International Review of Business Research Papers
Vol. 9. No. 3. March 2013 Issue. Pp. 1 – 21

Changes in Comparative Advantage of South Korea and Her Major Trading Countries*

Seung Jin Kim**

South Korea and her major trading countries (i.e., China, the USA, and Japan) are now suffering from an economic recession, which can be overcome by further expanding trade volumes among these four countries. For this purpose, this paper will analyze how comparative advantage of these four countries in 35 industries of the manufacturing sector changed over time for the period of 1999-2009. It was found that export products of China are the most concentrated for the period of 1999-2009. This concentration of Chinese export products is followed by Japan, South Korea, and the USA in that order. Since this kind of high concentration of export products is not desirable, it should be diversified to avoid any potential economic loss associated with unfavorable trade-environmental changes against these concentrated export products. Export patterns of South Korea changed faster than those of the USA, China, and Japan for the period of 1999-2009. On the other hand, export patterns of Japan remained the most stable in the same period. Therefore both South Korea and CUJ (i.e., China, the USA, and Japan in short hereafter) should fully adjust their economies to ever-changing patterns of their exports. It was found that South Korea's export patterns do not resemble those of China due to the differences in factor endowment ratios of China and South Korea. Therefore South Korea can increase her exports to China by exploiting non-similarity of South Korean and Chinese export patterns. Both UJ (i.e., the USA and Japan in short hereafter) and South Korea had similar export patterns due to the resemblances in factor endowment ratios of UJ and South Korea. Especially, South Korean export patterns became increasingly similar to Japanese export patterns and South Korean products' competition with Japanese products in the world export market became increasingly severe. Therefore both UJ and South Korea should cooperate in exporting their products in the world market. It was found that South Korea exported products which are less skilled human capital intensive and more R&D intensive for the entire period of 1999-2009. For the case of China, less skilled human capital intensive and less R&D intensive products were found to be exported for the same period. Therefore both South Korea and China should try to export more of these products to the world market from now on. It was found that both the USA and Japan exported products which are more R&D intensive for the entire period of 1999-2009. Therefore both the USA and Japan should try to export more of these products to the world market from now on.

JEL Codes: F11, F13 and F14

1. Introduction

The economy of South Korea has experienced dramatic changes during the last four decades. From a typical, underdeveloped agrarian economy of 1950s, South Korea emerged on the world stage as one of the front runners among the NIEs (Newly Industrializing Economies) in 1980s and now becomes one of the major exporting countries of automobiles, iron and steel, electronic products, shipbuilding, and petrochemical products. This outstanding economic achievement is truly remarkable

---

* This work was supported by Hankuk University of Foreign Studies Research Fund of 2013.
**Prof. Seung Jin Kim, Dept. of International Economics and Law, Hankuk University of Foreign Studies, 270 Imundong, Dongdaemunku, Seoul 130-791, South Korea. Email: seunjkim@hufs.ac.kr

considering the poor endowment of natural resources and the small domestic market. For this reason, the economic development strategy of South Korea has been frequently referred to as a suitable model for other countries on the road to development.

According to Economic Statistics System of the Bank of Korea (i.e., ecos.bok.or.kr), China made an economic miracle by achieving 10.5% GDP growth rate on average for the last decade and has now been the second biggest country next to the USA in terms of a size of GDP from 2010 on, even if her growth rate slowed down last year. The USA, however, has been suffering from a so-called global economic crisis by recording -0.3% and -3.1% GDP growth rate in 2008 and 2009 respectively ever since a sudden collapse of Lehman Brothers in September 2008. Japan has also been suffering from a global economic crisis by making -5.5% and -0.9% GDP growth rate in 2009 and 2011 respectively.

According to Korean Trade Statistics published by the Korean International Trade Association (KITA) (i.e., kita.net), South Korean exports to China in 2011 amounted to US$ 134.19 billion (i.e., 24.2% of South Korea's total exports) and South Korean imports from China reached US$ 86.43 billion (i.e., 16.5% of South Korea's total imports). Accordingly, South Korea enjoyed US$ 47.75 billion trade surplus with China.

In 2011 South Korean exports to the USA amounted to US$ 56.21 billion (i.e., 10.1% of South Korea's total exports) and South Korean imports from the USA reached US$ 44.57 billion (i.e., 8.5% of South Korea's total imports). Accordingly, South Korea enjoyed US$ 11.64 billion trade surplus with the USA. On the other hand, South Korean exports to Japan in 2011 amounted to US$ 39.68 billion (i.e., 7.1% of South Korea's total exports) and South Korean imports from Japan reached US$ 68.32 billion (i.e., 13.0% of South Korea's total imports). Consequently, South Korea suffered from US$ 28.64 billion trade deficit with Japan.

Despite of a very close trade between South Korea and her major trading countries (i.e., China, the USA, and Japan, CUJ in short hereafter), they are now suffering from an economic recession engendered by a so-called an EU sovereign debt crisis. Therefore one way of overcoming the on-going economic recession in these 4 countries will be to further expand trade volumes among these countries. In this respect, it is very timely to analyze how comparative advantage of South Korea and her major trading countries in the manufacturing sector changed over time for the period of 1999-2009.

For this purpose, Section 2 will briefly survey a revealed comparative advantage (RCA in short hereafter) index developed by Balassa (1965) and methodology and research design of this paper will be suggested in Section 3.

Section 4 will measure RCA (Revealed Comparative Advantage) indices of South Korea and her major trading countries in the manufacturing sector for the period of 1999-2009 by using OECD (2011) trade matrix. On top of this, Section 4 will also try to find the determinants of RCA indices of South Korea, China, USA, and Japan in the manufacturing sector for the last decade by utilizing both correlation coefficients and multiple regression analyses, which was never attempted in the previous papers

(Kim (2002, 2010) and others). Accordingly this paper is the first attempt which tries to analyze the RCA determinants of South Korea and her major trading countries for the period of 1999-2009 so far.

Section 5 will summarize major empirical results and conclude the paper with a few remarks.

2. Literature Review

2.1 Heckscher-Ohlin Theorem (i.e., Modern Version of Comparative Advantage Theorem)

According to the Heckscher-Ohlin type of two-country-two-product-two-factor model, trade patterns between countries will be determined by the comparative advantage structures between the two countries, determined by factor intensities of two products and factor endowment ratios of two countries. For example, Korea is relatively labor abundant and the USA is relatively capital abundant. Suppose that a product of X_1 is relatively labor intensive and a product of X_2 is relatively capital intensive. Then Korea has a comparative advantage in the production of X_1 and the USA has a comparative advantage in the production of X_2 since before trade Korea can produce X_1 at a lower cost vis-à-vis the USA and the USA can produce X_2 at a lower cost vis-à-vis Korea.

Since it is not so easy to measure prices of X_1 and X_2 empirically in an actual world due to heterogeneity of those products, Balassa (1965) introduced an RCA index as shown in Section 2.2.

2.2 Revealed Comparative Advantage (RCA) Index

To measure the international competitiveness of the i-th industry in the j-th country, Balassa (1965) suggested an RCA index as follows:

$$RCA_i^j = ((EX_i^j \,/\, WEX_i) \,/\, (TEX^j \,/\, TWEX)) \cdot 100 \quad \text{---------- (2-1)}$$

where RCA_i^j is an RCA index of the i-th industry in the j-th country,
EX_i^j is the i-th industry's export value of the j-th country,
WEX_i is the world's export value of the i-th industry,
TEX^j is the total export value of the j-th country,
$TWEX$ is the world's total export value.

As obvious in the above equation, the j-th country will have a comparative advantage in the i-th industry if the value of RCA_i^j is greater than 100. On the contrary, the j-th country will have a comparative disadvantage in the i-th industry if the value of RCA_i^j is less than 100.

Due to convenience of calculating an RCA index, some trade-related papers utilized the RCA index for measuring comparative advantage structure of trading countries. As stated above, this paper will not only measure RCA indices themselves but also try to find the determinants of RCA indices, which is the first attempt of its kinds.

3. Data and Methodology

3.1 Data

To calculate RCA indices of South Korea, China, USA, and Japan in the manufacturing sector for the period of 1999-2009, we used the OECD (2011) trade matrix, which reports all the trade data between each and every OECD member country and non-member countries of OECD from the viewpoint of OECD member countries. (Since South Korea has been a member country of OECD ever since 1990s, it is quite appropriate for us to use an OECD trade matrix.) As shown in Table 1, our basic sample of industries for the manufacturing sector consists of 35 industries at a SITC 2-digit level, which is an optimal sample size for our research. On top of that, the OECD trade matrix is now published for these 35 manufacturing industries. The classification of manufactured products by factor intensity and end uses is also listed in Table 2.

Table 1: List of 35 Industries in Manufacturing Sector

SITC Code	Name of Industry	SITC Code	Name of Industry
51	Organic Chemicals	71	Power Generating Machinery And Equipment
52	Inorganic Chemicals	72	Specialized Machinery
53	Dyeing, Tanning And Coloring Materials	73	Metal Working Machinery
54	Medicinal and Pharmaceutical Pro ducts	74	Other Industrial Machinery and Parts
55	Essential Oils and Perfume Materials	75	Office Machines And ADP Equipment
56	Fertilizers	76	Telecommunications And Sound Recording Apparatus
57	Plastics in Primary Forms	77	Electrical Machinery, Apparatus And Appliances, n.e.s.
58	Plastics in Non-primary Forms	78	Road Vehicles
59	Chemical Materials and Products, n.e.s.	79	Other Transport Equipments
61	Leather, Leather Manufactures And Dressed Furskins	81	Prefabricated Buildings, Sanitary, Heating and Lighting Fixtures, n.e.s.
62	Rubber Manufactures, n.e.s.	82	Furniture and Parts Thereof
63	Cork and Wood Manufactures (excluding Furniture)	83	Travel Goods, Handbags, etc.
64	Paper and Paper Manufactures	84	Articles of Apparel And Clothing Accessories
65	Textile Yarn, Fabrics and Related Products	85	Footwear
66	Non-metallic Mineral Manufactures, n.e.s.	87	Professional and Scientific Instruments, n.e.s.
67	Iron and Steel	88	Photo Apparatus, Optical Goods, Watches and Clocks
68	Non-ferrous Metals	89	Miscellaneous Manufactured Articles, n.e.s.
69	Manufactures of Metal, n.e.s.		

Table 2: Classification of Manufactured Products by Factor Intensity and End Uses

	SITC 2 digit Code
1) Labor-Intensive Products	61 63 65 66 69 76 81 82 83 84 85 89
2) Capital/Technology-Intensive Products	51 52 53 54 55 56 57 58 59 62 64 66 67 68 71 72 73 74 75 76 77 78 79 86 87 88 89
3) Nondurable Consumer Products	55 57 65 83 84 85 86 88 89
4) Durable Consumer Products	66 69 76 77 78 81 82 88 89
5) Capital Goods	69 71 72 73 74 75 77 78 79 87 88
6) Labor-Intensive Intermediate Products	61 63 65 66 69
7) Capital-Intensive Intermediate Products	51 52 53 54 55 56 58 59 62 64 66 67 68 88

Source: Ministry of International Trade and Industry, Government of Japan, White Paper on International Trade (1986: 405-406).

3.2 Methodology

In order to find major determinants of RCA of South Korea, China, USA, and Japan in the manufacturing sector for the period of 1999-2009, the following correlation coefficients and multiple regression analyses are used. The models for correlation analysis are as follows.

$RCA^j = f(PKL),\ RCA^j = f(SHKL),\ RCA^j = f(RD)$----------(3-1)

where RCA^j is the country j-th RCA index,

PKL is a physical capital intensity defined as *(physical capital)/(labor)*ratio,

SHKL is a skilled human capital intensity defined as *(skilled human capital)/(labor),*

RD is an R&D intensity defined as *(R&D related expenditure)/(total sales value),*

j = *k*(South Korea), *c*(China), *u*(USA), and *j*(Japan).

To be specific, our correlation analysis model and hypotheses are as follows.

$RCA^k = f(PKL),\ RCA^k = f(SHKL),\ RCA^k = f(RD)$

? - +

$RCA^c = f(PKL),\ RCA^c = f(SHKL),\ RCA^c = f(RD)$

- - -

$RCA^u = f(PKL),\ RCA^u = f(SHKL),\ RCA^u = f(RD)$

? ? +

$RCA^j = f(PKL),\ RCA^j = f(SHKL),\ RCA^j = f(RD)$

? ? +

(Notice that the sign below an independent variable is an expected sign by our model, which are our hypotheses.)

For the multiple regression, the following log-linear models are estimated by OLS (ordinary least squares) method with assumption of no multicollinearity.

$$\log (RCA^j)=A_1+A_2\cdot\log(PKL)+A_3\cdot\log(SHKL)+A_4\cdot\log(RD)\text{--------(3-2)}$$

Since independent variables of PKL and SHKL are highly correlated with each other, only SHKL and RDI are used in the process of multiple regression to overcome the multicollinearity problem as follows.

$$\log (RCA^{j}) = A_1 + A_2 \cdot \log(SHKL) + A_3 \cdot \log(RD) \text{----------(3-3)}$$

To be specific, our multiple regression analysis model and hypotheses are as follows.

$$\log (RCA^{k}) = A_1 + A_2 \cdot \log(SHKL) + A_3 \cdot \log(RD)$$
$$\qquad\qquad\qquad\qquad\quad - \qquad\quad +$$
$$\log (RCA^{c}) = A_1 + A_2 \cdot \log(SHKL) + A_3 \cdot \log(RD)$$
$$\qquad\qquad\qquad\qquad\quad - \qquad\quad -$$
$$\log (RCA^{u}) = A_1 + A_2 \cdot \log(SHKL) + A_3 \cdot \log(RD)$$
$$\qquad\qquad\qquad\qquad\quad ? \qquad\quad +$$
$$\log (RCA^{j}) = A_1 + A_2 \cdot \log(SHKL) + A_3 \cdot \log(RD)$$
$$\qquad\qquad\qquad\qquad\quad ? \qquad\quad +$$

(Notice that the sign below an independent variable is an expected sign by our model, which are our hypotheses.)

Repeatedly, this study on the determinants of RCA indices of the above-mentioned four countries in the last decade by utilizing both correlation coefficients and multiple regression analyses was not attempted in the previous papers (Kim (2002, 2010) and others) and accordingly this paper is the first attempt which tries to analyze the RCA determinants of South Korea and her major trading countries for the period of 1999-2009 so far.

4. Findings

4.1 Changes in RCA of South Korea and her Major Trading Countries in the Manufacturing Sector

The commodities whose RCA indices are within the 5th rank in both South Korea and her major trading countries for the period of 1999-2009 are listed in Table 3.

Table 3: List of Industries Whose RCA Indices are Within the 5th Rank in South Korea and Her Major Trading Countries: 1999-2009

Country	Year	SITC 2-digit code in each rank				
		1st rank	2nd rank	3rd rank	4th rank	5th rank
South Korea	1999	77	75	76	65	67
	2000	75	77	76	65	67
	2001	76	75	77	65	62
	2002	76	75	77	62	65
	2003	76	77	75	79	62
	2004	76	77	75	79	62
	2005	76	77	62	78	79
	2006	76	79	87	77	62
	2007	76	87	77	62	73
	2008	76	79	77	62	73
	2009	76	79	77	62	67
China	1999	83	85	81	84	89
	2000	83	85	81	84	89
	2001	83	85	81	84	89
	2002	83	85	81	84	89
	2003	83	85	81	89	84
	2004	83	85	81	75	84
	2005	83	85	84	81	82
	2006	83	85	75	84	81
	2007	83	85	75	84	82
	2008	83	85	84	82	76
	2009	83	85	75	84	76
USA	1999	79	71	59	77	58
	2000	79	87	71	59	77
	2001	87	79	71	59	77
	2002	79	87	71	59	77
	2003	79	71	87	59	58
	2004	79	87	71	59	57
	2005	79	87	71	59	57
	2006	79	87	71	59	57
	2007	79	87	71	59	72
	2008	79	87	71	59	57
	2009	79	87	71	59	54
Japan	1999	73	88	78	76	72
	2000	73	88	78	72	77
	2001	73	88	78	72	76
	2002	73	88	78	72	76
	2003	73	88	78	72	76
	2004	73	88	78	72	87
	2005	73	88	78	72	87
	2006	73	88	78	72	87
	2007	73	88	78	72	87
	2008	73	78	88	72	62
	2009	88	73	78	72	58

Throughout the entire period, South Korea has comparative advantage in the production of commodities which are (a) relatively labor-intensive, such as *textile yarn, fabrics and related products (SITC 65)* and (b) relatively capital/technology-intensive, such as *telecommunications and sound recording apparatus (SITC 76)*, *electrical machinery, apparatus and appliances, n.e.s. (SITC 77), rubber manufactures, n.e.s. (SITC 62), other transport equipments (SITC 79), office machines and ADP equipment (SITC 75), iron and steel (SITC 67), professional and scientific instruments, n.e.s. (SITC 87), metal working machinery (SITC 73),* and

road vehicles (SITC 78) (refer to Table 2 for the classification of manufactured products by factor intensity and end uses. Also notice that in order to save the space of this paper only SITC code will be listed from now on. Look at Table 1 for the name of each SITC code listed).

On the other hand, China has comparative advantage in the production of commodities which are (a) relatively labor-intensive, such as *SITC 83, SITC 85, SITC 81, SITC 84, SITC 82,* and *SITC 89* and (b) relatively capital/technology-intensive, such as *SITC 75* and *SITC 76*.

Throughout the entire period, the USA has comparative advantage in the production of commodities which are relatively capital/technology-intensive, such as *SITC 79, SITC 87, SITC 71, SITC 59, SITC 77, SITC 57, SITC 58, SITC 72,* and *SITC 54*.

On the other hand, Japan has comparative advantage in the production of commodities which are relatively capital/technology-intensive, such as *SITC 73, SITC 88, SITC 78, SITC 72, SITC 76, SITC 87, SITC 58, SITC 62,* and *SITC 77*.

The numbers of industries whose RCA indices are greater than 100 and standard deviation of RCA Indices in both South Korea and her major trading countries for the period of 1999-2009 are listed in Table 4. Throughout the entire period, the USA has comparative advantage in 19.1 industries while South Korea has comparative advantage in 11.5 industries on the average during the period of 1999-2009. This means that the USA has comparative advantage in the more diversified industries than South Korea during the period of 1999-2009.

As for an average value of standard deviation of each country's RCA during the period of 1999-2009, South Korea has the bigger value (i.e., 83.2) than the USA (i.e., 63.2). This again means that South Korea's export products are highly concentrated, while the US export products are more diversified. (As shown in pp. 65-66 in Yamazawa (1970), it can be easily demonstrated that the lower the standard deviation of RCA indices (i.e., export specialization indices) of a certain country, the more diversified the export specialization pattern of the country.) Furthermore, South Korea's standard deviation of her RCA increased from 67.5 in 1999 to 100.8 in 2009, which means that the South Korean exports became more concentrated over time in the period of 1999-2009.

Table 4: Numbers of Industries Whose RCA Indices are Greater Than 100 and Standard Deviation of RCA Indices in South Korea and Her Major Trading Countries: 1999-2009

Year	# of Industries are	Whose RCA greater than 1*			Standard Deviation of RCA			
	South Korea	China	USA	Japan	South Korea	China	USA	Japan
1999	11	15	17	11	67.5	199.9	54.4	81.9
2000	10	15	19	11	66.1	194.5	55.9	88.1
2001	11	15	18	13	68.1	180.2	55.8	90.3
2002	10	15	18	13	73.8	169.3	59.8	89.2
2003	9	14	18	13	82.8	157.5	64.1	96.4
2004	10	13	20	13	85.3	149.0	68.3	99.3
2005	12	13	22	14	85.3	141.7	68.3	105.0
2006	12	14	21	14	91.3	141.2	68.6	104.9
2007	13	14	20	13	92.1	135.6	68.1	102.9
2008	14	12	19	12	102.6	136.9	66.8	113.1
2009	14	14	18	16	100.8	126.8	65.5	101.9
Average	11.5	14.0	19.1	13.0	83.2	157.5	63.2	97.5

*** 1 means 100% here.**

On the other hand, Japan and China have the bigger value in standard deviation of their RCA (i.e., 97.5 and 157.5 respectively) than South Korea. This means that export products of Japan and China are highly concentrated, while South Korean export products are more diversified. (Repeatedly, it should be noted that the lower the standard deviation of RCA index of a certain country, the more diversified the export specialization pattern of the country, which was proved in pp. 65-66 in Yamazawa (1970).) Furthermore, Japan's standard deviation of her RCA increased from 81.9 in 1999 to 101.9 in 2009, which means that the Japanese exports became more concentrated over time in the period of 1999-2009. China's standard deviation of her RCA, however, decreased from 199.9 in 1999 to 126.8 in 2009, which means that the Chinese exports became more diversified over time in the period of 1999-2009.

As shown in Table 5, the Spearman (rank-order) correlation coefficient between 2009 RCA index and 1999 RCA index has the highest value in Japan (i.e., 0.93), which is followed by China (i.e., 0.92), the USA (i.e., 0.73), and South Korea (i.e., 0.67). This means that export patterns of South Korea changed faster than those of the USA, China, and Japan for the period of 1999-2009. On the other hand, export patterns of Japan remained the most stable in the same period.

Table 5: Spearman Correlation Coefficients Between 2009 RCA Index and Respective Year's RCA Indices of South Korea and Her Major Trading Countries: 1999-2008[1)]

Year	South Korea	China	USA	Japan
1999	0.67***	0.92***	0.73***	0.93***
2000	0.70***	0.93***	0.86***	0.94***
2001	0.70***	0.93***	0.89***	0.95***
2002	0.77***	0.95***	0.90***	0.95***
2003	0.82***	0.94***	0.95***	0.96***
2004	0.89***	0.95***	0.95***	0.96***
2005	0.88***	0.90***	0.96***	0.97***
2006	0.92***	0.98***	0.95***	0.97***
2007	0.97***	0.97***	0.98***	0.97***
2008	0.96***	0.83***	0.99***	0.94***

1) '*' indicates that the coefficients are statistically significant at the 10 percent level, '' 5 percent level, and '***' 1 percent level, respectively. The same notation will be used hereafter.**

Table 6 displays the Spearman correlation coefficients between South Korea's 2009 RCA index and respective year's RCA index of CUJ (i.e., China, the USA, Japan in short hereafter). By looking at this table, we can guess which year of CUJ's export patterns the South Korean export patterns most likely resemble. South Korea's 2009 RCA index has insignificant Spearman correlation coefficients with China for the period of 2005-2009. This means that South Korea's export patterns do not resemble those of China due to the differences in factor endowment ratios of South Korea and China.

On the other hand, South Korea's 2009 RCA index has positively significant Spearman correlation coefficients with UJ (i.e., the USA and Japan in short hereafter) throughout the entire period of 1999-2009. This means that both UJ and South Korea had similar export patterns due to the resemblances in factor endowment ratios of UJ and South Korea. Furthermore, South Korea's 2009 RCA index has the highest Spearman correlation coefficient with Japan's 2003 RCA index. This implies that export patterns of South Korea in 2009 were more similar to those of Japan in the early 2000s than in the mid-2000s.

Table 6: Spearman Correlation Coefficients Between South Korea's 2009 RCA Index and Respective Year's RCA Indices of the USA, Japan, and China: 1999-2009

Year	South Korea's 2009 and China's Respective Year	South Korea's 2009 and USA's Respective Year	South Korea's 2009 and Japan's Respective Year
1999	-0.35**	0.44***	0.78***
2000	-0.33*	0.55***	0.78***
2001	-0.36**	0.51***	0.78***
2002	-0.33*	0.52***	0.78***
2003	-0.33*	0.44***	0.79***
2004	-0.29*	0.39**	0.77***
2005	-0.28	0.39**	0.76***
2006	-0.24	0.41**	0.76***
2007	-0.23	0.41**	0.78***
2008	-0.11	0.37**	0.76***
2009	-0.15	0.34**	0.78***

The Spearman correlation coefficients between South Korea's RCA index and CUJ RCA indices respectively in the period of 1999-2009 are displayed in Table 7. South Korea's RCA index has insignificant correlation coefficients with China's RCA index for the period of 1999-2009, which means that South Korean export pattern is not similar to China's export patterns. This implies that South Korea can increase her exports to China by exploiting non-similarity of South Korean and Chinese export patterns. The correlation coefficients between South Korea's RCA index and the US RCA index, however, are positively significant for the period of 2006-2009. Furthermore, the correlation coefficients between South Korea's RCA index and Japan's RCA index are positively significant for the entire period of 1999-2009. This again means that both UJ and South Korea had similar export patterns due to the resemblances in factor endowment ratios of UJ and South Korea. Especially, South Korean export patterns became increasingly similar to Japanese export patterns over time for the period of 1999-2009 and accordingly South Korean products' competition with Japanese products in the world export market became increasingly severe.

Table 7: Spearman Correlation Coefficients between South Korea's RCA Index and Her Major Trading Countries' RCA Index: 1999-2009

Year	Korea and China	Korea and the USA	Korea and Japan
1999	**0.18**	**0.12**	**0.47*** **
2000	**0.16**	**0.15**	**0.46*** **
2001	**0.11**	**0.14**	**0.49*** **
2002	**0.03**	**0.24**	**0.55*** **
2003	**-0.07**	**0.23**	**0.60*** **
2004	**-0.08**	**0.20**	**0.67*** **
2005	**-0.09**	**0.17**	**0.63*** **
2006	**-0.12**	**0.32***	**0.70*** **
2007	**-0.15**	**0.38** **	**0.82*** **
2008	**-0.11**	**0.34** **	**0.71*** **
2009	**-0.15**	**0.34** **	**0.78*** **

4.2 RCA Determinants of South Korea and her Major Trading Countries in the Manufacturing Sector

4.2.1 RCA Determinants of South Korea

For the entire period of 1999-2009, an RCA^k variable has (a) negative correlation coefficients with PKL and SHKL and (b) positive correlation coefficients with RD (Table 8).[i] Furthermore, significantly negative correlation coefficients were found in the cases of both simple and Spearman rank correlation coefficients between RCA^k and SHKL for the period of 1999-2002, which means that South Korea exported products which are less skilled human capital intensive for those years. On top of that, significantly positive correlation coefficients were found in the cases of both simple and Spearman rank correlation coefficients between RCA^k and RD for the period of 2002-2009, which means that South Korea exported more R&D intensive products for the period.[ii]

Table 8: Correlation Coefficients Between RCA^k and Industrial Characteristics Variables: 1999-2009

Year	Industrial	Characteristics	Variables related to	RCA^k
		PKL	SHKL	RD
1999	Simple	-0.19	-0.40**	0.06
	Spearman	-0.24	-0.39**	0.10
2000	Simple	-0.18	-0.34**	0.19
	Spearman	-0.20	-0.32*	0.15
2001	Simple	-0.18	-0.36**	0.19
	Spearman	-0.17	-0.33**	0.19
2002	Simple	-0.18	-0.32*	0.30*
	Spearman	-0.13	-0.30*	0.27
2003	Simple	-0.17	-0.28	0.39**
	Spearman	-0.06	-0.22	0.33*
2004	Simple	-0.15	-0.25	0.40**
	Spearman	-0.06	-0.15	0.38**
2005	Simple	-0.14	-0.21	0.39**
	Spearman	-0.11	-0.12	0.33*
2006	Simple	-0.13	-0.18	0.52***
	Spearman	-0.05	-0.11	0.37**
2007	Simple	-0.14	-0.20	0.33**
	Spearman	-0.03	-0.05	0.43**
2008	Simple	-0.06	-0.14	0.53***
	Spearman	0.12	0.03	0.47***
2009	Simple	-0.09	-0.13	0.57***
	Spearman	0.09	0.05	0.51***

According to multiple regressions results of South Korea, the coefficients of SHKL and RD turn out to be significantly negative and positive respectively for the entire period of 1999-2009 (Table 9). This proves that South Korea exported products which are less skilled human capital and more R&D intensive for the entire period of 1999-2009.

Table 9: Multiple Regression with log (RCA^K) as a Dependent Variable: 1999-2009

Year	Independent variables		Constant	Test Stat.		
	log (*SHKL*)	log (*RD*)		R^2	F test	Prob>F
1999	-1.02***	0.38**	3.53***	0.316	7.40	0.00
	(0.265)	(0.177)	(0.221)			
2000	-0.99***	0.47**	3.41***	0.300	6.86	0.00
	(0.277)	(0.185)	(0.230)			
2001	-1.01***	0.51***	3.40***	0.322	7.61	0.00
	(0.271)	(0.181)	(0.225)			
2002	-0.98***	0.60***	3.33***	0.334	8.04	0.00
	(0.273)	(0.182)	(0.227)			
2003	-1.00***	0.69***	3.19***	0.346	8.46	0.00
	(0.288)	(0.192)	(0.239)			
2004	-0.92***	0.75***	3.11***	0.337	8.12	0.00
	(0.299)	(0.199)	(0.249)			
2005	-0.73**	0.71***	3.17***	0.233	4.85	0.01
	(0.350)	(0.234)	(0.291)			
2006	-0.85**	0.83***	3.06***	0.311	7.24	0.00
	(0.336)	(0.224)	(0.279)			
2007	-0.79**	0.83***	3.13***	0.326	7.73	0.00
	(0.322)	(0.215)	(0.267)			
2008	-0.65*	0.85***	3.18***	0.328	7.82	0.00
	(0.322)	(0.215)	(0.267)			
2009	-0.60*	0.88***	3.21***	0.371	9.43	0.00
	(0.305)	(0.203)	(0.254)			

Note: Standard errors in parentheses. The same notation will be used hereafter.

4.2.2 RCA Determinants of China

For the entire period of 1999-2009, a RCA^C variable has significantly negative correlation coefficients with PKL, SHKL, and RD (Table 10), which means that China exported products which are less physical (and skilled human) capital intensive and less R&D intensive products for the period.[iii]

Table 10: Correlation Coefficients Between *RCA*^{c} and Industrial Characteristics Variables: 1999-2009

Year	Industrial	Characteristics	Variables related to	*RCA*^{c}
		PKL	SHKL	RD
1999	Simple	-0.28	-0.38**	-0.33*
	Spearman	-0.57***	-0.55***	-0.50***
2000	Simple	-0.30*	-0.38**	-0.35**
	Spearman	-0.55***	-0.54***	-0.52***
2001	Simple	-0.31*	-0.39**	-0.35**
	Spearman	-0.54***	-0.52***	-0.52***
2002	Simple	-0.33*	-0.41**	-0.34**
	Spearman	-0.57***	-0.56***	-0.51***
2003	Simple	-0.33*	-0.41**	-0.34**
	Spearman	-0.56***	-0.54***	-0.52***
2004	Simple	-0.34**	-0.42**	-0.34**
	Spearman	-0.55***	-0.51***	-0.53***
2005	Simple	-0.35**	-0.45***	-0.36**
	Spearman	-0.59***	-0.58***	-0.58***
2006	Simple	-0.36**	-0.45***	-0.35**
	Spearman	-0.59***	-0.56***	-0.54***
2007	Simple	-0.36**	-0.44***	-0.35**
	Spearman	-0.56***	-0.51***	-0.55***
2008	Simple	-0.33*	-0.46***	-0.32*
	Spearman	-0.47***	-0.52***	-0.41**
2009	Simple	-0.38**	-0.47***	-0.31*
	Spearman	-0.60***	-0.58***	-0.46***

According to multiple regressions results of China, the coefficients of SHKL and RD turn out to be significantly negative for the entire period of 1999-2009 (Table 11).[iv] This proves that China exported products which are less skilled human capital intensive and less R&D intensive for the entire period of 1999-2009.

Table 11: Multiple Regression with log (RCA^c) as a Dependent Variable: 1999-2009

Year	Independent variables		Constant	Test Stat.		
	log (*SHKL*)	log (*RD*)		R^2	F test	Prob>F
1999	-0.73**	-0.56**	4.47***	0.402	10.74	0.00
	(0.332)	(0.221)	(0.276)			
2000	-0.67**	-0.60***	4.57***	0.428	11.97	0.00
	(0.317)	(0.211)	(0.263)			
2001	-0.62*	-0.57***	4.58***	0.410	11.14	0.00
	(0.310)	(0.206)	(0.257)			
2002	-0.73**	-0.50**	4.49***	0.410	11.11	0.00
	(0.306)	(0.204)	(0.255)			
2003	-0.62**	-0.53**	4.56***	0.403	10.82	0.00
	(0.299)	(0.200)	(0.249)			
2004	-0.59*	-0.56***	4.61***	0.414	11.29	0.00
	(0.295)	(0.197)	(0.246)			
2005	-0.67**	-0.53***	4.57***	0.495	15.68	0.00
	(0.257)	(0.171)	(0.214)			
2006	-0.69**	-0.47**	4.64***	0.453	13.25	0.00
	(0.266)	(0.178)	(0.221)			
2007	-0.58**	-0.48***	4.73***	0.427	11.91	0.00
	(0.262)	(0.175)	(0.218)			
2008	-0.74**	-0.26	4.45***	0.351	8.66	0.00
	(0.272)	(0.181)	(0.226)			
2009	-0.72***	-0.33*	4.57***	0.418	11.50	0.00
	(0.251)	(0.167)	(0.208)			

Note: Standard errors in parentheses. The same notation will be used hereafter.

4.2.3 RCA Determinants of the USA

For the entire period of 1999-2009, a RCA^u variable has positive correlation coefficients with PKL, SHKL, and RD (Table 12). Furthermore, significantly positive correlation coefficients were found in the cases of Spearman rank correlation coefficients (a) between RCA^u and PKL for the entire period of 1999-2009 and (b) between RCA^u and SHKL for the period of 2003-2009, which means that the USA exported products which are more physical (and skilled human) capital intensive. On top of that, significantly positive correlation coefficients were found in the cases of both simple and Spearman rank correlation coefficients between RCA^u and RD for the entire period of 1999-2009, which means that the USA exported more R&D intensive products for the period.

Table 12: Correlation Coefficients Between RCA^u and Industrial Characteristics Variables: 1999-2009

Year	Industrial	Characteristics	Variables related to	RCA^u
		PKL	SHKL	RD
1999	Simple	0.12	0.08	0.73***
	Spearman	0.38**	0.18	0.65***
2000	Simple	0.06	0.09	0.58***
	Spearman	0.29*	0.21	0.64***
2001	Simple	0.05	0.08	0.56***
	Spearman	0.34**	0.24	0.64***
2002	Simple	0.10	0.13	0.62***
	Spearman	0.36**	0.28	0.61***
2003	Simple	0.14	0.16	0.62***
	Spearman	0.42**	0.32*	0.63***
2004	Simple	0.16	0.19	0.66***
	Spearman	0.44***	0.33*	0.61***
2005	Simple	0.16	0.18	0.63***
	Spearman	0.46***	0.37**	0.60***
2006	Simple	0.15	0.18	0.62***
	Spearman	0.45***	0.37**	0.61***
2007	Simple	0.17	0.18	0.65***
	Spearman	0.44***	0.35**	0.63***
2008	Simple	0.17	0.18	0.63***
	Spearman	0.46***	0.37**	0.59***
2009	Simple	0.20	0.21	0.58***
	Spearman	0.49***	0.42**	0.59***

According to multiple regressions results of the USA, the coefficients of RD turn out to be significantly positive for the entire period of 1999-2009 (Table 13). This proves that the USA exported products which are more R&D intensive for the entire period of 1999-2009.

Table 13: Multiple Regression with log (RCA^u) as a Dependent Variable: 1999-2009

Year	Independent variables		Constant	Test Stat.		
	log (*SHKL*)	log (*RD*)		R^2	F test	Prob>F
1999	-0.14	0.54***	3.92***	0.417	11.46	0.00
	(0.181)	(0.120)	(0.150)			
2000	-0.07	0.52***	4.06***	0.394	10.42	0.00
	(0.188)	(0.125)	(0.156)			
2001	-0.05	0.53***	4.04***	0.396	10.48	0.00
	(0.192)	(0.128)	(0.160)			
2002	0.01	0.54***	4.02***	0.402	10.77	0.00
	(0.201)	(0.134)	(0.167)			
2003	0.06	0.55***	4.01***	0.394	10.38	0.00
	(0.216)	(0.144)	(0.179)			
2004	0.09	0.57***	4.02***	0.397	10.52	0.00
	(0.224)	(0.149)	(0.186)			
2005	0.12	0.55***	4.05***	0.376	9.62	0.00
	(0.233)	(0.155)	(0.193)			
2006	0.14	0.56***	4.05***	0.382	9.88	0.00
	(0.235)	(0.156)	(0.195)			
2007	0.11	0.59***	3.98***	0.406	10.93	0.00
	(0.232)	(0.154)	(0.192)			
2008	0.16	0.55***	4.03***	0.392	10.31	0.00
	(0.231)	(0.154)	(0.192)			
2009	0.22	0.54***	4.01***	0.391	10.25	0.00
	(0.235)	(0.157)	(0.195)			

Note: Standard errors in parentheses. The same notation will be used hereafter.

4.2.4 RCA Determinants of Japan

For the entire period of 1999-2009, the results show positive relationships between a RCA^j variable and RD variables (Table 14). Furthermore, significantly positive correlation coefficients were found in the cases of Spearman rank correlation coefficients between RCA^j and RD, which means that Japan exported more R&D intensive products for the period.

Table 14: Correlation Coefficients Between RCA^j and Industrial Characteristics Variables: 1999-2009

Year	Industrial	Characteristics	Variables related to	RCA^j
		PKL	SHKL	RD
1999	Simple	-0.04	-0.05	0.21
	Spearman	0.16	0.13	0.62***
2000	Simple	-0.05	-0.05	0.20
	Spearman	0.14	0.13	0.62***
2001	Simple	-0.04	-0.05	0.19
	Spearman	0.17	0.13	0.63***
2002	Simple	-0.03	-0.04	0.18
	Spearman	0.18	0.13	0.62***
2003	Simple	-0.04	-0.04	0.21
	Spearman	0.18	0.14	0.63***
2004	Simple	-0.05	-0.05	0.19
	Spearman	0.16	0.13	0.62***
2005	Simple	-0.04	-0.04	0.18
	Spearman	0.18	0.14	0.61***
2006	Simple	-0.04	-0.03	0.19
	Spearman	0.19	0.15	0.62***
2007	Simple	-0.04	-0.03	0.22
	Spearman	0.18	0.14	0.62***
2008	Simple	-0.10	-0.05	0.18
	Spearman	0.13	0.11	0.61***
2009	Simple	0.03	-0.02	0.21
	Spearman	0.26	0.20	0.62***

According to multiple regressions results of Japan, the coefficients of RD turn out to be significantly positive for the entire period of 1999-2009 (Table 15). This proves that Japan exported products which are more R&D intensive for the entire period of 1999-2009.

Table 15: Multiple Regression with log (RCA^j) as a Dependent Variable: 1999-2009

Year	Independent variables		Constant	Test Stat.		
	log (*SHKL*)	log (*RD*)		R^2	F test	Prob>F
1999	-0.38	1.20***	2.68***	0.402	10.74	0.00
	(0.405)	(0.270)	(0.337)			
2000	-0.407	1.21***	2.69***	0.402	10.73	0.00
	(0.408)	(0.272)	(0.339)			
2001	-0.38	1.21***	2.72***	0.401	10.72	0.00
	(0.411)	(0.274)	(0.342)			
2002	-0.36	1.21***	2.70***	0.390	10.23	0.00
	(0.420)	(0.280)	(0.349)			
2003	-0.42	1.26***	2.67***	0.415	11.34	0.00
	(0.415)	(0.277)	(0.345)			
2004	-0.44	1.27***	2.66***	0.402	10.77	0.00
	(0.426)	(0.284)	(0.354)			
2005	-0.37	1.26***	2.71***	0.398	10.56	0.00
	(0.431)	(0.288)	(0.358)			
2006	-0.35	1.29***	2.68***	0.398	10.60	0.00
	(0.443)	(0.296)	(0.368)			
2007	-0.38	1.29***	2.71***	0.410	11.10	0.00
	(0.431)	(0.287)	(0.358)			
2008	-0.52	1.28***	2.64***	0.371	9.45	0.00
	(0.452)	(0.302)	(0.376)			
2009	-0.23	1.21***	2.93***	0.386	10.04	0.00
	(0.437)	(0.291)	(0.363)			

Note: Standard errors in parentheses. The same notation will be used hereafter.

5. Conclusions and Limitation

From the above study, the following policy recommendation can be suggested.

(1) For the period of 1999-2009, South Korea has comparative advantage in the production of commodities which are (a) relatively labor-intensive, such as *SITC 65* and (b) relatively capital/technology-intensive, such as *SITC 76, SITC 77, SITC 62, SITC 79, SITC 75, SITC 67, SITC 87, SITC 73* and SITC 78. On the other hand, China has comparative advantage in the production of commodities which are (a) relatively labor-intensive, such as *SITC 83, SITC 85, SITC 81, SITC 84, SITC 82,* and *SITC 89* and (b) relatively capital/technology-intensive, such as *SITC 75* and *SITC 76*. Therefore South Korea and China should try to export more of these products respectively to the world market from now on, which is an original and timely policy suggestion of this paper.

(2) Throughout the entire period, the USA has comparative advantage in the production of commodities which are relatively capital/technology-intensive, such as *SITC 79, SITC 87, SITC 71, SITC 59, SITC 77, SITC 57, SITC 58, SITC 72,* and *SITC 54.* On the other hand, Japan has comparative advantage in the production of commodities which are relatively capital/technology-intensive, such as *SITC 73, SITC 88, SITC 78, SITC 72, SITC 76, SITC 87, SITC 58, SITC 62,* and *SITC 77*. Therefore the USA and Japan should try to export more of these products respectively to the world market from now on, which is an original and timely policy suggestion of this paper.

(3) For the period of 1999-2009, export products of China are the most concentrated. This concentration of Chinese export products is followed by Japan, South Korea, and the USA in that order. Since this kind of high concentration of export products are not desirable, it should be diversified to avoid any potential economic loss associated with unfavorable trade-environmental changes against these concentrated export products.

(4) It was found that export patterns of South Korea changed faster than those of the USA, China, and Japan for the period of 1999-2009. On the other hand, export patterns of Japan remained the most stable in the same period. Therefore both South Korea and CUJ should fully adjust their economies to ever-changing patterns of their exports.

(5) It was found that South Korea's export patterns do not resemble those of China due to the differences in factor endowment ratios of China and South Korea. Therefore South Korea can increase her exports to China by exploiting non-similarity of South Korean and Chinese export patterns.

(6) It was found that both UJ and South Korea had similar export patterns due to the resemblances in factor endowment ratios of UJ and South Korea. Especially, South Korean export patterns became increasingly similar to Japanese export patterns and South Korean products' competition with Japanese products in the world export market became increasingly severe. Therefore both UJ and South Korea should cooperate in exporting their products in the world market.

(7) It was found that South Korea exported products which are less skilled human capital intensive and more R&D intensive for the entire period of 1999-2009. For the case of China, less skilled human capital intensive and less R&D intensive products were found to be exported for the same period. Therefore both South Korea and China should try to export more of these products to the world market from now on.

(8) It was found that both the USA and Japan exported products which are more R&D intensive for the entire period of 1999-2009. Therefore both the USA and Japan should try to export more of these products to the world market from now on.

Even if the above conclusions were drawn from this paper, it has its own limitation. Therefore the more in-depth study on this topic should be pursued in the near future.

Endnotes

[i] The only exceptions are Spearman rank correlation coefficients (a) between RCA^k and PKL and (b) between RCA^k and SHKL for both 2008 and 2009, which are positive.

[ii] The only exception is a Spearman rank correlation coefficient between RCA^k and RD in 2002, which is not significant.

[iii] The only exception is a simple correlation coefficient between RCA^c and PKL in 1999, which is not significant.

[iv] The only exception is a coefficient of RD in 2008, which is not significant.

References

Balassa, B. 1965, 'Trade liberalization and revealed comparative advantages', *The Manchester School of Economic and Social Studies,* vol. 33, no. 2, pp. 91-123, Manchester, England.

Bank of Korea, *Economic Statistics System (ecos.bok.or.kr)*, Seoul, Korea.

Kim, S.J. 1988, 'The composition of trade flows for a less developed economy: the case of Korea',.*Asian Economic Journal*: vol. 2, no. 2, pp. 139-164, Osaka, Japan.

Kim, S.J. 2002, *Trade patterns between Korea and the United States: overcoming Korea's financial crisis through expanding her trade volume with the United States*, International Trade and Business Institute, Seoul, Korea.

Kim, S.J. 2004, *Pure Trade Theory,* Yulgok Books Co., Seoul, Korea.

Kim, S.J. 2007, 'Korea's trade intensity with her major trading countries in the manufacturing sector: Its changes over the last decade', *International Area Review*, vol. 10, no. 1, pp. 151-174, Hankuk University Foreign Studies, Seoul, Korea.

Kim, S.J. 2010, 'Changes in comparative advantage of OECD East European countries and Korea', *Eastern European Studies,* vol. 25, pp. 355-382, Institute of Eastern European and Balkan Studies, Seoul, Korea.

Korean International Trade Association, *Korean Trade Statistics (kita.net)*, Seoul, Korea

Ministry of International Trade and Industry, Government of Japan 1986, *White Paper on International Trade*, Tokyo, Japan.

OECD 2011, *International Trade by Commodity Statistics,* vol. 5, Paris, France.

Yamazawa, I. 1970, 'Intensity analysis of world trade flow', *Hitotsubashi Journal of Economics,* vol. 10, pp. 61-90, Tokyo, Japan.