Exports, Imports, and Economic Growth in North Korea*

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Abstract

North Korea is trying to transit its economic system towards market oriented economy. Many transition economies have experienced rapid growth through inflow of foreign capital and expansion of exports. The objective of this paper is to investigate relationship between trade and economic growth in North Korea. We employed Johansen cointegration test and Granger causality test for this study using annual data over the period from 1991 to 2015 that is based on data available. Empirical results found that there is a long-run relationship between exports and growth, and imports and growth. And there is uni-directional causality running from exports to growth, and bi-directional causality between imports and growth in North Korea. These results reveal that export expanding policy will stimulate exports and economic growth. Imports also stimulates economic growth in North Korea. We can conclude that introduction of open-door policy is essential for sustainable economic growth in North Korea. North Korea has a high potential for rapid growth because of rich natural resources and geographical advantage located among Asia's biggest economy China, South Korea and Japan. North Korea could fully enjoy the latecomer's advantage in economic development lessons that experienced by many transition economies. The politic reform and economic reform may attract foreign capital and it strongly stimulates North Korea's trade. Therefore, North Korea should promote the export in order to promote economic growth by introduction of open-door policy and economic reform such as guarantee of foreign direct investment, trade liberalization, trade facilitation, and eliminate the non-tariff barriers.

Keywords: North Korea; Export; Cointegration test; Granger causality test

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Introduction

North Korea is trying to introduce the open-door policy and market based economic system. The country has a high potential for rapid economic growth because of rich natural resources and geographical advantage located among Asia's biggest economy China, South Korea and Japan. North Korea could enjoy the latecomer's advantage in economic development lessons that experienced by many transition economies. The transition towards market based economy took place in many socialist countries, such as China in 1970s, Vietnam and Myanmar in 1980s. These transition economies have experienced rapid expansion of international trade and economic growth. The experiences of Asian transition economies could help North Korea with development policy for long term economic growth in North Korea.

China has achieved remarkable growth since adaption of open-door policy in 1978 and economic reform policy towards market based economy. The reform has attracted foreign direct investment and it strongly stimulated China's international trade. Foreign direct investment and exports significantly contributed to rapid growth on China's economy (Liu et al, 2002; Akyüz, 2011; Hye, 2012; Nguyen, 2017). Vietnam has experienced also very high economic growth since the Doi Moi (open-door) policy, shifting from a centrally planned economy to a market oriented economy, was introduced in 1986. Vietnamese government started opening doors to international trade, foreign direct investment and development assistance (Liaw et al, 2012; Hoang, 2014). The open-door policy has increased in foreign direct investment and productivity, and it stimulated the economy to a remarkable extension (Nghiep and Quy, 2000; Wagstaff and Nguyen, 2002; Nguyen and Sun, 2012). With the liberalization of economy, foreign direct investment began to flow into Vietnam. Doi Moi policy led Vietnam to escape the poverty trap and emerged as a lower middle-income country in the late 2000s (Thot, 2013).

In Myanmar, in spite of the introduction of open market economy and foreign investment law in 1988, there was no considerable changes in its economy for more than two decades. A compound of the economic mismanagement and sanctions imposed by the US has hindered Myanmar's economic growth (Oh and Thant, 2016). Myint and Rasiah (2012) analyzed the impact of foreign capital inflows into Myanmar's export-oriented labor-intensive garment manufacturing industries, on employment, wages and working conditions. The study found that international isolation economically and politically has left firms and workers in Myanmar vulnerable to capital exploitation. Military government has led additional sanctions from the US and other advanced countries. However, Myanmar has achieved rapid growth since economic liberalization policy was implemented in 2011. Myanmar's opening economy and liberalization policy has had a positive benefit to the country, by March 2013, commitments of foreign investment into Myanmar had increased fivefold (Kingsbury, 2014).

According to our best knowledge, there are very few studies to investigate causal relationship between exports, imports, and growth in North Korea using econometric

analysis. Therefore, this study is important for policy makers in North Korea. This paper is organized as follows. Section 2 briefly reviews the North Korea's economy and international sanctions. Section 3 provides the existing literature on North Korea, and relationship between trade and growth. Section 4 explains the data and methodology. Section 5 discusses empirical results. And section 6 concludes this study and discusses policy implication.

North Korea's Economy and International Sanctions

North Korea is one of the most centrally controlled and least open economies. It has faced chronic economic problems due to frequent natural disasters and mismanagement by Kim family. North Korea have depended heavily on foreign aid since independence from Japanese colonies. Especially, after the Korean War (1950-1953), North Korea received financial support from the communist economies such as the Soviet Union, China and other social countries (Armstrong, 2009). Despite continuing support and aid from the Soviet Union and China, by the early 1990s, the level of North Korea's economic stagnation was so deep that, for the first time in its history, North Korea's leaders admitted the failure of its economic plan (Noland, 2003; Kim, 2014; Zakharova, 2016). South Korea, Japan, the US and the international community (WFP, UNICEF, other UN organizations) have provided humanitarian assistance for North Korea since it has suffered severe food shortages caused by natural disasters in the middle of 1990s. However, North Korean leaders have strengthened North Korea's position as a self-contained and self-reliant nuclear power (Walter and Clemens, 2010) .

North Korean economy in 2016 improved compared with previous year, its GDP increased by 3.9 percent. According to the Bank of Korea, North Korea's GDP in real terms in 2016 is 28.5 billion us dollars. And all exports from North Korea excluding inter Korea trade grew 4.6 percent and imports also grew 4.8 percent in 2016. International societies have been imposing economic sanctions on North Korea after the first nuclear test in 2006. However, Chinese government has encouraged Chinese companies to expand trade and investment in North Korea since 2005. As a result, China's trade and investment with North Korea has risen dramatically (Reilly, 2014). China, the biggest trading partner for North Korea, accounted for about 90 percent of whole North Korea's trade in 2016, banned all imports from North Korea and oil export to North Korea in February 2017. Severe economic sanctions by China and other international society may drive North Korea into open-door policy. Now, North Korean leader, Kim Jong-un, is trying to take a political gamble with the US (the US-North Korea summit).

According to the KOTRA (Korea Trade-investment Promotion Agency), North Korea's trade is severely restricted not only by sanctions imposed by international societies but also by the actions of the North Korean government . North Korea's trade depends seriously on China and natural resources such as coal and iron. Many transition countries achieved a great performance of economic growth. Foreign capital and international trade played an important role on economic development in transition economies. It is time to

concern economic development policy for sustainable growth in North Korea. It is crucial that Analyze the impact of exports and imports on economic growth in the short-run and long-run. Many empirical studies have found that export expansion promotes economic growth through many channels (Balassa, 1978; Jung and Marshall, 1985; Coe and Helpman, 1995; Dollar and Kraay, 2004; Awokuse, 2008). By-directional causal relationship exists between foreign capital and trade in that foreign direct investment induces trade and vice versa (Nguyen, 2017). In this paper, we examine the effects of exports and imports on economic growth in North Korea.

Literature Review

Numerous researchers have conducted studies on North Korean economy. For instance, Lee (2018) examined how domestic economic activity and regional inequality evolve within North Korea during a period of economic sanctions using nighttime lights data between 1992 and 2013. This study found that as North Korea becomes more isolated, there is relatively more economic activity in the capital city, trade hubs with China, and manufacturing regions compared to the rest of the country. Henderson et al (2012) estimated economic growth using nighttime lights data between 1992 and 2008 in North Korea. They found that nighttime lights were correlated with GDP, and there was no growth in the same period in North Korea. Many researchers analyzed the impact of sanctions in North Korea (Haggard and Noland, 2010; Haggard and Noland, 2017; Dethomas, 2016; Lee, 2018), and North Korea's regime (Yoon, 2011; Park and Snyder, 2012; Vyas et al, 2015).

However, most of the studies related North Korea is the descriptive analysis. There are very few studies related trade-growth nexus in North Korea because of restriction of official statistics . Sato and Fukushige (2011) examined causal relationship among exports, imports and economic growth in North Korea using time series data from 1964 to 2008. The empirical results show Granger causality running from imports to GNP in the first half of the period and running from GNP to imports in the second half of the period. They found evidence that North Korean economy has changed since 1991 because of the collapse of the Soviet Union. Kim et al (2007) estimated North Korea's GNP growth rate and GNP per capita from 1954 to 1989. A panel cointegration technique was used to assess the level of productivity in North Korean economy in comparison with that of the Soviet Union. This study found that the average annual growth rate of GNP and GNP per capita was 4.4 percent and 1.9 percent respectively, and productivity in North Korea was lower than that of the Soviet Union by 33 percent. Jin (2003) examined directional causality between openness (export and import) and economic growth in North Korea employing Granger causality test. The study used annual data for the period 1953-1999. The results of Granger causality tests supported the openness-growth relationship.

Many researchers have examined the direction of causality between exports, imports and economic growth. There is a two-way causal relationship between these variables. The export-led growth hypothesis asserts that exports expansion has a positive impact on economic growth. Exports alleviate foreign exchange constraints and enhance efficiency

through innovation (Jung and Marshall, 1985; Romer, 1989; Esfahani, 1991). He and Zhang (2010), Herrerias and Orts (2010), and Kwan and Kwok (1995) examined the direction of causality between exports and growth for China. The studies found evidence in favor of the export-led growth hypothesis. Nguyen et al (2017) investigated the relationship among GDP, foreign direct investment, trade, inflation rate and state investment in Vietnam. They employed a vector correction model to examine relationship among variables using quarterly data from 2001 to 2011. They found a long-run relationship among the variables and foreign direct investment exerts a strong impact on exports.

Some studies have indicated that the causality is bi-directional. For instance, Mah (2005) for China, Awokuse (2005) for Korea, Liu, Shu and Sinclair (2009) for 9 Asian economies. Liu et al (2002) examined the causal links between trade, economic growth and foreign direct investment in China. They obtained the result that there was a long-run relationship between growth, exports, imports and foreign direct investment, and bi-directional causality between growth, foreign direct investment and exports.

Data and Methodology

In order to investigate the relationship between exports, imports, and economic growth in North Korea, we use annual data from 1991 to 2015 that is based on data available. The Bank of Korea and KOSIS (Korean Statistical Information Service) have released North Korean macroeconomic data because North Korean government does not publish its official statistics.

The relationship between economic growth and export can be expressed as follows:

$$\ln GDP_t = \alpha + \beta \ln Export_t + \varepsilon_t \quad (1)$$

where GDP is the real GDP per capita that represents economic development (Chaudhary et al, 2009). Export is real export from North Korea towards the World excluding Korea. The α is constant term, β is coefficient of variable of export, ε is error term. We obtained nominal GDP, GDP deflator and population from KOSIS. Data for export and import are from the KOTRA. All variables are converted into natural logarithms. Before we conduct cointegration test and Granger causality test we carry out test all variables for stationary. In this paper, we employ Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test. The general from of ADF test expressed as follows:

$$\Delta Y_t = \alpha + \beta_1 Y_{t-1} + \sum_{i=1}^{k} \beta_2 \Delta Y_{t-1} + \varepsilon_t \quad (2)$$

where Δ is the first difference operator, Y is a time series data, α is a constant, k is the optimum number of lags in the dependent variable and εis error term. We employ the Johansen cointegration approach developed by Johansen (1988) and Johansen and Juselius (1990) to explore the existence of a long-term relation between export and economic growth,

and import and economic growth. This approach uses the maximum likelihood procedure to determine the presence of cointegration vectors. The Johansen testing procedure uses the vector autoregressive (VAR) model as equation (2). Where Yt is the vector of I(1) that is stationary in its first different form. The coefficient matrix between the levels of series decomposes to $\beta=\gamma\delta$ where the matrix contains the cointegration vectors. The trace test and maximum eigenvalue test statistics are used to determine the number of cointegration vectors (Johansen and Juselius, 1990). The first step of the Johansen test is to choose the number of lags in the VAR model.

This paper attempts to investigate directional causality which used Granger causality test proposed by Toda and Yamamoto (1995). When time series data are integrated, Toda and Yamamoto have shown that the conventional F-statistic for Granger non-causality test is not valid as the test does not have a standard distribution (Caporale and Pittis, 1999; Giles and Mizra, 1998). The approach proposed by Toda and Yamamoto is to employ a modified Wald (MWALD) test for restriction on the parameters of the VAR (k) where k is the lag length of the system. The basic idea of the Toda and Yamamoto approach is to artificially augment the correct order, k, by the maximal order of integration, say dmax. Once this is done, a (k+dmax) the order of VAR is estimated and the coefficients of the last lagged dmax vectors are ignored (Caporale and Pittis, 1999). Therefore, in order to apply the Toda and Yamamoto approach, we need to know the true lag length (k) and the maximum order of integration (dmax) of the series under consideration.

The novelty of the Toda and Yamamoto procedure is that it does not require pre-testing for the cointegrating properties of the system and thus avoids the potential bias associated with unit roots and cointegration tests (Zapata and Rambaldi, 1997; Shan and Tian, 1998). The test has an asymptotic distribution when a VAR (kqdmax) is estimated. This ensures that the usual test statistic for Granger causality has the standard asymptotic distribution where valid inference can be made. The test (MWALD) statistic is valid regardless of whether a series is I(0), I(1) or I(2), non-cointegrated or cointegrated of an arbitrary order 'so long as the order of integration of the process does not exceed the true lag length of the model' (Toda and Yamamoto, 1995). To undertake Toda and Yamamoto version of the Granger non-causality test, we represent the growth(Y)-heath (H) model in the following VAR system:

$$Y_t = a_0 + \sum_{t-1}^{k} \alpha_{1t}\, Y_{t-1} + \sum_{j=k+1}^{d_{max}} \alpha_{2j}\, Y_{t-j} + \sum_{t=1}^{k} \Phi_{1t}\, E_{u-j} + \sum_{j=k+1}^{d_{max}} \Phi_{2j}\, E_{u-j} + \lambda_{1t} \quad (3)$$

$$E_u = \beta_0 + \sum_{t-1}^{k} \beta_{1t}\, E_{u-1} + \sum_{j=k+1}^{d_{max}} \beta_{2j}\, Y_{u-j} + \sum_{t=1}^{k} \delta_{1t}\, Y_{t-j} + \sum_{j=k+1}^{d_{max}} \delta_{2j}\, Y_{u-j} + \lambda_{1t} \quad (4)$$

Empirical Results

Prior to conducting Johansen cointegration test and Toda-Yamamoto

Table 1. Unit root test

	ADF test statistic		Phillips-Perron test statistic	
Variable	t-statistic	p-values	t-statistic	p-values
GDP	-3.212**	0.0322	-4.545***	0.0015
Export	-3.303*	0.0945	-5.533***	0.0002
Import	-6.090***	0.0003	-6.090***	0.0000

Note: *, **, and *** represent significance at 10%, 5%, and 1% levels.

Granger causality test we applied Perron unit root test (Perron, 1989). The results of unit root test are reported in Table 1. Unit root test shows that time series data of economic growth, exports and imports become stationary when we carry out the test in first difference. It shows that export, import and growth are one order of integration, I(1). We can reject the null hypothesis that there is a unit root.

We need to select optimal leg length to run the test. Optimal lag length is reported in Table 2. We selected the optimal number of lags based on the Schwartz Bayesian Criterion (SBC) and the Akaike Information Criterion (AIC) (Narayan and Smith, 2008). The results indicate that lag 2 is the optimal lag length.

Table 2. Chose the optimal lag order

Lag	LogL	LR	FRE	AIC	SC	HQ
0	65.8157	NA	7.86E-06	-6.0776	-5.9782	-6.0560
1	83.4793	30.2804	2.15E-06	-7.3789	-7.0805	-7.3142
2	89.814	9.6527*	1.75E-06*	-7.6013*	-7.1039*	-7.4933*
3	92.1548	3.1211	2.12E-06	-7.4433	-6.7469	-7.2921
4	96.5666	5.0421	2.17E-06	-7.4825	-6.5872	-7.2882

* Indicates lag order selected by the criterion.

LR: sequential modified LR test statistic (each test at 5% level).

FRE: Final prediction error.

AIC: Akaike information criterion.

SC: Schwarz information criterion.

HQ: Hannan-Quinn information criterion.

Table 3 shows the result of the Johansen cointegration test. According to the trace statistic and maximum Eigenvalue statistic, we find that the null hypothesis of no cointegration (none) is statistically significant at the 5% level. Thus, we can conclude that there is one cointegrating relation between the variables in export and growth.

Table 3. Results of Johansen Cointegration Test

Hypothesized No. of CE(s)	Trace statistic		Max-Eigen statistic	
	statistic	p-values	statistic	p-values
None*	15.619	0.0479	15.1427	0.0362
At most 1	0.4763	0.4901	0.4763	0.4901

Note: *, ** and *** represent significance at 10%, 5% and 1% level.

The Granger causality test from Toda-Yamamoto test is shown in Table 4. The results show that there is uni-directional causality running from export to economic growth in the case of North Korea. It shows that the promotion of export will contribute to economic growth in North Korea. On the other hand, economic growth does not cause the export expansion. The results also show that there is bi-directional causality between import and economic growth in North Korea. This finding is consistent with existing literature on relationship between export and economic growth such as Anwar (2014) for Pakistan, He and Zhang (2010) for China, Mahadevan (2007) for Malaysia, and relationship between import and growth such as Zang and Baimbridge (2012) for South Korea and Japan, Islam et al (2012) for lo w income countries.

Table 4. Result of Toda-Yamamoto Granger causality test

Hypothesis	Modified Wald statistic	p-values
Export does not Granger cause GDP	7.9907**	0.0184
GDP does not Granger cause Export	2.2768	0.3203
Import does not Granger cause GDP	5.5201*	0.0633
GDP does not Granger cause Import	6.9323**	0.0312

Note: *, ** and *** represent significance at 10%, 5% and 1% level.

These findings are very important because it indicates that export is an important factor to promote economic growth. Therefore, North Korea should promote the export in order to promote economic growth by introduction of open-door policy and economic reform such as guarantee of foreign direct investment, trade liberalization, trade facilitation, and eliminate the non-tariff barriers.

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