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A Dynamic Study Between Export from China to South Korea and Economic Growth in China

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Abstract

This paper applies annual data from 1998 to 2016 to search for the dynamic operating mechanism between export from China to South Korea and economic growth in China. The vector error correction model is utilized to conduct an empirical analysis. The results indicate that there is a long-run relationship between them. In more specifically, if the export from China to South Korea increases by 1 per cent, the economic growth in China will increases by 0.769 per cent. Meanwhile, the result of Granger causality test also reveals that there is an unidirectional causality between them exists under 5 per cent significance level. More importantly, the result of vector error correction mechanism shows that when the economic growth is derivate from the long-run equilibrium in the short run, it will return to the long-run equilibrium by 2.2 per cent.

Keywords: Economic Growth, Export from China to South Korea, Vector Error Correction Model
JEL Classification: C02; F10; F19

INTRODUCTION

Since the establishment of China and South Korea diplomatic relations in 1992, economic and trade relations between China and South Korea have made great progress. Especially, due to China-South Korea free trade agreement signed, South Korea has become the second largest country in Asia to trade with China. The Commerce Department said that the export trade from China to South Korea is one of the most important powerful engine to drive economic growth in China. According to the data from the General Administration of Customs of the People's Republic of China, the amount of export from China to South Korea is only 2.41 billion U.S. dollars. However, in 2016, it has rapidly increased up to 111.41 billion U.S. dollars. Namely, its average annual growth rate is 581.05 per cent during these 19 years. Meanwhile, it is just this period that the economy in China also has obtained tremendous progress. More specifically, when the diplomatic relation is established between China and South Korea, the GDP in China is no more than 491 billion U.S. dollars. However, in 2016, it has greatly increased to 11000 billion U.S. dollars. In other word, its average annual growth rate is 112.65 per cent during these 19 years. Presumably, the export from China to South Korea and the economic growth move in the same direction.

Recently, this proposition attracts quantities of economists and researchers to study on it. Therefore, this paper tries to explore the dynamic relationship

between export from China to South Korea and economic growth in China. The biggest difference between this paper and others is that China is a biggest country and South Korea is relative smaller in Asia. In economic theory, export trade can increase trade balance of a country, which can promote economic growth. However, big entity economy has a great effect on small. Conversely, small entity economy may not can affect the big. The current situation of China and South Korea is in keeping with this economic theory. This is also the difference and innovation of this paper when compared it with other researches. The paper applies annual data from 1998 to 2016 to conduct an empirical analysis under the vector error correction model so as to make the operating mechanism between export from China to South Korea and economic growth in China more clear. Therefore, on the basis of empirical analysis results, measures should be taken to balance the relationship between two of them.

At present, there is no unanimity in the empirical and theoretical literature on the causal relationship between export and economic growth in the economic field. It is said that the foreign trade and the economic growth move in the same. due to this, Wei & Chen (2010) investigates that two of them have a quite closed relation. They find that the export has a positive effect on economic growth. Moreover, their empirical analysis results also reveal that there exists mutual causality between export and economic. Chen & Tang (2010) take Tianjin city as a case to explore the relationship between export and economic based on co-integration test. their findings indicate that the export has a positive effect on economic growth in its current period and lag one period in the short run. Seen from the long run, there is a long-run relationship between two of them. He, Gu & Fan (2010) established a simultaneous equations model to grope the mechanism of action among exchange rate, export and economic growth. Their results demonstrate that the depredation of exchange rate can expand the export, which can promote economic growth. However, the economic growth and export expansion can lead to an increase in real exchange rate, which satisfies Balassa-Samuelson Hypothesis. Additionally, the Exported Led Growth Hypothesis exists between export and economic growth. Conversely, the Growth Led Export Hypothesis does not hold between two of them. Li (2011) sets Hubei province as an example to conduct an empirical analysis using current twenty-year data. His findings reveal that an increase in the export can result in the economic growth as the multiplier effect. Li (2010) searches for the relationship between export and economic growth combining with theoretical and practical. He not only treats the total export as independent variable, but also treats the service export, the goods export, the primary export, industrial export and others categorized by the Standard International Trade Classification as independent variables. The empirical analysis results show that an increase in export can directly lead to an increase in economic growth. Furthermore, the employment, consumption, government expenditure and import are also be affected. Owing to this, the export can indirectly promote economic growth.

Lei, Yuan & Fu (2011) apply the annual data from 1979 to 2008 to examine the relationship between export and economic growth. The co-integration results show that the export has a positive effect on economic growth in the long run. The results of error correction model verifies that the export has a negative effect on economic growth in the short run. Still the results of Granger

causality test reveal that the export can lead to economic growth. Conversely, the economic growth can not result in export. Dai (2011) uses the panel data to investigate the impact of service export on economic growth from 1997 to 2009. His findings show that the service export has a significantly positive effect on economic growth. Namely, the more complicated the service export is, the more significant its impact on economic growth is. Wang (2011) probes into the traditional issue about linkage the export trade and economic growth. He finds that has positive effect on economic growth whether in the long run or in the short run. Zhang & Wu (2011) take use of the partial least squares regression to reexamine the relationship among consumption, investment, export and economic growth. They utilize the data from 1997 to 2008 and divide this period into three parts via Hodrick Prescott filter analyzing the economic cycle. Their findings indicate that the export has an impact on economic growth from decreasing to increasing.

Liu (2012) performs an empirical analysis to looking for the operating mechanism among export trade, economic growth and employment. His findings demonstrate that there is a long-run relationship among them. He also finds that the economic growth is the Granger causality of export trade. However, the export trade is not the Granger causality of economic growth. Han, Zhang & Li (2012) set BRICS (Brazil, Russia, China, India and South Africa) as an example to investigate the impact of foreign trade and foreign direct investment on economic growth. They use the Cobb-Douglas production to construct panel-data model. Their findings show that the foreign trade has an effect on economic growth in BRICS and its effect on BRICS's economic growth move in the same direction. But there is a big difference in BRICS. Gao, Wang & Su (2012) utilize the semi-parametric generalized additive model to analyze the impact of export specialized on economic growth. Their results suggest that actually the export in China shows in the form of non-linearity. Due to the specialization of export, it has an unfavorable effect on economic growth. Zhao and Lei (2013) set Shanxi province as a research object to analyze the impact of trade on economic growth from 1990 to 2011. Based on an empirical analysis, Their findings show that an increase in export can promote economic growth in Shanxi province. Its impact on economic growth is relatively significant. Gai et al. (2013) focused on the relationship between agricultural export and economic growth in Shandong province. The long-run and short-run equilibrium relationship between them exists. The results show that the agricultural export has a positive effect on economic growth and there is a unidirectional between them from the agricultural export to economic growth.

Zhou & Lv (2014) use the monthly data to construct the structure vector autoregression. there is the long-run dynamic relationship among export, foreign direct investment and economic growth. The results of empirical analysis reveal that the impact of foreign direct on economic growth is very significant, However, the impact of export on economic growth is quite limited. Hu (2014) conduct the Hodrick Prescott filter, relation correlation analysis, co-integration test and Granger causality test to find out the contribution of export to economic growth. He finds that the export poses a great contribution to economic growth. Zhang & Huang (2015) try to investigate the interaction between export product diversification and economic growth. They apply province panel data from 1998

to 2009 to conduct an empirical analysis under the semi-parameter regression model. His findings manifest that the diversification of export product can facilitate economic growth. Meanwhile, the economic growth can not lead to the diversification of export product. Xing (2015) uses the data from 1982 to 2012 to study the current situation of service export and economic growth. He performs an empirical analysis under the vector error correction model. He finds that in the short time the fluctuation of export has a positive effect on economic growth. More importantly, there is a long-run relationship between of them. However, He also finds that the impact of export on economic growth is not very significant due to the lower development of tertiary industry.

Gibba (2016) investigated empirically how export determines and economic growth sustains in Sub-Saharan Africa using Angola, Cote d'Ivoire, Nigeria, and South Africa as case studies. He implies the estimation of the Augmented Dickey Fuller unit root test, and Granger causality test to test the positive effects of export expansion and diversification to economic growth with the help of a vector auto regression model. His findings indicate that the total export of the examined countries have a positive effect on their economic growth at a rate of 85.7 per cent, 49.1 per cent, 76.9 per cent, and 87 per cent, for Angola, Cote d'Ivoire, Nigeria, and South Africa respectively. Verter & Bečvářová (2016) investigate the impact of agricultural exports on economic growth in Nigeria by using ordinary least square regression, Granger causality, Impulse Response Function and Variance Decomposition approaches. Both the ordinary least square regression and Granger causality results agree the hypothesis that agricultural exports-led economic growth in Nigeria. Their results, however, indicate an inverse relationship between the agricultural degree of openness and economic growth in the country. Impulse Response Function results fluctuate and reveal an upward and downward shocks from agricultural export to economic growth in the country. The Variance Decomposition results also show that a shock to agricultural exports can contribute to the fluctuation in the variance of economic growth in the long run. Mahadika, Kalayci, & Altun (2017) use time-series and co-integration test from 1981 to 2013, They examines the long-run relations between foreign direct investment, economic growth and export volume of Indonesia. The impact of Indonesian export volume and foreign direct investment on Indonesian GDP are measured in their research. They find that export volume and foreign direct investment have significant influence on economic growth of Indonesia. In addition, according to Johansen co-integration test, there is a long-run relationship between economic growth, foreign direct investment and export volume of Indonesia.

METHOD

An error correction model belongs to a category of multiple time series models which are most commonly used for data where the emphasizing variables have a long-run stochastic trend, also known as co-integration. Error correction models are a theoretically-driven approach which is useful for estimating both short-run and long-run effects of one time series on another. The term error-correction is related to the fact that last-periods deviation from a long-run equilibrium, the error, influences its short-run dynamics. Thus, error correction

models directly estimate the speed at which a dependent variable returns to equilibrium after a change in other variables.

Yule (1936); Granger & Newbold (1974) are the first to pay attention to the problem of spurious correlation and detect solutions on how to explain it in time series analysis. Provided two absolutely unrelated but integrated time series which are non-stationary, the regression analysis of one on the other will plan to generate an apparently statistically significant relationship and thus, a researcher might falsely believe to have found evidence of a true relationship among these variables. The ordinary least squares will no longer be consistent and commonly used test-statistics will be non-valid. In particular, Monte Carlo simulations indicate that one will reach a very high R-squared, very high individual t-statistic and a low Durbin-Watson Statistic. Technically speaking, Phillips (1986) verifies that parameter estimates will not converge in probability, the intercept will diverge and the slope will have a non-degenerate distribution as the sample size becomes bigger. However, there might a common stochastic trend to both series that a researcher is genuinely interested in because it demonstrates a long-run relationship among these variables. Due to the stochastic nature of the trend it is not possible to break up integrated series into a deterministic (predictable) trend and a stationary series containing deviations from trend. Even in deterministically detrended random walks which goes spurious correlations will eventually emerge. Thus detrending doesn't solve the estimation problem. In order to still take use of the Box-Jenkins approach, one can difference the series and then, estimate models such as ARIMA, Provided that many commonly used time series appear to be stationary in first differences. Forecasts from such a model will still indicate cycles and seasonality present in the data. However, any information about long-run adjustments that the data in levels may contain is omitted and longer term forecasts will be unreliable. This lead to develop the error correction methodology, which retains the level information.

Granger 2-step approach

The first step of this method is to pretest the individual time series that one uses in order to make sure that they are non-stationary in the first place. This can be conducted by Augmented Dickey–Fuller test which is to test if errors are serially correlated or otherwise. Taking the case of two different series and for example, if both are I(0), standard regression analysis will be valid. If they are integrated of a different order, one should transform the model.

If they are both integrated to the same order (commonly I(1)), an error correction model of the form can be estimated:

$$A(L)\Delta y_t = r + B(L)\Delta x_t + \alpha(y_t - \beta_0 - \beta_1 x_{t-1}) + v \quad \ldots\ldots\ldots\ldots\ldots \quad (1)$$

If both variables are integrated and this error correction model exists, they are co-integrated by the Engle–Granger representation theorem.

The second step is, then, to estimate the model which is using ordinary least squares:

$$y_t = \beta_0 + \beta_1 x_t + \mu_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

If the regression is not spurious as determined by test criteria described above, the ordinary least squares will not only be valid, but in fact super

consistent (Stock, 1987). Then the forecasted residuals $\breve{\mu}_t = y_t - \beta_t - \beta_1 x_t$ from this regression are saved and used in a regression of differenced variables plus a lagged error term.

$$A(L)\Delta y_t = r + B(L)\Delta x_t + \alpha\breve{\varepsilon}_{t-1} + v_t \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

One can then test for co-integration which is using a standard t-statistic on α. While this approach is easy to apply, there are, however numerous problems: The first is that univariate unit root tests which are used in the first stage have low statistical power. The second is that choice of dependent variable in the first stage influences testing results. The third is that one can potentially have a small sample bias. The fourth is that co-integration test on does not obey a standard distribution. The fifth is that validity of the long-run parameters in the first regression stage where one gets the residuals cannot be verified because the distribution of the ordinary least squares estimator of the co-integrating vector is highly complicated and non-normal. The sixth is that at most one co-integrating relationship can be examined.

Vector Error Correction Model

The Engle-Granger approach as described above exists quantities of weaknesses. Namely, it is restricted to only a single equation with one variable designated as the dependent variable, which is explained by another variable that is assumed to be weakly exogeneous for the parameters of interest. It also depends on forecasting the time series to work out whether variables are I(0) or I(1). These weaknesses can be explained via the use of Johansen's procedure. Its advantages include that forecasting is not necessary, there can be numerous co-integrating relationships, all variables are regarded as endogenous and tests which are relating to the long-run parameters are possible. The resulting model is known as a vector error correction model, as it pluses error correction features to a multi-factor model which is known as vector auto regression. The procedure is performed as follows: The first step is to estimate an unrestricted vector auto regression which is involving potentially non-stationary variables. The second step is to test for co-integration which is using Johansen test. The third step is to form and analyze the vector error correction model.

RESULTS AND DISCUSSION

Data Description

There are two variables in this paper. They are the real GDP and the real amount of export from China to South Korea. Due to the establishment of China and South Korea diplomatic relations in 1992, it is hard to search for data more before 1992. Additionally, the official website of National Bureau of Statistics of the People's republic of China only provides data from 1998. Therefore, the annual dat from 1998 to 2016 will be applied to conduct an empirical analysis. In order to get real values, all datum are deflated by their deflators. To remove the heteroscedasticity existence in the data, all variables are taken the logarithm. They will be displayed in Table 1.

Table 1. Variables and their definitions

Variable	Definition	Source
log *RGDP*	Real GDP	National Bureau of Statistics of the People's republic of China
log *CTK*	Real amount of export from China to South Korea	National Bureau of Statistics of the People's republic of China

Source: Authors (2018)

Unit Root Test

In this paper, all datum are time series. Before using these datum to conduct an empirical analysis, the stationarity of them should be tested so as to avoid the specious regression. If the datum at their own levels are stationary, the model can be established at these own levels directly. Conversely, if not, the difference should be performed until they are stationary. This paper will use Augmented Dickey-Fuller test to verify the stationarity of these time series. More specifically, the hypothesis is that all variables are non-stationary. If the testing result rejects the original hypothesis in terms of significance, it will indicate that this time series is stationary. On the contrary, if not, it will demonstrate that this time series is non-stationary. The testing results will be shown in Table 2.

Table 2. Result of unit root test

Variable	ADF Test Statistic	Test critical value 5%	P-Value	Result
log *RGDP*	-0.757	-3.052	0.806	Non-rejected
log *CTK*	-2.776	-3.040	0.081	Non-rejected
D log *RGDP*	-3.302	-3.052	0.031	Rejected
D log *CTK*	-3.703	-3.052	0.014	Rejected

Source: Authors (2018)

Note: D represents the first difference

Table 2 indicates the results of unit root test. the results reveal that the real GDP and the export from China to South Korea does not get through under 5% significant test. It means that these two variables are non-stationary at their own levels. However, after first difference, these two variables become stationary under 5% significant test. Then, co-integration test should be conducted further.

Co-integration Test

In general, There are two methods often using to perform a co-integration test. one is the Johanson co-integration test. Another is the Engle-Granger two-step method. Because this paper only involves two variables, the Engle-Granger two-step method will be applied to conduct a co-integration test.

If x_t and y_t are non-stationary and co-integrated, then a linear combination of them must be stationary. In other words:

$$y_t - \beta x_t = \mu_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

where μ_t is stationary.

If we knew μ_t, we could just test it for stationarity with something like a Dickey-Fuller test. However, because we do not know μ_t, we must estimate this

first, generally by using ordinary least squares, and then run our stationarity test on the estimated μ_t series, often denoted $\breve{\mu}_t$. A second regression is then run on the first differenced variables from the first regression, and the lagged residuals $\breve{\mu}_{t-1}$ is included as a regressor. The result of ordinary least squares give in Table 3.

Table 3. Results of Ordinary Least Squares

Variable	Coefficient	Std. Error	t-Statistic	Prob.
$\log CTK$	0.769	0.050	15.344	0.000
C	3.192	0.081	39.300	0.000
$R-squared = 0.933$		$AdjustedR-squared = 0.929$		$D.W. = 2.312$

Source: Authors (2018)

$$\log RGDP = 0.769 \log ETK + 3.192 \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

Equation (5) indicates that the real GDP has a positive effect on export from China to South Korea in the long run. Meanwhile, $\log ETK$ gets through the significant test under 5% level. $AdjustedR-squared = 0.929$ indicates that the explanatory variable has a good ability to interpret the explained variable. $D.W. = 2.312$ also shows that all sequences have no auto correlation. In order to keep this long-run relationship more precise, the stationarity of residual in equation (5) should be kept. The unit root test of residual in equation (5) gives in Table 4.

Table 4. Unit Root Test of Residual in Equation (2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test Statistic		-3.848	0.012
Test critical values:	1% level	-3.887	
	5% level	-3.052	
	10% level	-2.667	

Source: Authors (2018)
Note: *Mackinnon (1996) one-side p-values

Table 4 indicates that the residual of equation (5) is stationary under 5% significant level. Combined Table 3 and Table 4, it means that there is a long-run relationship between real GDP and export from China to South Korea. More specifically, seen from the long run, 1 per cent increase in the export from China to South Korea will result in 0.769 per cent in economic growth in China.

Granger Causality Test

The co-integration test proves that there is a long-run equilibrium relationship between real GDP and export from China to South Korea. The Granger causality test aims to test the causality between real GDP and export from China to South Korea. The result of Granger causality test shows in Table 5.

Table 5. Granger Causality test

lags	Null Hypothesis	Obs	F-Statistic	Prob.
1	$\log ETK$ does not Granger Cause $\log RGDP$	18	71.559	0.000
1	$\log RGDP$ does not Granger Cause $\log ETK$		0.008	0.932

Source: Authors (2018)

Table 5 indicates that the hypothesis that $\log ETK$ does not Granger Cause $\log RGDP$ is rejected. And the hypothesis that $\log RGDP$ does not Granger Cause $\log ETK$. It means that an unidirectional causality between export from China to South Korea and economic growth exists under 5 % significance level. Still more, the conclusion that $\log ETK$ does not Granger Cause $\log RGDP$ is rejected is in accordance with co-integration test results. It indicates that the export from China to South Korea can promote the economic growth in China.

Vector Error Correction Model

The co-integration test results suggest that the long-run equilibrium relationship between export from China to South Korea and economic growth in China exists. But this kind of dynamic equilibrium relationship is always changeable when the system suffers from shocks. However, the mechanism of systematic error correction can help this derivation generally to return to equilibrium state. Therefore, we can investigate the short-run relationship between export from China to South Korea via establishing vector error correction model. The vector error correction model gives:

$$D\log RGDP_t = \alpha D\log GRGDP_{t-1} + \beta D\log ETK_{t-1} + \lambda ecm_{t-1} + C \quad \ldots\ldots\ldots\ldots \quad (6)$$

By conducting estimation, the coefficients of equation (6) gives in Table 6.

Table 6. Coefficients of Vector Error Correction Model

Coefficient	α	β	λ	C
Value	0.779 (0.205) [3.809]	0.088 (0.030) [2.877]	-0.022 （0.038） [-5.592]	0.066 (0.111) [0.590]

Source: Authors (2018)

Note: Standard errors in ( ) & t-statistics in [ ]

Specifically, the estimation of vector error correction model gives:

$$D\log RGDP_t = 0.779D\log RGDP_{t-1} + 0.088D\log ETK_{t-1} - 0.022ecm_{t-1} + 0.066 \quad (7)$$

Equation (7) indicates the estimated results of vector error correction model. The value of adjusted R-squared is 0.783. it means that this model has a strong ability to address the relation among them. the coefficient of ecm_{t-1} is – 0.022 and it gets through significant test under 5% level. Also, the negative coefficient of ecm_{t-1} represents the converse correcting mechanism. When ecm_{t-1} is greater than zero, ecm_{t-1} can reduce the $D\log RGDP_t$. When ecm_{t-1} is less than zero, ecm_{t-1} can increase the $D\log RGDP_t$. This reflects that the impact of each kinds of factors on in the short run. The magnitude of ecm_{t-1}'s coefficient stands for that the ability of short-run derivation of $D\log RGDP_t$ returns to the long-run equilibrium. The coefficient of ecm_{t-1} is –0.022, which means that the adjusting degree (2.2%) of $D\log RGDP_t$ from short-run fluctuation to log-run fluctuation. In summary, if $D\log RGDP_t$ derives from the long-run equilibrium, $D\log RGDP_t$ will be beck to the long-run equilibrium by 2.2 per cent under the function together with all factors.

Impulse Response Function

In shock processing, the impulse response function of a dynamic system is its shock offering when presented with a brief shock suffering, called an impulse. More generally, an impulse response function is the reaction of any dynamic system in response to some external change. In both cases, the impulse response function describes the reaction of the system as a function of time (or possibly as a function of some other independent variable that parameterizes the dynamic behavior of the system). In this paper, the results of impulse response function show in Figure 1 and Figure 2.

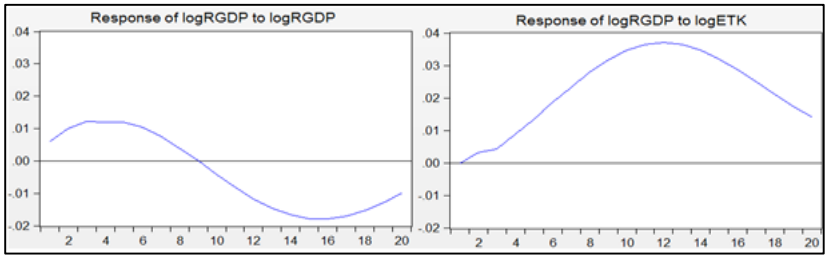

Figure 1. Response to Cholesky One S.D. Innovations (log *RGDP* to log *ETK*)
Source: Authors (2018)

Figure 1 illustrates that the economic growth suffers a standard deviation's shock from itself and the export from China to South Korea. In relation to a standard deviation's shock from itself, when the economic growth suffers a standard deviation's shock from itself, it has a positive effect on itself from period one (0.006) to period three (0.012). Then, its impact will keep unchanged until period five (0.012). After that, its impact will be weakened from period five (0.012) to period sixteen (-0.018). However, from period sixteen, its impact start to increase.

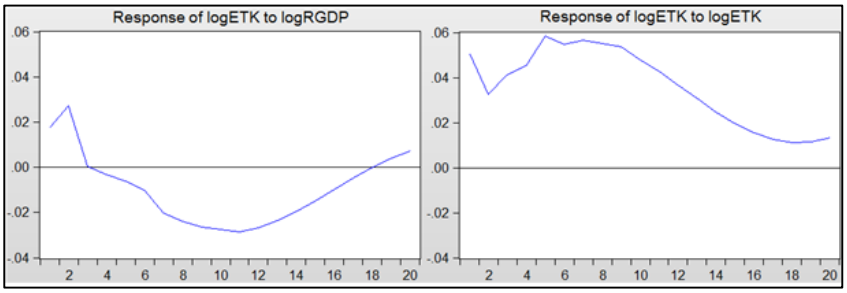

Figure 2. Response to Cholesky One S.D. Innovations (log *ETK* to log *RGDP*)
Source: Authors (2018)

As for a standard deviation's shock from the export from China to South Korea, when the economic growth suffers a standard deviation's shock from the export from China to South Korea, it has a positive effect on economic growth from period one (0.000) to period twelve (0.037). After that, its impact will be weakened.

Figure 2 illustrates that the export from China to South Korea suffers a standard deviation's shock from itself and the economic growth. In relation to a standard deviation's shock from itself, when the export from China to South Korea suffers a standard deviation's shock from itself, it has a negative effect on

itself from period one (0.050) to period two (0.032). Then, its impact become positive from period two (0.032) to period five (0.059). After that, its impact on itself will experience a little fluctuation. From period seven (0.057), its impact will be weakened again. In relation to a standard deviation's shock from economic growth, when the export from China to South Korea suffers a standard deviation's shock from economic growth, it has a positive effect on export from China to South Korea from period one (0.018) to period two (0.027). Then, its impact will become negative effect on export from China to South Korea from period two (0.027) to period eleven (-0.029). After that, its impact will become positive again.

Variance Decomposition

In econometrics and other applications of time series analysis, a variance decomposition is used to aid in the interpretation of a vector error correction model once it has been fitted. The variance decomposition indicates the amount of information each variable contributes to the other variables. It determines how much of the forecast error variance of each of the variables can be explained by exogenous shocks to the other variables. The results of variance decomposition show in Figure 3 and Figure 4.

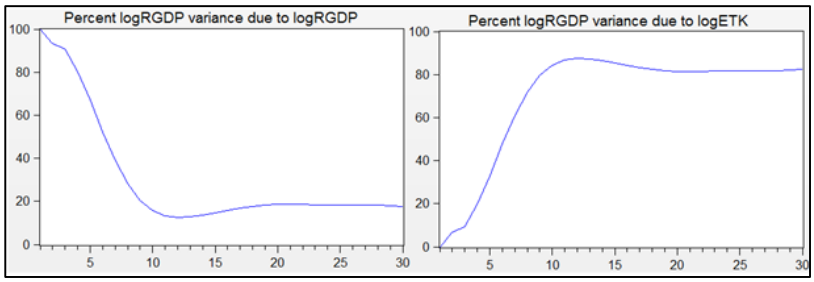

Figure 3. Variance Decomposition (log *RGDP* to log *ETK*)
Source: Authors (2018)

Figure 3 provides the contribution degree to the change of economic growth due to the economic growth, itself, and the export from China to South Korea. As for the contribution degree of itself, it presents a decreasing trend from period one (100%) to period twelve (12%). Then, it starts to increase. After period eighteen, its contribution degree is always keeping at 18 per cent. As for the contribution degree from the export from China to South Korea, it keeps increasing from period one (0%) to period twelve (88%). Then, it starts to decrease a bit. After period nineteen, it remains at 82 per cent. To sum up, the export from China to South Korea contributes much on economic growth.

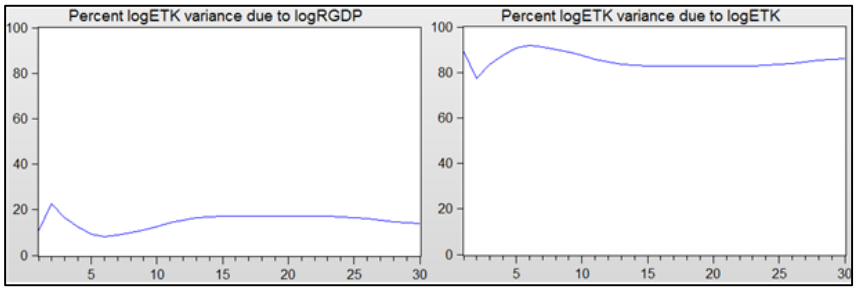

Figure 4. Variance Decomposition (log *ETK* to log *RGDP*)
Source: Authors (2018)

Figure 4 presents the contribution degree to the change of export from China to South Korea due to the economic growth and the export from China to South Korea, itself. As for the contribution degree of itself, it provides a decreasing trend from period one (89%) to period two (77%). From period two to period six, its contribution degree on itself starts to increase from 77 per cent to 92 per cent. Then, it begins to increase from period six (92%) to period fifteen (83%). After that, it keeps in the same level. Finally, it keeps in the degree of 86%. As for the contribution degree from the economic growth, it keeps increasing from period one (11%) to period two (23%). From period two to period six, its contribution degree on itself starts to decrease from 23 per cent to 8 per cent. Then, it starts to increase a bit. Eventually, it remains at 14 per cent. In summary, the economic growth contributes much on export from China to South Korea.

CONCLUSION

This paper uses annual time series from 1998 to 2016 to explore the dynamic operating mechanism between export from China to South Korea and economic growth in China under vector error correction model. The co-integration test indicates that there is a long-run relationship between them. More specifically, an increase in the export from China to South Korea will result in an increase in economic growth in China. Moreover, the Granger causality test also demonstrates that the export from China to South Korea is a major factor to influence economic growth in China namely, the export from China to South Korea can promote economic growth in China. Most importantly, the results of vector error correction model reveal that the adjusting ability of economic growth from short-run fluctuation to long-run equilibrium state is positive. In other word, if the economic growth is derived from the long-run equilibrium, under the function together with all factors, the economic growth will generally return to long-run equilibrium. In summary, the export from China to South Korea has positive effect on economic growth in China.

REFERENCES

Chen, Y., & Tang, H. (2010). Co-integration Analysis on the Relationship Between Export and Economic Growth-Based on of the Data of Tianjin from 1980 to 2007. *Technoeconomics & Management Research, 1*, 16–19.

Dai, X. (2011). Technology Complexity, Economic Growth: Based on Multinacional Panel Data. *Nankai Economic Studies, 3*, 57–68.

Gai, X., Han, R., Guo C. X., & Li, M. G. (2013). A Study on the Relationship between Agricultural Product Export and Agricultural Economic Growth. *Guangdong Agricultural Sciences, 2*, 205–209.

Gao, L. Y., Wang, L. L., & Su. Q. Y. (2012). Professionalization of China's Export and it Economic Growth. *Economic Research Journal*, *5*, 83–95.

Gibba, A. (2016). Evaluarion of Export Expansion Impact on the Economic Growth in Sub-Saharan Africa. *Journal of Management, 29*(2), 57–61.

Granger, C. W., & Newbold, P. (1974). Spurious regressions in econometrics. *Journal of econometrics, 2*(2), 111–120.

Han, J. B., Zhang, Z., & Li, Y. X. (2012). A Contrastive Study on the Impact of Import and Export and FDI on the Economic Growth of the BRIC Five Countries. *Journal of International Trade, 11*, 66-73.

He, X. R., Gu, M., & Fan, F. S. (2010). Exchange rate of RMB, Export Trade and Economic Growth: Based on Competitive Bilateral Trade between China-U.S and China-Japan. *Statistics & Information Forum*, *25*(5), 41–46.

Hu, J. (2014). Export Trade and Economic: Evidence from Jiangsu Province. *Journal of Jiangsu University: Social Science Edition*, *16*(2), 57–63.

Lei, Q. Z., Yuan, H. Y., & Fu, J. Y. (2011). Export Trade and Economic Growth: Application from China. *Inquiry into Economic Issues*, *4*, 7–11.

Li, B. L. (2011). Contribution of Export Trade on Economic Growth in Hebei. *Reform & Opening*, *2*(4), 1–12.

Li, L. H. (2010). Impact of Foreign Trade on Economic Growth in China. *Scientific Decision / Scientific Decision Making*, *3*, 10–22.

Liu, X. P. (2012). Export Trade, Economic Growth and Employment in China: Based on the Data from 1978-2010. *Journal of International Trade*, *11*, 32–41.

Mahadika, I. N., Kalayci, S., & Altun, N. (2017). Relationship between GDP, Foreign Direct Investment and Export Volume: Evidence from Indonesia. *International Journal of Trade, Economics and Finance*, *8*(1), 51.

Phillips, P. C. (1986). Understanding spurious regressions in econometrics. *Journal of econometrics*, *33*(3), 311–340.

Stock, J. (1987). Asymptotic Properties of Least Squares Sstimators of Cointegrating Vectors. *Econometrica: Journal of the Econometric Society*, 1035–1056.

Verter, N., & Bečvářová, V. (2016). The impact of agricultural exports on economic growth in Nigeria. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, *64*(2), 691–700.

Wang, P. (2011). China's Export Trade and its Economic Growth. *Mathematics in Practice and Theory*, *41*(15), 45–49.

Wei, J. Y., & Chen, Y. N. (2010). An Empirical Analysis of the Relationship between Foreign Trade and Economic Growth in China. *Journal of Huazhong University of Science and Technology (Social Science Edition)*, *24*(3), 113–117.

Xing, X. J. (2015). Service Trade and Economic Growth: Based on Data from1982-2012. *Technoeconomics & Management Research*, *9*, 28–32.

Yule, E. (1936). Spontaneous Rupture of a Pregnant Uterus and Subsequent Atrophy of Fibroids. *The British Medical Journal*, 582–582.

Zhang, M. Z., & Huang, S. L. (2015). Impact of Diversity of Export Product on Economic Growth.

Zhang, Z. J., & Wu, D. Y. (2011). Consumption, Investment, Export and Economic Growth: Based on PLS. *Journal of Hunan University (Social Sciences)*, *25*(6), 61–65.

Zhou, J., & Lv, D. H. (2014). Export, FDI and Economic Growth: Based on SVAR Model. *Journal of Shanghai Lixin University of Commerce*, *28*(2), 104–112.

Zhao, Q., & Lei, Y. (2013). Export Trade and Economic Growth: Evidence from Shanxi Province. *Journal of Northwest University (Philosophy and Social Sciences Edition)*, *43*(4), 80–85.