteristics, ***A Study on the Northeast Asia***, 26(2), 1-25.
- [17] Choi, Y. H. & Nam, D. Y. (2014). A Study on Steel Trade Structure and Export Competitiveness of Korea, China and Japan, ***Journal of Chinese studies***, 43, 505-528.
- [18] Lee, Y. S. & Kwon, S. G. (2015). The KoreaChina FTA and the Export Promotion Strategies for Korean Agri-Food to China, ***International commerce & law review***, 67, 187-208.
- [19] Baek, Y. M. & Lee, J. S. (2016). A Study on Strategy for Facilitating Exports of Korean Food to China through E-Commerce, ***E-trade review***, 14(1), 1-21.
- [20] Na, W. C. (2014). Analysis of the Chinese bottled water market and export strategy for Korean firms, ***Korea trade review***, 39(1), 77-108.
- [21] Chang, E. J. & Park, W. B. (2015). A Study on the Entry Strategy for Korean firms to Chinese bottled water market in the Korea-China FTA era, ***AJU Law***, 9(3), 519-546.

