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국제학석사학위논문

**Intra Industry Trade Pattern in
Bilateral Trade of China and Korea**

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2013년 8월

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**Intra Industry Trade Pattern in
Bilateral Trade of Korea and China**

A thesis presented

by

Lee, Miyoung

to

Graduate Program in International Commerce for
the Degree of Master of International Studies

August 2013

Graduate School of International Studies

Seoul National University

Seoul, Korea

**Intra Industry Trade Pattern in
Bilateral Trade of China and Korea**

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이 論文을 國際學 碩士 學位論文으로 提出함.

2013년 8월

서울大學校 國際大學院

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Bilateral Trade of Korea and China**

Presented by Lee, Miyoung

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Abstract

Intra Industry Trade Pattern in Bilateral Trade of Korea and China

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This study investigates the patterns and determinants of China's intra-industry trade (IIT) with Korea, one of major trading partner for each other. Thanks to China's rapid economic growth and also to global trend that enhances regional integration, bilateral trade of China and Korea was highly affected within its trade pattern. Recently, the IIT share has been rising accounting nearly half of its trade. In this regard, this study examines the IIT pattern of China and Korea.

The trade pattern has been analyzed from 2000 to 2011, developing econometric models to test the specific determinants of the IIT between China and Korea. Also at the same time, I disentangled IIT to Horizontal and Vertical IIT to compare the regression result with IIT as a whole. This was to find out any differences detected from China's economic development.

The empirical result has shown that research intensity, income per capita gap, China's industrial development played significant role in IIT. R&D which represents Korea's technological improvement in product and China's industrial development played positive role for IIT, however the income per capital gap had a negative relations. This fosters the previous studies assumptions. However, FDI, which has been a key determinant that drives

IIT did not show significance in the regression. Still it is worth to see the result of the regression since it reflects the recent fluctuation of inward FDI to China.

Keyword: Intra-industry Trade, Horizontal Intra Industry Trade, Vertical Intra Industry Trade, Product differentiation, FDI, China's economic growth

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Introduction

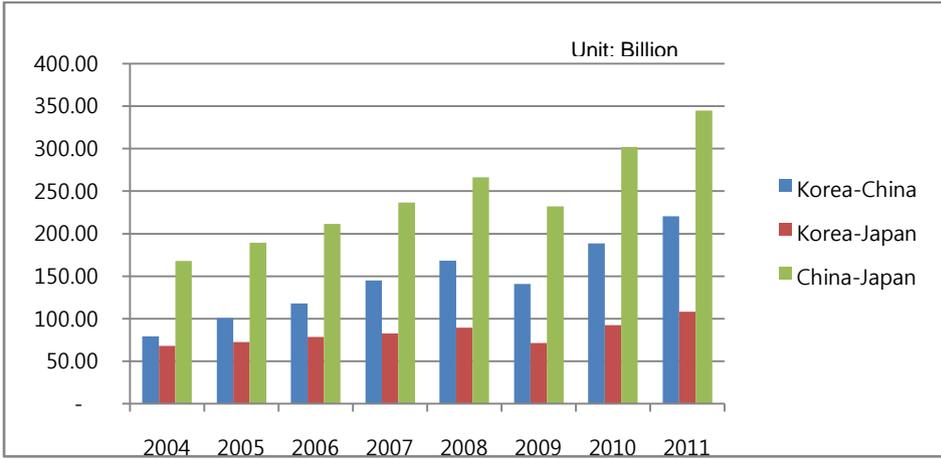
FTA negotiation finally initiated

Over a decade, the FTA negotiation was on the table among Korea, Japan and China, and it finally has initiated the negotiation in March 26th, 2013. There exist different and complicated interests among the three countries and their own status was correspondingly more hesitated. Last May, 2012, Korea, Japan and China have reached the agreement to begin the free trade negotiation. Korean government is expected to expand its export through common market, which will rank in third place in regional market, amounting 15 trillion USD (nominal GDP). By this step forward toward North East Asia common market, Korea is expected to have positive effect in both real GDP and trade, according to Korean Institute of International Economic Policy (KIEP)¹. In short term, the GDP will be increased by 0.32~0.44% for the next 5 years and in long term, it will be increased in 1.17~1.45% in the next 10 years of the consequence. Welfare would be improved amounted to 7.19~9.63 billion USD and 11.6~16.3 billion USD in short term and long term respectively. The economic environment and the relations are changing dramatically thanks to the China's drastic economic development. This has clearly affected the region and has inclined to bring the changes in trade pattern in the region. In this regard, this research examines the trade pattern and its trends that are incorporated with Chinese economic advancement in North East Asia region.

Trading Trend among Korea, Japan and China

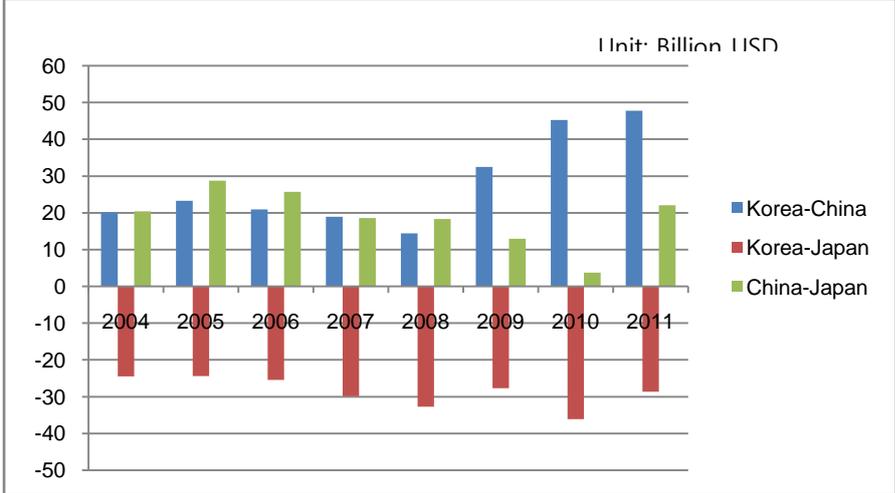
The trading trend among three countries has been more and more integrated since the Chinese open market policy in 2001. The Trade volume has been increasing in bilateral trade; Korea-China, Korea-Japan and China-Japan. The absolute amount of the trade is in increasing trend except in 2009, due to the global financial crisis. Among the bilateral relations, the two countries, Korea and Japan's trade toward China in 2011 has increased more than twice as that of in 2004.

¹ Analysis the impact of Korea China FTA, 2012, Korea Institute of Economy and Policy



Graph 1 Total Trade Volume
 Source: Korea Central Bank Statistics and Jetro

Graph 2 shows the bilateral trade balance among the three countries. Korea records surplus with China and the opposite with Japan. China also has trade surplus with Japan. This triangular relation among the three countries shows the inter-comprehensive trade patterns, surplus and deficit to one another. Despite trade decrease in financial crisis in 2008, the scale of trade balance is in increasing trend, but the balance of the comprehensiveness is no longer even to that of the previous period. The trade deficit and surplus pattern show the “division of labor” in three countries², which proves their economic dependency.



Graph 2 Trade Balance among countries
 Source: Korea Central Bank Statistics and Jetro

Additionally, the trade patterns of the three countries have changed significantly. The intra industry trade has been increasing continuously, finally dominating inter-intra industry when the trade after the China Open Economy initiated. The table compares the changes between 1996, 2006 and 2010.

Country	Trade Pattern	1996	2006	2010
Korea-Japan	Inter Industry Trade	67.30%	49.30%	46.40%
	Intra Industry Trade	32.70%	50.70%	52.40%
Korea-China	Inter Industry Trade	64.30%	54.50%	48.10%
	Intra Industry Trade	35.70%	45.50%	56.20%
Japan-China	Inter Industry Trade	68.40%	59.40%	52.50%
	Intra Industry Trade	31.60%	40.60%	46.60%

Table 1 Trade pattern among Korea China and Japan

Source: Korea Central Bank Statistics and JETRO

In this research, withstanding current economic stance and the rising share of Intra Industry Trade in North East Asia, will focus on the pattern of Intra Industry Trade (IIT) in bilateral trade between China and Korea. Initially would briefly overview the previous studies to find out significant factors that influences the IIT and secondly find out the current status and lastly conduct an empirical analysis with my own hypothesis.

The Rise of China

This economic relation cannot be explained without mentioning Chinese great leap forward. Even sustaining 8% GDP growth during Global Financial Crisis, the economic development of China facilitated tight relations among three countries.

As mentioned above, there were certain patterns of relationship among the three countries. Mainly this trade relation was benefited from close region that reduced the transportation cost, the imbalance in economic development.

However, as China's industry advances and accumulates capital resources, the relations of the three countries started to change. Chinese government is aiming to reach guomingongfu (國民共富), the common wealth of the nation, expecting the domestic consumption of mainland China to drive its own economy and by 2020, and also is to catch up Korea automobile, renewable energy and pharmaceutical industry³. In 2011, Korean products of the largest global market share have been reduced from 71 to 61, mostly overtaken by China⁴. This development of China would impact tri-angler relations in trade among Korea, Japan and China⁵.

In this regard, this research is focusing on how the variation of trade affected the Economy of North East Asia. To examine carefully the mechanism of the trade patterns of the three countries, this research is focused on the Intra Industry Index and its effectiveness in trade pattern of its bilateral trades.

Also, competitiveness in Machinery goods and parts and components are developing in quicker stance. According to the Industry Competitiveness Report by Samsung Economic Research Institute (SERI), China's machinery parts and components and Software that are included in intermediate goods, shows

³2011, 중국의 시장, 기술, 산업의 잠재력 평가 및 발전전망, Samsung Economic Research Institute

⁴ 2013, 추격하는 개도국, 쫓기는 한국, 2011년 우리나라 세계수출시장 점유율 1위 품목 분석, Institute for International Trade

This research on market share of global export market was conducted within HS code 6 digits. Even the Korean products that record the largest global market share, 13 out of 61 products are closely catching up by China.

competitiveness over Japan and Korea, and this trend is expected to be continued in the future.⁶ Improved competitiveness of the Chinese intermediate goods attracts the foreigners who implemented facilities in China for production. Hence, the replacement from Japan or Korea is increasing nowadays. China wins the competitiveness with so called “Good Enough Market” that can be translated to cheap price and good quality⁷.

This implies that China is not only taking role as the world’s factory but moving towards its own production and marketing by competing with neighboring countries in present. The triangular trade relationship among the three countries is expected to be changes from vertical to horizontal trade.

⁶ Analysis on Intermediate goods (Machinery, Software) of China, 2013, SERI Report (www.seri.org)

⁷ Analysis on Intermediate goods (Machinery, Software) of China, 2013, SERI Report (www.seri.org)

Previous Studies

Intra Industry Trade is explaining trade relations between countries with homogeneous economic stance in the same industry, denies the comparative advantage theory of H-O model. So even in the same industry the trade exists since the country with both comparative advantage and disadvantage in the same product. Considerable academic attention has been devoted to providing proper interpretation of the phenomenon over the past four decades.

Intra Industry exists with assumptions;

- 1) With similar demand, countries trade back and forth in similar but differentiated products
- 2) Technical development transfer products widely with mass production, gradually moving to developing countries

Abdl-el-RaIntra disentangled to total IIT into horizontal and vertical IIT on the assumption that price reflects product quality and can be represented by unit values. Horizontal Intra Industry Trade (HIIT) is trade in differentiated product with similar quality but different attributes whereas Vertical Intra Industry Trade involves vertically differentiated goods that are distinguished by quality.

From this theoretical view, following researches have applied in trade pattern of East Asian countries, including Korea, China and Japan.

Junyeop Lee – A study on the International Division of Labor in North Asia Based on the Intra Industry Trade among Korea, China and Japan

This study analyzed trends of trade structure variation among Korea, China and Japan. It has used HS 4digits industrial data of 1990-2002, Intra industry that comprised vertical and horizontal intra-industry trade indices were examined⁸. During the period, this research has found out the Intra Industry Index (IIT) is more effective between Korea and Japan, which have high GDP per capita, where as the importance of the Vertical Intra Industry Trade (VIIT) was more keen to the trade between Japan and China, whereas the Horizontal Intra Industry Trade (HIIT) has shown little relevance.⁹

Lee conducted empirical studies of how VIIT and HIIT is affected by the variables of GDP per capita and the gap of GDP per capita and Ratio of exportation of manufacturing goods. The results show that GDP per capita and the ratio of manufacturing goods exportation were the determinant factors¹⁰. In his research, the FDI and Economies of Scale were not selected as variables to examine the trade pattern of the three countries.

However HIIT among the three countries had no significant outcome in empirical studies, merely showing that HIIT is in rising trend. From 1990, the VIIT is to be declining over the period and the HIIT showed the opposite.

Mitsuyo Ando - Fragmentation and Vertical Intra Industry Trade in East Asia

In general theory of IIT, Unit Price was the criterion that distinguishes VIIT from HIIT. The HIIT can be simply explained by the product differentiation whereas VIIT defines itself as quality ladder; high income countries export in high quality product in high price, while low income countries export low

⁸Junyeop Lee, A study on the International Division of Labor in North Asia Based on the Intra-Industry Trade among Korea, China and Japan,2003, Abstract

⁹The VIIT and HIIT indices were calculated followed by Greenway et al. (1994) method, if indices include in $0.75 \leq \text{Export Unit Value} / \text{Import Unit Value} \leq 1.25$, it refers to HIIT, and if not included, it refers to VIIT.

¹⁰In his research, the GDP per Capita does not imply to the product specialization of the each country but was used for the replacement of the factor endowment. Thus, low GDP per Capita refers to more likely labor intensive country and the opposite refers to capital intensive country.

quality product in low price¹¹.

Vertical Intra-Industry Index has drastically increased in North East Asia region. Ando raised the question if the product differentiation with large gap in price, as in theory, can explain the VIIT of the three countries. He concluded that VIIT increase in 1990s was not product itself but the back-and-forth transaction for the production process¹². He initially calculated the proportion of the industry followed by HS code two digit in East Asia and found machinery share has been significantly increased. Especially, vertical transactions were likely to be found in machinery parts and components¹³. However, the HIIT was not significant in the explosion of IIT in North East Asia region.

Ryuhei Wakasugi– Vertical Intra Industry Trade and Economic Integration in East Asia

Wakasugi applied Gravity Model to examine the influence of the VIIT on recent trade explosion in East Asia, EU and NAFTA and compared the results. Additionally, relations of the elasticity of the trade volume and VIIT increase have been examined.

In general, many theoretical analyses have found that international production process causes the faster grow in trade volume than the income levels of involved countries. In East Asia, empirical results confirmed that the trade increase is accompanied by VIIT.

This finding distinguishes the trade pattern of NAFTA and EU, which has relatively homogeneous in economic and legal conditions. They are more likely depending on HIIT than East Asia. Wakasugi found that heterogeneous economic stance in East Asia is a crucial factor for trade increase. In theory, VIIT refers to trade of goods belonging to the same industrial category, since the productions of each country are in different stages with different factor intensity; it correspondingly occur division of labor. Thus, he assumes that a large increase of trade can be accelerated by the fragmented structure of trade. The factor fragmentation can be pointed out in four categories, 1) economic regulations and trade

¹¹ Abd- el - Rahman (1991), defined this as a "threshold method"

¹²Intra industry trade resulting from international fragmentation, the importance of which is addressed by Jones, Keirzkowski and Leonard (2002)

¹³ General machinery (HS84), electric machinery (HS85), transport equipment(HS86-89)

barriers, 2) Government restriction in FDI 3) degree of protection of intellectual property right, 4) lack in better educated human resources.

Kwangsuk Han, Jaeho Lee

By disentangling VIIT from IIT, Kwangsuk Han, Jaeho Lee conducted regression model to find out FDI's impact on vertical intra industry trade between China and Korea.

The main objects of these studies were to analyze the determinant factors of each international trade pattern and to verify the VIIT patterns as the traditional IIT concept which is essentially different from the VIIT patterns because the character of the VIIT patterns is based on the qualitative difference in products.

In Theory, VIIT is determined by the difference in GDP per Capita between trade partners, FDI amount, whereas HIIT is determined by various factors such as GDP per capita, GDP, scale, ratio of manufacturing industry. This study is to confirm its assumption that FDI flow from advanced countries and developing countries are probably a part of "international division of labor" in the production activities by enterprises.

In addition, this research assumed that expansion of international trade between the two countries in the specific industry is associated with an increase in the size of the same industry in China

This studies foster the assumption that VIIT recently attracted in Northeast Asia trade pattern followed by increasing volume of FDI, Industry share of China, and the Industrial Gap .

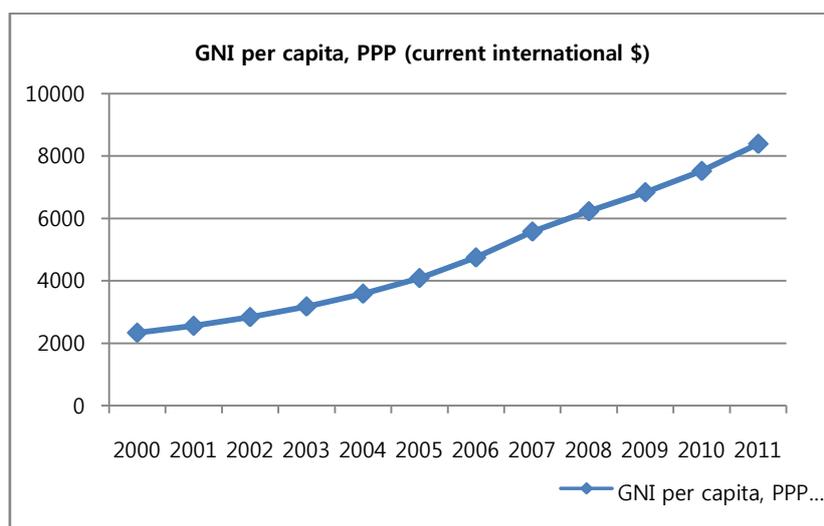
With Empirical Analysis, corresponding to the economic relations of Northeast Asia (Notably division of labor), share of IIT increases under 1) the ratio of FDI from Korea to production volume of corresponding industry is higher, 2) Industrial scale of corresponding industries in China is larger and 3) Industrial gap between China and Korea is greater.

Questions on Previous Studies (Overview)

The adaptation of the dramatic changes of China

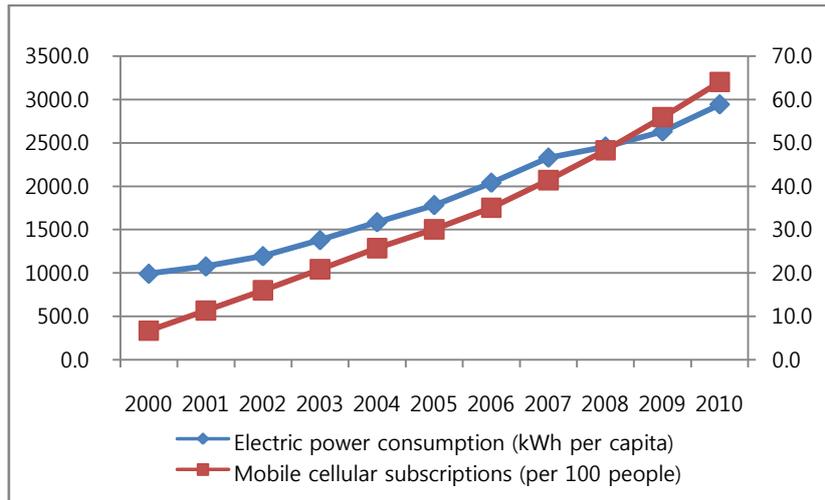
Three of the previous studies are examined under the precondition of the heterogeneous factor endowment. Lee has shown that the GDP per Capita is the crucial factor that affects the VIIT increase among Korea, Japan and China. Ando focused on the export explosion in East Asia region and has concluded that it is product process fragmentation that influenced the increase of VIIT. Lastly, Wakasugi finally defined labor of division is the crucial factor in the trade volume increase in economically integrated region, including East Asia, EU and NAFTA, is significantly affected by VIIT. Also he has proved that this relation is more typically well applied in North East Asian region.

These empirical studies were conducted within the period from late 1990s to early 2000s. As we have experienced, without any doubt, China's economic development in late 2000s has shown that its economic circumstance is different from that of the early 2000s. This trend was strengthened after the Global Financial Economic Crisis 2008, which has underpinned its status in global economy. This would result in the changed in factor endowment, that were coincided with the rise of VIIT.



Graph 3 GNI per Capita

Source: World Bank

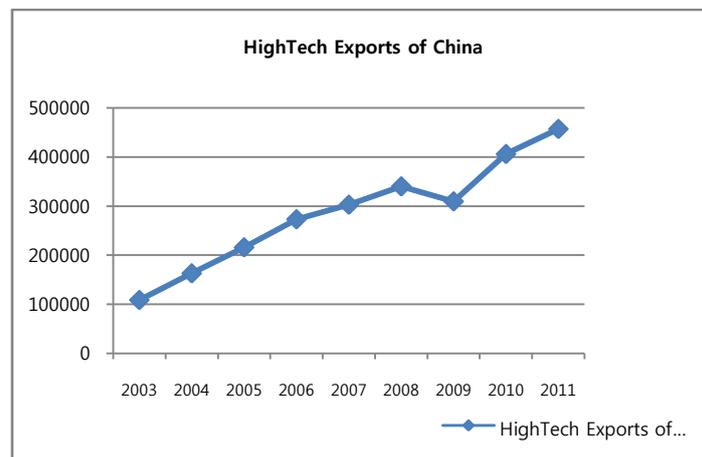


Graph 4 Electrical power consumption and mobile cellular subscription

Source: World Bank

China's Capita per income has been more than tripled from 2001, showing steady growth. Also, the electric power consumption has been enlarged up to three times compared to that of 2000 and the mobile phone subscription has become more likely common to ordinary people, 70 out of 100 are now using as of 2010.

By and large, the Intra Industry Trade in North East Asian countries could have been affected. The prospering consumer demand in China will also foster the development of China's local industry.



Graph 5 High Tech Exports of China

Source: Wold Bank Data bank

On supply side, China's high tech export soared up to nearly five time that of in 2003. High-technology exports are products with high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery.

Also, as previous studies have shown, the factors that impact the intra-industry trade were proved. Among the three countries in particular, the income level difference, FDI Investment to China and Exporting countries' technological improvement (R&D) were the most influential.

Methodology

Overview

Previous studies lack the competency and the development of China in late 2000s. As shown above, Intra Industry Index, especially in machinery parts has been increased among the three countries. This empirical study focuses on the influence of the IIT and its variants in Korea-China trade model. It will confine to the certain field of industry by finding out the industries that has a trend of converting from VIIT to HIIT. The industries are confined to ten groups, which has proportioned the most in bilateral trades with high GL index¹⁴. These industries represent the most of the IIT in bilateral trades. Comparing the results between 2000 and 2011, GL index seemed to increase in general except two groups, which denotes Industrial Material and Textiled Clothing.

In order to examine the features of China's IIT with Korea in a in-depth manner, the trading products is HS codes are reorganized and classified into ten groups. Such classification will be also applied in the next empirical analysis. The categorization is demonstrated in the following table. The products are aggregated from HScode digit 6 level.

HS code	Category	Group
HS 01~24	Food and beverage	A
HS 25~38	Chemical	B
HS 39~40, 68~70	Industrial Materials	C
HS 44~49	Wood and Pulp	D
HS 50~67, 41~43	Textile and Clothing	E
HS 71~83	Metal	F
HS 84	Machinery	G
HS 85	Electric	H
HS 86~89	Transport	I
HS 90~99	Miscellaneous	J

Table 2 Classification of HS code by industry

Source: UN Comtrade

¹⁴ To select the industries that mostly impact the bilateral trades in three countries, following method has been used. The detailed result will held in appendix 1.

- 1) Calculated GL Index of HS code 2 digit $((1-IX-MI)/(X+M))*100$: GL index over 50 were selected
- 2) Calculated the proportion of industry : Products that proportions 1st and 2nd largest were selected
- 3) Selected the industry that contents the both were finally decided for the variant factor for the econometric industry

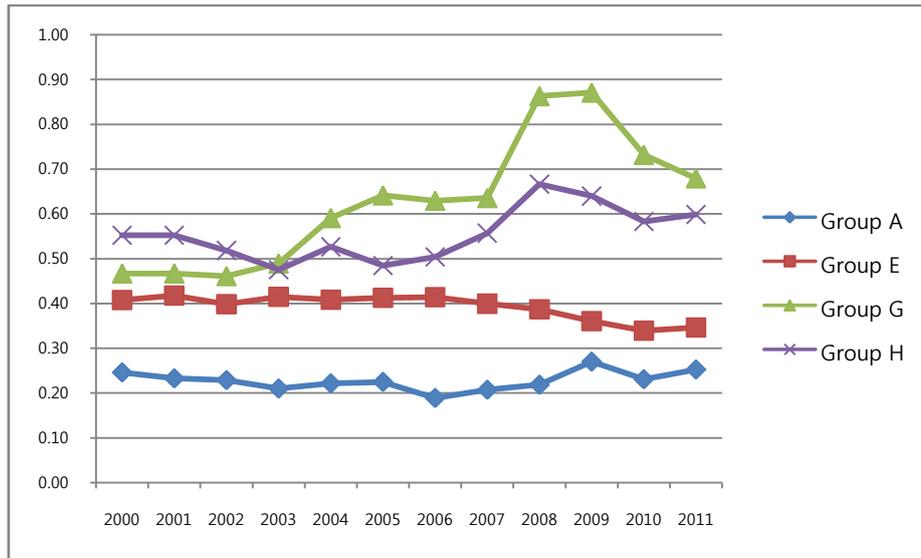
From this categorization, GL index and its share by sectors are calculated. In 2000, textiles, chemical and metal which represent most of primary and secondary industries take the most of share with high GL index. On the other hand, the electric industry predominates the share of intra industry trade. GL index are increased in most of sectors, however, the sectors that predominated in share with high GL index in 2000 have been decreased in 2011. This shows that the trade pattern in industry sectors has been changed over decade.

	2000		2011	
	GL	Share	GL	Share
Food and beverage (A)	0.25	3%	0.25	1.92%
Chemical (B)	0.45	19%	0.59	16.03%
Industrial Materials (C)	0.46	10%	0.33	7.08%
Wood and Pulp (D)	0.35	3%	0.43	0.58%
Textile and Clothing (E)	0.41	20%	0.35	4.75%
Metal (F)	0.51	12%	0.53	10.39%
Machinery (G)	0.47	8%	0.68	11%
Electric (H)	0.55	21%	0.60	32%
Transport (I)	0.52	2%	0.34	3.63%
Miscellaneous (J)	0.42	2%	0.47	0.95%

Table 3 GL Index and its share by industry

Source: World Bank Data bank

This GL Index and its share by industry shows that there were significant increase for both machinery and electric whereas decrease in industrial materials and textile clothing. Also, chemical and textile was the most dominant industry in 2000 whereas it became the electric and machinery the most dominant in 2011. This shows that intra industry trade pattern has been changed among the industries in decade.



Graph 6 The comparison of GL Index Proportion by industry sectors
 (Source: UN comtrade)

To oversee the chronological trend of the main industries, Group G and H, which represent Machinery and Electronics respectively shows increasing trend, whereas the Machinery and Electrical products show the opposite. From this clue, the research narrowly focused on these two industries and its trend in GL index. In this regard, for observation of horizontal intra industry sector, these two industry has been carefully examined.

The table below shows HIIT shares in percentage of each industry sector.

	2001	2005	2008	2011
Food and beverage	0.48	0.28	0.16	0.17
Chemical	0.09	0.33	0.59	0.58
Industrial Materials	0.22	0.36	0.63	0.40
Wood and Pulp	0.14	0.42	0.38	0.28
Textile and Clothing	0.57	0.71	0.27	0.22
Metal	0.45	0.57	0.59	0.55
Machinery	0.68	0.54	0.49	0.53
Electric	0.60	0.38	0.55	0.31
Transport	0.16	0.29	0.33	0.50
Miscellaneous	0.43	0.88	0.30	0.13

Table 4 HIIT shares in each industry sector

Source: UN Comtrade

In HIIT share, Food and beverage and Textile and Clothing had largest are in Intra Industry Trade along with Machinery and Electrical products. As time goes by, the industries in Machinery and Electrical products has less HIIT share compare to previous years, but with volatilities whereas Textile and Food industries have shown continuous decrease.

Drawing out more detailed analysis, the correlations of HIIT will be calculated in HS digit 6 of HS84 and HS85, which includes the product mainly in machinery.

Trading Partner	Total trade volume of HS85 (million USD)	Ratio to Total Trade Volume	GL INDEX
KORCHN	37,281	27.9%	80.95
CHNJPN	229,461	24.4%	66.95
JPNKOR	79,536	21.6%	74.00

Table 5 Share of Electrical product in each bilateral trade

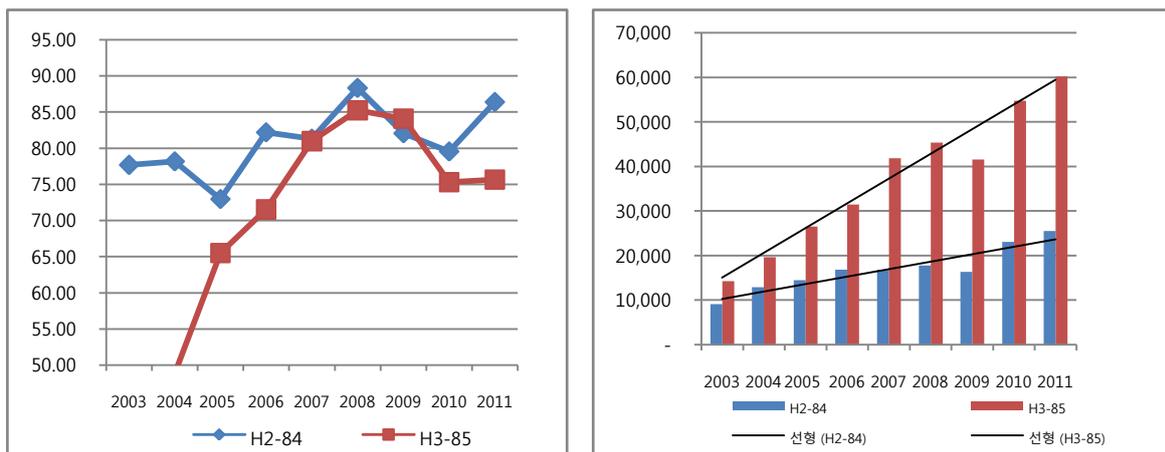
Source: UN Comtrade

Trading Partner	Total trade volume of HS84 (million USD)	Ratio to Total Trade Volume	GL INDEX
KORCHN	130,858	13.4%	70.30
CHNJPN	229,461	19.1%	75.11
JPNKOR	79,536	15.8%	44.18

Table 6 Share of Machinery product in each bilateral trade

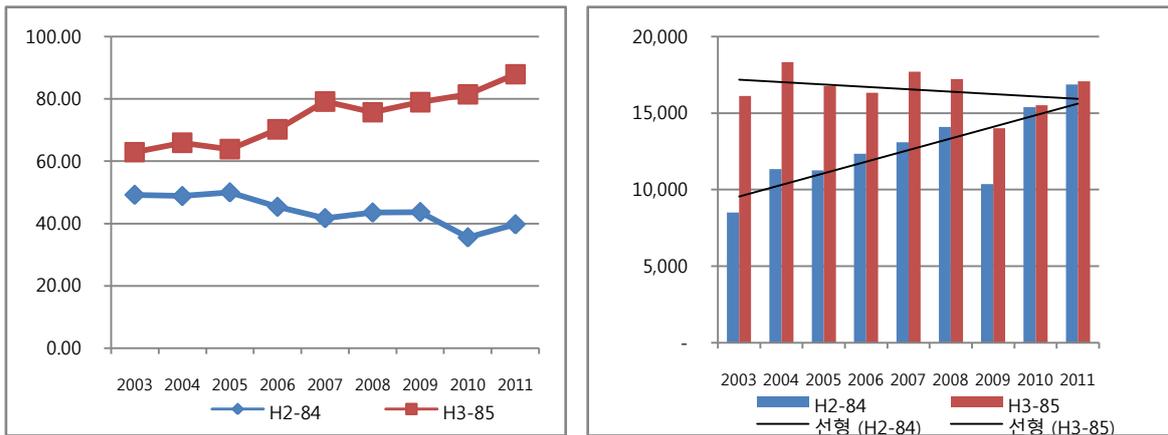
Source: UN Comtrade

Tables above show that HS84 and HS85 proportion the most in each bilateral trade. Including the HS84, HS85, it comprises nearly 40% of the total trade. Also GL index has remained among the highest. Therefore, this econometric analysis would confine to HS84 and HS85.



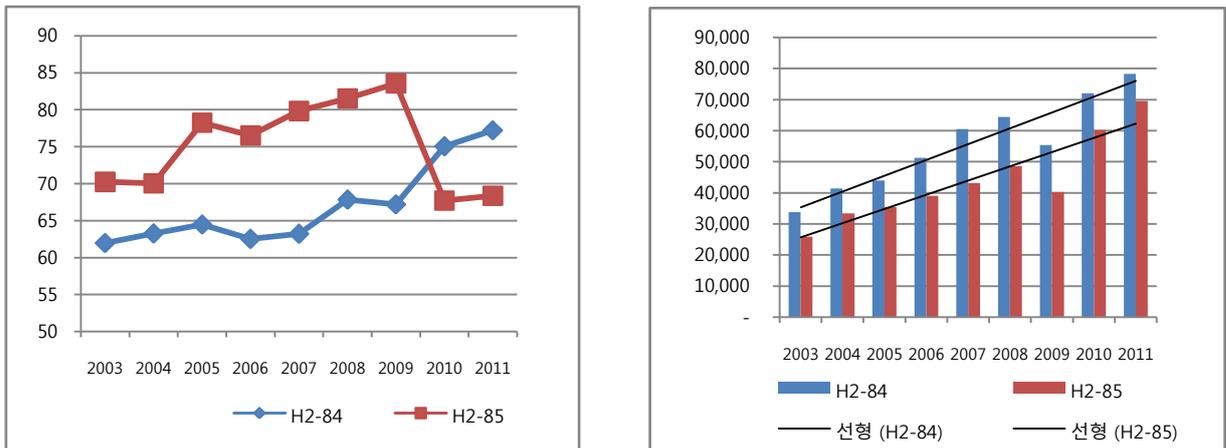
Graph 7 GL Index and Trade pattern of China and Korea

(source: www.uncomtrade.org, unit: million USD)



Graph 8 GL Index and Trade pattern of China and Korea

(source: www.uncomtrade.org, unit: million USD)



Graph 9 GL Index and Trade pattern of Japan and Korea

(source: www.uncomtrade.org, unit: million USD)

This concludes that there are the increasing trends in Horizontal Intra Industry Trade between Korea and China. The trade pattern of bilateral trade from 2003 to 2011 shows that the trade volume was continuously increasing whereas the GL index does not conform its path from 2009. Although the trade volume shows constant increase (For bilateral trade between Korea and China, it has shown slight decrease in HS 85 trade volume), GL Index of HS code 85 dropped almost 30%, showing less recovery until present. By this regard, HIIT trend is also applied in regression.

Methodology

Overseen current economic situation in East Asia and relative studies, GL has shown clear increase among Korea, Japan and China. Especially the HIIT has more potential in machinery industry, where China is now developing in fast pace. This research is to focus on the correlation between the HIIT index and the economic development of china to the total trade volume as well as the trade pattern of the bilateral trade within whole Intra Industry Trade.

As written in previous chapter, the variants that are to impact the Intra Industry Trade in Korea-China trade are FDI, Technical development, Income level difference and China's industrial share. The more detailed explanation regarding the individual variants are written below;

- Income Difference between the two countries

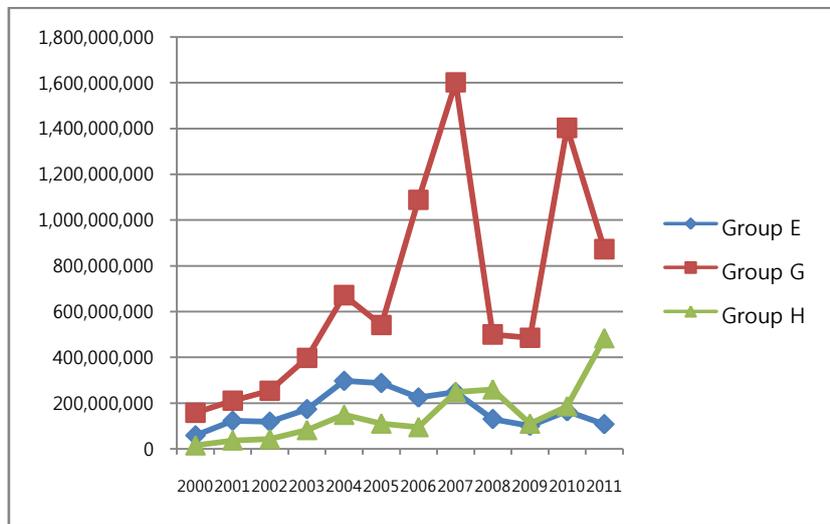
Defined as the difference in absolute values in GDP per worker between China and the Korea, the intensity and the probability of IIT are positively correlated with differences per capita income between trading partners in the presence of VIIT but negative to HIIT¹⁵. The income difference has been narrowed thanks to China's rapid economic development. As in theory argues the difference in income level among the trade partners gets smaller the more intra industry trade occurs, this difference in GDP per Capita of each country can prove this assumption.

¹⁵ The economic distance is represented by the difference in GDP per capital as indicated by Fontagne, Freudenberg, and Peridy (1997). This variable is measured in similar way as 'the variable DGDP.

- FDI

As previous study shows, the FDI is one of the important factors in Intra Industry Trade among the two countries. Since the Korean company's investment in China is closely linked with back and forth trade in product process, the inward FDI to China from Korea could be one of the significant factor that determine Intra Industry Trade. However, since this back and forth trade in based on the vertical trade pattern, this would be more effective in HIIT, rather than VIIT.

The recent fluctuation of the FDI in machinery industry that dominates the FDI in China is expected to have impact in intra industry trade.

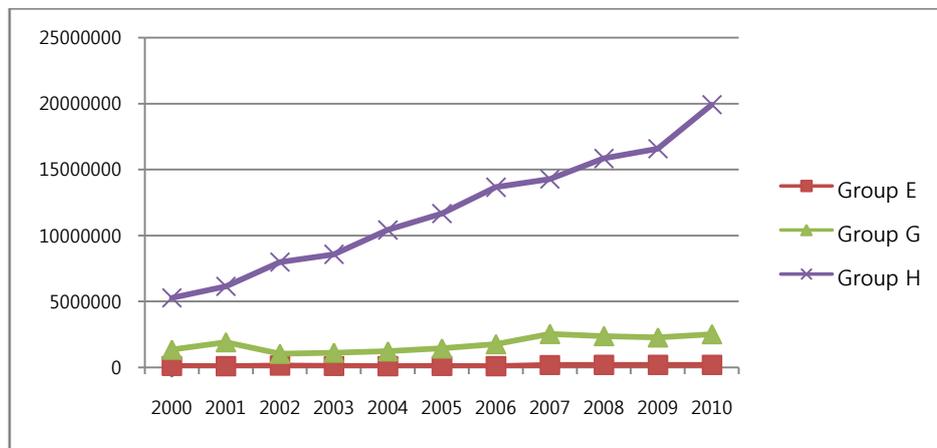


Graph 10 China's inward FDI from Korea

Source: EXIM Bank, Korea

- R&D

Research and Development of Korea represents the technological development of Korean industries. Its technological development facilitates the trade within the certain products. For example the more advanced product in country A would attract the customer in country B. This increased demand would result in the increase in intra industry trade. Korea's dominated R&D expanse in Electrical industries is synchronized with its competitive products in Mobile phone and Electrical devices.¹⁶



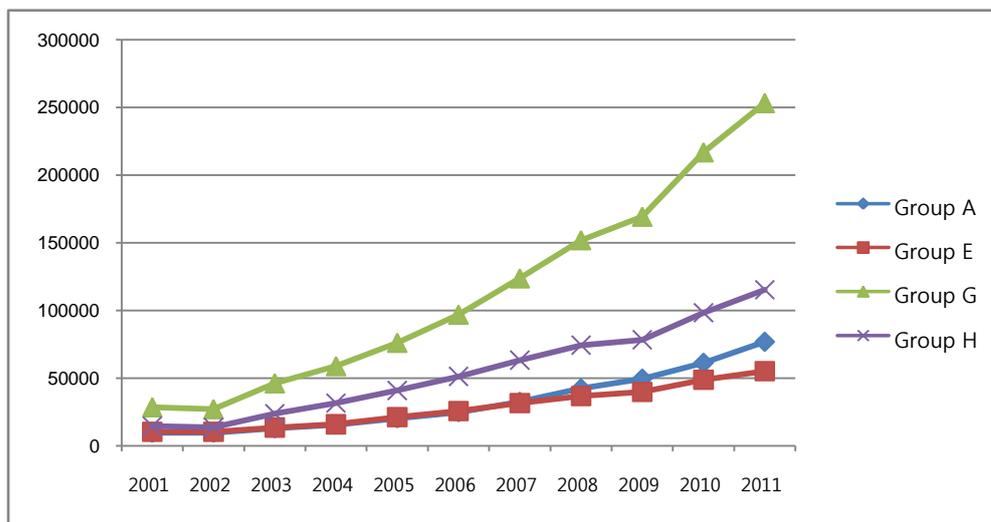
Graph 11 R&D Investment expenditure in Korea by industry

Source: OECD Statistics

¹⁶ According to Shake and Sutton (1984), they assumed that, R&D input, which is considered as a kind of fixed cost, plays an important role in determining product quality. Thus, with entry barriers, only the best firms bearing big advantage of scale economy can afford constant larger expenses for R&D and survive in the world market.

- *China's Industry share*

China's production which can be represented by industry sector GDP shows continuous increase during decade. Especially the Group G, which represents Machinery's increasing rate and the absolute amount of production dominate the other industries, including Electrical (G), Agricultural (A) and Textile (E). The Increasing production and share by sectors would represent the industrial development of China. This is defined as the ratio of production volume of the target individual industry to the total industries of China. It is introduced to verify the theoretical assumption that the expansion of international trade increase affect in the size of the same industry in China. Thus as the intra industry trade increases the industry size by sectors would also have positive effect.



Graph 12 China's Industry production in value

Source: OECD Statistics

Hypotheses

In empirical analysis, I would like to examine how these variants are correlated with GL index. In addition, by disentangling the intra industry trade into Vertical and Horizontal Intra Industry Trade, individual analysis with the variants and also comparison with GL index will be implemented.

Hypotheses are suggested as below

- 1. IIT is expected to be negatively correlated with the difference in per capita income between two countries.*

Difference of per capita income is a frequently used variable to proxy the difference of consumer patterns and factor endowments between two trading countries. Similar consumer preferences lead to an overlap in demand structure and create a wider market for the exchange of differentiated commodities in the same categories. Additionally, this will be identically applied to HIIT and VIIT.

- 2. Intra Industry Trade is more prominent if research intensity is high.*

Technological differentiation in determining intra-industry trade is importance for its potential to provide a source of comparative advantage in international market. Technological development in firm can improve the productivity of the belonging country. This improvement contributes to either less price or advanced product which leads to more demands in trading partner countries. This technological development can be represented by the research expenditure of the each industry sector.

3. *Intra Industry Trade is expected to be positively correlated with inward FDI*

Until present, triangular trade has been one of the classical patterns in North East Asia Trade. FDI was the critical factor proving that the back and forth trade among the three countries predominates the intra-industry trade¹⁷. FDI and IIT relations strengthen the vertical intra industry trades. Low production costs and the improving economic environment made China an ideal export platform to foreign firms, especially to those from Japan and Korea, which enjoy favorable geographic proximity to Chinese market. By relocating their production facilities to China, multinational enterprises (MNEs) from Japan and Korea are able to combine their superior production technology with China's ample endowments. They produce various products that are subsequently shipped back to their home market. These trading patterns significantly impact the bilateral trade with China.

4. *China's Industry share by sector is associated with the increase in bilateral trade with Korea and China.*

As the trade expands in particular sector of the industry, the production of the involved industry also expands. As in Korea and China's trade is based on the production process, bilateral trade increase in same industry would enhance the development of the belonging industry in China.

¹⁷ Mitsuyo Ando (2006) in Fragmentation and Vertical Intra Industry Trade in East Asia have proved that the FDI is the key factor in IIT in East Asia and that this is derived from the back and forth trading occurred in production process.

- *Modified Model*

By examining each variable with expected results, the model has been modified as follows;

$$\text{IIT (GL Index)}_{\text{CHNKOR}} = \beta_0 + \beta_1 \text{DPGDP}_{\text{CHNKOR}} + \beta_2 \text{InFDI}_{\text{CHN}} + \beta_3 \text{R\&D}_{\text{KOR}} + \beta_4 \text{INDSH}_{\text{CHN}}$$

DPGDP denotes the difference in individual income of the two countries, InFDI denotes the inward FDI of China from Korea, R&D denotes the R&D expenditure of Korea by the industrial sector and INDSH denotes the industry share of China by each industry sector.

Additionally, as shown in previous chapter, I assumed that the Horizontal Intra Industry has been increased which would have impacted the IIT. By all means I added another model that can examine the relations of HIIT share and the variable that are introduced in this research. The following models were also tested. The calculation of the HIIT share is written in detail in Appendix 1.¹⁸ The time period for the analysis is from 2000 to 2011.

GDP per Capita data is from World Bank, Inward FDI from Korea to China from Korea EXIM bank, Korean R&D expenditure per industry from OECD statistics and China's industry share from Bureau of Statistics, China.

$$1) \text{VIIT (share)}_{\text{CHNKOR}} = \beta_0 + \beta_1 \text{DPGDP}_{\text{CHNKOR}} + \beta_2 \text{InFDI}_{\text{CHN}} + \beta_3 \text{R\&D}_{\text{KOR}} + \beta_4 \text{INDSH}_{\text{CHN}}$$

$$2) \text{HIIT (share)}_{\text{CHNKOR}} = \beta_0 + \beta_1 \text{DPGDP}_{\text{CHNKOR}} + \beta_2 \text{InFDI}_{\text{CHN}} + \beta_3 \text{R\&D}_{\text{KOR}} + \beta_4 \text{INDSH}_{\text{CHN}}$$

¹⁸ The HIIT share replaced the GL Index. According to Kim and Kwak (2012), the share of HIIT trade volume in total trade volume of bilateral trade was used for empirical test to find out correlations with the variants that affect the intra industry trade in general theories.

Econometric Results

1. GL Index

This table shows the regression without FDI. This result shows supports previous research strongly. As income gap narrows, the IIT gets bigger. As Korea's technological development grows, it also contributes to the enlargement of intra-industry market. As China's industry development occurred, it provided with positive sign to IIT. However, the FDI, which played significant role in IIT of China and Korea, it resulted in rather unstable reflection to the regression. It is due to FDI fluctuation in mid 2000s.

Variable	Parameter Standard Estimate	Standard Error	T Value	Pr> t
Intercept	1.90049	0.56087	3.39	0.001
DPGDP	-0.25493	0.1007	-2.53	0.013
_LOG_R_D	0.15974	0.06126	-2.61	0.0106
INDSHcn	0.5682	0.23698	2.4	0.0184

Table 7 GL Index

Variable /Time	~2006	2007~2011	2000~2011
	Estimate Parameter	Estimate Parameter	Estimate Parameter
DPGDP	-0.48328 (-0.70)	-0.08335 (0.42)	-0.01535 (0.13)
InwardFDI (log)	0.17917 (-2.21)	-0.07825 (-0.82)	-0.04376 (-1.46)
R&D Investment (log)	0.11488 (1.38)	0.18702 (1.55)	0.11718 (1.65)
China Industry Share	0.81315 (-0.90)	8.55364 (2.38)	0.18561 (0.19)
R square	0.716	0.903	0.6795
Adj R square	0.6435	0.8599	0.6353

Table 8 Regression result of GL Index by periods

The empirical result is shown on the table. Period of analysis has been divided into two groups, from 2000~2006 and 2007~2011. Due to the fluctuation of the inward FDI from 2006, the correlation from this different circumstance in intra industry trade should be also examined. The results mostly meet the hypotheses in period from 2000 to 2011. The R square is 0.6795, recording relatively high in the analysis.

In accordance with the analysis, as Income per Capita difference between the two countries gets smaller the more intra industry trade occurs. This analysis also supports the hypothesis, so that as the correlation shows the negative sign.

However, the inward FDI and the Intra Industry Trade have shown negative result which reverses my hypothesis. This result was affected by the fluctuation in FDI inward investment from 2006. Its plunge and soaring repeating by year and year has weakened the correlation with Intra Industry Trade. FDI in period after 2007 foster this analysis, whereas from 2000 to 2006, FDI had correlation with Intra Industry Trade which supports the hypothesis and the theory of Intra Industry Trade.

R&D is also showing positive correlation with Intra Industry Trade, which underscores the technological development in Korea, is another factor that attracts the demand in the partner country China.

China's industry share also generates positive signs; so that the China's local industrial development is positively correlated with intra industry trade. In brief the regression results support the hypothesis in general. As China's individual income gets higher, as industry share shows more increase it supports the IIT. And as Korea's investment in China increases and its technological improvement in product occur, it also supports the IIT in positive way.

2. Horizontal and Vertical Intra Industry Trade

Variable	GL	Horizontal Share	Vertical Share
	Estimate Parameter	Estimate Parameter	Estimate Parameter
DPGDP	-0.01535 (0.13)	-0.75783 (-0.43)	0.02074 (0.10)
Inward FDI (log)	-0.04376 (-1.46)	0.2053 (3.66)	-0.234 (-3.82)
R&D Investment (log)	0.11718 (1.65)	-0.08367 (-0.62)	0.21939 (1.75)
China Industry Share	0.18561 (0.19)	-4.95771 (-3.11)	1.76461 (0.90)
R square	0.6795	0.7759	0.4034
Adj R square	0.6353	0.7032	0.3015

Table 9 Regression result of Horizontal and Vertical Intra Industry Trade

To satisfy the hypothesis with the disentangled IIT, horizontal vertical, additional regression result is suggested below. Since the horizontal refers to the product with different attributes and vertical refers to product in different quality, there trading pattern should have different result¹⁹.

In regression, the Horizontal and Vertical has shown the opposite result. When the income difference gets smaller, VIIT correlated in positive whereas HIIT correlated negative. When Inward FDI was prominent with VIIT, HIIT didn't show the similar result. Furthermore, for Industrial Share by each sector of China, it is positively correlated with vertical whereas the horizontal, it has shown strong negative signs. The comparison of VIIT and HIIT show that there are different pattern in trade. Also as explained previously, the FDI is closely linked with Korea's production line, it should be more related with the VIIT more than HIIT.

¹⁹ In previous studies, the horizontal was not included but vertical. Rosanna Pittiglio, Horizontal and Vertical Intra Industry Trade: An Empirical Test of the 'Homogeneity Hypothesis', The World Economy, 2012 have suggested the determinants are not consistent in researches. Even in same variants, the result varies within different researches. This shows that the bilateral economic relations pattern matters in Intra Industry Trade.

Since the VIIT still overwhelms the IIT in bilateral trade, the VIIT mostly coincide with the GL index, but with more strong correlations. Difference in FDI is expected to have influenced by the recent fluctuation of FDI investment. Table below shows the share of HIIT and VIIT in bilateral trade of Korea and China.

Conclusion

As the result shows, the bilateral trade of China and Korea is fostered by Intra Industry trade. This means that the China's economic development strongly supports IIT. However when it comes to disentangled IIT, the result has some questions remained. In VIIT and HIIT, the variants has shown opposite result one to another. This is mainly based on the particular relationship of Korea and China trade relations. China in the market produces cheaper products and at the same time exports Korea's processed goods. In addition, recently China has also become a competent player in certain industries including electrical and machinery goods. These complicated trade relations seems to be reflected in both VIIT and HIIT.

One notable thing is that HIIT and VIIT has exactly the opposite result, which means as HIIT share grows this would have different impact in IIT as a whole. Especially, when looking at the R&D, HIIT have shown negative correlation. So that the technical difference in VIIT would have positive result in trade relations, whereas this would not be expected for the HIIT. Korea's technological development which has won the product competence may not have that much effectiveness when the same quality product is produced in China. This reversed result should be examined in further studies.

Also in FDI, since the Korea's FDI is currently showing volatility, this should be also carefully examined for the intra industry trade relation in the future. Since the VIIT is highly supported by this division of labor in both countries, whether such relations would be preceded in the future is another critical factor that determines the IIT.

Intra Industry Trade was a key factor in the past and in the present that supported the bilateral trade so far. And currently both Korea and China is heading for stronger economic ties including bilateral FTA. These movements are expected to have advantage for both countries, with bigger market and more investment.

This research was to carefully examine the trade pattern which supports the IIT and what is the critical factor in trade relations amid China's rapid economic growth.

As the result shown, IIT and VIIT as a whole strongly supports the IIT as income difference gap

reduced, and China's industrial development and with more investment and technological development of Korea. These are also the general theories that supports in IIT in theories. However, when looking at horizontal industry, this is not explainable. Carefully speaking, the industrial development of China does not support the bilateral trade as much as it does in VIIT. These relations would be fundamentally based on big market with more competition. In further studies, this should be more observed with more cases in more related industries in specific.

Still, since the VIIT is the dominated IIT pattern, bilateral IIT seems to have more positive impact with China's economic growth and Korea's technological development.

Appendix 1

The VIIT and HIIT trend among the three countries are resulted as follows. The bilateral trade flows of each detailed commodity category into the three patterns;

a) one way trade, b) horizontal intra industry trade and c) vertical intra industry trade.

$M_{kk'j}$:value of economy K's imports of product j from economy K'

$M_{k'kj}$:value of economy K's imports of product j from economy K',

$UV_{kk'j}$: average unit value of economy K's import of product j from economy K'

$UV_{k'kj}$: average unit value of economy K's imports of product j from economy K

Table 1.

Type	Degree of trade overlap	Disparity of unit value
“One Way Trade”	$\frac{\text{Min}(M_{kk'j}, M_{k'kj})}{\text{Max}(M_{kk'j}, M_{k'kj})} \leq 0.1$	Not applicable
“Horizontal Intra Industry Trade” (HIIT)	$\frac{\text{Min}(M_{kk'j}, M_{k'kj})}{\text{Max}(M_{kk'j}, M_{k'kj})} > 0.1$	$\frac{1}{1.25} \leq \frac{UV_{kk'j}}{UV_{k'kj}} \leq 1.25$
“Vertical Intra Industry Trade” (VIIT)	$\frac{\text{Min}(M_{kk'j}, M_{k'kj})}{\text{Max}(M_{kk'j}, M_{k'kj})} > 0.1$	$\frac{UV_{kk'j}}{UV_{k'kj}} < 1.25$ or $\frac{UV_{k'kj}}{UV_{kk'j}} > 1.25$

References

- Kwangsuk Han, Jaeho Lee, “FDI and Vertical Intra-Industry Trade between Korea and China”, Korea and the World Economy, Vol13, 2012
- Joonyeop Lee, 한일 산업내무역구조 분석을 통한 동북아 국제분업체계 연구, 2003
- Abd-el-Rahman, Kamal, “Firm’s Competitiveness and National Comparative Advantages as Joint Determinants of Trade Composition”, Weltwirtschaftliches archive, 127(1), 1991
- Ando, M and F.Kimura, “The Formation of International Production and Distribution Networks in East Asia”, NBER Working Paper, No.10167, National Bureau of Economic Research, Cambridge, MA, 2003
- Rosanna Pittiglio, Horizontal and Vertical Intra Industry Trade: An Empirical Test of the ‘Homogeneity Hypothesis’”, The World Economy, 2012
- Grubel, H.G. and Lloyd P.J, “Intra Industry Trade: The Theory and Measurement of International Trade in differentiated products”, London, Macmillan, 1975
- Krugman, P, “Intra Industry Specialization and the gains from trade”, Journal of Political Economy 89, 1981
- Greenaway, D. and Milner, C., “A cross section analysis of Intra Industry Trade in the U.K” European Economic Review, vol25, 1984
- Shaked, A., and J. Sutton, Natural Oligopolies and International Trade. In H. Kierzowski (ed.), Monopolistic Competition and International Trade, Oxford: Clarendon Press, 1984
- Clark, D. P. and D.L Stanley, Determinants of Intra-Industry Trade Between the United States and Industrial Nations International Economic Journal, 2003

한·중 산업내무역 패턴 연구

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중국 1992년 개혁개방 이후 한중일 무역 비중이 급속도로 성장하였다. 그 중 산업내무역 비중은 2011년 현재 한중일 전체 무역에 절반 이상을 차지하면서 가장 중요한 무역 형태가 되었다.

산업내무역은 공통 산업 내에서도 무역이 이루어지는 것을 일컫는다. 기존 연구에 의하면 본래 산업내무역이 활발하게 이루어지기 위해서는 양국의 소득수준, 경제규모가 비슷한 조건에서 이루어진다고 보고 있다. (Grubel and Lloyd 1975)

또한 산업내무역은 수평산업내무역과 수직산업내무역으로 나뉘어진다. 수직무역은 질적 차이를 보이는 상품의 교역구조를 바탕으로 이루어지며, 수평무역은 상품의 차별성을 바탕으로 이루어진다고 보았다.

동북아지역의 산업내무역은 지금까지 수직적산업내무역구조와 더 높은 연관성이 있다고 볼 수 있다. 한중일은 3국 간의 경제 격차가 크에도 불구하고 산업내무역은 계속해서 증가세를 보였다. 이는 요소경쟁우위를 바탕으로 중국의 값싼 노동력을 이용한 노동분업형태를 가장 주요한 원인으로 보고 있다. 한국과 일본 자국의 기업들이 생산공장을 중국에 가동함으로써 중간제품과 완제품의 상호무역 (back and forth trade)을 바탕으로 하는 수직적 무역이 이루어진 것이다. 이 무역 패턴은 산업내무역에 가장 많은 비중을 차지하고 있으며 기계, 전자 산업 부분의 산업내무역이 전체의 50%가까이 차지하는 것을 비추어 봤을 때에도 높은 설명력을 갖는다. 특히, 이 부분은 한국과 일본 발 중국 FDI 투자와도 깊은 연관성을 가지고 있다.

그러나 최근 중국의 경제 성장은 이와 같은 '전통적' 방식의 수직적 산업내무역구조의 변화를 야기할 수 있을 것으로 보인다. 특히 중국의 1인당 소득이 1992년 대비 2011년에는 4배 증가한 8000 USD를 기록하였다. 이로 인해 중국의 전기 사용과 이동통신 사용은 전례 없이 증가하였다. 또한 중국의 HighTech 상품의 수출도 급성장한 것으로 보고 있다. 이러한 중국의 경제상황은 기존 산업내무역구조의 패턴에도 중요한 영향을 미쳤을

것으로 보았다. 특히 공급과 수요의 측면에서 보았을 때 중국의 산업성장으로 인한 수출 상품의 변화와 중국 내부의 수요증가에 대한 부분을 생각해 볼 수 있다. 이는 전체 산업 내무역은 물론 산업내수평무역지수가 늘어날 수 있음을 확인할 수 있었다.

이러한 배경을 바탕으로 본 논문은 중국의 경제 급성장 이후 기존의 수직적산업내무역연구를 바탕으로 수평적산업내무역으로 확장해 산업내무역 패턴에 어떠한 영향을 미쳤는지를 보고 있다.

특히, 산업내무역지수를 나타내는 GL지수 와 수평적무역지수에 한중교역에 가장 영향을 미치는 변수인 R&D, FDI, 소득격차, 중국산업별 생산 비율을 변수로 선정하였다. 연구결과 전체 산업내무역지수와 수평적무역지수 모두에 FDI의 중요성이 상대적으로 적어지는 것을 확인할 수 있다. 특히 수평산업내무역에서 FDI는 상관성이 음의 값을 갖는 것으로 나타났다. 오히려 더 양의 상관도를 갖는 변수는 소득격차와 중국내 산업발전이었다.

산업내무역의 패턴변화에 대한 연구는 기존 한중 무역관계에 고려할 만한 요소로 볼 수 있을 것이다. 중국의 산업 발전은 기존의 수직적 무역구조에서 수평적 무역으로 전환하고 있는 결과를 야기했다. 이러한 지속적인 변화는 향후 한중 무역 구도에도 주요한 변수가 될 것임을 확인할 수 있다.

주요어: 산업내무역, 수평적 산업내무역, 한중무역, 중국경제발전, 상품차별, 소득격차,
학번: 2009-22194