



저작자표시-동일조건변경허락 2.0 대한민국

이용자는 아래의 조건을 따르는 경우에 한하여 자유롭게

- 이 저작물을 복제, 배포, 전송, 전시, 공연 및 방송할 수 있습니다.
- 이차적 저작물을 작성할 수 있습니다.
- 이 저작물을 영리 목적으로 이용할 수 있습니다.

다음과 같은 조건을 따라야 합니다:



저작자표시. 귀하는 원저작자를 표시하여야 합니다.



동일조건변경허락. 귀하가 이 저작물을 개작, 변형 또는 가공했을 경우에는, 이 저작물과 동일한 이용허락조건하에서만 배포할 수 있습니다.

- 귀하는, 이 저작물의 재이용이나 배포의 경우, 이 저작물에 적용된 이용허락조건을 명확하게 나타내어야 합니다.
- 저작권자로부터 별도의 허가를 받으면 이러한 조건들은 적용되지 않습니다.

저작권법에 따른 이용자의 권리는 위의 내용에 의하여 영향을 받지 않습니다.

이것은 [이용허락규약\(Legal Code\)](#)을 이해하기 쉽게 요약한 것입니다.

[Disclaimer](#) 

경제학박사학위논문

# **North Korea's Trade with China: Aggregate and Firm-level Analysis**

북중무역:

집계 데이터와 기업수준 데이터를 통한 분석

2014년 8월

서울대학교 대학원

경제학부 경제학 전공

정 승 호

## **Abstract**

# **North Korea's Trade with China: Aggregate and Firm-level Analysis**

Seung Ho, JUNG  
Department of Economics  
The Graduate School  
Seoul National University

This dissertation uses firm-level as well as aggregate data to investigate the economic relationships between North Korea and China. More specifically, it analyzes the effects of North Korea-China trade on the economic growth of North Korea. It further discusses the impacts of sanctions by South Korea and Japan on North Korea-China trade. Finally it estimates the determinants of the performance of firms that are trading with North Korea in China

Chapter 2 uses cointegration tests and Vector Error Correction Model (VECM) to examine causality between Sino-North Korean trade and economic growth of North Korea from 1970 to 2012. To carry out empirical analysis, VECM is constructed, which is comprised of four variables, GDP, exports, imports, and investment. Investment is used as the key explanatory variable of economic growth, and imported capital as a proxy of investment. The cointegration equation suggests that the mechanism of North Korea's economic growth is basically similar with that of low income, market-oriented countries, in the sense that trade and foreign capital inflows do matter for its growth. The estimation of the VECM shows that, in the long-run, exports, imports, and investments Granger-cause income through error correction mechanism, but not

vice versa. With respect to short-term causality, however, the variables have little causal relations with each other except for causality flows from imports to exports. This shows that traditional barter-type settlement is still prevalent in Sino-North Korean trade.

Chapter 3 addresses the question whether North Korea–China trade dilutes the effects of the unilateral sanctions imposed by South Korea and Japan, and if so, to what extent and in what way. It finds structural adjustment of North Korea’s export pattern in size and trade type for the purpose of diluting the effectiveness of the unilateral sanctions, imposed by South Korea in particular. It also finds that South Korea’s economic sanctions significantly boost North Korea’s exports to China, and the export increase has been large enough to cover the loss from South Korea’s sanctions. In particular, North Korea has increased both exports to the Chinese domestic market (through general trade) and exports transferred in China (through bonded trade). These findings show that North Korea has mitigated the economic damage of sanctions by employing a broad range of techniques for trade diversion. The changes would take place because incentives of both North Korean regime and foreign firms meet well particularly after South Korean sanctions.

Finally, Chapter 4 identifies the determinants of Chinese firms’ performance by using the survey data of the firms that trade with North Korea in Dandong, China. The survey was conducted in 2012 and 2013 to assess the impact of the sanctions imposed by South Korea in 2010. 138 firms engaged in trade with North Korea are used in the analysis out of 174 sample firms. With special attention paid to the firms’ relationships with their North Korean partners, it finds that the business ties with army-affiliated North Korean counterparts have a stronger positive effect on the performance of Chinese firms than the ties with other counterparts. In particular, the business ties between the *Han zu*

companies and the army-affiliated North Korean partners are found to be the most influential. This empirical finding suggests that North Korea's "military first" policy *de facto* regulates resource allocation mechanisms in North Korea's export sectors, after the imposition of South Korean sanctions. It also finds that Chinese firms that have more partners and formal dispute resolution channels tend to achieve more favorable outcomes in cross-border exchanges with North Korea, because these features function as hedge against the risk from North Korea's unstable 'Wa-Ku' system.

The following chapters are all self-contained and can be read independently.

Keywords: North Korea–China trade, Economic Sanctions, Transition Economy,  
Firms' Performance, VECM, Dynamic Panel Model

*Student Number* : 2008-30805

# Contents

<b>Chapter 1. Introduction .....</b>	<b>1</b>
1. Motivation .....	1
2. Objectives and Methodology .....	3
<b>Chapter 2. Economic Growth and Trade of North Korea with China: Cointegration and Granger Causality Test .....</b>	<b>6</b>
1. Introduction .....	6
2. Data .....	11
2.1 GDP .....	12
2.2 Investment .....	13
2.3 Trade Data with China .....	17
3. Hypotheses .....	18
3.1 Conventional Socialism Hypothesis .....	18
3.2 Hypothesis Based on Conventional Growth Theory .....	20
3.3 Export-Led Growth Hypothesis .....	22
4. Empirical Results .....	22
4.1 Unit root tests .....	22
4.2 Tests for Optimal Order Length .....	23
4.3 Cointegration .....	24
4.4 Granger Causality Tests .....	28
4.5 Parameter stability test .....	31
5. Conclusion .....	37
References .....	39
Appendix 1: Bounds test procedures .....	41
<b>Chapter 3. The Impact of Economic Sanctions on North Korea – China Trade: A Dynamic Panel Analysis .....</b>	<b>43</b>
1. Introduction .....	43
2. Empirical Framework .....	47
3. Data .....	53
4. Empirical Results .....	55
4.1 Basic Model: Sanctions' Effects on Total Exports .....	55

4.2 Extended Model: Sanctions Effects by Trade Type .....	58
5. Conclusion.....	64
References .....	67
Appendix 1: Economic Sanctions of South Korea and Japan on North Korea .....	70
Appendix 2: China Custom’s Trade Types (Customs Regimes) and Codes .....	71

**Chapter 4. The Performances of Chinese Firms in North Korean Trade: Evidence from Firm-Level Data .....72**

1. Introduction .....	72
2. Hypotheses .....	74
2.1 Business ties with North Korean partners .....	74
2.2 Market linkage .....	76
3. The Survey and Descriptive Statistics.....	77
3.1 Outline of Survey.....	77
3.2 Descriptive Statistics .....	79
4. The Model .....	83
5. The Results .....	85
5.1 Basic Regressions .....	85
5.2 Interaction effects .....	90
6. Conclusion.....	92
References .....	95
Appendix 1: Graphic Representation of Chinese Firms’ Business network with its North Korean partners .....	97
Appendix 2: Graphic Representation of Chinese Firms’ Market linkage ...	103

**Chapter 5. Conclusion..... 106**

## List of Tables

Table 2.1 Test for unit roots Results using ADF and PP tests .....	23
Table 2.2 VAR Lag Order Selection Criteria .....	24
Table 2.3 Johansen's Test for the number of cointegration vectors.....	25
Table 2.4 Test of Weak Exogeneity .....	26
Table 2.5 Bounds Test for Cointegration.....	27
Table 2.6 Results of Granger Causality .....	31
Table 2.7 Summary of Granger Causality .....	31
Table 3.1 North Korea's exports trend in 2000's .....	48
Table 3.2 Descriptive statistics of the variables .....	54
Table 3.3 Basic model panel regression estimates.....	57
Table 3.4 North Korea's exports changes from the South Korea's economic sanctions.....	58
Table 3.5 Extended model panel regression estimates .....	59
Table 4.1 Summary of Data.....	81
Table 4.2 Regression results: Basic Model .....	88
Table 4.3 Regression results 2: Interaction effect .....	90



## List of Figures

Figure 2.1 Long-term patterns of China's Volume (left axis) and Share (right axis) in North Korean Trade .....	8
Figure 2.2 Comparison of Estimated North Korean Growth Rates between Bank of Korea and Kim et al. (2007) & Kim (2008).....	13
Figure 2.3 Estimated Nominal Investment Series Based on Budget Data.....	15
Figure 2.4 Nominal Trend of North Korea's the Capital Goods Imports from the World.....	16
Figure 2.5 Long-term patterns of North Korea's Real exports and imports to/from China.....	18
Figure 2.6 CUSUM and CUSUMQ tests for Full Sample Period.....	34
Figure 2.7 CUSUM and CUSUMQ tests for Pre-Crisis Sample Period (1970~1989).....	35
Figure 2.8 CUSUM and CUSUMQ tests for Post-Crisis Sample Period (1990~2012) .....	36
Figure 3.1 The trend of North Korea's exports to China by trade type .....	46
Figure 3.2 The trend of commodity composition of North Korea's exports to China by general trade.....	61
Figure 3.3 The trend of commodity composition of North Korea's exports to China by processing trade.....	62
Figure 3.4 The trend of commodity composition of North Korea's exports to China by bonded trade.....	63
Figure 4.1 Time-Line of South Korean Sanctions and Performance Measures.....	84
Figure 4.2 Business Network between Chinese Firms with North Korean army-Affiliated Firms .....	98
Figure 4.3 Business Network between Chinese Firms with North Korean Party Affiliated Firms .....	99
Figure 4.4 Business Network between Chinese Firms with North Korean Cabinet Affiliated Firms .....	100
Figure 4.5 Business Network between Chinese Firms with North Korean Regional Government Affiliated Firms .....	101
Figure 4.6 Business Network between Chinese Firms with North Korean Individuals .....	102
Figure 4.7 Linkage with Chinese Market.....	104
Figure 4.8 Linkage with South Korean Market.....	105
Figure5.1 Sample period of Each Chapter .....	106

## **Chapter 1. Introduction**

### **1. Motivation**

Despite North Korea (Democratic People's Republic of Korea, or DPRK)'s basic guiding principle, *chuche* ideology (self-reliance), the dependency of North Korea's economy on external transactions has been substantial since the establishment of the country. China and the USSR provided huge economic aid immediately after the Korean War, and these alliances continued even amid the Sino-Soviet conflict (Lim, 1995; Lee, 2000). After the collapse of the Soviet Union in 1991, China has been North Korea's most important economic partner. It is believed that the economy of North Korea depended more and more on China for its survival and development, as North Korea increasingly became isolated from its major trade partners, such as South Korea and Japan. In terms of trade, China is DPRK's single largest exporter, providing fuel, food, consumption goods and capital goods, and also its largest importer, or the main source of foreign exchange. Thus, it is clear that the bilateral trade between the two countries is a key variable to understand the North Korean economy.

Against this backdrop, the Sino-North Korean trade relationship attracted considerable attention from the academia and policy makers (Cho et al., 2005; Cho et al., 2005; Lee, 2006; Kim et al., 2006; Kim et al., 2008; Koh et al., 2008; Haggard et al., 2011, 2012; Kim, 2011, Kim, 2013). However, most of the studies focus on descriptions of aggregate trade data, such as the trends of total trade volumes, and commodity compositions of imports or exports. One reason behind this phenomenon may be due to the unavailability or limited availability of long-term and detailed data. Recently the macro data, however, has improved

considerably. The long-term trade statistics from various sources, containing detailed information, could be relatively easily accessed by the public. In addition, as research outputs on North Korean economy are accumulating, some long-run time series of several important macro variables, such as real GDP growth and capital stock, are beginning to be estimated (Kim, 2002; Kim et al., 2007). Taking advantage of these improved data, some empirical studies about North Korea's trade (or North Korea – China Trade) have been carried out. These studies are mainly divided into two branches in terms of research objectives. One group of research examines the impact of North Korea's trading relationships with China on its growth (Cho et al., 2005; Lee, 2006; Sato & Fukushige, 2011; Kim, 2011). The second group indentifies the effectiveness of the economic sanctions on North Korean trade (or growth) (Noland, 2008; Lee, 2010; Jeong & Bang, 2011).

The first two chapters of this thesis are motivated to develop the previous literature by applying a newly constructed macro database and diverse estimation methods. Using yearly data from 1970 to 2012, the second chapter examines the long-term and short-term relationships between North Korea's economic growth and trade. Chapter 3 addresses the effect of the unilateral sanctions imposed by South Korea and Japan on the Sino-North Korean trade by employing the dynamic panel estimation method.

The second motivation is to extend the research areas of the bilateral trade to micro-level data analysis. Chinese firms, particularly those located in the border area with North Korea, are known to play central roles in the trade with North Korea. The firm-level studies on the Chinese firms doing business with North Korea are expected to unveil the questions which are difficult to be addressed by macro-level aggregate data analyses. From the firm-level data, we can gain knowledge on the North Korean business environment, changes of

North Korean trade policies, business networks with North Korean partners, and their effects on the firms' performances. In addition, these firm-level analyses give us a lucid explanation of the dynamics behind the aggregate data. Despite the importance of firm-level analyses, little has been done empirically so far. Most researches dealing with this issue normally rely on the interview data with Chinese firm managers/regional government officers or secondary data sources from the mass media (Bae, 2008; Lee & Hong, 2013). The only study using survey data (Haggard et al., 2011; Haggard et al., 2012), leaves us with limited implications. Despite the sensitivity of the cross-border transactions, their survey was conducted indirectly by a Chinese consulting firm with a mere 7% completion rate of the interview. In contrast, this study uses on-the-spot survey data from face-to-face interviews to examine performances of Chinese firms in Dandong when trading with North Korea (refer to Chapter 4).

In sum, the motivations of this dissertation lie in the following. First, it contributes to the current macro-aggregate data analyses by constructing long-run time series from various sources and trade panel dataset containing detailed commodity transactions information, and by applying advanced estimation techniques. Second, this study extends to a micro-level data analysis which helps readers comprehensively understand the issue of North Korea-China trade.

## **2. Objectives and Methodology**

This study is aimed to scrutinize North Korea-China trade by undergoing both aggregate and firm level analyses. The first two chapters focus on the trade relations between the two countries and the last chapter investigates the performance of Chinese firms engaging in trades with North Korea.

The second chapter examines the causal relationship between Sino-

North Korean trade and North Korean growth. Based on the time series from 1970 to 2012, we perform cointegration tests and Granger causality tests based on a vector error correction model (VECM). To evaluate the interrelationship between trade and growth, we also employ the investment variable, in order to avoid spurious causality results due to omitting a key variable, and the imports of capital goods variable as a proxy of investment. We use the conventional Johansen procedure to test the cointegration relationship, as well as implement Bounds test which is known to be robust in a small sample size. In addition, we construct a VECM comprised of the following four variables, GDP, exports, imports, and investment, and perform the Granger causality in the VECM, in order to identify the direction of the causality and to distinguish between the short-run and long-run Granger causality.

In Chapter 3, we study the impact of the economic sanctions imposed by South Korea and Japan on the North Korea-China trade. To analyze the changes of North Korea's exports in response to the sanctions, we construct a panel dataset of North Korea's bilateral trade with China, South Korea, and Japan at the HS4 digit-level during the period 2001-2012. The data contain detailed information on prices and quantities of each commodity. In particular, it has information on North Korea's trade types with China, which enables us to identify the sanction effects depending on the trade type. This is important because North Korea can mitigate sanction effects by increasing not only exports with China domestic market but also exports transferred in China (through bonded trade). This study uses dynamic models to allow adjustment or persistent effects of economic sanctions over time and employs a system GMM (Generalized Method of Moments) estimator to address the endogeneity problem due to the inclusion of lagged variables.

In Chapter 4, we attempt to empirically analyze determinants of Chinese

firms' performances when they trade with North Korea. We have constructed a dataset out of the face-to-face surveys of the firms in Dandong that do business with North Korea. 138 firms out of 174 samples engaged with trade are used for estimations in this chapter. The core of the survey is about business networks with North Korean partners and market linkages. As previous studies note, in many developing and transition economies where formal market institutions are not well-developed, social/business ties are important for a firm's performance and transactions. To obtain robust results, we assess firms' performances with respect to the growth of profit over the last 2-3 years and various combinations of differences in trade volumes before and after South Korean sanctions. The measures are derived for evaluating the effects of South Korean sanctions, which took effect in 2010, on Sino-North Korean trade at the firm-level.

## **Chapter 2. Economic Growth and Trade of North Korea with China: Cointegration and Granger Causality Test**

### **1. Introduction**

China has been North Korea (Democratic People's Republic of Korea, or DPRK)'s most important economic partner since the collapse of the Soviet bloc in the early 1990s. In terms of trade, China is DPRK's single largest exporter, providing fuel, food, consumption goods and capital goods, and also its largest importer, being the main source of foreign exchange. The China's share in North Korea's foreign trade kept increasing as economic sanctions worsened due to the long-term isolation of North Korea from alternative commercial partners such as South Korea and Japan. As of 2012, China accounted for 68%, which amount to \$6 billion, of trade<sup>1</sup>. These expanded Sino-North Korean economic ties are believed to sustain and possibly develop the North Korean economy.

The bilateral trade relationship is also important to investigate the characteristics of North Korean economy. Most of all, the important position of China in North Korea's trade has been secured despite of the multiple external/internal shocks North Korea have been faced, thus this long-term and stable bilateral trade may reflect the basic properties of North Korean trade or its relationship with economic growth. North Korea's foreign trade can be featured by its high concentration in four individual countries: the USSR, China, Japan, and South Korea (Choi, 1991). In 1991, the volume of North Korea's trade with the Soviet Union dropped sharply to less than half of the 1990 value, because

---

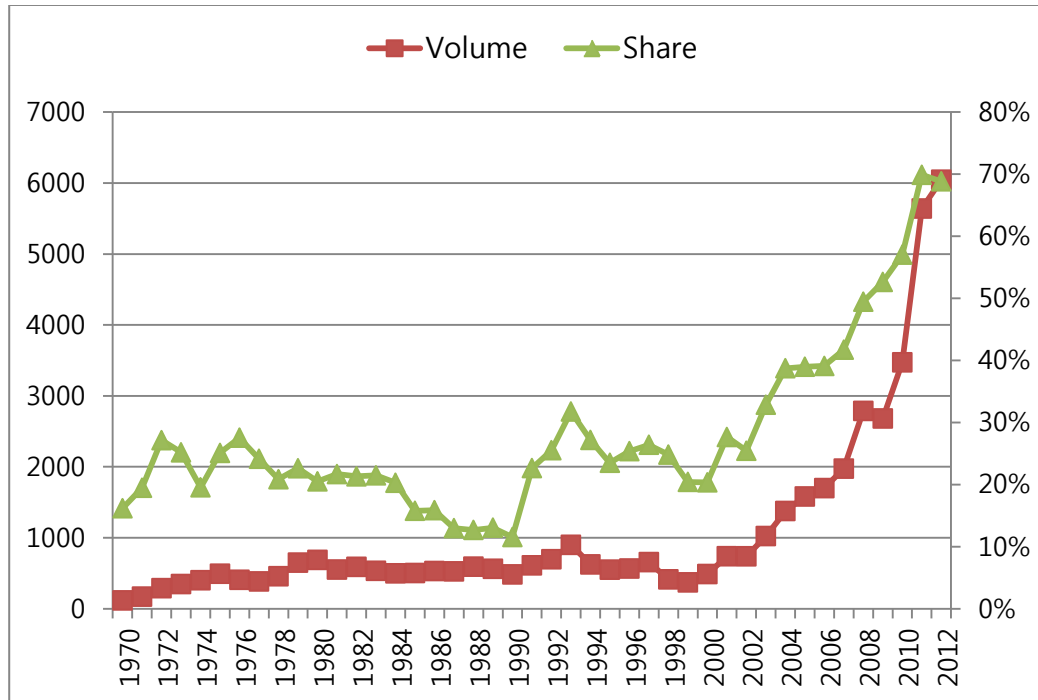
<sup>1</sup> This statistics are included in Inter-Korean trade volume. In South Korean official statistics, Inter-Korean trade is considered intra-country trade not inter-country trade, therefore it is not included in North Korea's foreign trade statistics. In this paper, however, we include inter-Korea trade as part of North Korea's trade in order to understand overall pattern in North Korea's trade.

both countries agreed that trade henceforth shall be settled in hard currency at world prices (Lim, 1995). Both South Korea and Japan were once top exporting/importing countries of North Korea, but their importance in North Korea's trade sharply decreased after imposition of economic sanctions in 2000s. However, China was took the second position from 1970 to 1990, and the collapse of the Soviet Union put China in first place in North Korean trade. (See Figure 2.1) Because of the long-term sustained relation between North Korea and China, we can test diverse hypotheses on North Korean trade and economic growth. For example, whether the mechanism of North Korea's economic growth, in particular impact of trade on growth, may be expected to differ (same) from (with) the observed in market-oriented economies. In addition, North Korea with China originally reported by China customs is more reliable than its aggregated total data compiled from different sources. These data are so-called "mirror-statistics," the commodity data reported by North Korea's trading partners are known to be inaccurate because some countries' customs often confuse the commodities' origins between South and North Korea.



**Figure2.1 Long-term patterns of China's Volume (left axis) and Share (right axis) in North Korean Trade**

(Unit: Million Dollars, Percentage)



Along this line, the Sino-North Korean trade relationship has been studied as a key research topic in North Korean economic analyses. One of the earliest studies on the bilateral trade based on long-term trade data (Choi, 1991) constructs North Korea's foreign trade data from 1946 to 1988, and examines the long-term trade performance and changes in its pattern. Using import functions, the article reports that borrowing (proxied by trade deficits) from the USSR significantly increase North Korean imports from the USSR in the period 1968-1988, whereas no significant relationship between borrowing and imports is found in Sino-North Korean trade. His interpretation of this result is that economic supports from USSR have stronger effects than those from China.

Similarly, Lim (1995) employs import demand function and data during 1962-1992, and empirically identifies the income elasticity of import demand for imports across the countries trading with North Korea. The article reports that the income elasticity of imports from China is the lowest, implying that China is North Korea's most stable supplier.

Koh et al. (2008) analyze the bilateral trade in different dimensions. Their research interest is whether China, through trade with North Korea, provides a considerable economic support to DPRK. The study reports that China's export prices to North Korea are not lower than those to other countries, whereas China's import prices from North Korea are systematically set lower than those from other countries. The authors interpret that China's trading activities with North Korea are based on commercial decisions rather than Chinese government's policy favor.

Among the previous studies, some studies directly examine how North Korea's trading relationships with China would have made impact on its growth. Cho et al. (2005) employ a production function augmented with exports and trade, as well as imports. The results show that a 1% increase in North Korea's per capita trade with China would increase its per capita income by 0.408%. In addition, Lee (2006) estimates North Korea's average economic growth rate for the years 2000-2004 driven by the trade with China hovered at 3.5% using the imported augmented production function and national income identities. The article suggests that without trade growth for the year, North Korea could have continued to face negative growth rates since 1999. Recently, Kim (2011) argues that North Korean exports to China are cointegrated with North Korea's GDP. In contrast, no relations are found between trade and growth in the short-run regression models.

Existing literatures focusing on North Korea's growth and Sino-North

Korean trade fail to take into account of the endogeneity of the trade variable. As omitted variables and reverse causality are known for the sources of the endogeneity, Frankel and Romer (1999) and Irwin and Tervio (2002) employ geographic variables as instruments and report that the OLS estimates of cross-country regressions understate the effects of trade on income, compared to the IV estimates. In addition, there has been a long debate about the direction of causality between trade and economic growth. According to the ELG (export-led growth) hypothesis, export expansion may increase productivity through economies of scale (Helpman and Krugman, 1985). Moreover, it can provide foreign exchanges that allow more imports, which in turn facilitates capital formation and output growth. Some studies indicate that there is also a potential for a reverse causality flow from economic growth to export (growth-led exports). It is based on the ideas that economic growth leads to enhancement of skills and technology, creating comparative advantage that causes export expansions (Lancaster, 1980; Krugman, 1984; Bhagwati, 1988). The ILG (import-led growth) hypothesis emphasizes the importance of foreign inputs to economic growth, based on the endogenous growth model. Particularly for the less developed countries, foreign imported capital goods are more effective for capital accumulation than domestically produced capital goods (Lee, 1995; Mazumdar, 2001). Yet, previous studies on North Korea exclusively focus on the direction from trade to growth and fail to consider the reverse causal flow from growth to trade.

In this paper, we attempt to develop the discussion in three ways. First, we perform Granger causality tests augmented with a lagged error correction term where the series are cointegrated. This application of a vector error correction model (VECM) will allow the direction of the causality to be revealed, as well as distinguish between the short-run and long-run Granger causality

(Engle & Granger, 1987; Cuadros et al., 2004; Narayan & Smyth, 2006; Awokuse, 2007; Mehrara, 2007). In case of the bilateral trade relationship, it is hard to find relevant instruments to control for the endogeneity of trade, so the Granger causality method may be a plausible alternative. In fact, Granger causality is also widely applied in searching for the direction of causality and the strength of the relationship. Giles and Williams (2000) reviewed 150 export-growth papers published between 1963 and 1999, and reported that two thirds of the papers were based on the concept of Granger causality and on various tests of it. Recently, Sato & Fukushige (2011) also examine the causal relationship among total exports, imports, and economic growth in North Korea using the bivariate Granger causality test.

Second, we extend the data span to 43 years, from 1970 to 2012 in order to minimize the small sample bias. This sample period includes the times not only before and after the collapse of socialist bloc but also the recent period when strong bilateral sanctions were imposed by South Korea and Japan. The long sample period is particularly important in a study of a country like North Korea that has experienced several episodic shocks which may have influenced the Sino-North Korean trade, income and investment.

Third, while a substantial body of studies using the Granger causal method focus on only the trade and growth relationship and ignore the investment variable, we employ investment in order to avoid spurious causality results from omitting the important variable.

## **2. Data**

The data used in this analysis include North Korean exports and imports to/from China, imports of capital goods from the world, and population. The time

interval starts from 1970 and ends in 2012, and data sources are Kim et al. (2007), Kim (2008), Choi (1991), Lim (1995), *IMF International Financial Statistics*, Korea Trade-Investment Promotion Agency (KOTRA) and *WDI database*. In order to eliminate population growth effects, all variables in the analysis use per capita values. All the variables also are transformed into logs because this helps to induce stationarity.

## 2.1 GDP

Real GDP series is obtained by multiplying North Korea's GDP (with the base year 2000) by each year's growth rate<sup>2</sup>, and then converted to GDP per capita by dividing by the total population. Data on growth rates come from Kim et al. (2007) and Bank of Korea (BOK). From 1970 to 1989, we used Kim et al. (2007)'s estimation. They used Maddison's approach (1998), calculating an annual growth rate by using the weighted average growth rates in agricultural, industrial, and service sectors of the economy. They also adjusted estimation results in consideration of the hidden inflations in the industrial sector. After 1990, Bank of Korea (BOK) started the estimations of North Korea's GDP growth rate using SNA (System of National Account)<sup>3</sup>. Thus, we combine two estimates, and extend the series of growth rates from 1970 to 2012.

Kim (2008) extends estimates of growth rates of North Korea's GDP to the period of 1990-2007 by applying the same methodology of Kim et al. (2007)<sup>4</sup>.

---

<sup>2</sup> We calculate base year GDP in 2000 multiplying GDP per capita in 2000 (\$464), which North Korean government submitted to UN, by its population in 2000.

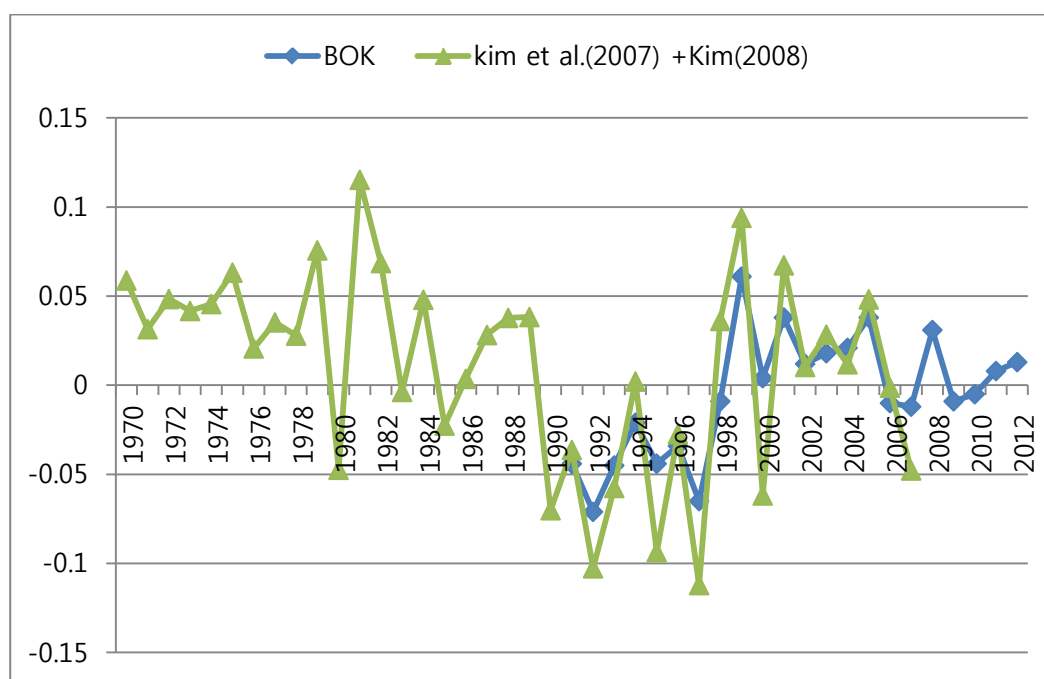
<sup>3</sup> Ministry of Unification estimated the growth rate of North Korea in the 1980s. However, the estimation method was not revealed to the public. The United Nations also provides estimates of the growth rates. According to the meta data, UN estimates heavily rely on the South Korean sources, so their estimates are almost similar with the estimates from BOK.

<sup>4</sup> The study uses the growth rates of industrial production estimated by the Bank of Korea because North Korea has not provided the growth rates of industrial production since 1989. Kim (2007)

As seen in Figure 2.2, the general trends between the two series are similar with each other, although the Kim's estimates have wider variances compared with the estimates from Bank of Korea,

**Figure 2.2 Comparison of Estimated North Korean Growth Rates between Bank of Korea and Kim et al. (2007) & Kim (2008)**

(Unit: Percentage)



## 2.2 Investment

Investment is believed to be an important element of the economic growth in development literatures. Therefore, to evaluate the interrelationship between trade and growth, we employ an investment factor in order to avoid spurious causality results arising from omitting key variable.

Kim et al. (2007) estimated the investment volumes of North Korea

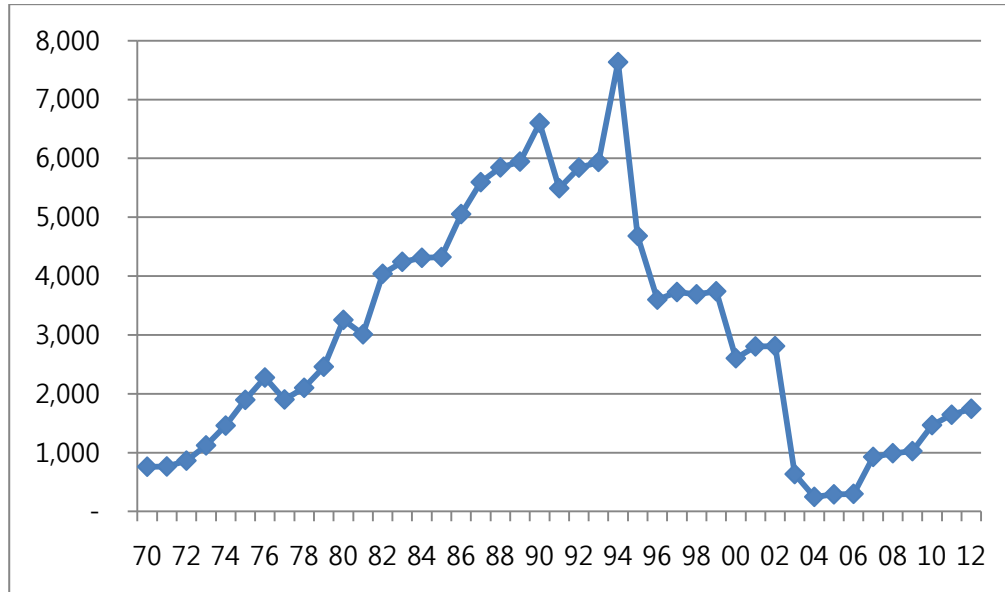
based on the assumption that the “basic construction investment” item in its national budget approximately corresponds to the “fixed capital formation” in other market economies. Because North Korean government did not issue official statistics of the basic construction investment item after 1977, they extended the series under the assumption that the sum of the half of the volume of ‘people’s economic expenditure’ and ‘defense expenditure’ is equivalent to the volume of basic construction investment. As seen in Figure2.3, however, the estimated investment series based on the budget data do not seem to reflect the reality of North Korea’s investment trend. Estimated investment was high during the early 1990s when North Korea was suffering from the serious recession. On the contrary, the scale of investment sharply dropped in 1995 and 2003 due to changes in its fiscal system<sup>5</sup>. These changes make it difficult to use the budget data to estimate investment, particularly after 1990.

---

<sup>5</sup> One of the important changes in the budget system was related to the coverage of basic construction investment. Some items in basic construction investment were cut down from 1980, and most of the items were reduced or abolished after 1995 and 2002. Due to these considerable reductions, the value of basic construction investment was no more equivalent to the fixed capital investment in other market economies. The following Table briefly presents the changes in the coverage of basic construction investment.

Before		Revision	After
Basic construction investment	Net investment	Same	Basic construction investment
	Investment for expansive reproduction of fixed asset	Firms partly self-financed	
	Investment for reproduction of fixed asset	Abolished	-
	Replacement investment	Abolished	
	Subsidy	Abolished	

**Figure 2.3 Estimated Nominal Investment Series Based on Budget Data**  
(Unit: million dollars)



Therefore, instead of the budget data, we use imports of capital goods as the proxy of investment and assume the following proportional relationship between investment and capital goods imports.

$$I_t \propto \text{capital goods imports}_t$$

This basically relies on the assumption that imported capital goods, rather than domestically produced capital goods, account for the major portion of investment<sup>6</sup>. Figure 2.4 shows the trend of capital goods imports<sup>7</sup>. Capital goods

<sup>6</sup> This argument is partially supported by the recently conducted surveys of North Korean refugees. According to Cho et al. (2005), when questioned “How do firms obtain capital goods?” 47.8 percent of the respondents replied that “Firms import capital goods from the foreign countries” whereas only 36.2 percent responded that “Government provides capital goods in line with the national plan.” Similarly, Kim et al. (2010) also reported that only 47 percent of the factory equipment was supplied by the government and the rest was purchased at the market.

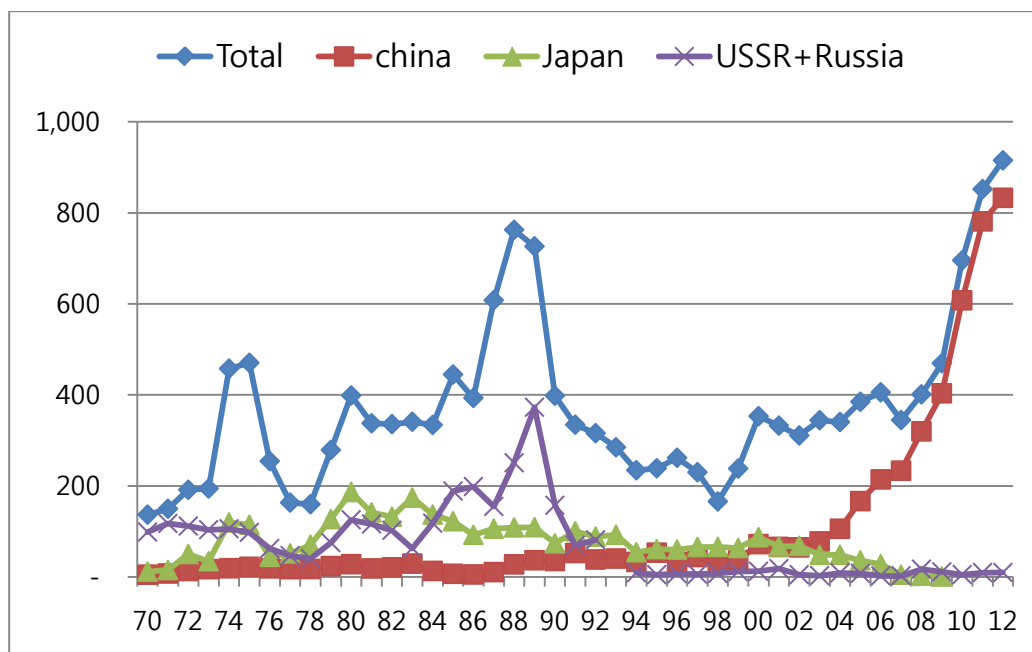
<sup>7</sup> From 1970 to 1992, we defined ‘capital goods’ as imported SITC7 imports (Machinery and transport



imports from South Korea are excluded from North Korea's total imported capital volume. Most of the imports are used for construction of the Kaesong industrial park or South Korean companies in the park, thus it may be difficult to lead the North Korean economic growth overall. Comparing with the previous estimates, which are based on the budget data, the trend of imported capital goods is more likely to reflect the North Korean investment trend because the dynamics is much more similar with the downfall and recovery of North Korean economy. To convert the series onto the real level, Chinese Consumer price index is used as a price deflator.

**Figure 2.4 Nominal Trend of North Korea's the Capital Goods Imports from the World**

(Unit: million dollars)



equipment). After 1992, it is calculated by summation of imports HS 84-89.

### 2.3 Trade Data with China

The trade data are compiled from different sources, such as Choi (1991) and KOTRA. These data are so-called “mirror-statistics,” originally reported by China customs. Real exports and imports are obtained by deflating their nominal values by the Chinese consumer price index<sup>8</sup> from IMF *International Financial Statistics*. In the case of imports from China, we use the values subtracting imports of capital goods from total imports<sup>9</sup>. Capital goods imports from China are already considered in the investment data, because investment is proxied by capital goods imports (See Section 2.2). In addition, we confine estimation period to 1970 -2012, because Sino-North Korean nominal trade volumes before 1970 were trivial, less than 100 million dollars. Before 1970, the Chinese economy was still suffering from the consequences of ‘Great Leap Forward’ and ‘Cultural Revolution’, and commercial exchanges between the two countries remained at the immature stage.

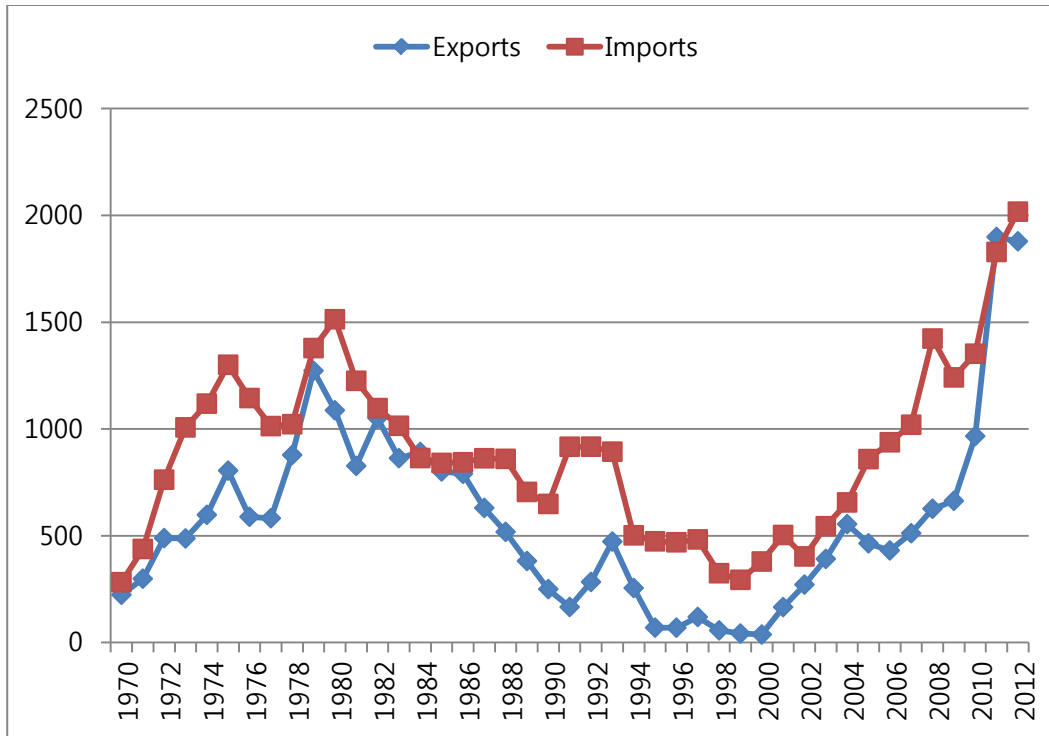
---

<sup>8</sup> Export price index or import price index may be better for deflating nominal values when available. The CPI index normally fails to pick up changes in terms of trade (Jung and Marshall, 1983)

<sup>9</sup> When capital goods are included in total imports from China, the empirical results change only slightly.

**Figure 2.5 Long-term patterns of North Korea's Real exports and imports to/from China**

(Unit: million dollars)



### 3. Hypotheses

#### 3.1 Conventional Socialism Hypothesis

Previous studies on the socialist economy system indicated that trade has limited effect on the economic growth. Kornai (1992) indicate that the external economic activities of a classical socialist economy are controlled by bureaucratic management and principles of planning, not market coordination, and complication and lengthiness of the decision making caused by bargaining within the bureaucracy exacerbate the inflexibility of foreign trading and credit

activity. Because of that, he argues that the classic socialist system is always turning to import substitution instead of export promotion.

Furthermore, Holzman (1985) argue that trade among socialist countries would have negative economic effects. The paper argue that, in case of Comecon (or CMEA), economic opportunities for trade were so poor that there may have been no trade creations and that, in the case of Eastern Europe, trade may in fact have been reduced.

Especially, North Korea explicitly states that international trade should be made to serve the development of self-reliant economy. According to the 'Economic Dictionary' which is published by North Korean official Social Sciences Publishing Company, it reported "the most important thing in the international trade policy of the Workers' Party is to develop international trade based on self-supporting national economy". And, North Korea defines a self-supporting national economy as "an economic system where all factors of production such as human and material resources are secured within the economy itself and a complete coupling between production and consumption allows its production and consumption cycle"<sup>10</sup>. Following the principle, the regime has tried to limit the role of exports to obtain foreign exchange, and imports also have been restrictedly allowed to the commodities which are domestically unavailable or scare. We could test the following hypothesis between the growth and the bilateral trade using the method of cointegration equation and Granger causality test.

*Hypothesis 1-A: North Korea-China trade will not granger cause (have no influence on, or have negatively influence on) the North Korean growth (in the*

---

<sup>10</sup> Economic Dictionary I, II (Lee 2004)

*long-run equation*).

Distinguished characteristic of Sino-North Korean trade pattern may be found in its settlement system. Much of North Korean trade was conducted in a form of barter before collapse of socialist block. Currently, the barter transactions still are known to be prevalent in Sino-North Korean trade. Lee and Hong (2013) indicated that Chinese trade companies located in the border areas are accustomed to barter transactions, and some companies even prefer such transactions precluding involvement by financial institutions, to reduce extra expenses and avoiding taxes. The resurgence of the barter is also truth in developing and some transitional economies, barter can be a way to hide some aspects of the on-going business, which can reduce the firm's tax burden (Marin and Schnitzer, 2002; Marvasti and Smyth, 1998; Schneider, 2010).

Therefore, If North Korea makes the settlement for much of the imports from China mainly through the barter system and, we can expect the causality flow from imports to exports. Thus, we propose the following hypothesis:

*Hypothesis 1-B: North Korea's imports from China will granger cause North Korea's exports to China*

### **3.2 Hypothesis Based on Conventional Growth Theory**

If North Korea has maintained these inner-directed or import-substitute strategy, the mechanism of its economic growth may be expected to differ from the observed in market-oriented economies. Otherwise, the relationships between trade, particularly for imported capital and economic development in non-Communist economies may be expected to bear on North Korea economic

development patterns as well.

Following the conventional growth theory, openness has been indicated to be a major source of productivity growth in developing countries. Regarding the link between trade and growth, Grossman and Helpman (1991), Rivera- Batiz and Romer (1991), and Quanh and Rauch (1990) show that trade can increase the economic growth by providing a wider range of intermediate input, which in turn facilitate more R&D or learning by doing activities.

In addition, previous studies on development emphasize the foreign capital input is important for the growth of developing countries. In particular, Lee (1995) reports that lower income countries, by importing relatively cheaper capital goods from high income countries, increase the efficiency of capital accumulation and thereby the growth rates of income.

However, researches on the North Korean economy find that the economy more relies on the domestically produced capital goods rather than foreign imported capitals. Bazhanova (1992) indicate that North Korea made an effort to domestically produce capital goods through development of its own machinery industry. In addition, Eberstadt (2007) report North Korea's the proportion of imported capital goods to gross domestic capital formation was lowest level in 1980 and 1990. Therefore, we propose the following hypothesis based on conventional growth theory:

*Hypothesis 2-A: North Korea-China trade will granger cause (have influence on) the North Korean growth (in the long-run equation).*

*Hypothesis 2-B: Imports of capital goods will granger cause (have influence on) the North Korean growth (in the long-run equation).*

### **3.3 Export-Led Growth Hypothesis**

The extensive growth literatures have empirically supported export-led growth (ELG) hypothesis. As prominent examples, the studies cited the growth records of Asian newly industrializing countries (NICs), in particular, Hong Kong, Singapore, Korea and Taiwan. More recently, countries like Indonesia, Malaysia, Thailand, and China are nominated as second generation of NIC's. Looking at the Asian economies, the connection between strong export orientation and periods of rapid growth and development is normally highlighted (Giles and Williams, 2000; Kokko, 2002; Awokuse, 2007). Therefore, if the growth model of East Asian countries has been applied to North Korea, we expect causality from exports to imports or from exports to growth as following:

*Hypothesis 3: North Korea exports to China trade will granger cause the North Korean growth (or North Korean imports).*

## **4. Empirical Results**

### **4.1 Unit root tests**

The Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) unit root tests are applied to check data stationarity with the null hypothesis, "non-stationarity." The ADF and PP statistics for log levels of real per-capita GDP, real per-capita exports, real per-capita imports, real per-capita investment, do not exceed the critical values in absolute terms. However, when the first difference of each variable is taken, the ADF and PP statistics are higher than 1% critical values. Based on the estimated results in Table 2.1, we can conclude that all variables in

the model are  $I(1)$ .

**Table 2.1 Test for unit roots Results using ADF and PP tests**

	ADF		PP	
<i>Levels (log)</i>	t-statistic	P-value	t-statistic	P-value
GDP	-0.58705	0.8627	-1.045156	0.7282
Export	-1.165955	0.6802	-1.380376	0.5828
Import	-1.39112	0.5776	-1.73109	0.4087
Investment	-1.53954	0.5038	-1.24569	0.6456
<i>1<sup>st</sup> difference</i>	t-statistic	P-value	t-statistic	P-value
GDP	-4.517218***	0.0008	-4.710863***	0.0004
Export	-4.939357***	0.0002	-4.847509***	0.0003
Import	-4.871456***	0.0003	-4.826171***	0.0003
Investment	-4.699957***	0.0005	-4.482231***	0.0009

Note: 1) Intercept was included in the regression for testing all variables.

2) Lags were determined by Schwarz Information Criterion.

## 4.2 Tests for Optimal Order Length

Prior to applying Granger causality test, we proceed to establish the optimal lag length of the system. Table 2.2 presents the values of various information criteria and other methods for determining the lag order. The LR test, SC, HQ criteria choose 1 lag, while FPE, AIC choose to include 2 lags. Toda and Yamamoto (1995) show that if the order of integration of the variables does not exceed the true lag length of the model, the usual lag selection procedure (Wald, LR test) is valid. As discussed in the previous section 4.1, if all variables in our model are



$I(1)$ , then the usual lag selection procedure by Wald or LR test is always consistent. Based on the LR test results, we opt for a system with a lag length of one.

**Table 2.2 VAR Lag Order Selection Criteria**

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-45.93	NA	0.0002	2.56	2.73	2.62
1	73.66	208.53*	7.54E-07	-2.75	-1.90*	-2.45*
2	90.40	25.75	7.47e-07*	-2.79*	-1.25	-2.24
3	99.40	12.01	1.15E-06	-2.43	-0.21	-1.64
4	109.65	11.55	1.78E-06	-2.14	0.77	-1.10

\* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion

### 4.3 Cointegration

#### 1) Johansen Rank Test

In order to determine the number of cointegration vectors, we employ the Johansen's reduced rank procedure (Johansen 1988; Johansen & Juselius 1990). In the procedures, there are two tests statistics which are trace and max-eigen statistics, and the null hypothesis is that the number of cointegration vectors is less than or equal to  $r$ , where  $r=0$  to 3. The outcomes of both tests suggest the acceptance of the hypothesis that a single cointegration vector is present in our model.

**Table 2.3 Johansen's Test for the number of cointegration vectors**

<i>Cointegration Rank</i>	Trace Statistic		Max-Eigen Statistic	
	Trace Statistic	P-value	Max-Eigen Statistic	P-value
r=0	56.95711***	0.0056	36.12333***	0.0032
r≤1	20.83378	0.3681	13.82538	0.3795
r≤2	7.008393	0.5767	3.660279	0.8934
r≤3	3.348114	0.0673	3.348114	0.0673

As is well known, the cointegration vector is not identified unless we impose identifying restrictions. To identify cointegration vector, we employ weak exogeneity test. In the VECM,  $\Pi$  matrix contains information of the long-run relationships, where  $\Pi = \alpha\beta'$ , and  $\alpha$  represents the speed of adjustment to disequilibrium and  $\beta$  is a matrix of long-run coefficients (Harris, 1995). Conditional on there being only one cointegration vector, we impose restrictions on the adjustment coefficients. For example, If  $\alpha_2 = 0$  in VECM system (equation (2)), then the exports is said to be exogenous with respect to the  $\beta$  parameter, meaning that the equation for  $\Delta LEX$  contains no information about the long-run  $\beta$ , thus the cointegration relationships do not enter into this equation. Table 2.4 displays the results of the LR test for binding restrictions. The only first hypothesis is rejected at the conventional 5% level, implying exports, imports, and investment are weakly exogenous, indicating the cointegration vectors do not enter these equations.

**Table 2.4 Test of Weak Exogeneity**

Hypothesis	$\chi^2(1)$	P-value	Equation
$\alpha_1 = 0$	<b>9.79975</b>	<b>0.00174</b>	$\Delta(\text{LGDP})$
$\alpha_2 = 0$	2.36634	0.12398	$\Delta(\text{LEX})$
$\alpha_3 = 0$	0.01382	0.90642	$\Delta(\text{LIM})$
$\alpha_4 = 0$	3.27296	0.07043	$\Delta(\text{LINV})$

## 2) Bounds Test

We also use a relatively recent approach to testing for cointegration, which is the Bounds testing procedure<sup>11</sup>, within an autoregressive distributive lag (ARDL) framework, developed by Pesaran and others (Pesaran and Shin, 1999; Pesaran et al. 2001). The important advantage of Bounds test is that it has better small-sample properties. Pesaran and Shin (1999) show that with the ARDL framework, the OLS estimators of the short run parameter are  $\sqrt{T}$ -consistent and the ARDL based estimators of the long run coefficients are super-consistent even in a small sample size.

The Bounds test results suggest that the variables are cointegrated when the log of real per-capita GDP is the dependent variable at the 10% level of significance. This result is consistent with the result from the LR test for restrictions on adjustment coefficients.

---

<sup>11</sup> The detailed procedures, refer to Appendix 1

**Table 2.5 Bounds Test for Cointegration**

<i>F</i> -Statistics	5% critical value bounds		10% critical value bounds	
	<i>I</i> (0)	<i>I</i> (1)	<i>I</i> (0)	<i>I</i> (1)
$F_G(GDP   EX, IM, INV) = 3.867$	3.23	4.35	2.72	<b>3.77</b>
$F_{EX}(EX   GDP, IM, INV) = 1.583$				
$F_{IM}(IM   GDP, EX, INV) = 1.872$				
$F_{INV}(INV   GDP, EX, IM) = 1.742$				

### 3) Cointegration Equation

Normalizing cointegrating vector with respect to the log of real per capital income, the long-run equilibrium relationship is as follows.

$$\begin{aligned}
 LGDP_{t-1} = & 6.362 + 0.187LEX_{t-1} - 0.335LIM_{t-1} + 0.192LINV_{t-1} \\
 & (5.647) \qquad \qquad (-5.215) \qquad \qquad (7.607) \qquad (1)
 \end{aligned}$$

Note: The numbers in the parentheses under estimated coefficients are t-values.

At this point, the equation can be interpreted as the long-run reduced form relationships. Note that the equation shows some important properties of Sino-North Korean trade and North Korean growth.

The estimation results suggest that the mechanism of North Korea growth is basically similar with typical growth pattern of low-income, market-oriented economy. Although the results is derived from Sino-North Korean trade not from North Korea's total trade, external trade, and foreign capital input do matter for its growth.

In detail, coefficients of exports and imports do have the signs that are consistent with the national income identification. This suggests that much of the trades between North Korea and China are basically done commercial-based from the long-term perspectives. If economic aids from China occupy a dominant portion in North Korea's imports from China, the coefficient is expected to have a positive relation with per-capita income. This finding supports the argument of Koh et al. (2008), that no Chinese policy involvement in price decisions in exports and imports (e.g. friendly prices) is found in China-North Korean trade data from 2001 to 2007, which suggests that China's trade with North Korea are based on commercial incentives. Our results using the extended data in 1970-2012 also give the same implication of the commercial characteristics of the bilateral trade.

Additionally, the positive relationship between investment proxied by capital goods imports and per capita GDP implies that the North Korean economy has a feature of low income level. Lee (1995) reports the coefficient of the ratio of imports in investment (imported capital goods/GDP) is significantly positive in the sample of 68 non-OECD countries, whereas the coefficient shows a negative sign in the sample of OECD countries. Thus, the significant positive association between the capital goods imports and the GDP in the cointegration equations means that North Korea remains in the less developed country.

#### **4.4 Granger Causality Tests**

Given the results of the previous sections, we conduct Granger causality tests augmented by lagged error correction terms. If there is no cointegration relationship among the  $I(1)$  variables, valid results in Granger causality tests are drawn from the VAR model using the first differencing variables. However, this

transformation may cause the loss of long-run information between level variables. In such cases, the inclusion of error correction term (ECT) is needed to capture long-term causal relations. We augment ECT in GDP equation, because cointegration tests suggest that level variables are cointegrated only when per-capita GDP is the dependent variable. Thus, the Granger causality test involves specifying a multivariate  $p$ -th order VECM as follows:

$$(1-L) \begin{bmatrix} LGDP_t \\ LEX_t \\ LIM_t \\ LINV_t \end{bmatrix} = \begin{bmatrix} \gamma_1 \\ \gamma_2 \\ \gamma_3 \\ \gamma_4 \end{bmatrix} + \sum_{i=1}^p (1-L) \begin{bmatrix} \beta_{11i} & \beta_{12i} & \beta_{13i} & \beta_{14i} \\ \beta_{21i} & \beta_{22i} & \beta_{23i} & \beta_{24i} \\ \beta_{31i} & \beta_{32i} & \beta_{33i} & \beta_{34i} \\ \beta_{41i} & \beta_{42i} & \beta_{43i} & \beta_{44i} \end{bmatrix} \begin{bmatrix} LGDP_{t-i} \\ LEX_{t-i} \\ LIM_{t-i} \\ LINV_{t-i} \end{bmatrix} \\ + \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \\ \alpha_4 \end{bmatrix} \begin{bmatrix} ECT_{t-1} \\ 0 \\ 0 \\ 0 \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \end{bmatrix} \quad (2)$$

where  $(1-L)$  is the difference operator,  $ECT_{t-1}$  is the lagged error-correction term derived from the long-run cointegration relationship.

Table 2.6 contains short-run and long-run Granger causality within the Error Correction Mechanism. The Wald test of the first differencing explanatory variable indicates the significance of short-run causal effects. The  $t$ -statistics on the coefficients of the lagged ECT indicates the significance of the long-run causality. We also display a summary of causality flow in Table 2.7.

The estimation of the VECM shows that ECT is statistically significant at the 1% significance level with a correct (negative) sign in GDP equation. This

implies that the long-run exports, imports, and investments Granger-cause income through error correction mechanism, but not vice versa. In other words, the result implies that the disequilibrium in the cointegration relationship causes changes in per capita incomes. This would confirm the argument that Sino-North Korean trade and foreign capital imports are important variables for North Korea's growth. In particular, North Korean exports to China and foreign capital imports could be significant to its growth, as both variables appear to be positively related with income in the cointegration equation.

With respect to short-term causality, variables have little causal relations with each other except that causality flows from imports to exports at the 10% significance level. This is partially because traditional barter-type settlement is still prevalent in the Sino-North Korean trade. Due to North Korea's inability to settle payment in hard currency, North Korea makes the settlement for the imports from China mainly through the barter system and, consequently, this brings to causality flow from imports to exports (Lee, 2004). Chinese firms trading with North Korea also have incentives to use barter-based transactions. Lee and Hong (2013) indicated that Chinese trade companies located in the border areas are accustomed to barter transactions, and some companies even prefer such transactions precluding involvement by financial institutions, to reduce extra expenses and avoiding taxes. Furthermore, this kind of Sino-North Korean trade pattern is far different from that of East Asian countries. In their case, reversely, it is believed that exports may cause imports, because exports can provide foreign exchange that allows for more imports of intermediates and capital goods which in turn raises capital formation and thus stimulate output growth.

**Table 2.6 Results of Granger Causality**

Dependent Variable	Source of Causation				
	Short run (Wald $\chi^2$ test)				Long run
	$\Delta LGDP_t$	$\Delta LEX_t$	$\Delta LIM_t$	$\Delta LINV_t$	$ECT_{t-1}$ (t-statistics)
$\Delta LGDP_t$	-	1.186 (0.276)	0.003 (0.954)	0.007 (0.932)	-0.203*** (-3.397)
$\Delta LEX_t$	0.000 (0.999)	-	3.327* (0.068)	0.828 (0.363)	-
$\Delta LIM_t$	0.874 (0.350)	1.066 (0.302)	-	0.360 (0.527)	-
$\Delta LINV_t$	1.766 (0.184)	0.284 (0.594)	0.080 (0.777)	-	-

Note: \*,\*\*,\*\*\* refer to significance at 10%, 5%, and 1% level respectively. Figures in parenthesis below  $\Delta LGDP_t$ ,  $\Delta LEX_t$ ,  $\Delta LIM_t$ ,  $\Delta LINV_t$  are p-value

**Table 2.7 Summary of Granger Causality**

Source of Causation	Direction of Causation
Long run	Exports, Imports, Investment $\rightarrow$ GDP
Short run	Imports $\rightarrow$ Exports

#### 4.5 Parameter stability test

North Korea has experienced several episodic events which may have changed the estimated parameter of the long-run relationship over the time period. Therefore, it needs to be tested whether the parameters of the cointegrating vector is stable or not.

To check on parameter stability, the Pesaran and Pesaran (1997) test is



used. According to Pesaran and Pesaran (2007), the short-run dynamics are essential for the stability of the long-run coefficients. The test involves estimating the following error correction models:

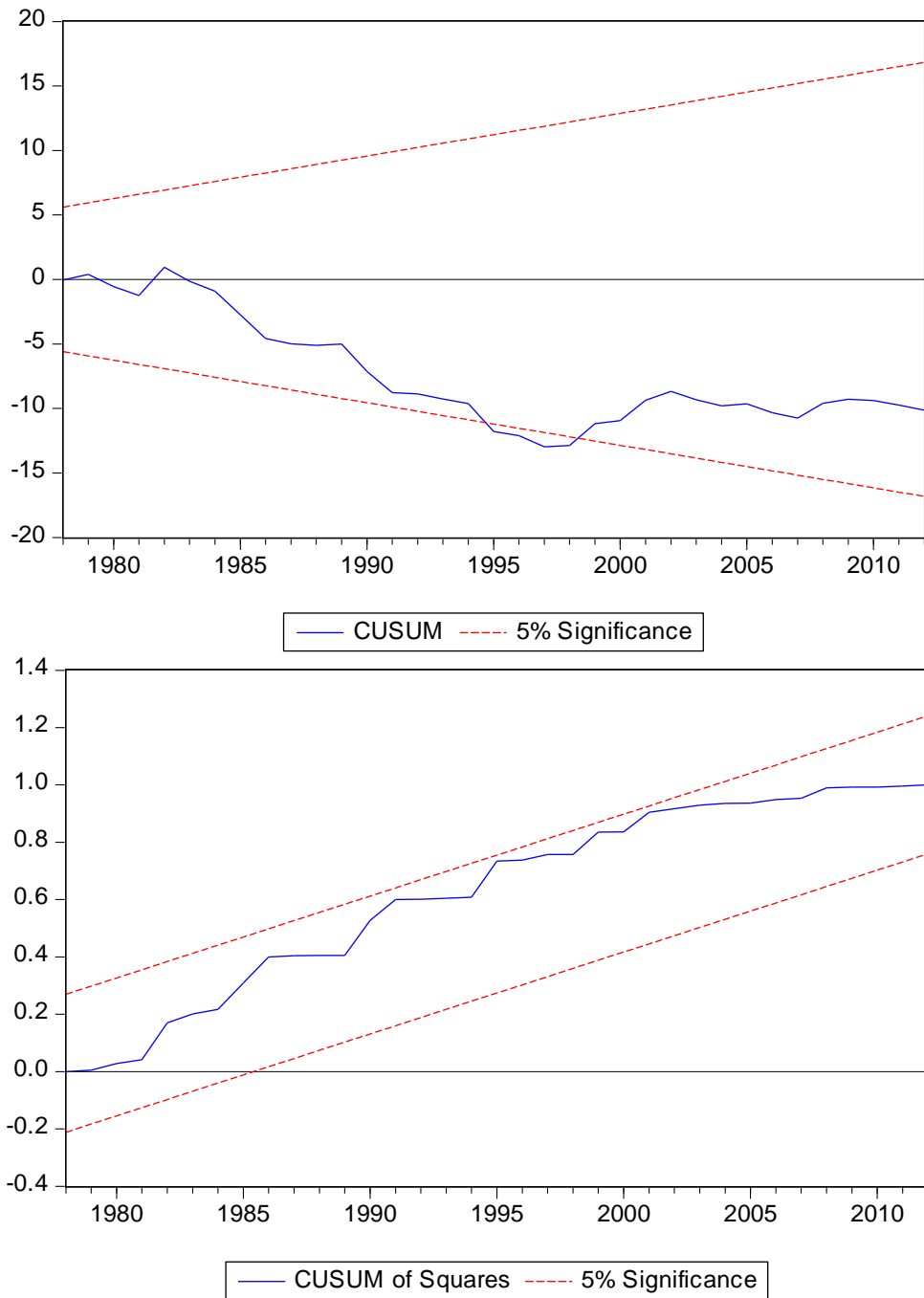
$$\begin{aligned} \Delta LGDP_t = & \alpha_0 + \sum_{i=1}^n s_1 \Delta LGDP_{t-i} + \sum_{i=1}^n s_2 \Delta LEX_{t-i} + \sum_{i=1}^n s_3 \Delta LIM_{t-i} + \sum_{i=1}^n s_4 \Delta LINV_{t-i} \\ & + k_1 ECT_{t-1} + \varepsilon_{1t} \end{aligned} \quad (3)$$

Here all variables are as previously defined and the ECT is calculated from the long run cointegrating vector. Once the models have been estimated, Pesaran & Pesaran (2007) suggest applying the cumulative sum of recursive residuals (CUSUM) and CUSUM of square (CUSUMQ) tests proposed by Brown et al. (1975) to determine the long-run parameter stability.

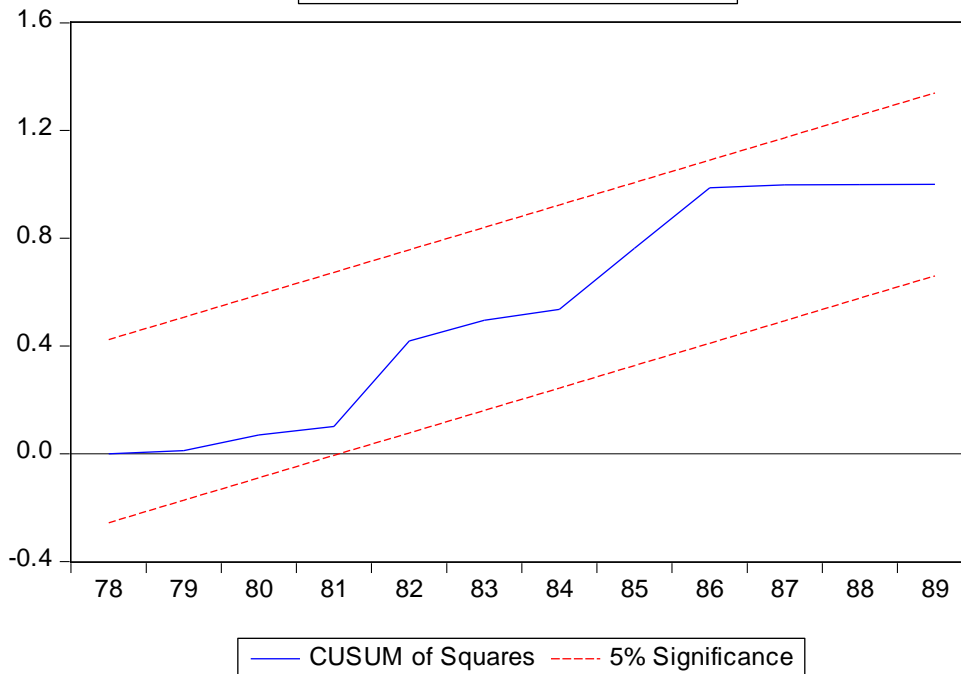
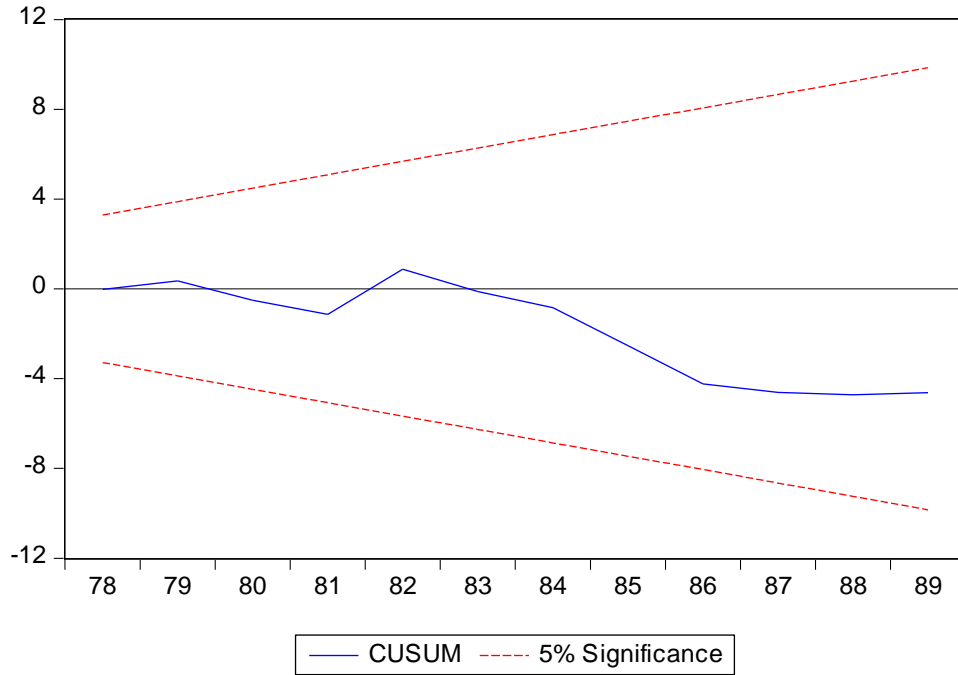
This study performs parameter stability tests for the full sample period (1970-2012), the pre-crisis periods (1970-1989) and the post-crisis period (1990-2012), respectively, to test whether North Korea's economic crisis in 1990 has an effect on the stability of parameters of the cointegrating vector. First, Figure 2.6 plots the CUSUM and CUSUMQ statistics for full sample period. The results indicate the coefficients are stable over the sample period in CUSUMQ test because CUSUMSQ statistics are confined within the 5% critical boundary of parameter stability. CUSUM test, however, suggests the parameters are unstable over the period, because the statistics break the bounds from 1995 to 1998 when North Korea suffered recession unprecedented in its severity. As seen in Figure 2.7 and 2.8, the tests of each sub-sample period (1970-1989 and 1990-2012) reveal the long run parameters are stable regardless of sample periods. These findings indicate that series of external economic shocks including the collapse

of Soviet block and economic sanctions might not cause structural break of the fundamental traits of North Korea-China long-term trade relationship.

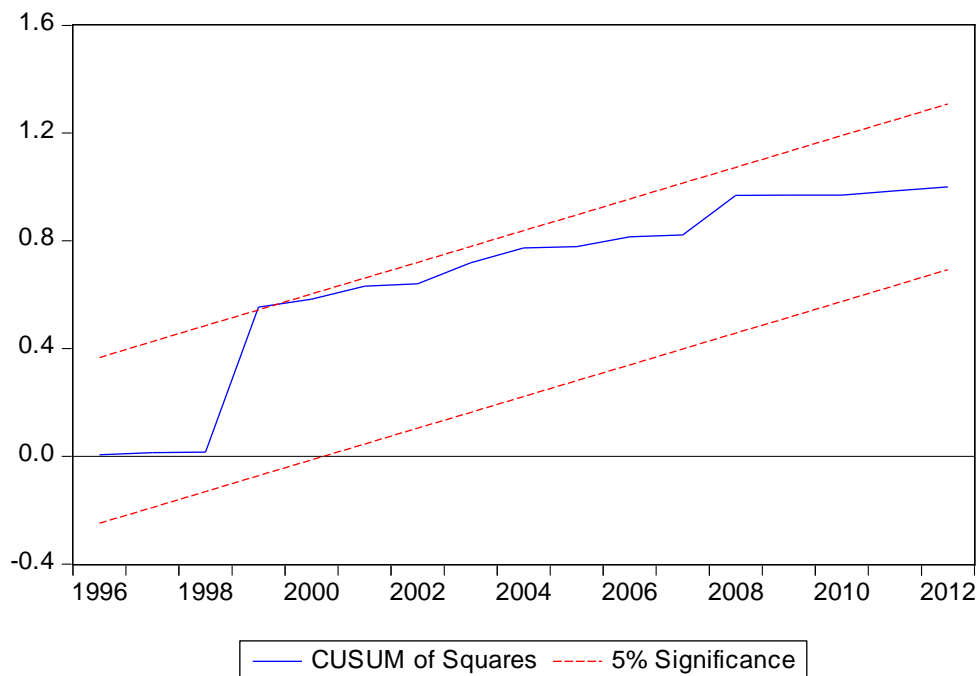
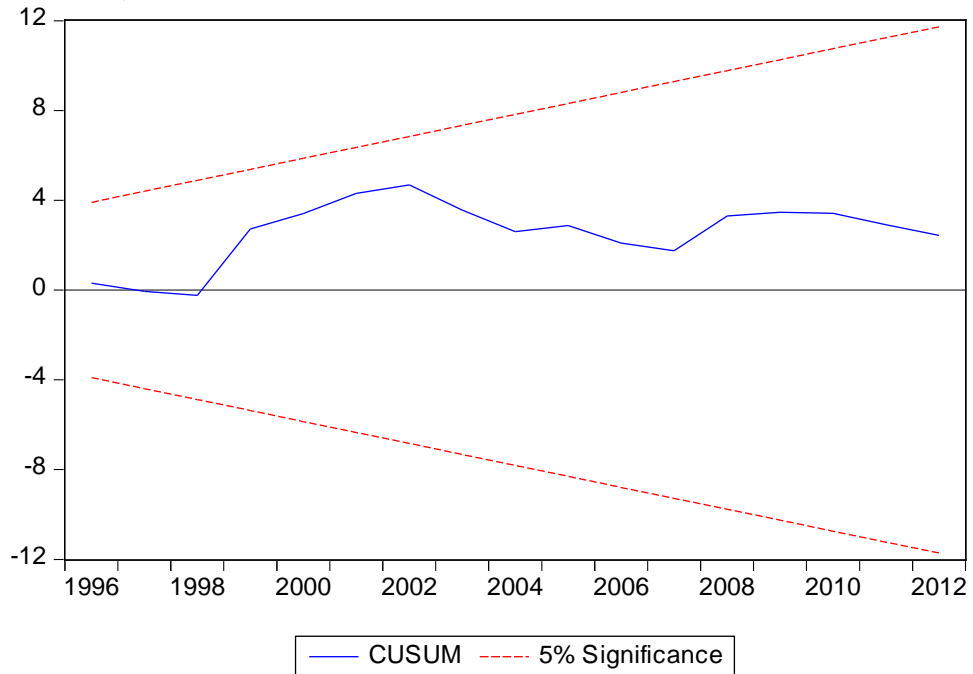
**Figure 2.6 CUSUM and CUSUMQ tests for Full Sample Period**



**Figure 2.7 CUSUM and CUSUMQ tests for Pre-Crisis Sample Period (1970~1989)**



**Figure 2.8 CUSUM and CUSUMQ tests for Post-Crisis Sample Period (1990~2012)**



## 5. Conclusion

This paper uses cointegration tests and error-correction model to examine causality between Sino-North Korean trade and North Korean growth from 1970 to 2012. To evaluate the interrelationship between trade and growth, we also employ the investment variable and imports of capital goods as a proxy of investment to solve the omitted variable bias problem.

First, based on the Johansen and bounds procedures, we find a single cointegrating relationship which is normalized with respect to the log of real per capital income. And, the cointegration equation suggests that the mechanism of North Korea growth is basically similar to the typical growth pattern of low-income countries' economies, because like normal developing countries, trade and foreign capital inputs do matter for growth. Particularly, a significant and negative sign on the coefficient of imports from China implies that much of the trades between North Korea and China are basically done commercial-based from the long-term perspectives. And, the positive relationship between investment proxied by imported capital goods and per capita GDP imply that North Korean economy has a feature of low-income level. A policy implication from the finding is that any trade restriction on the importing of capital goods deteriorates the economy in the long-run.

Second, we construct a VECM, comprised of GDP, exports, imports, and investment. The VECM allows to identify the direction of causality, as well as distinguish between short-run and long-run causality. The estimation of the VECM shows that, in the long-run, exports, imports, and investments Granger-cause income through error correction mechanism, but not vice versa. This would confirm the argument that Sino-North Korean trade and foreign capital imports are important variables for North Korea's growth in the long-run. With

respect to short-term causality, however, the variables have little causal relations with each other except that causality flows from imports to exports. This shows that traditional barter-type settlement is still prevalent in the Sino-North Korean trade. This trade pattern is far different from that of East Asian countries (Japan, South Korea, and Taiwan) where exports might causes growth (or imports) because of adapting the exports promotion policies in the 70's or 80's.

Finally, we perform parameter stability tests for the full sample period (1970-2012), the pre-crisis periods (1970-1989) and the post-crisis period (1990-2012), respectively, to test whether North Korea's economic crisis in 1990 has an effect on the stability of parameters of the cointegrating vector. The tests reveal the long run parameters are stable regardless of sample periods. These findings indicate that series of external economic shocks including the collapse of Soviet block and economic sanctions might not cause a structural break of the fundamental traits of North Korea-China long-term trade relationship.

## References

- Choi, S. Y. (1992) *Foreign Trade of North Korea, 1946-1988*, Ph.D. Thesis, Northern University.
- Lim, K. T. (1995) *North Korea's Foreign Trade, 1962-1992*, Ph.D. Thesis, State University of New York.
- Koh, L. H., Lee S. Kim S. K. and Lee J. H. (2008) *Analysis of North Korea's Trade Structure and Its Implication for Inter-Korean Trade*, Seoul: Korea Development Institute. (in Korean)
- Lee, Y. H. (2006) *The effect of Sino-North Korean trade on North Korean Economy*, Bank of Korea. (in Korean)
- Brown, R. L., Durbin, J. and Evans, J. M. (1975) Techniques for testing the constancy of regression relationships over time, *Journal of the Royal Statistical Society*, Series B, 37, 149–92.
- Pesaran, M. H. and Pesaran, B. (1997) *Working with Microfit 4.0: Interactive Econometric Analysis*, Oxford University Press, Oxford.
- Pesaran, M. H. and Shin, Y. (1999) *An autoregressive distributed lag modelling approach to cointegration analysis*, in *Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium* (Ed.) S. Strom, Cambridge University Press, Cambridge.
- Pesaran, M. H., Shin, Y. and Smith, R. (2001) Bounds testing approaches to the analysis of level relationships, *Journal of Applied Econometrics*, 16, 289–326.
- Kim, B. Y. (2008) National Income of North Korea: Estimates and Evaluation, *Korean EXIM Bank North Korean Economy*, 2008, Autumn. (in Korean)
- Kim, B. Y. (2011) The Determinant of North Korea Economic Growth, *POSRI Business Review*, Vol.11 No.1: 63-81. (in Korean)
- Toda, H. Y. and Yamamoto T. (1995) Statistical Inference in Vector Autoregressions with Possibly Integrated Processes', *Journal of*



*Econometrics*, Vol.66:225–250.

Lee, J. W. (1995) Capital goods imports and long-run growth, *Journal of Development Economics*, Vol. 48, 91-110.

Cho, M. C., Yang M. S., Jung S. H., and Park S. C. (2005) *The Increase of North Korea's Economic Dependence on China and Its Implications for South Korea*. Seoul: Korea Institute for International Economy Policy. (in Korean)

Kim, B. Y., Kim, S. J. and Lee, K. (2007) Assessing the economic performance of North Korea, 1954-1989: Estimates and growth accounting analysis, *Journal of Comparative Economics* **35**(3): 564-582.

Maddison, A. (1995) *Monitoring the World Economy, 1820-1992*, OECD.

UN Comtrade database online.

World Development indicators.

## Appendix 1: Bounds test procedures

$$\begin{aligned}\Delta LGDP_t = & \alpha_0 + \sum_{i=1}^n b_{Gi} \Delta LGDP_{t-i} + \sum_{i=1}^n c_{Gi} \Delta LEX_{t-i} + \sum_{i=1}^n d_{Gi} \Delta LIM_{t-i} + \sum_{i=1}^n e_{Gi} \Delta LINV_{t-i} \\ & + \sigma_{1G} LGDP_{t-1} + \sigma_{2G} LEX_{t-1} + \sigma_{3G} LIM_{t-1} + \sigma_{4G} LINV_{t-1} + \varepsilon_{Gt}\end{aligned}\quad (1)$$

$$\begin{aligned}\Delta LEX_t = & \alpha_{0E} + \sum_{i=1}^n b_{Ei} \Delta LGDP_{t-i} + \sum_{i=1}^n c_{Ei} \Delta LEX_{t-i} + \sum_{i=1}^n d_{Ei} \Delta LIM_{t-i} + \sum_{i=1}^n e_{Ei} \Delta LINV_{t-i} \\ & + \sigma_{1E} LGDP_{t-1} + \sigma_{2E} LEX_{t-1} + \sigma_{3E} LIM_{t-1} + \sigma_{4E} LINV_{t-1} + \varepsilon_{Et}\end{aligned}\quad (2)$$

$$\begin{aligned}\Delta LIM_t = & \alpha_{0M} + \sum_{i=1}^n b_{Mi} \Delta LGDP_{t-i} + \sum_{i=1}^n c_{Mi} \Delta LEX_{t-i} + \sum_{i=1}^n d_{Mi} \Delta LIM_{t-i} + \sum_{i=1}^n e_{Mi} \Delta LINV_{t-i} \\ & + \sigma_{1M} LGDP_{t-1} + \sigma_{2M} LEX_{t-1} + \sigma_{3M} LIM_{t-1} + \sigma_{4M} LINV_{t-1} + \varepsilon_{Mt}\end{aligned}\quad (3)$$

$$\begin{aligned}\Delta LINV_t = & \alpha_{0I} + \sum_{i=1}^n b_{Ii} \Delta LGDP_{t-i} + \sum_{i=1}^n c_{Ii} \Delta LEX_{t-i} + \sum_{i=1}^n d_{Ii} \Delta LIM_{t-i} + \sum_{i=1}^n e_{Ii} \Delta LINV_{t-i} \\ & + \sigma_{1I} LGDP_{t-1} + \sigma_{2I} LEX_{t-1} + \sigma_{3I} LIM_{t-1} + \sigma_{4I} LINV_{t-1} + \varepsilon_{It}\end{aligned}\quad (4)$$

$\Delta$  is the first difference operator, LGDP is the log of real per capital income, LEX is the log of real per capital exports, LIM is the log of real per capital imports, LINV is log of per capita investment. The  $F$  test is used to determine whether a long-term relationship exists between the variables through testing the significance of the lagged levels of the variables. When a long-run relationship exists between the variables, the  $F$  test indicates the variable that needs to be normalized.

The null hypothesis of no cointegration among the variable in Eq (1) is  $H_0 : \sigma_{1G} = \sigma_{2G} = \sigma_{3G} = \sigma_{4G} = 0$ . This is denoted as  $F_G(GDP | EX, IM, INV)$ .

Separate tests on each equation of lagged levels of the variables could also be conducted; for instance, testing  $H_0 : \sigma_{1E} = \sigma_{2E} = \sigma_{3E} = \sigma_{4E} = 0$  for Eq(2). Pesaran et al. (2001) report exact critical values for the  $F$  test. If computed  $F$  statistics is higher than the upper bound critical value, the null hypothesis of no cointegration is rejected.

## **Chapter 3. The Impact of Economic Sanctions on North Korea – China Trade: A Dynamic Panel Analysis**

### **1. Introduction**

Economic sanctions are the essential events in understanding the North Korean economy in the 2000s. The United Nations Security Council Resolution (UNSCR) 1718 and 1874 were adopted in 2006 and in 2009, respectively, in response to North Korea's consecutive nuclear tests. The multilateral sanctions included sanctions on weapon systems and sales of luxury goods to North Korea, but did not include sanctions on nonmilitary commercial trade (Haggard and Noland, 2009). In contrast, unilateral sanctions by its principal economic partners, South Korea and Japan, contained much stronger measures<sup>12</sup>. In the aftermath of sinking of the *Cheonan* battleship in March 2010, South Korea has suspended all trade relations with North Korea except for the Kaesong Industrial Complex (KIC). Moreover, North Korea's trade volume with Japan sharply dropped to zero after Japan's complete trade embargo due to the bilateral tension over the abductions of Japanese citizens<sup>13</sup>.

The effectiveness of the economic sanctions<sup>14</sup> on North Korea economy, however, still remains unclear. Noland (2008) and Jeong & Bang (2011) report that the economic sanctions by UNSCR 1718 did not have any significant effect on North Korea's exports and imports. Lee & Kim (2011) observes a negative

---

<sup>12</sup> The United States also has implemented a unilateral sanction against North Korea since the end of the Korean War. This long-run application of sanction makes economic relations between the U.S. and North Korea minuscule.

<sup>13</sup> For detailed list of sanctions, refer to Appendix 1.

<sup>14</sup> Van Bergeijk(1994) distinguishes between the effectiveness and success/failure of economic sanctions. The effectiveness deals with (potential) damage that is to be inflicted on the target economy, while success/failure deals with the target's behavioral changes as a consequence of diplomatic economic measures.

relationship between the sanctions by UNSCR 1874 and North Korea's aggregate exports, but again no apparent relationship is found between the sanctions and North Korea's imports. Lee (2010) finds that Japan's economic sanctions diminished North Korea's export to Japan, but the size of export loss was mostly compensated by North Korea's increased exports with other countries. Finally, Lee (2010) and Lee & Lee (2012) argue that South Korea's sanctions measure may incur significant adjustment costs to the North Korean economy in increasing exports to China, because North Korean exports to South Korea is not easy to transferable to the Chinese Market<sup>15</sup>. In addition, it points out that exporting strategic goods such as coal and iron ores may deteriorate North Korean domestic productions.

Despite differences in the sanctions' impact on North Korean trade, most studies generally have reached a consensus on the limited effect of the sanctions in damaging the North Korean economy as a whole, indicating that the expanded trade between North Korea and China, North Korea's largest trade partner, would relieve a great deal of pressure imposed by both multilateral and unilateral sanctions (Mimura, 2005; Whitty et al., 2006; Noland 2008; Haggard and Noland, 2009; CRS, 2010; Lee & Kim, 2011; Jeong & Bang, 2011).

This study addresses the question whether North Korea–China trade dilutes the effect of the sanctions, and if so, to what extent and in what way. For a clearer analysis, this article narrows down the question to changes in North Korea's exports by the unilateral sanctions applied by South Korea and Japan. Given informal and illicit cross-border trades and the lack of Chinese cooperation in the border areas, multilateral sanctions mainly targeting North Korea's import have proven to be difficult to strengthen (Haggard and Noland,

---

<sup>15</sup> Mining products are the main North Korean exporting commodities to China, whereas garments account for the major portion to South Korea.

2009; CRS, 2010). From this perspective, it is critical to evaluate the sanctions' impact on North Korea's exports rather than imports, because the matter is directly related to the amount of cash flow blocked by the sanctions, which may be important for military development.

To analyze the changes of North Korea's exports in response to the sanctions, we construct a panel dataset of North Korea's bilateral trade with China, South Korea, and Japan at HS4 digit-level covering the period 2001-2012. Based on the dataset, we implement two empirical approaches. First, we use the data of total trade volumes in order to determine the aggregate impact of South Korean and Japanese sanctions on North Korea's export to China. Second, this essay extends the scope of the research, which most previous studies ignored, to the types of trade<sup>16</sup> between North Korea and China. In fact, North Korea can nullify sanctions' effects by increasing not only export volumes with China's domestic market but also by increasing transit trading through China.

As seen in Figure 3.1, the trends of three trade types dynamically changed over the period. In the early 2000, the bonded trade was shown to be a dominant way of trade when North Korea exported to China. This is partially because much of the inter-Korea trade was taken place through China. Although the volume of inter-Korea trade skyrocketed after the first inter-Korean summit

---

<sup>16</sup> The author divides North Korea's exports statistics with China into three basic trade types (more detailed information for trade type, refer to Hammer, 2006; KOTRA, 2006)

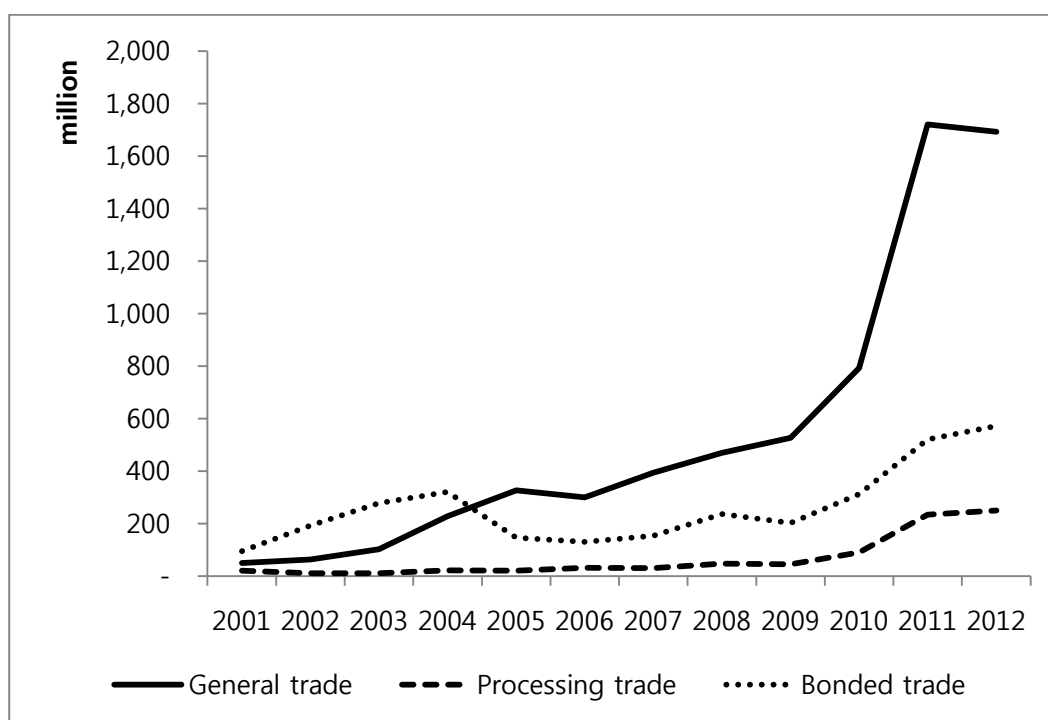
- **General trade** refers to exports intended for the Chinese domestic market. North Korea's major exports are mining products.

- **Processing trade** refers mainly to imports of raw material that are intended to be assembled or transformed in North Korea, and subsequently re-exported (normally by subcontracting operations). North Korean firms only gain processing fees through this kind of trade. North Korea's major exports are clothing product.

- **Bonded (warehouse) trade** refers to exports not intended for the Chinese domestic market. But the exports only transit China and re-exporting to a third county. Bonded trade accounts for 30% of the total trade between North Korea and China. North Korea's major exports are clothing and mining products.

in 2000, the infrastructures for the direct trade between Korea were not well established at that time. As the South Korean government implemented strict inspection measures on imported goods which pass through China and as the Japanese government imposed strong sanctions, the share of the bonded trade plummeted from 2005 to 2009. After South Korean imposed sanctions in 2010, the export volumes of all trade types surged, and the general trade was the highest jumped one among trade types.

**Figure 3.1 The trend of North Korea’s exports to China by trade type**



Source: China Customs

Taking account to the features of the bilateral trade, we construct equations that reflect North Korea’s trade types with China to identify how the sanctions’ effects across trade types vary. This study uses dynamic models to

allow adjustment or persistent effects of the economic sanctions over time and employs the system GMM estimator to address the endogeneity problem.

The results show structural adjustments of North Korea's export pattern in size and types for the purpose of voiding the effectiveness of unilateral sanctions, especially the sanctions imposed by South Korea. We find that South Korea's economic sanctions significantly boost North Korea's exports to China. The exports increase was enough to cover the loss from South Korean sanctions. We further find that all types of trades between North Korea and China are increased in response to the South Korea's trade restrictions. The expansion in mining exports through general trade is the largest. In addition, bonded trades that are transferred in China also have been an effective expedient to circumvent sanctions, because it can possibly make North Korea evade foreign customs regulations. This finding supports the argument that even severe sanctions on commercial trade of North Korea have little impact because North Korea mitigates the economic damage from sanctions by employing a broad range of techniques for trade diversion.

The rest of the paper is structured in 5 sections. Section 2 discusses the empirical model. Section 3 provides a description of the data. The main results and discussions are presented in Section 4. Section 5 summarizes the core findings of this paper and discusses some policy implications.

## **2. Empirical Framework**

In order to investigate the influence of political variables on normal bilateral trade flows, the gravity model of international trade has often been used (Van Bergeijk, 1994; Caruso, 2003). Following this approach, some also applied the model to analyze the effect of sanctions imposed on North Korea (Lee, 2010;



Jeong & Bang, 2011; Lee & Kim, 2011). However, the abnormality of North Korea's trade pattern casts doubt on the model's applicability.

As seen in Table 3.1, the geographic composition of North Korea's export has been transformed considerably. Both South Korea and Japan were once top importing countries of North Korea, but their importance in North Korea's exports sharply decreased just after each of them imposed severe restrictions on trade inflow from North Korea. On the contrary, the Chinese share has continuously increased up to almost 70% as the diplomatic climates around North Korea deteriorated. This shift clearly shows the dominant influence of political factors on exports of North Korea and the limited explanatory power of the gravity model, which suggests GDP of exporting/importing country or geographic distance between exporting and importing countries as the key variables<sup>17</sup>.

**Table 3.1 North Korea's exports trend in 2000's**

(Unit: million USD, %)

Year	Total Export Volume	Export Proportion by the Countries				note
		China	South Korea	Japan	Sum	
2001	822	20%	21%	27%	69%	
2002	1,008	27%	27%	23%	77%	
2003	1,066	37%	27%	16%	81%	Start of Japanese sanctions
2004	1,278	46%	20%	13%	79%	
2005	1,338	37%	25%	10%	72%	
2006	1,467	32%	35%	5%	73%	
2007	1,683	35%	45%	0%	80%	

<sup>17</sup> Moreover, the bonded trade with China and its unusual large size, 30% of the total trade between North Korea and China, could lead to biased results from the gravity model. The bonded trade is not an actual trade between North Korea and China. North Korea exports goods only through China, and no information is available of these commodities' final destinations.

2008	2,062	37%	45%	0%	82%	
2009	1,997	40%	47%	0%	86%	
2010	2,557	47%	41%	0%	88%	Start of South Korea's sanctions
2011	3,702	67%	25%	0%	92%	

Note: North Korea's total export volume was compiled by adding KOTRA's statistics and inter-Korea trade volume<sup>18</sup>.

Source: Korea Trade and Investment Promotion Agency (KOTRA), Korea International Trade Association (KITA), China Customs statistics, UN COMTRADE database.

Noland (2008) assesses the impact of sanctions on trade based on the import demand equation. Some macro variables, such as North Korean income, black market exchange rates, were included in the trade equation to control for the level of economic activity and domestic price of North Korea. As is well known, however, most North Korean macro data suffer from serious measurement errors in the estimation procedures (Lee, 2007).

Given the lack of theoretically applicable models and macro data availability, our estimation strategy is to maximize usage of trade data. To do that, we construct bilateral trade panel data by commodity rather than by country, to use the rich trade information as much as possible ranging from price and quantity to the values of each commodity.

In the dataset, we identify the following variables to explain North Korea's export to China. First, the lagged variable of the North Korea's export values is used as a repressor in the model. It allows the model to account for dynamics in the underlying process of the bilateral trade, and North Korea's behavioral adjustment in response of the sanctions. In this dynamic setting, we apply the system GMM (Generalized Method of Moments) estimator to deal

---

<sup>18</sup> North Korea's trade data often causes confusion because South Korea does not report its trade with North Korea to international authorities, considering it as inter-Korean, not international.

with the endogeneity problem due to the inclusion of the lagged variables (Arellano and Bover, 1995; Blundell and Bond, 1998).

Second, price level of trade goods should be taken into consideration in the function. Kim (2013) indicates rising unit prices, particularly for mining products, contribute to North Korea's increased trade outflow to China. Having little information of the price index of North Korea's trade, we alternatively use unit prices of each North Korea's export commodity to China to control price inflation effects of its exports to China.

Third, we include export values of South Korea and Japan to reflect trade linkage among countries. Regardless of the sanctions, the countries may have had substitutive or complementary relationship with North Korea in terms of exports. For example, if North Korea exports more (less) to China, it subsequently exports less (more) to others due to the North Korea' limited production capacity, internal policy changes or trade type changes.

To summarize, the basic model has the following functional form. We use subscript  $i$  and  $t$  to denote HS 4-digit commodity code<sup>19</sup> and year, respectively.

$$\ln C_{it} = \beta_1 + \beta_2 \ln C_{it-1} + \beta_3 \ln CP_{it} + \beta_4 \ln K_{it} + \beta_5 \ln J_{it} + \beta_6 Kdummy_t + \beta_7 Jdummy_t + \varepsilon_{it} \quad (1)$$

Where,

$\ln C_{it}$  : log of North Korea's exports value to China of commodity  $i$  in year  $t$ ;

$\ln C_{it-1}$  : lagged log of North Korea's exports value to China of commodity  $i$  in

---

<sup>19</sup> HS system of tariff nomenclature is an internationally standardized system of names and numbers for classifying traded products developed and maintained by the World Customs Organization (WCO).

year  $t$ ;

$\ln CP_{it}$  : log of unit price of North Korea's exports to China of commodity  $i$  in year  $t$ ;

$\ln K_{it}$  : log of North Korea's exports value to South Korea of commodity  $i$  in year  $t$ ;

$\ln J_{it}$  : log of North Korea's exports value to Japan of commodity  $i$  in year  $t$ ;

$Kdummy_t$  : South Korea's economic sanction dummy (if  $t \geq 2010$  =1, otherwise=0);

$Jdummy_t$  : Japanese economic sanction dummy (if  $t \geq 2003$  =1, otherwise =0);

To identify the sanctions' impact variations by trade types, we decompose North Korea's exports to China by trade types, and construct the following three equations. We use superscript  $G$ ,  $B$  and  $P$  to denote general trade, bonded trade and processing trade respectively.

$$\begin{aligned}\ln C_{it}^G &= \beta_1 + \beta_2 \ln C_{it-1}^G + \beta_3 \ln CP_{it}^G + \beta_4 \ln K_{it} + \beta_5 \ln J_{it} + \beta_6 Kdummy_t + \beta_7 Jdummy_t + \varepsilon_{lit} \\ \ln C_{it}^B &= \beta_1 + \beta_2 \ln C_{it-1}^B + \beta_3 \ln CP_{it}^B + \beta_4 \ln K_{it} + \beta_5 \ln J_{it} + \beta_6 Kdummy_t + \beta_7 Jdummy_t + \varepsilon_{lit} \\ \ln C_{it}^P &= \beta_1 + \beta_2 \ln C_{it-1}^P + \beta_3 \ln CP_{it}^P + \beta_4 \ln K_{it} + \beta_5 \ln J_{it} + \beta_6 Kdummy_t + \beta_7 Jdummy_t + \varepsilon_{lit}\end{aligned}\quad (2)$$

Where,

$\ln C_{it}^g$  : log of North Korea's exports value to China by general trade of commodity  $i$  in year  $t$ ;

$\ln C_{it}^B$  : log of North Korea's exports value to China by bonded trade of commodity  $i$  in year  $t$ ;

$\ln C_{it}^P$ : log of North Korea's exports value to China by processing trade of commodity  $i$  in year  $t$ ;

Despite the merits of commodity-based panel dataset, there are some limitations of this empirical setting. First, the model only considers North Korea's trade diversion effect from China to South Korea and does not take into account trade reduction (increase) effects from the third-party countries. To capture all trade reduction effects (increase) from third-party countries, country-based panel data which contain bilateral trade with North Korea is needed to construct. The trade reduction effects, however, are likely to be small, because the more than 70% North Korean exports go to either China or South Korea. In addition, North Korea's trade data with other countries, excluding South Korea, China, and Japan, are known to be inaccurate because some countries' customs often confuse the commodities' origins between South and North Korea. Secondly, the model specification does not account for a possible trade volume difference between the sanction-affected and the unaffected countries. Some previous studies by Jeong & Bang (2011) and Lee & Kim (2011) use the DID (Difference in Difference) estimation method to control for the difference based on country panel data. Jeong & Hong (2001) choose socialist countries as control group, whereas Lee & Kim (2011) selects the countries that have not submitted their national implementation reports to UN resolution 1874. However, as Abadie et al. (2010) indicated, setting control groups on the basis of researchers' subjective measures leads to uncertainty in reproducing the counterfactual outcomes which the treatment group would have experienced in the absence of the event of interest.

Finally, the price difference of imports between North Korean and others is not controlled. There might be a possibility Chinese firm's bargaining power

over North Korea lowering the price of the major North Korean exporting commodities (Koh 2008). However, more detailed commodities data, for example 6 or 8 HS level data, enable to specify quality difference that is not available for the full sample period.

### 3. Data

This study uses North Korea's bilateral exports data with China, South Korea, and Japan from 2001 to 2012. North Korea does not issue any official trade statistics, so the data was constructed based on the three countries' imports statistics<sup>20</sup>. Because each original dataset uses different HS code levels, we aggregate the data into panel HS-4 digit level in current U.S. dollars<sup>21</sup>. In particular, raw trade statistics from China customs contains trade types of each commodity's transactions categorized into nineteen custom regimes<sup>22</sup>. We reclassify North Korea's main trade types into three groups -- general trade, processing trade, and bonded trade (refer to Appendix 2). The main sources are China customs, Korea International Trade Association (KITA) statistics database, and UN Comtrade database.

It is worth noticing when the sanctions effectively initiated. In case of Japan, the first measure was strengthening Port State Control (PSC) inspection

---

<sup>20</sup> The trade values are recoded as CIF (Cost, Insurance and Freight) type value, not FOB (Free on Board) type value. Therefore, the statistics overestimated the real exports value of North Korea.

<sup>21</sup> Trade values are taken in logs and to deal with the issue of zeros, a very small number is added to those to allow for log transformation. Silva and Tenreyro(2006) pointed out that such an approach could arise biased estimates in presence of heteroskedasticity so we run panel regressions with robust standard errors to minimize possible bias.

<sup>22</sup> We mostly rely on China customs sources to construct the data of Chinese statistics. However, China customs did not report trade statistics with North Korea from Aug to Nov of 2009 just after North Korea's second nuclear test. For 2009 data, we refer to UN Comtrade database and reconstruct original data from China Customs.

on the Mangyongbong-92, a passenger ferry between North Korea and Japan, in June 2003. In case of South Korea, the so-called May 24 measures, which suspended all commercial trades with the exception of the KIC, were introduced in May 2010. Because of the intrinsic limitations of the annual dataset, we cannot designate the specific point when the sanctions began. However, foreign trade partners may respond in advance, even before a sanction starts, because just starting discussions on the imposition of an economic sanction escalates political tensions, and it surely increases the risk premium on transactions with North Korea. Following this, the data defines the starting point of Japan and South Korea's sanctions in 2003 and 2010, respectively.

Table 3.2 presents the descriptive statistics in our regression model.

**Table 3.2 Descriptive statistics of the variables**

<b>Variable</b>	<b>Mean</b>	<b>S.D.</b>
log of North Korea's exports value to China	10.80	3.32
log of North Korea's exports value to China by general trade	10.49	3.34
log of North Korea's exports value to China by bonded trade	10.53	3.17
log of North Korea's exports value to China by processing trade	10.49	3.19
log of North Korea's exports value to South Korea	6.95	6.39
log of North Korea's exports value to Japan	1.50	4.08
log of unit price of North Korea's exports to China	0.89	2.64
log of unit price of North Korea's exports to China by general trade	0.20	2.89
log of unit price of North Korea's exports to China by bonded trade	1.09	2.15
log of unit price of North Korea's exports to China by processing trade	1.19	1.93
South Korea's economic sanction dummy	0.32	0.46
Japanese economic sanction dummy	0.92	0.26

## **4. Empirical Results**

### **4.1 Basic Model: Sanctions' Effects on Total Exports**

Table 3.3 presents the estimation outcomes from Pooled OLS, Fixed effects and system GMM estimators for the basic model. In the dynamic panel models, it is well known that an OLS estimator gives an upward biased and inconsistent estimate in the presence of individual-specific effects, and the fixed effects estimator also gives a downward biased and inconsistent estimate in a short panel (Nickell, 1981). Thus, a consistent estimate of the coefficient of a lagged dependent variable can be expected to lie between the OLS and Fixed effects estimates (Bond et al., 2001). In this regard, the System GMM estimates in Table 3.3 are consistent and robust as well. The Hansen test of over-identification suggests that the set of instruments are valid, and AR(2) test shows no second-order autocorrelation. Hence, we interpret the results based on the system GMM estimator.

Regarding the sanctions' effects, we find that South Korea's economic sanctions increase North Korea's exports to China, whereas Japanese sanctions have an insignificant effect. Our result on Japanese sanction is in line with that of Lee (2010), who reports that, based on Granger Causality Tests, North Korea mitigates Japanese sanctions' effect not by increasing exports to China but by increasing exports to South Korea. After implementation of South Korean economic sanctions, however, North Korea cannot but expand exports to China because its export structure already is heavily relied on only two principle countries, China and South Korea. From this viewpoint, our estimated results reflect the reality of North Korea's trade pattern changes.

It is necessary to pay attention to the magnitude of the South sanctions'



coefficient. It has a relatively large size, which implies that the North's exports to China after the sanctions are predicted to increase by 63.7% ( $e^{0.493}-1$ ). Converting the effects to the US dollar level, the increased annual average exports due to the sanctions is estimated to be around 319 million dollars<sup>23</sup>. It means that North Korea's export diversion effects from expanded exports to China are larger than the loss from decreased exports to South Korea<sup>24</sup>. However, the actual average increase of North Korean exports to China between before and after South Korean sanctions is more than 1.5 billion dollars. Following the results, the estimates only partially explain the abnormal increase in North Korean exports to China after South Korean sanctions. Therefore, the unidentified factors which are not accounted into the model cause the rapid increase of the North Korean exports. For example, the North Korean regime needs to obtain more hard currency for the preparations of changing leadership.

The coefficient on lagged exports is significant as well. It indicates the dynamic of the bilateral is important. After controlling for the unilateral sanctions' effects, we observe weak positive/negative relationship between exports to China and exports to others.

---

<sup>23</sup> We calculate this value by differencing 'the expected average exports to China after sanctions' with 'the actual average exports to China before sanctions'. And the expected exports volume is derived from the coefficient of South Korea's sanctions. Alternatively, the predicted values could be used for this conversion. However, it is hard to be applicable in practice, because the predicted values by model are far different from real observations due to limitation of the model

<sup>24</sup> Roughly, the estimate of the amount of exports loss from inter-Korean trade by the sanctions is 278 million dollars. It is calculated by differencing 'the average of total exports to South Korea by general and processing trade (outside KIC) before the sanctions' with 'the average of total exports to South Korea by general and processing trade (outside KIC) after the sanctions'

**Table 3.3 Basic model panel regression estimates**

	<b>Pooled OLS</b>	<b>Fixed Effect</b>	<b>SYS GMM t-3</b>
<b>Dependent Variable:</b>	Log of export values to China		
Log of lagged export values to China	0.452*** (0.011)	0.133*** (0.017)	0.202*** (0.035)
Log of unit price	0.013 (0.019)	0.235*** (0.065)	0.220 (0.168)
Log of export values to South Korea	0.031*** (0.007)	0.006 (0.013)	-0.071* (0.040)
Log of export values to Japan	0.091*** (0.012)	-0.008 (0.017)	0.056* (0.031)
South Korea's economic sanctions dummy	0.688*** (0.106)	0.777*** (0.106)	0.493*** (0.159)
Japanese economic sanctions dummy	-0.315* (0.182)	-0.155 (0.144)	-0.163 (0.164)
R2	0.53	0.16	
F-test		[0.000]***	
AR(2) test			0.43
Hansen test			0.13
Number of observations	2,417		

Note: \*,\*\*,\*\*\* refer to significance at 10%, 5%, and 1% level respectively. Standard errors are in parentheses. All standard errors are calculated as being robust to heteroskedasticity.

## 4.2 Extended Model: Sanctions Effects by Trade Type

Table 3.5 lists the effects of economic sanctions on North Korea's three main trade types with China. The estimated results of sanctions' coefficients are very similar to the previous ones. Only South Korean sanctions' dummy is positively associated with North Korea's exports through all trade types, whereas Japanese one does not exert an influence across the models. For a clearer comparison with trade types, we summarize dollar denominated North Korean exports changes in response to the sanctions in Table 3.4. The first column reports of the export expansion with China, which is estimated in the regression model. The second column reports of the loss from South Korea's sanctions, which are the actual average differences in North Korea's exports to South Korea before and after the sanctions. In terms of volume, the result suggests that general trade and then bonded trade between North Korea and China are the trade types that were most positively affected by the sanctions.

**Table 3. 4. North Korea's exports changes from the South Korea's economic sanctions**

(Unit: million USD)

	Trade diversion effects from China	Loss from South Korea
General Trade	163	198
Bonded Trade	104	-
Processing Trade <sup>1</sup>	18	80
Total	319 <sup>2</sup>	278

Note1: In South Korea's inter-Korean trade statistics, it means processing trade outside KIC.

Note2: There is discrepancy between total value and each value by trade type in the first column, because the values are estimated from a single equation with different control variables.

**Table 3.5 Extended model panel regression estimates**

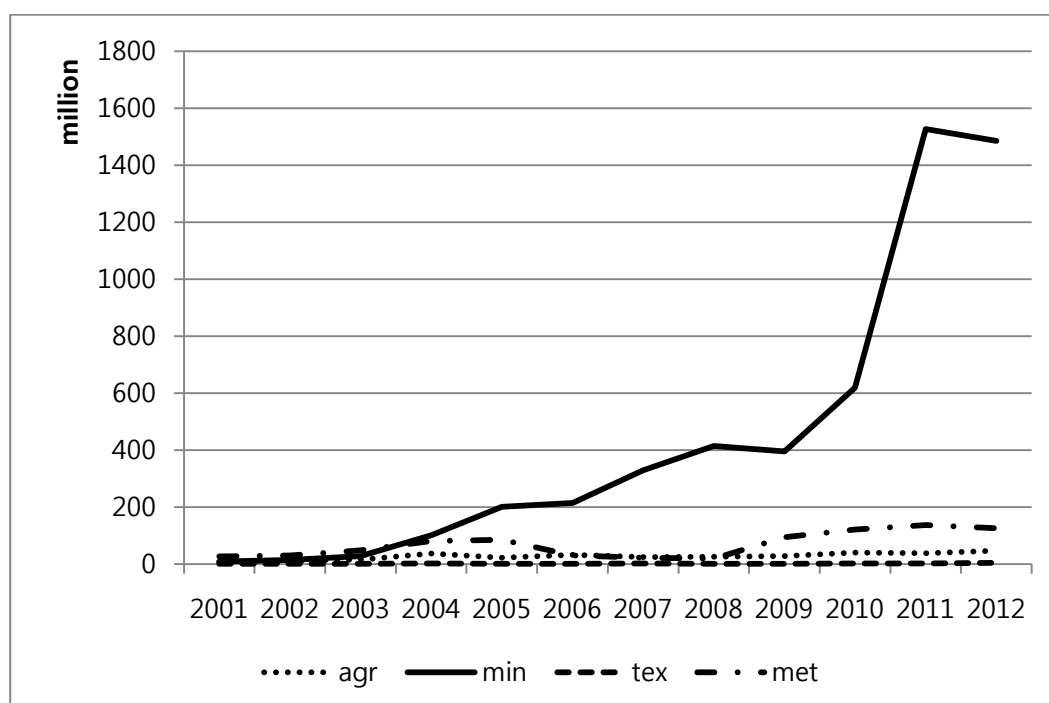
Estimator	Pooled OLS	Fixed Effect	SYS GMM t-3	Pooled OLS	Fixed Effect	SYS GMM t-2	Pooled OLS	Fixed Effect	SYS GMM t-2
<b>Dependent Variable:</b>	Log of export values to China by general trade			Log of export values to China by bonded trade			Log of export values to China by processing trade		
Log of lagged export values to China by General trade	0.456*** (0.013)	0.101*** (0.020)	0.190*** (0.068)						
Log of lagged export values to China by banded trade				0.331*** (0.012)	0.103*** (0.014)	0.132*** (0.024)			
Log lagged export values to China by processing trade							0.309*** (0.017)	0.082*** (0.020)	0.195*** (0.040)
Log of unit price by general trade	0.030 (0.021)	0.135 (0.117)	-0.246 (0.211)						
Log of unit price by bonded trade				0.034 (0.031)	0.323*** (0.077)	0.031 (0.211)			
Log of unit price by processing trade							-0.124** (0.053)	0.343*** (0.075)	-0.328 (0.299)
Log of export values to South Korea	-0.015 (0.010)	-0.006 (0.013)	-0.022 (0.064)	0.039*** (0.011)	0.012 (0.014)	-0.074* (0.045)	0.076*** (0.014)	-0.013 (0.021)	0.008 (0.057)
Log of export values to Japan	0.057*** (0.015)	-0.025 (0.021)	0.086** (0.043)	0.083*** (0.015)	-0.014 (0.018)	0.057 (0.031)	0.050** (0.021)	0.074*** (0.027)	-0.015 (0.036)
South Korea's economic sanctions dummy	0.580*** (0.138)	0.626*** (0.118)	0.467** (0.200)	0.609*** (0.148)	0.843*** (0.119)	0.426** (0.179)	0.837*** (0.214)	0.822*** (0.222)	0.527* (0.281)
Japanese economic sanctions dummy	0.603*** (0.214)	0.647*** (0.182)	-0.248 (6.919)	-0.697*** (0.241)	-0.648*** (0.207)	-0.3389 (0.240)	0.010 (0.352)	-0.668* (0.344)	-0.199 (0.3672)

R2	0.55	0.14		0.43	0.19		0.43	0.24	
F-test		[0.000]***			[0.000]***			[0.000]**	
AR2 test			0.237			0.769			0.403
Hansen test			0.132			0.283			0.188
Number of observation	1,413			1,412			627		

Note: \*, \*\*, \*\*\* refer to significance at 10%, 5%, and 1% level respectively. Standard errors are in parentheses. All standard errors are calculated as being robust to heteroskedasticity.

As Figures 3.2, 3.3, and 3.4 show, each trade type has very different commodity compositions<sup>25</sup>. Particularly after imposing the sanctions, mining exports have become dominant in the general trade, and clothing exports have become dominant both in the processing and the bonded trade.

**Figure 3.2 The trend of commodity composition of North Korea's exports to China by general trade**



Source: China Customs

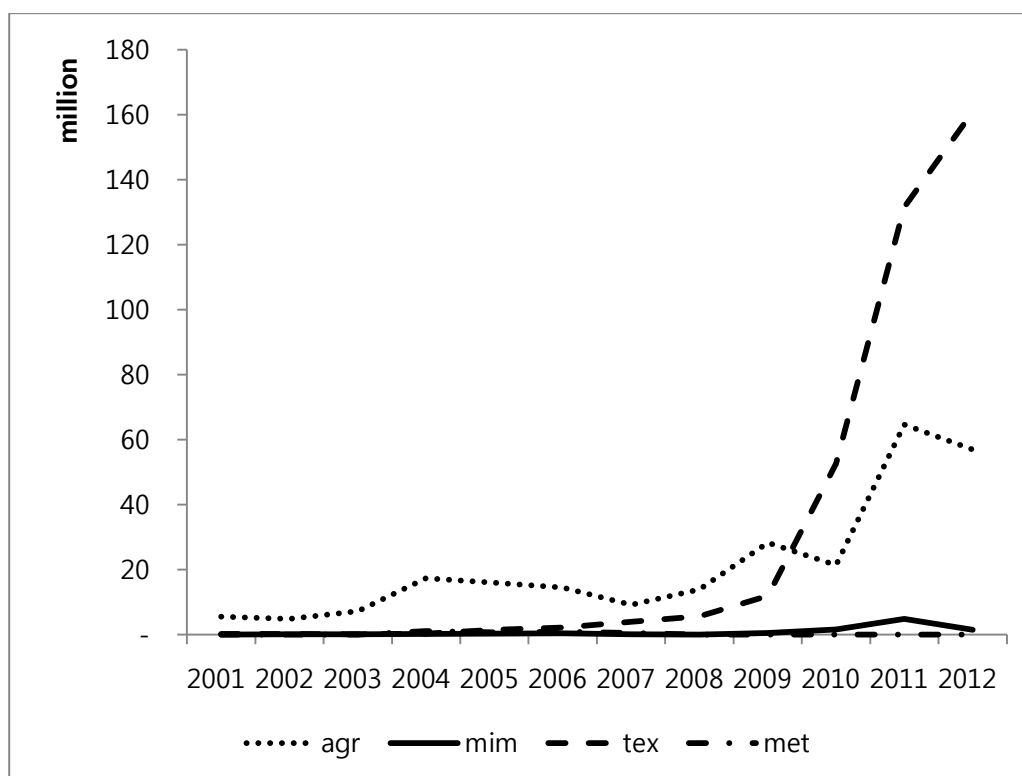
Note 1: HS code is converted to ISIC code (International Standard Industrial Classification of All Economic Activities). Conversation table is obtained from Jon Haveman's Industry Concordances at

[www.maclester.edu/research/economics/page/haveman/trade.resources/tradeconcordances.html](http://www.maclester.edu/research/economics/page/haveman/trade.resources/tradeconcordances.html)

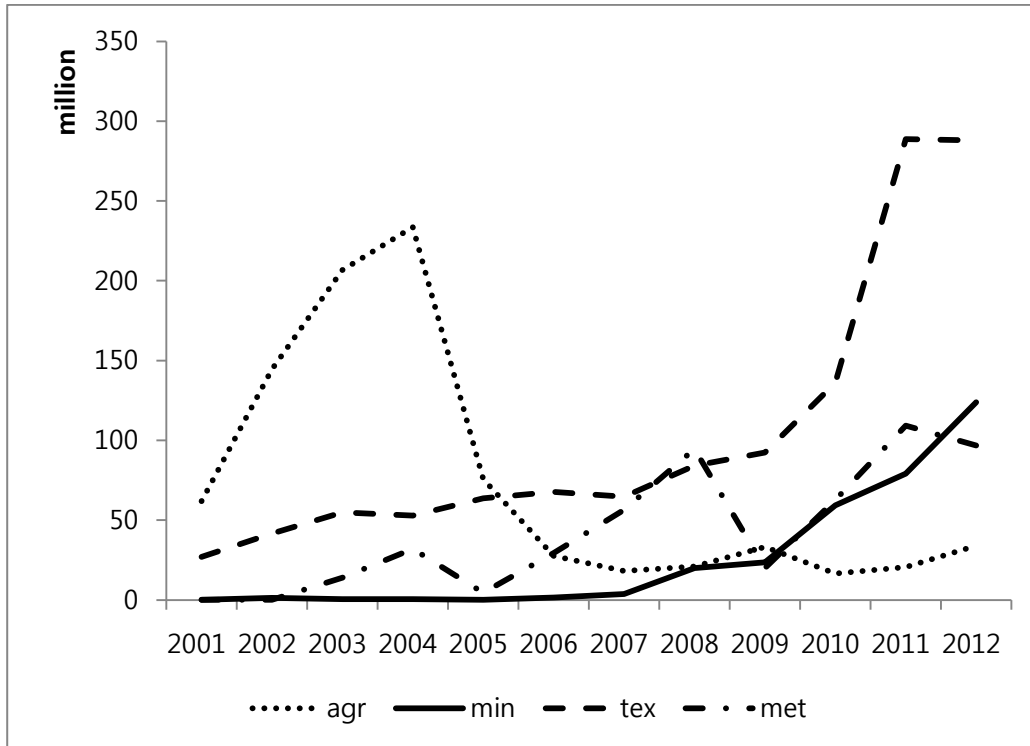
<sup>25</sup> To draw the figures, HS code of each trade value is converted to ISIC code (International Standard Industrial Classification of All Economic Activities), and aggregates the value by industrial level. The International Standard of Industrial Classification of All Economic Activities (ISIC) code was developed by the UN as a standard way of classifying economic activities. The ISIC code groups together enterprises if they produce the same type of goods or service or if they use similar processes (i.e. the same raw materials, process of production, skills or technology).

Note 2: Abbreviations in the figure stand for as following;  
 -agr: Agriculture, Hunting, Forestry and Fishing (ISIC code 1)  
 -min: Mining and Quarrying (ISIC code 2)  
 -tex: Textile, Wearing Apparel and Leather Industries (ISIC code 32)  
 -met: Basic Metal Industries (ISIC code 37)

**Figure 3.3 The trend of commodity composition of North Korea's exports to China by processing trade**



**Figure 3.4 The trend of commodity composition of North Korea's exports to China by bonded trade**



These distinct features of each export channel enable us to extend our analysis to the industrial level in North Korea. The increased exports through general trade are interpreted as the increased production of the mining industry. In the same manner, it is implied that the increased production of the clothing industry causes rapid growing exports both in bonded and processing trade types.

Combining trade types with its main export commodities gives us insight for knowing how sanction effects are diluted. First, North Korea has generated biggest trade increase from general trade, through which mining exports have entered into the Chinese domestic market. And, it is reported that much of mine exports are driven by the investment of Chinese firms (CRS, 2011;



OSC, 2012). In general, Chinese firms have imported mining products in exchange for providing mining equipments for North Korea.

Secondly, although a ban on inter-Korean business connections outside KIC is one of the main targets of South Korea's sanctions, the increased garment exports through bonded trade and processing trade with China have compensated the loss from South Korea. Especially, bonded trade may be an effective expedient to circumvent the sanctions. It is possible that foreign partners import North Korean garment products through bonded trade, and reship the goods with "Made in China" labels<sup>26</sup>. If so, these goods may enter any countries including South Korea, Japan and US without proper authorization, as well as receive preferential tariff rates in the most advanced markets and ASEAN countries.

In sum, we observe that North Korea has adjusted its industrial structures and trade types to minimize the economic damages from the sanctions. The changes are chiefly due to the fact that incentives of the North Korean regime and those of the foreign firms meet well particularly after the South Korean sanctions. However, as Lee (2012) indicated, the industrial adjustment may be costly to the North Korean regime as well as to its economy in general.

## **5. Conclusion**

In this paper, we find that an increased North Korea-China trade virtually dilutes the effect of the unilateral sanctions by South Korea. Using North Korea's panel data on exports from 2001 to 2012, we show that South Korea's sanctions significantly boosted North Korea's export to China, whereas Japan's sanctions

---

<sup>26</sup> Japanese authorities arrested some garment importers for importing goods originating in North Korea. The foreign traders also changed the country of origin of imported product to China. (Yomiuri, 2011.5.11)

had an insignificant effect. It is because the impact of the Japanese sanctions was weakened by the expansion of inter-Korean economic cooperation in the mid 2000s. As North Korea's export has had a high degree of dependence on China and South Korea, North Korea has no alternatives but to raise exports to China in response to the South Korea's sanctions. The South's sanctions have increased the North's average exports to China by 63.7%, compared to the volume before sanctions. This amount of expansion was big enough to cover the loss from the South Korean sanctions.

This paper suggests that trade types matter when analyzing export pattern dynamics of North Korea. Our findings on positive effects of South Korea's sanctions on general trades and bonded trades indicate that North Korea strengthens both the exports to the Chinese domestic market (general trade) and the exports passing through China (bonded trade). Considering specific export commodities at the industrial level, we find that North Korea has sold mining products through general trade and clothing products through bonded trade particularly after the imposition of the sanctions. In addition, some of those firms' behavioral adjustment to the sanctions could involve illicit trades. For example, bonded trade may be an effective expedient to circumvent the sanctions by modifying the country of origin (COO).

In short, North Korea has mitigated the economic damage from sanctions by employing a broad range of techniques for trade diversion. And, Chinese private entities actively involved in business with North Korea to take advantage of the opportunities of North Korean policy changes. This interaction eventually results in weakening effects of the sanctions. This finding is consistent with the findings in the previous political research. For example, Pape (1997) and Ripsman & Blanchard (2002) argue that an economic threat should have only limited effect because of the capacity of states to adjust to the welfare

losses that are imposed by economic sanctions.

## References

- Arellano M. & Bover. O. (1995) Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, 68, 29-52.
- Blundell R. & Bond. S. (1998) Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1), 115-143.
- Bond. S. R., Hoeffler. A. & Temple. J. (2001) *GMM Estimation of Empirical Growth Model*. CEPR Discussion Paper No. 3048.
- Caruso R. (2003) The Impact of International Economic Sanctions on Trade: An Empirical Analysis. *Peace Economics, Peace Science and Public Policy*, 9 (2), 1~34.
- CRS. (2010) *Implementation of U.N. Security Council Resolution 1874*. CRS report for Congress.
- \_\_\_\_\_. (2011). *Imports from North Korea: Existing Rules, Implication of the KORUS FTA, and the Kaesong Industrial Complex*. CRS report for Congress.
- Hammer A. B. (2006) *The Dynamic Structure of U.S.-China Trade, 1995-2004*. USITC Working. Paper No. 2006-07A.
- Haggard S. & Noland M. (2009) *Sanctioning North Korea: The Political Economy of Denuclearization and Proliferation*. WP 09-4, Peterson Institute for International Economics.
- Hughes. C. W. (2006) The political economy of Japanese sanctions towards North Korea: domestic coalitions and international systemic pressures. *Pacific Affairs*, 79 (3). 455-481.
- Jeong H.G. & Bang H.K. (2011) An Analysis of Effectiveness of International Economic Sanctions against North Korea. *The Northeast Asia Studies*, 41 (2), 205~236.

- Kim S. J. (2013) The reasons for trade expansion between North Korea and China and its implication for North Korean economy. *KDI review of the North Korean Economy*, 93~118. (in Korean)
- KOTRA. (2006) *Trend of Trade between North Korea and China and Its Implication*. Seoul: Korea Trade and Investment Promotion Agency. (in Korean)
- Lee J. H. & Kim S. K. (2011) *The Impact of UN Economic Sanctions on North Korea*. Policy Study series, Seoul: Korea Development Institute. (in Korean)
- Lee S. (2007) *The North Korean Statistics: availability and Creditability*. Seoul: Korea Institute for National Unification. (in Korean)
- \_\_\_\_\_ (2010) Economic Sanction and DPRK Trade. *KDI Journal of Economic Policy*, **32** (2), 97-143. (in Korean)
- Mimura M. (2005) *An Analysis of the Economic Effects of Japan's Economic Sanctions against North Korea*. Seoul: KIEP. (in Korean)
- Nickell, S. (1981) Biases in dynamic models with fixed effects. *Econometrica*, 49, 1417-1426.
- Noland M. (2008) *The (Non) Impact of UN Sanctions on North Korea*, WP 08-12, Peterson Institute for International Economics.
- OSC. (2011) *North Korea—Characteristics of Joint Ventures With Foreign Partners, 2004-2011*. Open Source Center Report.
- Pape. R. A. (1997) Why Economic Sanctions Do Not Work. *International Security*, 22(2), 90–136.
- Ripsman. N. M & Blanchard J.M. (2002) Lightning Rods Rather Than Light Switches: Arab Economic Sanctions Against Canada in 1979. *Canadian Journal of Political Science*, 35 (1), 151–174.
- Silva. J. M. C. & Tenreyro. S. (2005) The log of gravity. *The Review of Economic and Statistics*, 88(4), 641~658.

Van Bergeijk P. (1994). *Economic Diplomacy, Trade, and Commercial Policy: Positive and Negative Sanctions in a New World Order*. Edward Elgar Publishing Company

Whitty M., Kim S. & Crick T. (2006) The Effectiveness of Economic Sanctions: The case of North Korea. *North Korea Review*, 2 (1), 50~65.

### Appendix 1: Economic Sanctions of South Korea and Japan on North Korea

<b>South Korea</b> (so called May 24 measurement, 2010)	<b>Japan</b>
<p><b>Direct economic sanctions</b></p> <ul style="list-style-type: none"> <li>- Suspension of general and processing trade with the exception of the KIC</li> <li>- Ban on new investment in North Korea</li> <li>- Prohibition on entry into South Korea ports and strait of North Korean shipping</li> </ul> <p><b>Measures equivalent to economic sanction</b></p> <ul style="list-style-type: none"> <li>- Stoppage of food and fertilizer aid with the exception of infant aid</li> <li>- Prohibition on entry into North Korea and contact with North Korean with the exception of the area of the KIC</li> </ul>	<p><b>Direct economic sanctions</b></p> <ul style="list-style-type: none"> <li>-Stoppage of remittances</li> <li>-Total cessation of trade</li> <li>-Prohibition on entry into Japanese ports of North Korean shipping</li> </ul> <p><b>Measures equivalent to economic sanction</b></p> <ul style="list-style-type: none"> <li>-Stoppage of food aid</li> <li>- Port State Control (PSC) inspection on the Mangyongbong-92</li> <li>-Tightening of supervision of <i>Chosen Soren</i>-affiliated –<i>credit union of Chogiin</i></li> </ul>

Source: Ministry of Unification (MOU), Hughes (2006)

## Appendix 2: China Custom's Trade Types (Customs Regimes) and Codes

This article's category	Original Category	codes
General Trade	Ordinary trade	10
	Border trade	19
Processing Trade	Process & assembling	14
	Process with imported materials	15
Bonded Trade	Bonded warehousing trade	33
	Entrepot trade by bonded area	34
Others	International aid	11
	Donation by Overseas Chinese	12
	Compensation trade	13
	Goods on consignment	16
	Equipment for processing trade	20
	Goods for foreign contracted project	22
	Goods on lease	23
	Equipment/Materials investment by foreign-invested enterprise	20
	Outward processing	27
	Barter trade	30
	Duty-free commodity	31
	Equipment imported into Export Process Zone	35
	Other trade	39

Source: China Customs



## **Chapter 4. The Performances of Chinese Firms in North Korean Trade: Evidence from Firm-Level Data**

### **1. Introduction**

Chinese firms, particularly those located in the border area with North Korea, play a central role in creating China's trading relations with North Korea (OSC, 2011; Lee & Hong, 2013). However, due to difficulties of data collection, only few related empirical studies exist. The sole study using survey data (Haggard et al., 2011; 2012) based on 250 Chinese enterprises that are conducting or have conducted business activities with North Korea as of 2007, examines various firms' behaviors in entry, exit, and investment decisions (Haggard et al., 2011) as well as in trust, network and dispute settlement mechanism (Haggard et al., 2012). Despite the sensitivity of the cross-border transactions, the survey is conducted indirectly by a Chinese consulting firm and the success rate in conducting interviews is merely 7%. Hence, the results of Haggard et al. can have limited implications.

In this paper, the on-the-spot survey data out of face-to-face interviews are used to examine business performances of Chinese firms in Dandong, China. Dandong is North Korea's main trading gateway to China, and indeed, around 60% of Sino-North Korean trade is done directly through Dandong<sup>27</sup>. The Chinese entrepreneurs of those firms in Dandong and involved in business with North Korean partners have diverse backgrounds in terms of ethnicity and nationality. The majority are Han Chinese (*Han zu*, in Chinese), followed by Korean-Chinese (*Chaoxian zu*, in Chinese), who are ethnically originated from Korea,

---

<sup>27</sup> China daily, 2011.3.9

South Koreans, and Overseas Chinese in North Korea<sup>28</sup>. The North Korean business partners are also heterogeneous in terms of their affiliation, such as the workers' party, the army, the cabinet, and the regional governments. Different types of business networks that both sides possess may incur different impact on the performance<sup>29</sup>. The previous studies note that the social/business ties are important in determining performance and transactions of the firms especially, in many developing and transitional economies, where formal market institutions have not been well developed (Xin and Pearce, 1996; McMillan & Woodruff, 1999a; McMillan & Woodruff, 1999b; Peng and Luo, 2000; Li and Zhang, 2007; Raiser et al., 2007; Sheng et al., 2011). A series of questions in the survey about the Chinese firms' relationship with North Korean partners provide us with the unique feature of Chinese business networks in cross-border exchanges with North Korea.

The survey result also provides information about the Chinese firms' connection with domestic and foreign markets. The firm manager's ethnic background and geographic connection to the markets are shown to be deeply related. For example, companies owned by *Han zu* and overseas Chinese are likely to operate under general trade or the so called 'small-scale-cross-border trade,' which is more connected to the Chinese domestic markets. On the other hand, companies owned by *Chaoxian zu* and South Koreans tend to engage in

---

<sup>28</sup> "The population of PRC citizens in North Korea was estimated as 14,351 persons (in 3,778 households) in 1958, shrinking to a mere 6,000 by 1980, as they had been encouraged by the North Korean government to leave for China in the 1960s and 70s. Recent estimates of their population vary. China's official Xinhua News Agency published a figure of 4,000 overseas Chinese and 100 international students in 2008. The Chosun Ilbo, a South Korean newspaper, gave a higher estimate of 10,000 people in 2009. They live mostly in Pyongyang and in the areas near the Chinese border". Wikipedia's definition of "Chinese people in Korea"

<sup>29</sup> Chinese Firms' Business network by Affiliation of North Korean partners is graphically illustrated in Appendix 1

transfer or processing trade, mainly connected to the South Korean market<sup>30</sup>. This particular setting provides an interesting opportunity to evaluate the effects of South Korean economic sanctions against North Korea. Presumably, if the South Korean policy bans entry of any commodity that is “made in DPRK” with the only exception of goods produced in the Kaesung Industrial Complex (KIC), the performance of the firms relying on the business networks with South Korea may deteriorate.

The main findings of this paper are: (a) the performance of Chinese firms is positively affected when they have business ties with army-affiliated North Korean counterparts; (b) especially the business ties with the *Han zu* companies and the army-affiliated North Korean partners are most influential; (c) market linkages of the firms have no impact on firms’ performance.

## **2. Hypotheses**

### **2.1 Business ties with North Korean partners**

Since 1990, North Korea accelerated in decentralizing its external sectors, as the national budget crunch could not sustain its planned economy. The power groups including workers’ party, army, cabinet, and regional government rapidly launched trading companies and vested profits of mines, clothing factories, and farms in their branches for the purpose of generating their own operating budget and offering the target figures to the upper bodies. More specifically, the military’s privileged trading activities under the ‘Military-First policies’ (*Songun*)<sup>31</sup> in the 1990s have expanded and the trading firms affiliated to the

---

<sup>30</sup> Chinese Firms’ Business network by its market linkage is graphically illustrated in Appendix 2

<sup>31</sup> According to North Korea’s official account, Kim Jong-il initiated military-first politics in 1995 when he

army reportedly thrived (Yang, 2010; Im et al., 2011; Park, 2013). This booming business of the army-affiliated firms is supposedly supported by the ‘*Wa-Ku*<sup>32</sup>’ mechanism. *Wa-Ku* is a trade license required for any North Korean firm conducting commercial trades with foreign firms (Yang, 2010; Park, 2009). It outlines specific quantity of commodities or products with which a particular company is permitted to foreign trade (Yang, 2010; Park, 2009). In that sense, *Wa-ku* can be regarded as a privilege provided by the state. The competition to obtain *Wa-ku* among trading companies is severe; even state institutions compete with each other to have more *Wa-ku*. Among many of them, military companies are known to have obtained more rights (in other word, *Wa-Ku*) than others to control lucrative export sectors, such as minerals, mushrooms and seafood, under Kim Jung-il’s regime. In fact, some Chinese firm managers explicitly said in the interview that “the [North Korean] companies affiliated to the army are the most reliable and powerful partners.” Based on such background information, this paper proposes the following hypothesis:

*Hypothesis 1-A: Business ties with army-affiliated North Korean partners will be positively related to the performance of Chinese firms.*

In addition, previous studies emphasize the importance of *guanxi* (loosely translated as ‘connections’) in a firm’s success in the Chinese marketing context (Xin and Pearce, 1996; Amber et al., 1999). It is evident that the political ties with the Chinese government of *Han zu* companies are relatively stronger

---

expressed “his will for military-first politics aimed at completing the Juche-oriented revolutionary task, with the People’s Army as the pillar of the revolution and the main driving force of revolution” while visiting the guard post, Tabaksol (Choe Ki-whan 2003)

<sup>32</sup> One source indicates it is borrowed from Russian word referring to the Committee for Foreign Trade. Another guess is that it is from Japanese word, “waku” denoting “frame or boundary of discretion”.

than managerial ties of other ethnically minority groups<sup>33</sup>.

Given the Chinese government's important role in Sino-North Korean trade, these political ties seem to be imperative for a firm's success. A considerable number of successful *Han zu* companies, whose managers or managers' relatives are the former government officers at the local government of Dandong, were also included in the survey. Therefore, this paper proposes the following hypothesis:

*Hypothesis 1-B: Business ties between the Han zu companies and the army-affiliated North Korean partners are the more beneficial than other combinations of business networks.*

## **2.2 Market linkage**

Dandong has served as the trading hub of North Korean goods not only for China, but also for the rest of the world, including South Korea and Japan. Most North Korean exports to China in the form of bonded trade go through Dandong, and are re-exported to the third countries. The opposite way of trade flow also often takes place. This is why many Chinese companies engaged in bonded trade with North Korea are located in the largest border city, Dandong. From the interviews with the managers of the Chinese trading companies, it is found that these firms are mainly dealing with imports of agricultural or marine products directly from North Korea or manufactured garment products through process-on-commission of North Korean factories, and re-exporting transactions of those

---

<sup>33</sup> A 1994 State Ethnic Affairs Commission report to the Communist Party of China (CCP) Central Committee states that Minority nationalities are complaining that all the rich are Han people and that the Communist Party could not care less about the minorities. This problem, if ignored, surely will deepen nationality contradictions. (Hsin Pao 1994; Becquelin 1997)

imported products to South Korea or other countries. Notably, there are also cases of importing South Korean home appliances like TV, refrigerators, and washing machines and re-exporting them to North Korea. From the survey data, 32.6% of the firms replied that South Korea is either the final destination of the imported products from North Korea or the original exporting country to North Korea. Under such business circumstances, the South Korean economic sanctions which effectively ban any commercial trade with North Korea (excluding KIC) could affect the performance of the firms which have strong relationships with the South Korean market. Thus, the paper proposes the following hypothesis:

*Hypothesis 2: Business relationships with the South Korean market will be negatively related to the firm performance, after the imposition of South Korean sanctions.*

### **3. The Survey and Descriptive Statistics**

#### **3.1 Outline of Survey**

This study is based upon the surveys on the firms in Dandong who are involved in trades with North Korea. The surveys took place twice: the first from February to July, 2012, and the second from June to August, 2013. In order to minimize the response error, in-depth interviews were carefully carried out with the owners, managers or employees who were working at the North Korean business divisions of the firms. The samples were drawn from convenience sampling, rather than random sampling, because the official list of the Chinese firms doing business with North Korea was not available. The sample was constructed by

building the rapport with local managers and trade associations. The original sample consists of 174 firms of which 138 firms are engaged in trade, 54 firms engaged in investment, and 16 firms engaged in both trade and investment. The samples may include more than 10% of the total number of firms which conduct business activities with North Korea<sup>34</sup>. Only the samples of trade firms are used for this study. Due to the diversity of investment activities<sup>35</sup>, it is hard to measure the firms' performances using "return of investment" in the conventional method.

The survey questionnaires are based on "Business Environment and Enterprise Performance Survey (BEEPS)" developed by the European Bank of Reconstruction and Development (EBRD) and "Institutional Obstacles for Doing Business" by the World Bank. To reflect the features of businesses with North Korea, the paper also refers to a South Korean survey targeted to the firms involved in inter-Korean businesses, developed by Korea Development Institute (KDI) and Korea International Trade Association (KITA).

Nonetheless, the shortcomings of this survey should be considered critically. First, there may exist sampling bias. The firms in this survey are not selected randomly. The convenience sampling is likely to introduce bias into the results. In addition, sample selection problems also induce bias. Although we have included six firms that had done the business and exited the market, it is too small to remedy the sample selection bias.

Second, measurement errors, which are inevitable in surveys relying on interviewees' responses, can jeopardize the validity of causal inference. Lee and

---

<sup>34</sup> In the interview with Chinese newspaper, the mayor of Dandong said there are 500 registered boarder-trading companies doing business with North Korea in Dandong (Chinese Daily 2001.3.9). The samples may include around more than 10% of the total in Dandong. Our surveys includes both 101 registered firms and 75 individual businesses, so we estimate that our sample size cover at least 10% of the total.

<sup>35</sup> In survey, we categories investment types into five such as joint management, joint investment, equipment investment in light manufacturing, equipment investment in extractive industry and investment in hiring North Korean workers.

Hong (2013) notified that unofficial, sometimes illegal, transactions are prevalent in between North Korea and China at the firm-level trade in the border area. This kind of special feature in border transactions with North Korea may hinder Chinese respondents from answering some sensitive questionnaires.

Third, the survey is a single cross-sectional survey that can assess the specific impact of the 2010 South Korea's sanction against North Korea. Therefore, the empirical results from the survey would be interpreted as the firms' behavioral adjustment to the sanctions in a particular period, rather than the transaction norms of the two countries.

### **3.2 Descriptive Statistics**

The data are summarized in Table 4.1. The mean of sales revenue and margin are USD 5.3 million and 16.6%, respectively. These figures probably overestimate the performance of the whole Chinese firms trading with North Korea, as the survey is likely to have sampled the surviving firms.

*Han zu* companies are the largest in terms of sales revenue and differences in trade volumes before and after the South Korea's sanction on North Korean goods. However, in terms of margin, the profitability of overseas Chinese firms is the highest, followed by that of *Han zu* firms. This can be accounted partially for the differences in business areas. While *Han zu* firms are likely to be involved in official export and import business, overseas Chinese firms are known to be involved in small-scale wholesale and retail businesses on the basis of their network advantage inside North Korea. This is clearly seen when comparing the portions of the registered firms. It is found that 60.7% of the *Han zu* firms were registered, whereas only 47.4% of the overseas Chinese firms were. Notably, the fact that only South Korean firms report negative values in the



differences of all trade volumes imply that they were negatively affected by the South Korean sanctions.

To cross-check the answers of firms' performances, their profit growth rates over the last 2-3 years were asked as well. The results are consistent with other performance measures. 44.6% of the *Han zu* firms answered that their profits increased, whereas 58.9% of the South Korean firms reported that their profits deteriorated in recent years.

Regarding their North Korean partners, the Chinese firms were asked to notify the affiliation of their largest trading partners. The distribution of affiliations clearly reveals the decentralization of North Korea's external sectors. 16.1% of the *Han zu* companies engage in business mainly with army-affiliated North Korean partners, whereas only 10.5% of the South Korean firms do business with them. In particular, more than half of the South Korean firms have main business ties with individual persons, partially because many of them are involved in wholesale/retail trade. Individuals can be interpreted simply as North Korean workers/visitors temporarily staying in Dandong, or those who have implicit agreements to have rights and obligations on trade on behalf of the official firms or state institutions.

The duration of maintaining ties with the main counterparts is relatively short, with 55.9% of the firms having less than four years of relationship. The unstable *Wa-Ku* system in North Korea may be attributed to hindering long-term business relations of Chinese firms with North Korean ones.

Firms' linkage to domestic or foreign markets is measured by the final destination or the origins of the goods traded. For instance, the managers were asked about the final destination of the products the firms carry for importing or processing trade from/with North Korea. On the contrary, the managers of the companies exporting products to North Korea were asked about the origins of

goods. As so, the paper evaluates whether the firms' networks focus on their domestic market or foreign market -- mainly the South Korean market, as it is still an important market for Chinese firms. 32.6% of the firms answered that it is involved in the South Korean market. The relationships are much stronger especially for *Choxian zu* and South Korean firms, which is counted to be 43.8% and 68.4%, respectively.

Moreover, the survey asked managers about the dispute resolution mechanism. The five possible resolution channels were aggregated into two types: a formal resolution through the North Korean government, party, court or Chinese government, courts, embassy; an informal resolution through other firms, individual relations, or abandonment. *Han zu* companies reported that they mostly rely on the official dispute resolution channel, followed by the *Chaoxian zu* firms in the list. This may be due to the fact that political ties of these two groups are relatively well established in either North Korea or China.

**Table 4.1 Summary of Data**

Categories	<i>Han zu</i>	<i>Chao Xian zu</i>	<i>Overseas Chinese</i>	<i>South Korean</i>	<i>All firms</i>
<b>Number of Firms</b>	56	32	31	19	138
<b>Performances</b>					
<i>Sale revenue( \$)</i>	9,522,857	5,148,175	640,645	1,081,053	5,350,881
<i>Profit Margin (%)</i>	17.4%	14.6%	18.6%	13.9%	16.6%
<i>Difference in trade Volume Between 2011-2010(\$)</i>	1,084,038	68,759	120,000	-542,500	431,836
<i>Difference in trade Volume Between 2011-2009(\$)</i>	5,549,583	173,600	160,000	-1,315,333	2,353,611
<i>Difference in trade Volume Between 2012-2009(\$)*</i>	808,043	176,761	195,000	-1,150,909	327,775
<i>Profit growth over last 2~3 years</i>					
<i>-Increase</i>	<b>44.6%</b>	40.6%	26.7%	11.8%	35.6%
<i>-No Change</i>	35.7%	21.9%	66.7%	29.4%	38.5%

<i>-Decrease</i>	19.6%	37.5%	6.7%	<b>58.9%</b>	25.9%
<b>Affiliation of North Korean Partners</b>					
<i>Army</i>	16.1%	15.6%	12.9%	10.5%	14.5%
<i>Party</i>	28.6%	21.9%	29.0%	5.3%	23.9%
<i>Cabinet</i>	12.5%	15.6%	6.5%	26.3%	13.8%
<i>Regional government</i>	28.6%	46.9%	25.8%	5.3%	29.0%
<i>Individual</i>	14.3%	-	25.8%	52.6%	18.8%
<b>Market linkage</b>					
<i>China</i>	76.8%	43.8%	77.4%	5.3%	59.4%
<i>South Korea</i>	21.4%	43.8%	19.4%	68.4%	32.6%
<i>others</i>	1.8%	12.5%	3.2%	26.3%	8.0%
<b>Duration of the Relationships</b>					
<i>1-4 years</i>	63.6%	46.9%	51.6%	55.5%	55.9%
<i>5-10 years</i>	30.9%	43.8%	32.3%	33.4%	34.6%
<i>&gt;10 years</i>	5.5%	9.4%	16.1%	11.1%	9.6%
<b>Number of North Korean Partners</b>	3.0	3.4	4.5	4.1	3.6
<b>Official Dispute Resolution Dummy</b> (0=others, 1=official)	17.9%	15.6%	3.2%	10.5%	13.0%
<b>Bribery dummy</b> (0= no, 1= yes)	53.6%	43.8%	64.5%	26.3%	50.0%
<b>Register dummy</b> (0=individual business, 1=registered firm)	60.7%	62.5%	19.4%	47.4%	50.0%
<b>Firm's Age</b> (years)	8.0	8.1	6.2	10.2	7.9
<b>Number of Employees involving in North Korean business</b>	13.4	23.1	3.2	7.5	12.5
<b>Industrial Dummy1: Mining</b> (1= mining, 0= Others)	10.7%	18.8%	16.1%	-	12.3%
<b>Industrial Dummy2: Processing</b> (1= Processing, 0= Others)	17.9%	46.9%	32.3%	42.2%	31.2%

Note: \* Some statistics of 2012 trade volume are included in manager's estimated values, because 60.1% of samples (83 firms) are surveyed in 2012 and 39.9% of samples (55 firms) are survey in 2013.

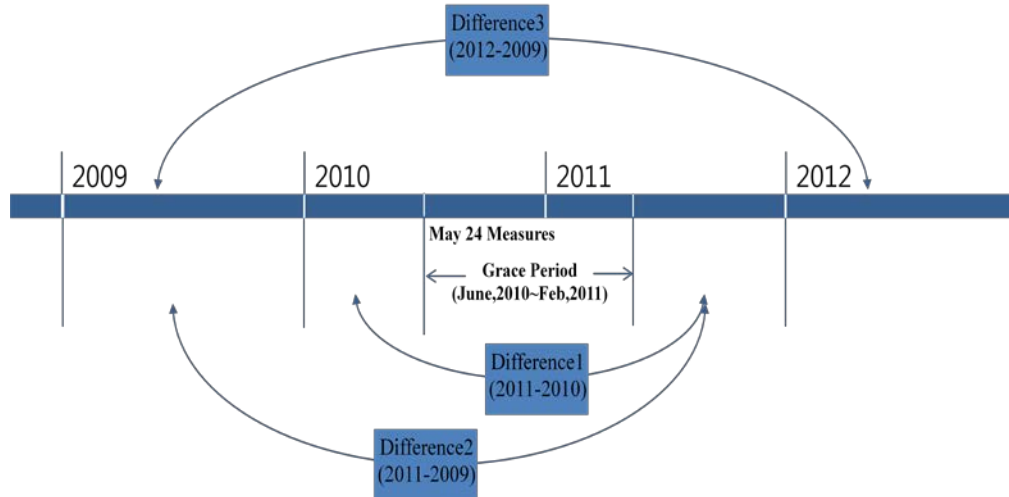
#### **4. The Model**

This section examines the determinants of the interviewed firms' performances. The regressions are with the dependent variables measuring performances in different dimensions. The paper assesses the firms' performances with respect to the growth of profit over the last 2-3 years and various combinations of differences in trade volumes before and after the South Korean sanctions.

The reason for preferring "the growth of profit" and the "trade differences" to measure performance over profit margin and sales revenue is that these measures reflect the performance trends of the firms and are likely to have less measurement errors than others.

As shown in Figure 4.1, three measures of trade volume differences of before and after the years when South Korean sanctions took place are represented by the differences in trade volumes between years 2011 and 2010, years 2011 and 2009, and lastly, years 2012 and 2009. These measurements are to cope with the difficulty in defining the before- and after- sanction period. South Korean sanctions, the so-called May 24 measures, were introduced in May 2010, and the South Korean government provided 8 months of grace period (June 1, 2010-Feb. 28, 2011) to the firms engaged in business with North Korea. The three measures of trade differences are employed as dependent variables and are to compare with the estimation results.

**Figure 4.1 Time-Line of South Korean Sanctions and Performance Measures**



Furthermore, the ordinal independent variable of the growth of profits is used as another measurement. The growth of profit is coded as integers of 1-3: 3 corresponding to “increased,” 2 to “no change” and 1 to “decreased.” Utilization of these different assessments is expected to strengthen robustness of the estimation results and to identify variation of the network’s effects among different performance measurements.

In order to test the importance of business network and market linkage in a firm’s performance, the regression model is specified as the following:

$$Performances_i = \alpha + \alpha FirmC + \delta BusE_i + \beta Network\_NK_i + \gamma Market_i + \lambda Ind_i + v_i \quad (1)$$

where *FrimC* is a vector of firm characteristics, *BusE* is a vector of business environments, *Networ\_NK* is a vector of variables characterizing networks with North Korean partners, *Market* is a vector of market linkage dummies, *Ind* is a

vector of industry dummies

The sets of independent variables suggested in the previous literature on business ties in transitional countries, discussed in Section 1, are used. The first set is of the key variables which represent Chinese firms' networks with North Korean partners and their linkage with foreign and domestic markets. Included are the affiliation of the North Korean counterparts, duration of business relationships, number of North Korean partners and market linkage dummies. The second set of the variables is related with the business environment factors such as dispute resolution channel and bribery dummy. The third set of variables contains the firm-specific characteristics that include the number of employees, firm age, registration dummy, and ethnic background. Finally, some actively trading industries are controlled by the inclusion of dummies on mining and processing industries.

Thus, the regression tests whether independent effects exist with respect to the key variables ( $\beta, \gamma$ ) on the firms' performances, when controlling other relevant explanatory variables including firms' characteristics, business environment and industries.

## **5. The Results**

### **5.1 Basic Regressions**

Table 4.2 displays the estimations results. The OLS regression reported in the first three columns of the table uses trade difference as an independent variable. The ordered logit regressions using the ordinal dependent variable of the growth of profit is reported in the fourth column.

The first set of variables contains business networks with the North Korean partner and market linkages. Throughout all the models except for model (4), Chinese firms having partnerships with army-affiliated firms tend to report higher performances than the firms affiliated with the cabinet (reference group). The positive and significant coefficients of the army dummy in the models (1) - (3) suggest that the army-affiliated firms have superior power over other institutions in North Korea and are able to obtain more 'Wa-Ku' in the foreign trade sector, particularly after the South Korean sanctions in 2010. Also, it implies that Chinese firms are swift in having business relations with these army firms, since the South Korean sanctions in 2010, in order to take advantage of the changes in North Korean policies. This empirical finding suggests that North Korea's "military first" polices *de facto* regulates resource allocation mechanisms in North Korea's external sectors.

The results also illustrate that the higher number of partners are significantly associated with performances, whereas the duration of business relationship does not exert influence either positively or negatively on the performances (models (1), (2), and (4)). This can be partly due to the instability of the 'Wa-Ku' system. The decisions for the provision of trade licenses are mostly made by the dictator himself or the few elite (or advisory) groups around the dictator (Park, 2009; Yang, 2010). This possibly makes 'Wa-Ku' unstable and difficult for individual North Korean trading firms to have long-run/stable cross-border business relationships. The Chinese firms that have more alternatives in the choices of their North Korean business counterparts are likely to hedge the risk against the 'Wa-Ku' system; thus the coefficient on the number of business partners is positive and significant. For the same reason, the duration of relationships may be unimportant for the performances.

As for the market linkage, the linkage with the South Korean market

does not affect any performance measure. This may be related with the Chinese firms' illicit practices. To circumvent the sanctions and continue transit trade between South and North Korea in Dandong, some firms are believed to modify the country of origin of the North Korean products and reship the goods with "Made in China" labels. In fact, some firm managers confessed in the interview that modifying the country of origin was widely practiced in the bonded warehouse in Dandong.

In terms of business environment, positive correlation is found between "using an official dispute resolution channel" and "firm's performances" measured in differences in trade volumes. If firms can gain access to formal dispute settlement mechanisms, which means resolving the business conflicts through the North Korean government, party, court or Chinese government, courts, embassy, the risks in North Korea's insufficient institutional infrastructure are likely to be reduced. In case of bribery, the signs on the coefficient of the bribe dummy variable are inconsistent across the models. It is positively associated with performance in the models (2) and (4), whereas its sign appears to be negative in model (1). Although the question on bribery was asked in an indirect way<sup>36</sup>, the sensitivity of the question may have caused measurement errors, a possible source of these inconsistent results.

In the ethnic background of the firm's owner, it is observed that only the South Korean dummy is negatively correlated with the performance in models (3) and (4), when Overseas Chinese is designated as reference group. The market linkage with South Korea is found to have no statistical significance. However, the South Korea dummy, which indicates South Korean ownership of the firms, seems to negatively affect the firm's performance. This implies an increasing

---

<sup>36</sup> The question on bribery is "Do you have experiences to pay some irregular "additional payments/gifts" to North Korea partners?"



tension between the two Koreas since the beginning of the Lee Myung-bak administration in 2008, as well as the sanctions in 2010, which may have further worsen the business relationship between the South Korean firms and the North Korean partners. Most of the official inter-Korean dialogues on economic cooperation ceased when the South Korean government suspended the food aid programs for North Korea in 2008. To make matters worse, a South Korean tourist was shot and killed at Mt. Geumgang tourist complex in 2008; it resulted in closing down of the tourism program. Amid deterioration of the inter-Korean relationship, the South Korean firms turned out to be more vulnerable to the South Korean sanctions.

Finally, after the sanctions, the firms involved in trading mining products experienced more trade growth than the firms trading other products.

**Table 4.2 Regression results: Basic Model**

<i>Dependent variable</i>		<i>Difference in Trade Volume1 (2011-2010) (1)</i>	<i>Difference in Trade Volume2 (2011-2009) (2)</i>	<i>Difference in Trade Volume3 (2012-2009) (3)</i>	<i>Profit Growth (Ordered Logit) (4)</i>	
<b><i>Business Network with NK partners</i></b>	<i>The affiliation of the NK firms</i>	<b><i>Army</i></b>	<b>5.614***</b>	<b>23.183**</b>	<b>1.670**</b>	0.472
			<b>(1.712)</b>	<b>(9.061)</b>	<b>(0.672)</b>	(0.731)
		<i>party</i>	2.016	6.920	0.810	0.066
			(1.488)	(7.784)	(0.524)	(0.609)
		<i>Cabinet</i>	<i>Reference Category</i>			
		<i>Regional governments</i>	2.483	9.554	0.557	0.066
	(1.522)		(7.936)	(0.537)	(0.630)	
	<i>individual</i>	1.194	2.569	0.269	0.492	
		(1.714)	(8.859)	(0.583)	(0.708)	
	<i>Duration of Relationships</i>	-0.231	-0.950	-0.012	0.007	
(0.193)		(1.003)	(0.065)	(0.082)		
<b><i>No of NK's Business partner</i></b>		<b>0.414**</b>	<b>1.898**</b>	0.066	<b>0.152*</b>	

			<b>(0.181)</b>	<b>(0.939)</b>	(0.064)	<b>(0.084)</b>	
<b>Market Linkages</b>	<i>South Korean Market</i>		0.013	0.571	-0.527	-0.765	
			(1.945)	(10.198)	(0.734)	(0.828)	
	<i>Other Market</i>	<i>Reference Category</i>					
	<i>Chinese Market</i>		-0.163	-0.679	-0.677	-0.126	
		(2.192)	(11.392)	(0.808)	(0.905)		
<b>Business Environments</b>	<b>Official Dispute Resolution dummy</b>		<b>2.602*</b>	<b>15.855**</b>	<b>1.009*</b>	0.108	
			<b>(1.479)</b>	<b>(7.778)</b>	<b>(0.566)</b>	(0.574)	
	<b>Bribery dummy</b>		<b>-1.970**</b>	<b>0.132***</b>	0.002	<b>0.794**</b>	
			<b>(0.957)</b>	<b>(0.049)</b>	(0.003)	<b>(0.400)</b>	
<b>Firm Characteristic</b>	<i>No of employment involving in North Korean business</i>		0.022**	-11.400**	-0.321	-0.004	
			(0.010)	(5.139)	(0.350)	(0.004)	
	<i>Registration dummy</i>		-0.669	-2.657	0.236	0.498	
			(1.020)	(5.579)	(0.373)	(0.421)	
	<i>Firm age</i>		0.121	0.324	-0.020	-0.073	
			(0.131)	(0.710)	(0.047)	(0.057)	
	<i>Ethnic Background</i>	<i>Han zu</i>		0.980	3.573	0.413	0.729
				(1.320)	(7.261)	(0.473)	(0.528)
		<i>Chaoxian zu</i>		-1.151	-9.353	-0.257	0.270
				(1.411)	(7.962)	(0.527)	(0.589)
<i>Overseas Chinese</i>	<i>Reference Category</i>						
<i>South Korean</i>		-0.960	-3.873	<b>-1.256*</b>	<b>-1.388*</b>		
		(1.808)	(9.693)	<b>(0.663)</b>	<b>(0.784)</b>		
<b>Industry dummy</b>	<i>Mining trade</i>		<b>2.400*</b>	<b>14.566*</b>	0.229	-0.328	
			(1.445)	(7.603)	(0.522)	(0.569)	
	<i>Processing trade</i>		1.363	7.113	-0.438	0.620	
			(1.297)	(7.185)	(0.479)	(0.519)	
	<i>Others</i>	<i>Reference Category</i>					
<i>_cons</i>		-2.928	-9.880	0.321			
		(3.045)	(15.745)	(1.078)			

R2	0.27	0.29	0.30	0.11
Observation	120	106	98	133

Notes: Standard errors are in parentheses. \*, \*\*, and \*\*\* refer to significance at the 10%, 5%, and 1% levels.

## 5.2 Interaction effects

Business network with North Korean army-affiliated partners may not have the same effects for every Chinese firm with different ethnic backgrounds. This was tested by checking the interaction of the army dummy with the ethnicity dummies.

The results, shown in Table 4.3, suggest the business ties between the *Han zu* companies and the army-affiliated North Korean partners are the most beneficial, in the models (1) and (2). Model (3) fails to estimate the interaction effect, because of the insufficient number of South Korean firms in this model specification. This result implies that the considerable benefits from the expanded bilateral trade during the post-South Korean sanction period were delivered to the *Han zu* companies doing business with army affiliated North Korean partners.

The rest of the regression results show similar results to the basic model.

**Table 4.3 Regression results 2: Interaction effect**

<i>Dependent variable</i>			<i>Difference in Trade Volume1 (2011-2010) (1)</i>	<i>Difference in Trade Volume2 (2011-2009) (2)</i>	<i>Difference in Trade Volume3 (2012-2009) (3)</i>	<i>Profit Growth (Ordered logit) (4)</i>
<i>Business Network with NK partners</i>	<i>Army* Ethnic dummy</i>	<i>Army*Han</i>	7.462**	37.134*	1.868	2.126
			(3.277)	(19.069)	(1.273)	(1.320)
		<i>Army*Chaoxian</i>	4.863	7.697	1.401	1.552
			(3.734)	(21.048)	(1.566)	(1.517)

		<i>Army*Overseas C.</i>	<i>Reference Category</i>			
		<i>Army*S.K</i>	-0.887	-12.989	(dropped)	1.639
			(5.775)	(31.324)		(1.949)
	<i>The affiliation of the NK firms</i>	<i>Army</i>	0.776	4.211	0.268	-1.023
				(3.092)	(18.245)	(1.196)
		<i>Party</i>	2.176	7.920	0.779	0.030
				(1.480)	(7.697)	(0.524)
		<i>Cabinet</i>	<i>Reference Category</i>			
		<i>Regional governments</i>	<b>2.795*</b>	10.387	0.558	0.079
				<b>(1.516)</b>	(7.863)	(0.536)
		<i>individual</i>	0.964	1.019	0.180	0.415
				(1.690)	(8.713)	(0.586)
		<i>Duration of Relationships</i>		-0.192	-0.718	-0.013
			(0.192)	(0.990)	(0.066)	(0.083)
	<i>No of NK's Business partner</i>		<b>0.372**</b>	<b>1.614*</b>	0.078	<b>0.160*</b>
			<b>(0.183)</b>	<b>(0.955)</b>	(0.065)	<b>(0.086)</b>
<i>Market Linkages</i>	<i>Korean Market</i>		-0.109	-1.270	-0.613	-0.771
					(1.932)	(10.077)
	<i>Other Market</i>		<i>Reference Category</i>			
	<i>Chinese Market</i>		-0.173	-0.233	-0.695	-0.099
				(2.157)	(11.135)	(0.812)
<i>Business Environments</i>	<i>Official Dispute Resolution dummy</i>		<b>3.347**</b>	<b>18.555**</b>	<b>1.050*</b>	0.182
					<b>(1.504)</b>	<b>(7.870)</b>
	<i>Bribery dummy</i>		<b>-2.128**</b>	<b>-12.740**</b>	-0.340	<b>0.803**</b>
				<b>(0.956)</b>	<b>(5.100)</b>	(0.351)
<i>Firm Characteristic</i>	<i>No of employment involving in North Korean business</i>		<b>0.021**</b>	<b>0.116**</b>	0.002	-0.005
					<b>(0.010)</b>	<b>(0.048)</b>
	<i>Registration dummy</i>		-0.512	-2.106	0.229	0.551
					(1.009)	(5.474)
<i>Firm age</i>		0.102	0.314	-0.023	-0.088	

		(0.130)	(0.697)	(0.047)	(0.058)
<i>Ethnic Background</i>	<i>Han zu</i>	-0.211	-2.126	0.224	0.499
		(1.381)	(7.487)	(0.490)	(0.550)
	<i>Chaoxian zu</i>	-1.925	-9.845	-0.385	0.102
		(1.502)	(8.362)	(0.555)	(0.637)
	<i>Overseas Chinese</i>	<i>Reference Category</i>			
<i>South Korean</i>	-0.898	-1.804	<b>-1.333**</b>	<b>-1.514*</b>	
	(1.815)	(9.694)	<b>(0.669)</b>	<b>(0.827)</b>	
<i>Industry dummy</i>	<i>Mining trade</i>	2.262	12.091	0.213	-0.310
		(1.431)	(7.492)	(0.522)	(0.582)
	<i>Processing trade</i>	0.979	5.256	-0.467	0.575
		(1.289)	(7.081)	(0.479)	(0.538)
	<i>Others</i>	<i>Reference Category</i>			
<i>_cons</i>	-2.151	-6.696	0.517		
	(3.023)	(15.523)	(1.089)		
R2	0.31	0.35	0.32	0.12	
Observation	120	106	98	133	

Notes: Standard errors are in parentheses. \*, \*\*, and \*\*\* refer to significance at the 10%, 5%, and 1% levels.

## 6. Conclusion

By utilizing the survey data on the firms doing business with North Korea in Dandong, this paper identifies the determinants of Chinese firms' performances. More specifically, the effects of business networks with the North Korean partners and of market linkages on the performances were examined. To obtain robust results, the firms' performances with respect to the profit growth rates over the last 2-3 years and various combinations of differences in trade volumes before and after the South Korean sanctions were assessed. These measurements were used mainly to avoid measurement errors and to cope with difficulty in

defining the pre- and post- South Korean sanction period.

The existence of business networks with North Korean partners plays a significant role in the firms' performances. It is clearly shown that business ties with army-affiliated North Korean partners are positively related to the performance of Chinese firms; especially the networks between *Han zu* companies and army-affiliated North Korean partners were observed to be the most effective and influential after the South Korean sanctions. These results provide some implications on the two countries' trade relationships after the South Korean sanctions in 2010. From the North Korean perspective, this empirical finding suggests that North Korea's "military first" polices *de facto* regulate resource allocation mechanisms in North Korea's external sectors. In the Chinese point of view, the finding points that a considerable amount of benefits from the expanded bilateral trade in the post-South Korean sanctions period were delivered to *Han zu* companies that engage in businesses with the army-affiliated North Korean partners.

The results indicate that the linkage with the South Korean market does not affect any performance measure. In order to circumvent the sanctions and continue the transit trade between South and North Korea in Dandong, the firms are known to use various techniques including illicit activities, for example, modifying the country of origin of the North Korean products. These practices can effectively nullify the impact of South Korean sanctions. In fact, the results in this paper, based on the firm-level data, are consistent with the findings based on the aggregate data used in the previous chapter (Chapter 3) which suggest that North Korea mitigates the effect of South Korean sanctions by increasing trade (especially, transit trade) through China. On the other hand, the dummy variable indicating South Korean ownership of the firm is shown to be negative correlated with the firm performance -- implying that the South Korea sanctions

hit the South Korean firms involved in business with North Korea in China the hardest.

Finally, Chinese firms that adapt well in the risky business environment with North Korea tend to record high performance. Availability of more alternative partner companies and formal dispute resolution channels promote favorable outcomes in cross-border exchanges. In effect, the Chinese firms attempt to have more partners and establish reliable resolution mechanism as a hedge against the risk from the unstable North Korea's '*Wa-Ku*' system, a key mechanism shaping the North Korean bilateral trade relationship.

In general, the results are in line with the previous studies on business ties within transitional or developing economies. The results confirm that in lack of formal market institutions, the firms rely much on the political, business networks that highly contribute to their performances.

## References

- Ambler, T., Styles, C. and Xiucun W. (1999) The effect of Channel relationship and guanxi on the performance of inter-province export ventures in the People's Republic of China, *International Journal of Research in Marketing*: 75~87.
- Haggard S., Lee J, and Noland M. (2011) *Integration in the Absence of Institutions: China-North Korea Cross-Border Exchange*. WP 11-13, Peterson Institute for International Economics.
- Haggard S., and Noland M. (2012) *Network, Trust, and Trade: The Microeconomics of China-North Korea Integration*. WP 12-08, Peterson Institute for International Economics.
- Im, K. T., Yang, M. S., and Lee S. K. (2011) *A Study on North Korea's Official Economy for Understanding the Costs and the Benefits of Unification*, Korea Institute for National Unification Working Paper 2011-03. (in Korean)
- Lee J. W. and Hong Y. K. (2013) *Economic Cooperation and Practices of Economic Transactions in Border Areas of North Korea and China*. Seoul: Korea Institute for International Economic Policy. (in Korean)
- Li H. and Zhang Y. (2007) The Role of Managers' Political Networking and Functional Experience in New Venture Performance: Evidence from China's Transition Economy, *Strategic Management Journal*, 28 (8), 791–804.
- McMillan J., and Woodruff. C. (1999a) Dispute Prevention without Courts in Vietnam, *Journal of Law, Economics, and Organization*: 637-658
- \_\_\_\_\_. (1999b) Interfirm Relationships and Informal Credit in Vietnam, *Quarterly Journal of Economics*: 1285–320.
- OSC. (2011) *North Korea—Characteristics of Joint Ventures With Foreign Partners, 2004-2011*. Open Source Center Report.
- Park, J. S. (2009) *North Korea, Inc.: Gaining Insights into North Korea Regime*



*Stability from Recent Commercial Activities*, United States Institute of Peace Working Paper.

Peng M.W. and Luo Y. (2000) Managerial ties and firm performance in a transition economy: the nature of a micro-macro link. *Academy of Management Journal*, **43**(3): 486–501.

Raiser M., Rousso A. and Teksoz U. (2007) Trust in Transition: Cross-Country and Firm Evidence, *Journal of Law, Economics, and Organization*: 407-433.

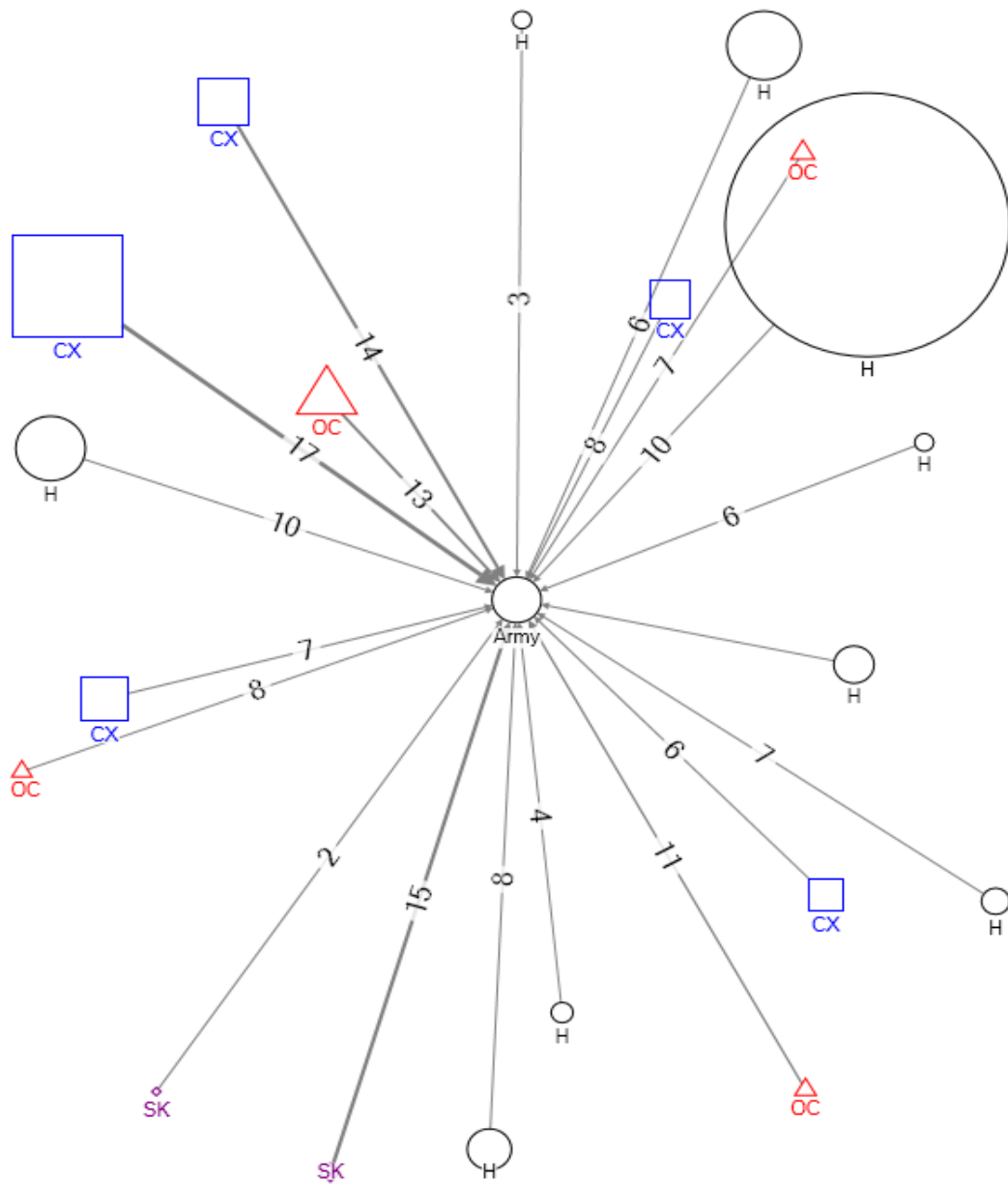
Xin K.R. and Pearce J. L. (1996) Guanxi: connections as substitutes for formal institutional support. *Academy of Management Journal*, **39**(6): 1641–1658.

Yang, M. S. (2009) *Marketization of the North Korean Economy*, Seoul: Hannul publishing company. (in Korean).

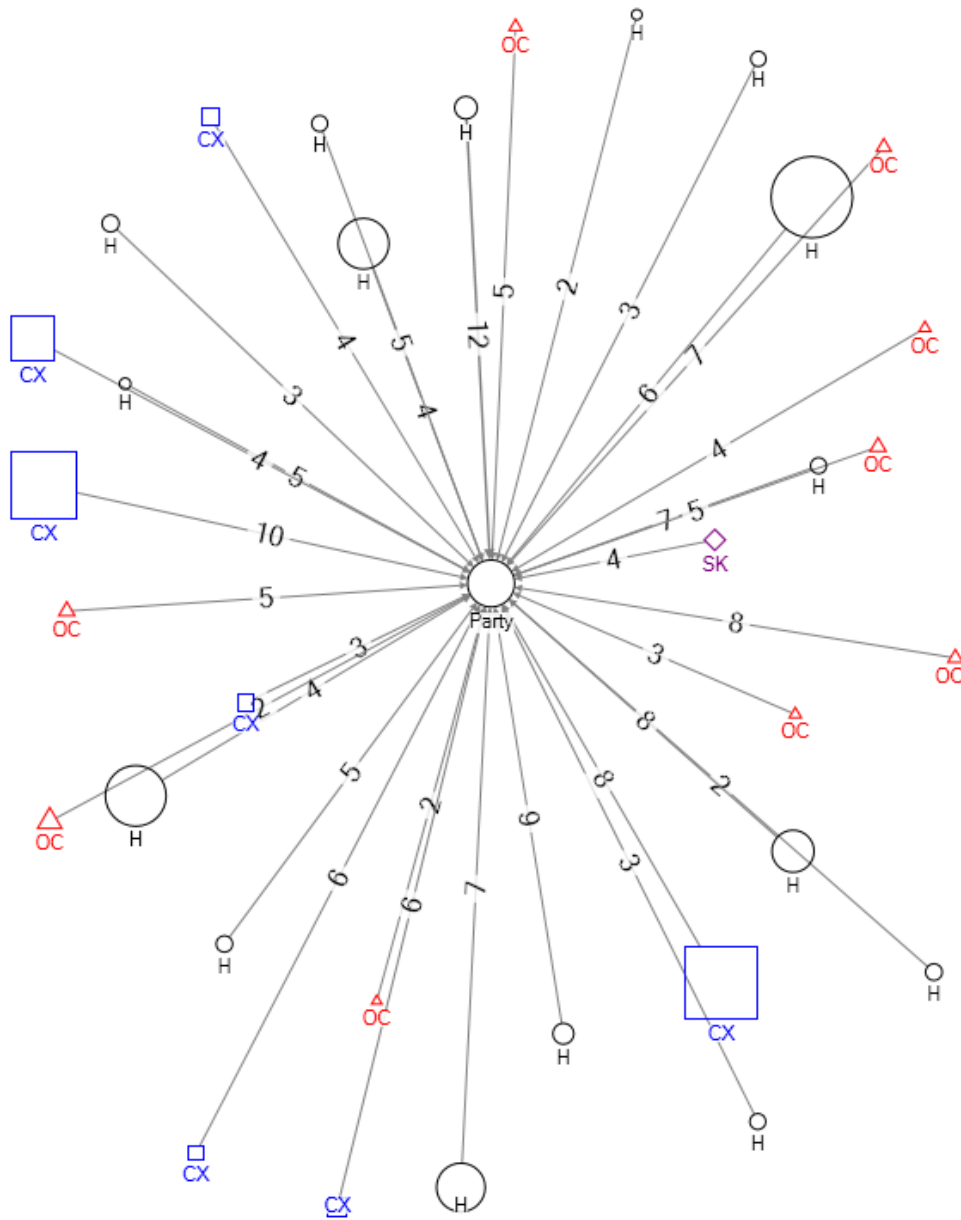
## **Appendix 1: Graphic Representation of Chinese Firms' Business network with its North Korean partners**

The series of Figure 4.2 through 4.6 are the graphic representations of Chinese Firms' Business networks with their North Korean business partners. The center of each graph denotes the affiliation of North Korean firms. For example, "army" in figure 4.2 means North Korean army-affiliated firms. H, SK, CX, OC respectively stand for *Han zu*, South Korean, *Cha xian zu*, Overseas Chinese firms which have business relationship with the center. Node size, numbers in lines represent sales revenue and duration of relationship, respectively.

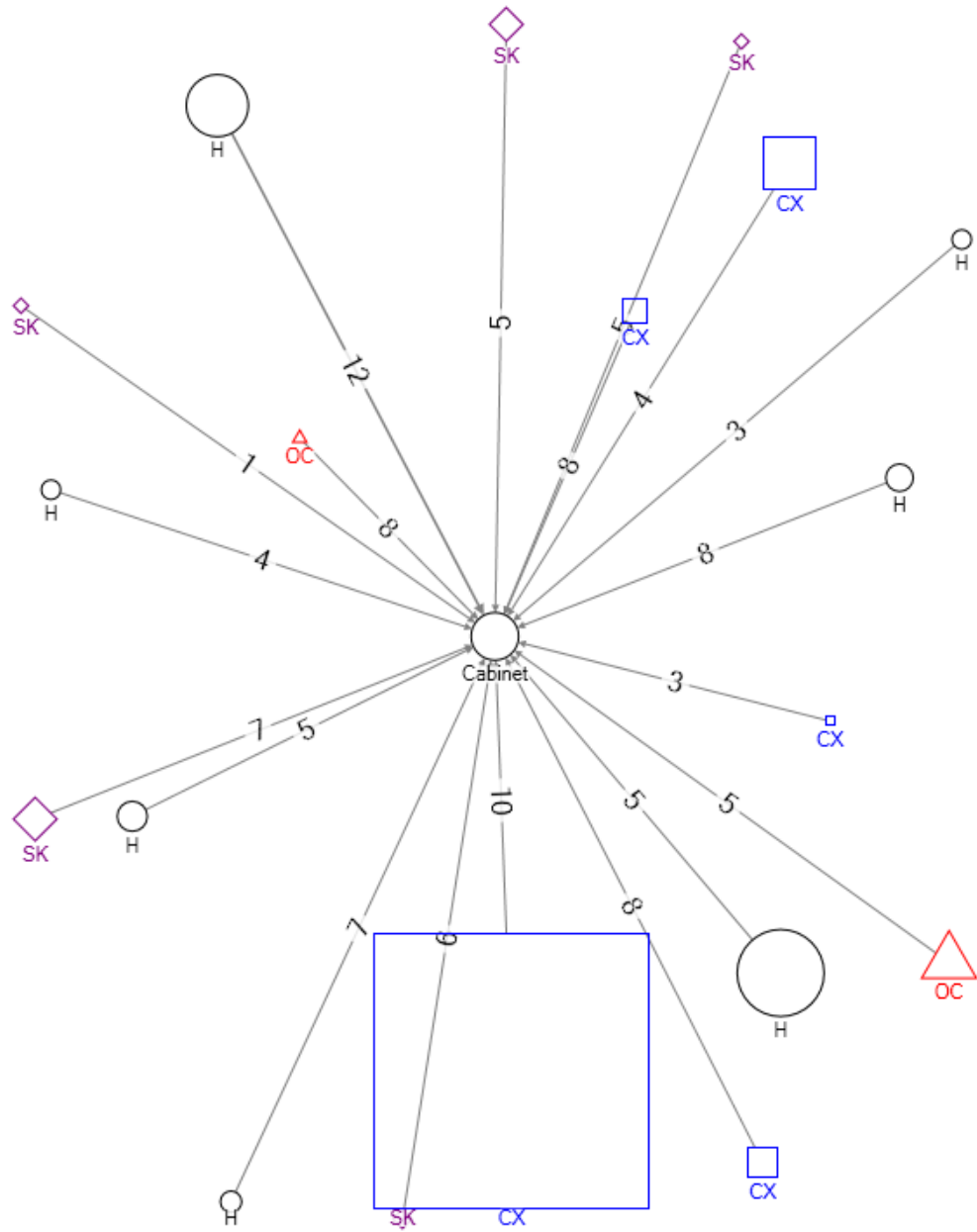
**Figure 4.2 Business Network between Chinese Firms with North Korean army-Affiliated Firms**



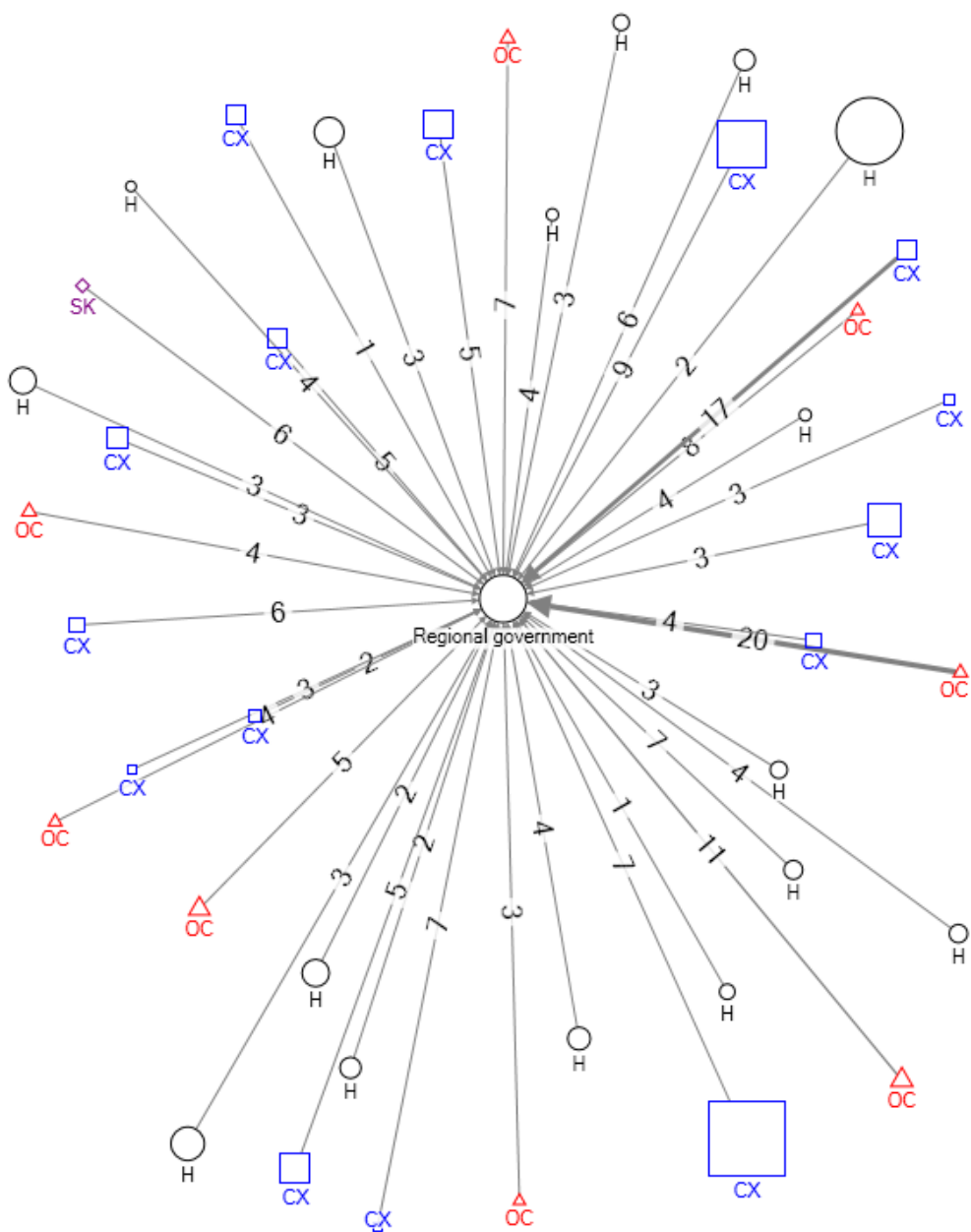
**Figure 4.3 Business Network between Chinese Firms with North Korean Party Affiliated Firms**



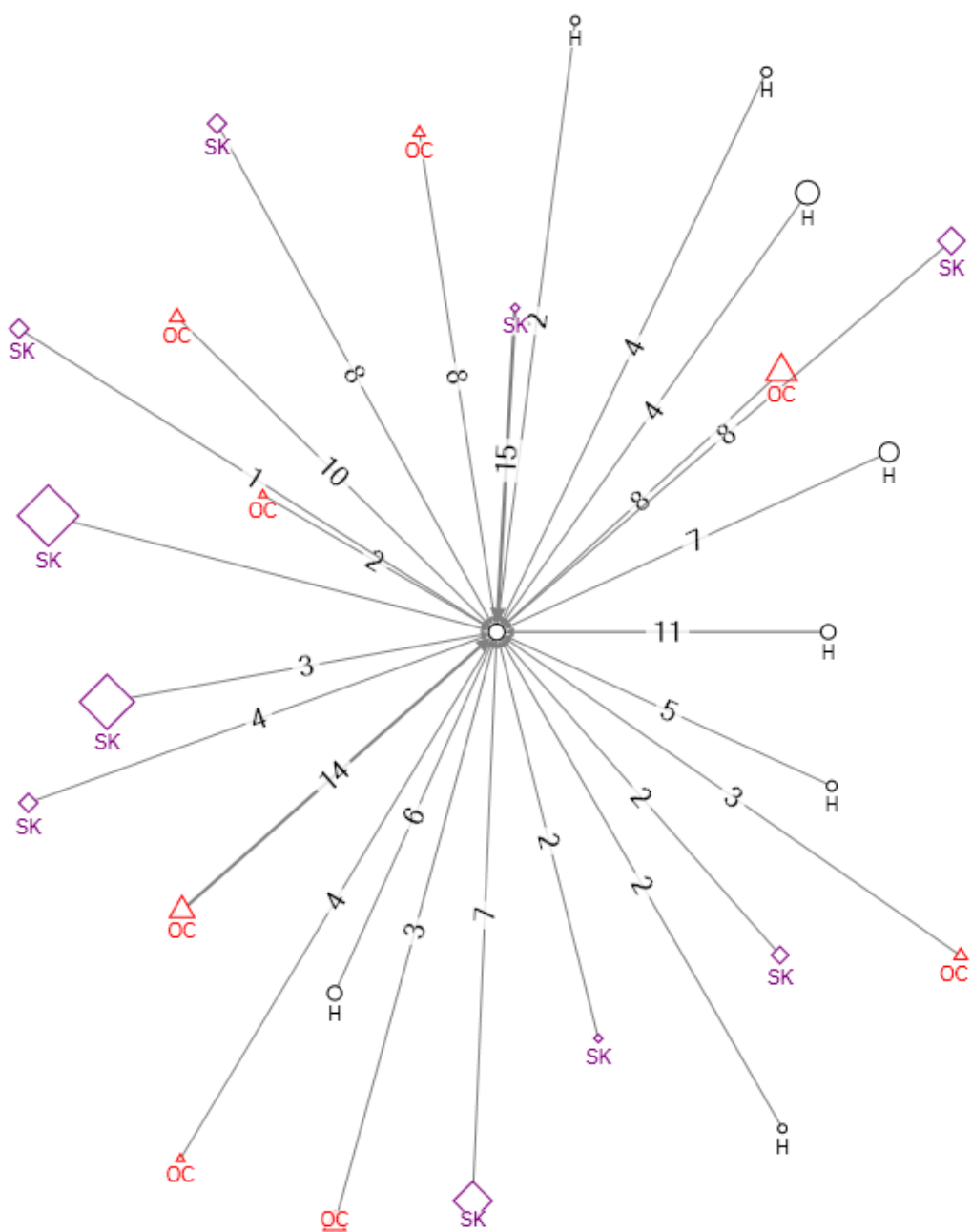
**Figure 4.4 Business Network between Chinese Firms with North Korean Cabinet Affiliated Firms**



**Figure 4.5 Business Network between Chinese Firms with North Korean Regional Government Affiliated Firms**



**Figure 4.6 Business Network between Chinese Firms with North Korean Individuals**



## **Appendix 2: Graphic Representation of Chinese Firms' Market linkage**

The series of Figures 4.7 and 4.8 are the graphic representation of Chinese Firms' Market linkages with South Korea and China, respectively. Similar to the previous graphic representation, H, SK, CX, OC each stand for *Han zu*, South Korean, *Chao xian zu*, Overseas Chinese firms which have business relationships with the center respectively. Node size, numbers in lines represent sales revenue and duration of relationship, respectively.



Figure4.7 Linkage with Chinese Market

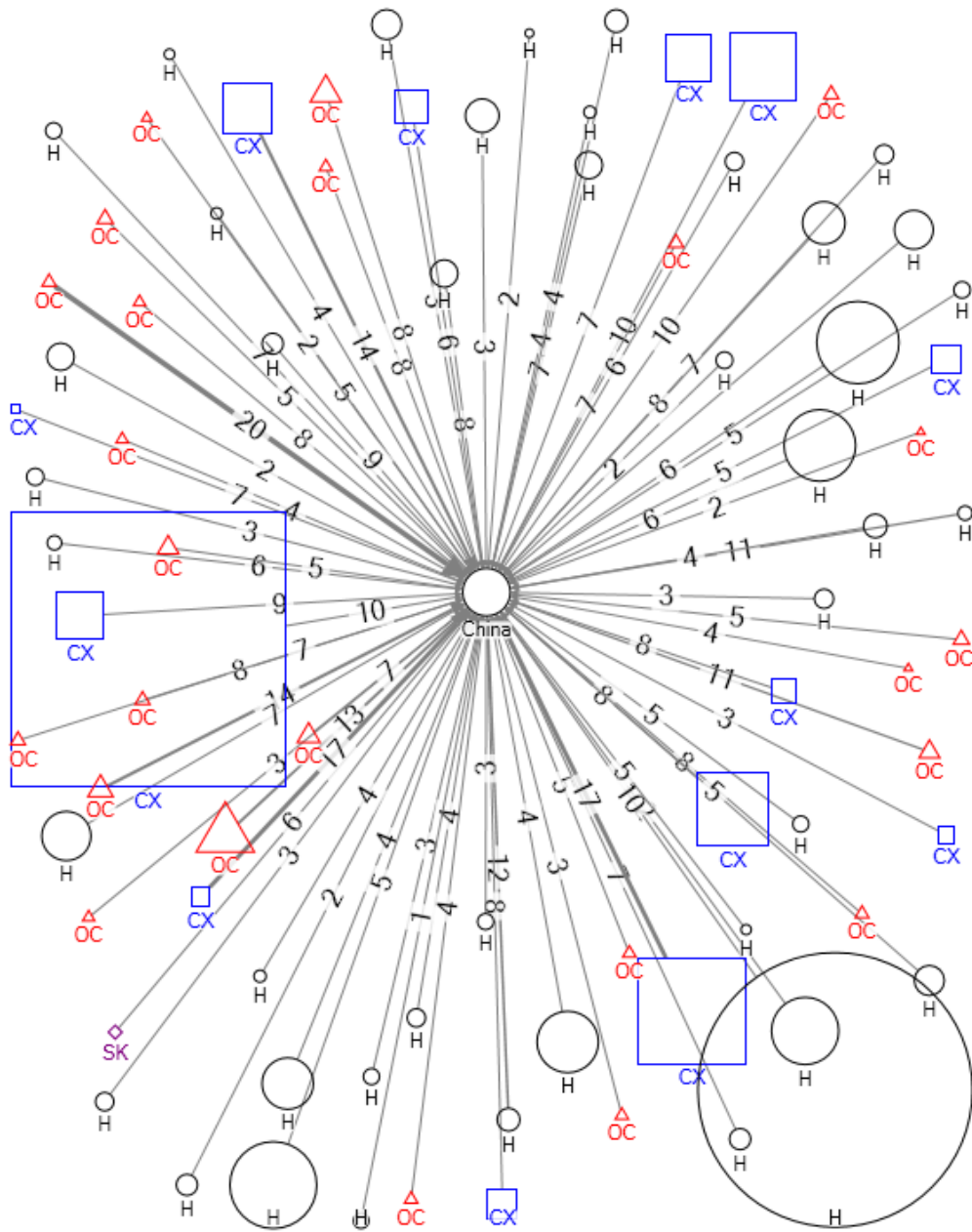
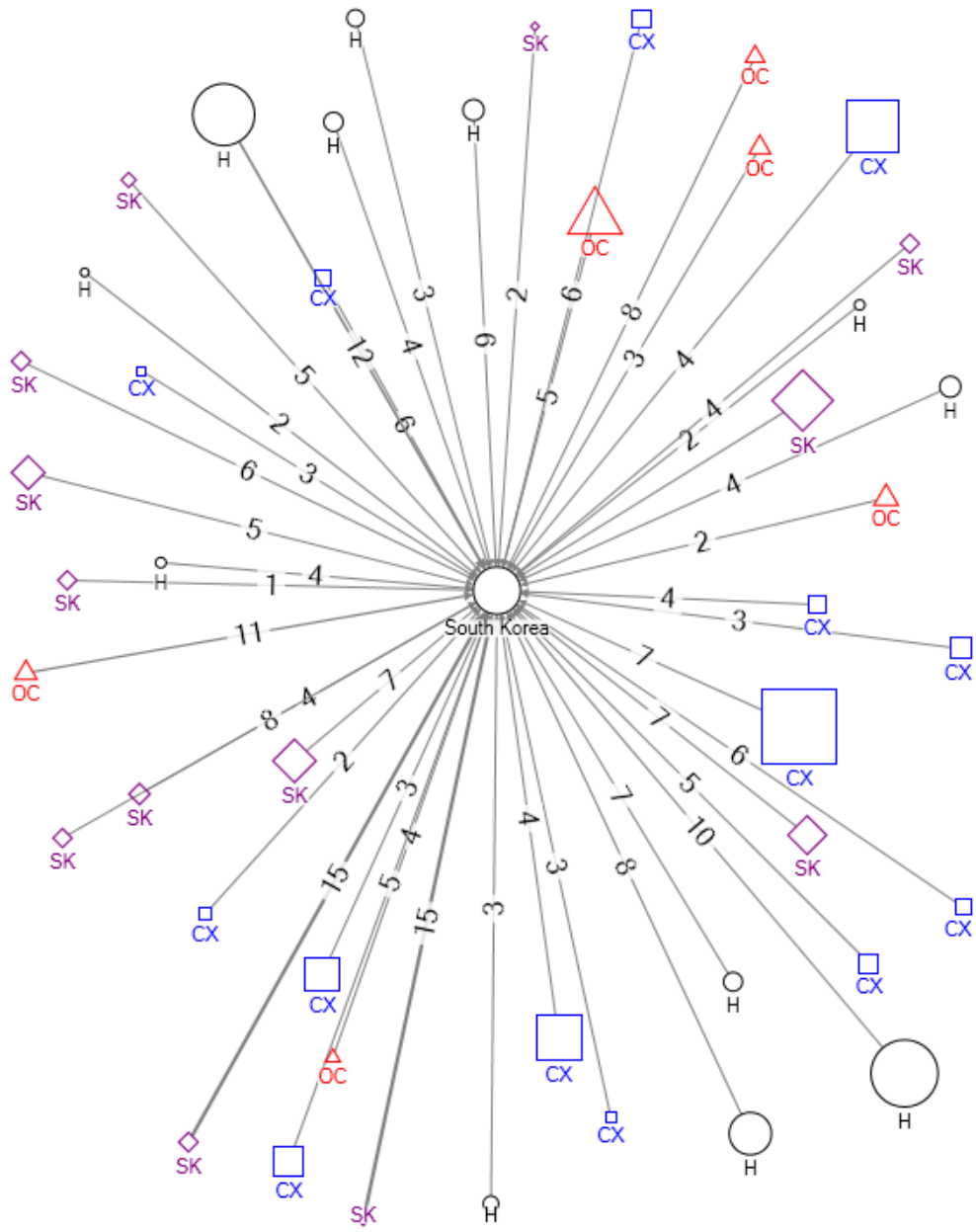


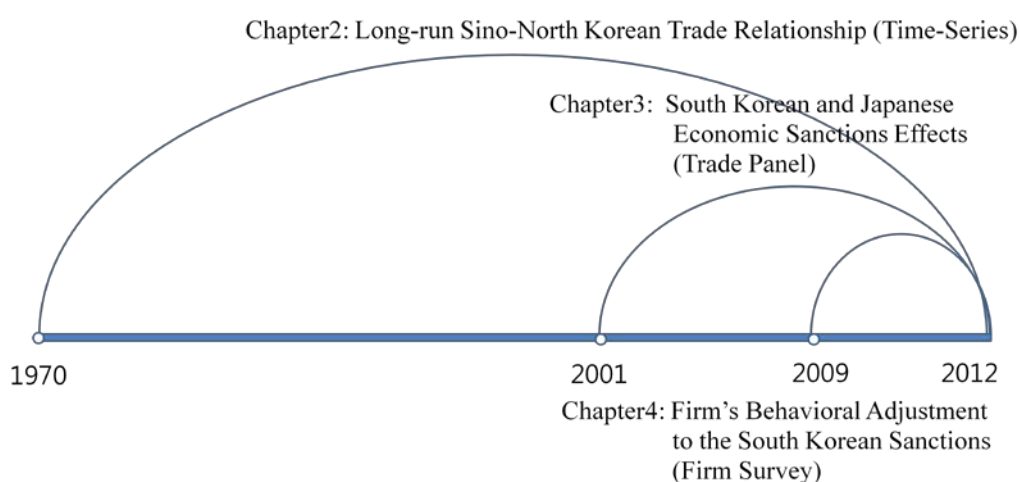
Figure 4.8 Linkage with South Korean Market



## Chapter 5. Conclusion

The three chapters from 2 to 4, which is the body of this dissertation, investigate the characteristics of Sino-North Korean trade relationship using data with diverse time horizon and different format respectively. In Chapter 2, long-run time-series data from 1970 to 2012 is used for the analysis of the causal relationship between the bilateral trade and economic growth of North Korea. And, the last two chapters of this thesis more focus on the assessment of sanctions effect on the trade relation. Chapter 3 examines the impact of the economic sanctions imposed by South Korea and Japan on the North Korea-China trade, using a panel dataset, which contains detailed information on prices, quantities, trade type of each commodity during the period 2001-2012. In the final chapter of the body, firm-level data, constructed by face-to-face surveys of the firms in Dandong, is used to assess the impact of South Korean sanctions in 2010 at the firm-level.

**Figure 5.1 Sample period of Each Chapter**



The main findings of the thesis are summarized as the following four points. Firstly, the long run trade relationship basically based on commercial incentives, rather than Chinese government intervention, is stable regardless external economic shocks including the collapse of Soviet bloc in the early 1990s and unilateral economic sanctions by South Korea and Japan in 2000s. The stable relationship could have been sustained because the relation has been mutually beneficial for the both countries' parties. In addition, the lack of Chinese government cooperation to block the commercial trade with North Korea even after North Korean provocative activities including consecutive nuclear tests contributes to the stability of the bilateral trade relationship.

Secondly, the effectiveness of sanctions, imposed by South Korea, has been mitigated by the expanded trade between North Korea and China. The panel data analysis finds that South Korea's economic sanctions significantly boost North Korea's exports to China, and the export increase has been large enough to cover the loss from South Korea's sanctions. In particular, North Korea mitigates the effects of South Korean sanctions by increasing the transit trade (bonded trade) through China. This finding is consistent with the results from the firm-level data analysis. As for the market linkage, linkage with the South Korean market does not affect any performance measures. This can be explained by the fact that the firms use various techniques including illicit activities, for example, modifying the country of origin of the North Korean products and re-exporting them to third countries. In short, interest of North Korea regime suffering from hard currency shortage coincides with that of Chinese firms trying to maximize profit, especially after the sanctions, and this interaction eventually results in weakening the effectiveness of sanctions.

Thirdly, business network with North Korean partners, especially with army-affiliated ones, are critical for the performance of Chinese firms after

imposition of South Korean sanctions. This may be because North Korea's "military first" policies *de facto* regulate resource allocation mechanisms in North Korea's external sectors. In addition, the role of Chinese firms, particularly *han zu* companies, have been strengthened in North Korea-China trade. It is found that North Korea's mining exports have become dominant in the trade with China after the sanctions and a large proportion of mine exports are driven by the investment of Chinese firms. Based on survey data, it is also found that the considerable benefits from the expanded bilateral trade in the post-South Korean sanctions period went to the *Han zu* companies doing business with army affiliated North Korean partners.

Fourthly, even though North Korea-China trade skyrocketed during 2000s, the institutions still have not been well developed for transactions between North Korea-China. Short-term causality flows from imports to exports implying traditional barter-type settlement is still prevalent in the Sino-North Korean trade. From the cointegration equation, it is further found that the mechanism of North Korea's economic growth is basically similar with the typical growth pattern of low income countries. In particular, foreign capital inflows do matter for its growth, which implies that any trade restriction on the importing of capital goods would deteriorate the economy in the long-run.

## 국문초록

### 북중무역:

#### 집계 데이터와 기업수준 데이터를 통한 분석

이 연구는 거시 집계 데이터를 통해 북중무역과 북한의 경제성장, 북중무역과 대북경제제재 간의 관계를 분석하였다. 또한 북중무역의 주요 행위자인 대북거래 중국기업의 성과 결정요인을 기업수준 데이터를 이용하여 연구하였다. 전체 논문은 아래 3편의 소논문으로 구성된다.

첫 번째 논문은 1970~2012년까지 장기 시계열 자료를 이용하여, 북중무역과 북한의 경제성장 간의 관계를 분석한 연구이다. 분석방법은 공적분 검정(cointegration test)과 벡터오차수정모형(VECM: Vector Error Correction Model)을 이용하였다. 장기 균형관계를 의미하는 공적분 방정식(cointegration equation)의 추정결과, 북한의 성장패턴은 대외무역과 해외수입자본재가 중요한 영향을 미치는 전형적인 저개발국의 성장패턴을 보이는 것으로 나타났다. 또한, VECM 모형을 기초로 한 그랜저 인과관계 검정(granger causality test)을 통해 장, 단기 인과관계를 분석하였다. 장기 인과관계에서는 오차수정기제(ECM: Error Correction Mechanism)를 통해 대중수입, 대중수출, 북한의 자본재 수입액을 대리변수(proxy variable)로 추정한 투자액이 북한의 소득을 granger cause하는 관계를 발견하였다. 즉, 북중무역과 투자가 북한 장기 경제성장의 중요 결정요인으로 추정된 것이다. 또한 북중간 이러한 장기 균형관계는 북한경제가 노출된 다양한 외부적 충격에도 불구하고 안정적인 것으로 나타났다. 단기 인과관계에서는 대중수입이 대중수출을 granger cause하는 것으로 분석되었다. 이는 과거 전통적인 사회주의 국가간의 바터무역(barter trade)이 북중무역에서 여전히 주요 무역 방식이기 때문인 것으로 해석된다.

두 번째 연구는 한국과 일본의 대북 경제제재가 북중무역에 어떠한 영향을 주었는지 분석한 논문이다. 이 연구는 양국의 경제제재효과를 2001~2012년까지 북한과 한국, 중국, 일본 간의 상품별 무역패널 데이터를 사용하여 분석하였다. 분석방법은 제재에 대한 북한의 행태 변화(behavioral adjustment)와 제재의 지속적 영향을 고려하기 위해 동적패널모형(dynamic panel model)을 사용하였고, 전기변수(lagged variable)의 내생성(endogeneity)을 통제하기 위해 system GMM(Generalized Method of Moments) estimator를 이용하였다. 주요발견으로는 첫째, 양국가의 대북제재 중 한국의 제재만이 북한의 대중 수출을 유의하게 증가시켰다는 점이다. 증가된 북한의 대중 수출액은 제재로 인하여 감소한 대남 수출의 손실액보다 큰 것으로 추정되었다. 둘째로 북한은 일반무역을 통한 중국 내 수출뿐만 아니라, 중국을 경유해 제 3국으로 수출되는 보세무역을 늘림으로써 한국의 경제제재 영향을 약화시켰다는 점이다. 이는 북한 정권이 무역전환 등의 방법을 통해 제재의 영향을 약화시키고 있다는 것을 시사한다. 특히, 이 과정에서 북한과 거래하는 중국기업들이 중요한 역할을 담당하고 있는 것으로 보인다.

세 번째 논문에서는 북중무역의 주요 행위자인 중국기업의 대북무역 성과를 결정하는 요인을 분석하였다. 2012년과 2013년 중국 단둥지역에서 174개 대북거래기업을 대상으로 실시한 기업 설문조사 자료 중 138개 무역기업 데이터가 분석에 사용되었다. 분석결과, 중국기업 중 북한의 군 소속기업과 주 사업관계를 가진 기업이 내각 소속기업과 주 사업관계를 가지고 있는 기업에 비해 유의한 양의 성과를 나타내는 것으로 추정되었다. 이는 2010년 한국제재 이후, 북한의 군 소속기업이 더 많은 독점적 무역권한(와크)을 받았기 때문에, 이들 북한기업과 거래한 중국기업의 성과가 개선된 것으로 해석할 수 있다. 이러한 결과는 소위 ‘선군정치’ 정책이 북한의 대외무역부분에서 실질적으로 자원 배분을 규제하는 방식임을 시사하는 것으로도 설명될 수 있다. 반면 한국시장과의 연계가 깊은 중국기업이라 할지라도 한국제재로 인한 성과의 부정적 영향은 유의하게 추정되지 않았다. 이는 중국기업이 원산

지 조작 등의 수단을 통해 한국의 제재를 회피하기 때문인 것으로 보인다. 마지막으로 대북거래의 위험성에 잘 대처한 중국기업들이 좋은 성과를 내는 것으로 분석되었다. 즉, 북한의 거래 파트너 수가 많을수록, 또한 공식적인 분쟁해결 수단을 확보한 기업일수록 북중 접경지역의 거래에서 우수한 성과를 기록하는 것으로 추정되었다.

주요어: 북중무역, 경제제재, 체제전환경제, 기업성과, 오차수정모형,  
동적패널모형

학번: 2008-30805