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Korea's Trade Intensity with Major EU Trading Countries:

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Abstract

This paper analyzes how South Korea's trade intensity with her most prominent EU trading countries in 19 industries of the manufacturing sector changed over time for the period 2012-2019. During this period, trade intensity with Germany, Italy and France increased, while trade intensity with the Netherlands decreased. The factors of change in trade intensity were analyzed by decomposing them into trade complementarity and special country bias.

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1. Introduction

The Korean economy has undergone dramatic changes since the 1960s. Korea has emerged on the world stage from a typically underdeveloped agricultural economy to an advanced economy with a per capita GDP of more than $30,000. This outstanding economic performance is truly astonishing given the country's poor natural resources and small domestic market. Exports have played a very important role in the process of economic development. It can be said that the export-led development strategy has been effective. Korea's economic development strategy has been frequently mentioned as a suitable model for other countries on the path of development.

Among Korea's various trading partners, EU countries[1] have traditionally been important trading partners, and through this, economic cooperation has been increased. It is a very important task for Korea to seek economic development and cooperation by understanding the competitive structure of imports and exports with EU countries.

Recently, Korea has been running a trade deficit with some major EU countries. In 2020, Korean exports to Germany recorded $9.6 billion (1.9% of Korea's total exports) and Korean imports from Germany reached $20.7 billion (4.4% of Korea's total imports). Consequently, Korea suffered from a $11.1 billion trade deficit with Germany. Korean exports to the Netherlands in 2020 recorded $4.0 billion (0.8% of Korea's total exports), while Korean imports from the Netherlands reached $6.2 billion (1.3% of Korea's total imports). In its trade with the Netherlands, Korea ran a deficit of $2.2 billion. Korea also recorded a small amount of trade deficit with Italy. Korean exports to Italy in 2020 recorded $3.2 billion (0.6% of Korea's total exports), while Korean imports from Italy recorded $6.7 billion (1.4% of Korea's total imports). Consequently, Korea suffered from a $3.4 billion trade deficit with Italy. Korean exports to France in 2020 recorded $3.0 billion (0.6% of Korea's total exports) and Korean imports from France reached $5.9 billion (1.3% of Korea's total imports). Consequently, Korea suffered from a $2.9 billion trade deficit with France.

This paper aims to analyze how South Korea's trade intensity with her major EU trading countries (Germany, Netherlands, Italy, and France, GNIF hereafter) based on the trade volume changed over time during the period 2012-2019. A study that analyzes the trade

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[1] The UK withdrew from the EU in February 2020 and is excluded from this study.

structure between Korea and the EU and identifies promising and potential import and export products is very necessary to promote cooperative relations between the two regions. Section 2 will briefly survey a trade intensity index model developed by Yamazawa (1970) and the methodology and research design of this paper will be suggested in Section 3.

Section 4 will measure a trade intensity index, a trade complementarity index, and a special country bias index between South Korea and GNIF for the period 2012-2019 by using the 6-digit level OECD trade data of Harmonized System (HS) and analyzing how South Korea's trade intensity with GNIF changed over time. On top of this, this paper will also analyze the determinants of South Korea's trade complementarity with GNIF over the last decade at both sectoral and aggregate levels. Furthermore, South Korea's promising and potentially exportable products to GNIF will be identified. Section 5 will summarize the most important empirical results and conclude the paper with a few remarks.

This paper is different from previous studies (e.g., Yamazawa (1970), Kim (2009, 2013), and Kim and Kim (2015)) in the sense that it is the most updated one, covering the period 2012-2019, and that it takes care of South Korea's trade intensity with her four major EU trading countries of GNIF. Another important difference is that the products are classified into three basic end-use classes (capital goods, intermediate goods and consumption goods) and the Broad Economic Categories, which are used in the UN, instead of the SITC 2-digit classification used in previous studies.

2. Literature Review

2.1 Multi-country-multi-product-multi-factor trade model

According to the Heckscher-Ohlin two-country-two-product-two-factor model, trade patterns are determined by the comparative advantage structures between two countries, ascertained by factor intensities of two products and factor endowment ratios of two countries (Balassa, 1965; Caves, 1975; Helpman and Krugman, 1985). In the multi-country model, however, various other factors are found to play important roles in determining trade patterns among those countries, as will be elaborated on below (Hufbauer, 1970; Krugman, 1979; Kierzkowski, 1984).

Two alternative models have been developed for analyzing the world trade flows. One is a gravity model [2] and the other a trade intensity index model, which will be explained in Section 2.2.

2.2 Trade intensity index model [3]

The trade intensity index model (Yamazawa, 1970) concentrates on the structure of departures of actual trade flows from trade flows estimated in gravity model. The index of intensity of country i's export trade with country j (in short, trade intensity index) is defined by

$$I_{ij} = \frac{X_{ij}/X_{i.}}{X_{.j}/X_{..}} \quad \text{--- (1)}$$

where X_{ij} is country i's export to country j, and $X_{i.}(\equiv \sum_j X_{ij})$, $X_{.j}(\equiv \sum_i X_{ij})$, and $X_{..}(\equiv \Sigma_i \Sigma_j X_{ij})$ represent the total export of country i, total import of country j, and the total volume of world trade respectively. [4]

It is easily proved that, in a simplified gravity model where bilateral trade is solely determined by the GDPs of countries i and j, I_{ij} is always equal to unity. [5] In other words, I_{ij} equals unity if the value of trade is proportional to the GDPs of the two countries; exceeds unity if trade becomes more intensive between the countries, and falls short of unity if trade becomes less intensive between the countries i and j. High trade intensity reflects such various factors as the strong complementarity in comparative advantage structures, smaller geographical distances, and mutually favorable trade agreements between the two countries.

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2 See footnote 8 on p. 125 in Kim (2004). The gravity model assumes that trade between two countries will mechanically be determined by the gross national product of exporting and importing countries and the economic distance between the two. The GNP of an exporting country represents the size of her supply capacity and that of an importing country her total demand. The volume of trade between the two trading countries tends to increase if the GNP of either country increases, and tends to decrease, if the economic distance between them (measured in terms of transportation cost) increases. If this relationship holds between any pairs of countries, country i's export to country j(X_{ij}) can be defined as follows:

$X_{ij} = \alpha Y_i^\beta Y_j^\gamma D_{ij}^{-\delta}$, where Y_i, Y_j is the GNP of countries i and j, D_{ij} is the measure of economic distance between two countries, and α, β, γ, δ the positive constants.

3 A more detailed survey of the trade intensity model could be seen on pp. 125-131 in Kim (2004).

4 The data for $X_{..}$ is supposed to use the total trade volume of the world. In order to secure consistency of the data set, we have to use the total OECD trade volume which is smaller than the total world trade volume. This might cause some bias to calculate the indices.

5 See footnote 4 on p. 62 in Yamazawa (1970).

This trade intensity index can be decomposed into trade complementarity index (C_{ij}) and special country bias index (B_{ij}) as follows. Country i's patterns of exports to and imports from the world are principally determined by its structure of comparative advantage and disadvantage vis-a-vis the world. Assuming a homogeneous commodity is traded in a world where both transport costs and artificial barriers to trade are negligible, the country i's export of commodity h to country j ($\bar{X}_{ij}^h$) is expected to be the product of 「*country j's total import of the h-th commodity ($X_{.j}^h$)*」 multiplied by 「*the share of country i in the world trade (i.e., export) of commodity h ($X_{i.}^h / X_{..}^h$)*」 as follows:

$$\bar{X}_{ij}^h = X_{.j}^h \left(\frac{X_{i.}^h}{X_{..}^h}\right) \quad \text{-- (2)}$$

In other words, the exporting country i's expected market share in the importing country j's market in the trade of the h-th commodity ($\bar{X}_{ij}^h / X_{.j}^h$) is supposed to be determined by the exporting country i's market share in the world market in the trade of the same commodity ($X_{i.}^h / X_{..}^h$) assuming that there are no trade barriers and no transportation costs.

This expected value of country i's export of commodity h to country j ($\bar{X}_{ij}^h$) can be rewritten as follows.

$$\bar{X}_{ij}^h = \frac{X_{i.}^h \, X_{.j}^h}{X_{..}^h} \quad \text{--- (3)}$$

The expected value of total exports from country i to country j is defined as the sum of expected values of all commodities.

$$\bar{X}_{ij} = \sum_h \bar{X}_{ij}^h \quad \text{--- (4)}$$

Country i's trade complementarity to country j (C_{ij}) or country i's expected trade intensity to country j (C_{ij}) is obtained by replacing the expected value of trade ($\bar{X}_{ij}$) for the actual one (X_{ij}) in the equation (1) as shown below:

$$C_{ij} = \frac{\bar{X}_{ij}}{X_{i.}} \bigg/ \frac{X_{.j}}{X_{..}} \quad \text{--- (5)}$$

The divergence between the expected value of trade and the actual value defines the degree of special country bias as follows:

$$B_{ij} \equiv I_{ij}/C_{ij} = \frac{X_{ij}}{\bar{X}_{ij}} = \frac{X_{ij}}{\sum_h \bar{X}_{ij}^h} = 1/\left\{\sum_h \left(\frac{X_{ij}^h}{X_{ij}}\right)\frac{1}{B_{ij}^h}\right\} \quad \text{--------------- (6)}$$

where B_{ij}^h is the degree of special country bias in the trade of commodity h ($B_{ij}^h = X_{ij}^h / \bar{X}_{ij}^h$) and B_{ij} turns out to be a weighted harmonic mean of B_{ij}^h.

The first line of equation (6) gives a decomposition of trade intensity into two components as follows:

$$I_{ij} = C_{ij} \cdot B_{ij} \quad \text{-- (7)}$$

which is the basic formula for our analysis.

2.3 Determinants of trade complementarity [6]

To find the determinants of trade complementarity (C_{ij}), it can be decomposed as follows:

$$C_{ij} = \sum_h \frac{X_{..}^h}{X_{..}} S_i^h \cdot R_j^h \quad \text{-- (8)}$$

where $S_i^h \left(= \frac{X_{i.}^h}{X_{i.}} \big/ \frac{X_{..}^h}{X_{..}}\right)$ and $R_j^h \left(= \frac{X_{.j}^h}{X_{.j}} \big/ \frac{X_{..}^h}{X_{..}}\right)$ are the shares of commodity h in country i's total exports and country j's total imports respectively both divided by commodity h's share in world total trade. (S_i^h is nothing but an RCA (Revealed Comparative Advantage) index of country i for commodity h, which was firstly introduced into a pure trade theory by Balassa (1965).) They measure the degrees of country i's export specialization and country j's import specialization in commodity h respectively. Since their weighted average over all commodities always takes a constant value of unity,

$$\sum_h \left(\frac{X_{..}^h}{X_{..}}\right) \cdot S_i^h = \sum_h \left(\frac{X_{..}^h}{X_{..}}\right) \cdot R_j^h = 1 \quad \text{------------------------------- (9)}$$

each of them takes value around unity. S_i^h of over (under) unity implies that country i exports commodity h more (less) intensively than the world average, and the higher (lower) the value of S_i^h, the stronger (weaker) is country i's export specialization in commodity h. Similarly, the higher (lower) the value of R_j^h, the stronger (weaker) is country j's import specialization in commodity h.

The vector of S_i^h over all commodities, (S_i^1, S_i^2,..., S_i^n), shows the structure of export specialization of country i, which reflects country i's structure of comparative advantage. Higher (lower) value of S_i^h indicates that country i has strong (weak) comparative advantage in the production of commodity h. Exactly the same thing also applies to the vector of indices of import specialization. The structure of import specialization, however, is affected not only

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[6] More detailed explanation about the determinants of trade complementarity could be found on pp. 125-131 in Kim (2004).

by the structure of comparative disadvantage, but also by protective commercial policies much more than that of export specialization.

The degree of concentration or diversification of country i's export specialization and country j's import specialization is affected by such important aspects of comparative advantage as the size of a country, skewed resource endowments, etc. They can be measured in terms of standard deviations of specialization indexes from their mean (i.e., unity), which are square roots of the variances defined as follows:

$$\sigma^2(S_i) = \sum_h \left(\frac{X^h_{..}}{X_{..}}\right) \cdot \left(S_i^h - 1\right)^2 \quad and \quad \sigma^2(R_j) = \sum_h \left(\frac{X^h_{..}}{X_{..}}\right) \cdot \left(R_j^h - 1\right)^2 \quad \text{-- (10)}$$

It can be easily demonstrated that the lower the standard deviation of the export (import) specialization index of a certain country, the more diversified the export (import) specialization pattern of the country.[7]

Covariance of the indices of country i's export specialization and those of country j's import specialization is defined as follows:

$$Cov(S_i, R_j) = \sum_h \left(\frac{X^h_{..}}{X_{..}}\right)\left(S_i^h - 1\right)\left(R_j^h - 1\right)$$

$$= \sum_h \left(\frac{X^h_{..}}{X_{..}}\right) S_i^h R_j^h - 1 - 1 + 1 \quad [8]$$

$$= C_{ij} - 1 \quad [9]$$

$$or \quad C_{ij} = Cov(S_i, R_j) + 1 \quad \text{------------------------ (11)}$$

Therefore, if country i's pattern of export specialization matches country j's pattern of import specialization closely, that is, if the indices of country i's export specialization and country j's import specialization are positively correlated (i.e., $Cov(S_i, R_j) > 0$), C_{ij} will take a value greater than unity. On the contrary, if they match poorly, that is, if they are negatively correlated (i.e., $Cov(S_i, R_j) < 0$), C_{ij} will take a value less than unity. If they are independent ($Cov(S_i, R_j) = 0$), C_{ij} will be equal to unity. Consequently, C_{ij} measures the degree of complementarity in the specialization structures of two trading countries.

The degree of complementarity, however, is not only influenced by the match of the specialization patterns of exports and imports, but also by their concentration or diversification. A country with a highly concentrated pattern of export specialization tends to

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7 See pp. 65-66 in Yamazawa (1970).

8 According to Equation (9), $\sum_h \left(\frac{X^h_{..}}{X_{..}}\right) S_i^h = \sum_h \left(\frac{X^h_{..}}{X_{..}}\right) R_i^h = 1$, Furthermore, $\sum_h \left(\frac{X^h_{..}}{X_{..}}\right) = 1$

9 By Equation (8).

have higher complementarity in her export activities than a country with a similar but more diversified pattern of export specialization.[10] Therefore, if the correlation coefficient between the specialization structure of exports and imports is calculated, the measure of the degree of match of the two patterns neutral from the degree of concentration or diversification can be obtained as follows:

$$\rho_{S_i R_j} = \frac{Cov(S_i,\ R_j)}{\sigma(S_i) \times \sigma(R_j)} \text{----------------------------- (12)}$$

3. Data and Methodology

3.1 Data

To calculate a trade intensity index, a trade complementarity index, and a special country bias index between South Korea and GNIF for the last decade by adopting an above-stated trade intensity index model developed by Yamazawa (1970), we used the 6-digit level trade data of Harmonized System (HS) in OECD web-DB, which reports all the trade data between OECD member countries and non-member countries from the viewpoint of OECD member countries.[11]

We use the conversion table that is provided by UN Trade Statistics to match the 6-digit level of trade data of harmonized system (HS) 2012 to the Classification by Broad Economic Categories (BEC).[12] The Statistical Commission of the UN suggested that data on BEC be compiled for 19 categories. Its main purpose is to provide a set of broad product categories for the analysis of trade statistics. The 19 product categories are designed to enable users to obtain aggregates as comparable as possible to the three basic end-use classes in the System of National Accounts (SNA): capital goods, intermediate goods and consumption goods.

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[10] See the example of Table 1 on p. 66 in Yamazawa (1970).

[11] The Organisation for Economic Co-operation and Development (OECD) is an intergovernmental economic organisation with 38 member countries. The OECD trade data for this study include 37 countries excluding Colombia which is not available in the database.

[12] See https://unstats.un.org/unsd/trade/classifications/correspondence-tables.asp

As shown in Table 1, our basic sample of industries for the manufacturing sector consists of 19 industries classified by BEC of UN Trade Statistics, which is an optimal sample size for our research.

Table 1: Classification by BEC and basic end-use classes in SNA

Categories	Classification of goods by BEC	Basic classes in SNA
	1. Food and beverages	
	11. Primary	
1	111. Mainly for industry	Intermediate
2	112. Mainly for household consumption	Consumption
	12. Processed	
3	121. Mainly for industry	Intermediate
4	122. Mainly for household consumption	Consumption
	2. Industrial supplies not elsewhere specified	
5	21. Primary	Intermediate
6	22. Processed	Intermediate
	3. Fuels and lubricants	
7	31. Primary	Intermediate
	32. Processed	
8	321. Motor spirit (e.g. gasoline or petrol)	*Not classified*
9	322. Other	Intermediate
	4. Capital goods (except transport equipment), and parts and accessories thereof	
10	41. Capital goods (except transport equipment)	Capital
11	42. Parts and accessories	Intermediate
	5. Transport equipment and parts and accessories thereof	
12	51. Passenger motor vehicles	*Not classified*
	52. Other	
13	521. Industrial	Capital
14	522. Non-industrial	Consumption
15	53. Parts and accessories	Intermediate
	6. Consumer goods not elsewhere specified	
16	61. Durable	Consumption
17	62. Semi-durable	Consumption
18	63. Non-durable	Consumption
19	7. Goods not elsewhere specified	*Not classified*

Source: *Classification by Broad Economic Categories Rev.5*, Statistical Papers Series M No. 53, Rev.5, Department of Economic and Social Affairs, United Nations. (https://unstats.un.org/unsd/trade/classifications/SeriesM_53_Rev.5_17-01722-E-Classification-by-Broad-Economic-Categories_PRINT.pdf)

3.2 Methodology

All the values that are required for this study will be calculated by taking the following steps:

(a) By substituting relevant OECD trade data into Equation (1), we can calculate I_{KG}, I_{KN}, I_{KI}, and I_{KF} where a subscript K, G, N, I, and F denotes South Korea, Germany, the Netherlands, Italy, and France respectively.

(b) By substituting relevant OECD trade data into Equation (3), we can calculate $\bar{X}_{KG}^h$, $\bar{X}_{KN}^h$, $\bar{X}_{KI}^h$, and $\bar{X}_{KF}^h$ where $h = BEC\ 111$ to 63 that have the unique category in Table 1.

(c) By summating $\bar{X}_{KG}^h$ over h from *BEC 111* to *63* as shown in Equation (4), we can calculate $\bar{X}_{KG}$, $\bar{X}_{KN}$, $\bar{X}_{KI}$, and $\bar{X}_{KF}$ can be calculated in the same manner.

(d) By substituting all the relevant data into Equation (5), we can derive C_{KG}, C_{KN}, C_{KI}, and C_{KF}.

(e) By substituting all the relevant data into Equation (6), we can derive B_{KG}, B_{KN}, B_{KI}, and B_{KF}. These values of B_{KG}, B_{KN}, B_{KI}, and B_{KF} derived by using the first part of Equation (6) should be equal to those values of B_{KG}, B_{KN}, B_{KI}, and B_{KF} by using the last part of Equation (6).

(f) S_K^h, R_G^h, R_N^h, R_I^h, and R_F^h where $h = BEC\ 111$ to 63 can be calculated by using the latter part of Equation (8). As explained above, S_K^h is South Korea's export specialization index (or RCA (Revealed Comparative Advantage) index of commodity h; and R_G^h, R_N^h, R_I^h, and R_F^h are the import specialization index of commodity h of Germany, the Netherlands, Italy, and France respectively. By utilizing the former part of Equation (8), we can derive C_{KG}, C_{KN}, C_{KI}, and C_{KF}. These values of C_{KG}, C_{KN}, C_{KI}, and C_{KF} derived here should be equal to those values of C_{KG}, C_{KN}, C_{KI}, and C_{KF} derived in Step (d).

(g) By utilizing Equation (10), $\sigma(S_K)$, $\sigma(R_G)$, $\sigma(R_N)$, $\sigma(R_I)$, and $\sigma(R_F)$ can be calculated. As explained above, $\sigma(S_K)$ is a standard deviation of South Korea's export specialization; and $\sigma(R_G)$, $\sigma(R_N)$, $\sigma(R_I)$, and $\sigma(R_F)$ are standard deviations of import specialization of Germany, the Netherlands, Italy, and France respectively. As shown in footnote 7, the lower the standard deviation of the export (import) specialization index of a certain country, the more diversified the export (import) specialization pattern of the country.

(h) By utilizing the former part of Equation (11), we can calculate $Cov(S_K, R_G)$, $Cov(S_K, R_N)$, $Cov(S_K, R_I)$, and $Cov(S_K, R_F)$. As shown above, $Cov(S_K, R_G)$ is a covariance of the indices of South Korea's export specialization and those of Germany's import specialization. $Cov(S_K, R_N)$, $Cov(S_K, R_I)$, and $Cov(S_K, R_F)$ can be defined in the same way. It should be noted that if we add a numerical number of one to $Cov(S_K, R_G)$, it will be C_{KG}. Likewise, if we add a numerical number of one to $Cov(S_K, R_N)$, $Cov(S_K, R_I)$, and $Cov(S_K, R_F)$, it will be C_{KN}, C_{KI}, and C_{KF} respectively.

(i) Finally, if we calculate the correlation coefficient between South Korea's export specialization structure and Germany's import specialization structure ($\rho_{S_K R_G}$) as shown in Equation (12), it will be the measure of the degree of match of the two patterns neutral from the degree of concentration or diversification. Exactly the same thing can be said of $\rho_{S_K R_N}$, $\rho_{S_K R_I}$, and $\rho_{S_K R_F}$.

On top of this, this paper will also analyze the determinants of South Korea's trade complementarity with GNIF over the period mentioned at both sectoral and aggregate levels. Furthermore, South Korea's promising and potentially exportable products to GNIF will be identified.

4. Findings

4.1 South Korea's trade intensity, trade complementarity and special country bias with major EU trading countries

South Korea's trade intensity, trade complementarity, and special country bias with the most prominent EU trading countries (Germany, the Netherlands, Italy, and France, GNIF hereafter) in the manufacturing sector for the period of 2012-2019 are displayed in Table 2.[13] The results show that in 2012 Korea's trade intensity with the Netherlands ($I_{KN} = 0.577$) was the highest among the major EU trading countries, which was followed by Italy ($I_{KI} = 0.471$), Germany ($I_{KG} = 0.372$), and France ($I_{KF} = 0.226$) consecutively. This tells us that the

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[13] Similar research on the Korean trade intensity with her various trading partners can be seen in Kim and Kim (2015).

Netherlands **used to be** South Korea's major trading partner among those countries. This is due to the following two factors. One is that South Korea's trade complementarity with the Netherlands (C_{KN} = 0.957) was the third highest next to France (C_{KF} = 0.996) and Germany (C_{KG} = 0.987). The other is that South Korea's special country bias with Netherlands was the highest (B_{KN}= 0.603). Compared with other EU major trading partners, actual exports to the Netherlands were higher than expected in 2012.

In 2019, however, major trading Italy **became** South Korea's partner (I_{KI}= 0.490), which was followed by the Netherlands (I_{KN}= 0.474), Germany (I_{KG}= 0.400), and France (I_{KF} = 0.274) consecutively. This is due to the following two factors. One is that South Korea's trade complementarity with Italy (C_{KI}= 0.962) was the third highest next to Germany (C_{KG}= 1.026) and France (C_{KF}= 0.975). The other is that South Korea's special country bias with Italy (B_{KI}= 0.509) was the second highest next to the Netherlands (B_{KN}= 0.510).

Table 2: South Korea's trade intensity, trade complementarity, and special country bias with major EU trading countries: 2012, 2019

Index	Year	Germany	Netherlands	Italy	France
Trade Intensity	2012	0.372	0.577	0.471	0.226
	2019	0.400	0.474	0.490	0.274
Trade Complementarity	2012	0.987	0.957	0.910	0.996
	2019	1.026	0.928	0.962	0.975
Special Country Bias	2012	0.377	0.603	0.517	0.226
	2019	0.390	0.510	0.509	0.281

It is remarkable that South Korea's trade intensity with Germany increased from 0.372 in 2012 to 0.400 in 2019, which evidences that Germany became more important as South Korea's major EU trading partner during the period 2012-2019. This is due to the following two facts. One is that South Korea's trade complementarity with Germany increased from 0.987 in 2012 to 1.026 in 2019, which means that South Korea's export structure and Germany's import structure switched from being competitive to complementary over the period 2012-2019. The other is that South Korea's special country bias with Germany also increased from 0.377 in 2012 to 0.390 in 2019 due to smaller economic distances, and mutually more favorable trade agreements between the two countries.

It is also noticeable that South Korea's trade intensity with France increased from 0.226 in 2012 to 0.274 in 2019, which shows that France became more important as South Korea's major trading partner during the period 2012-2019. This is due to the following two factors. One is that South Korea's trade complementarity with France decreased from 0.996 in 2012 to 0.975 in 2019, which means that South Korea's export structure and the French import structure became more competitive over the period 2012-2019. The other is that South Korea's special country bias with France increased from 0.226 in 2012 to 0.281 in 2019 due to smaller economic distances, and mutually more favorable trade agreements between the two countries.

On the other hand, South Korea's trade intensity with the Netherlands decreased from 0.577 in 2012 to 0.474 in 2019, which proves that the Netherlands became less important as South Korea's major trading partner during the period 2012-2019. This is due to the following two factors. One is that South Korea's trade complementarity with the Netherlands decreased from 0.957 in 2012 to 0.928 in 2019, which means that South Korea's export structure and the Dutch import structure became more competitive over the period 2012-2019. The other is that South Korea's special country bias with the Netherlands also decreased from 0.603 in 2012 to 0.510 in 2019 due to bigger economic distances, and mutually more unfavorable trade agreements between the two countries.

It should be noticed that South Korea's trade intensity with Italy increased from 0.471 in 2012 to 0.490 in 2019, showing that Italy became more important as South Korea's major trading partner for the period of 2012-2019. This is due to the following two factors. One is that South Korea's trade complementarity with Italy increased from 0.910 in 2012 to 0.962 in 2019, which means that South Korea's export structure and Italy's import structure became less competitive over the period 2012-2019. The other is that South Korea's special country bias with Italy decreased from 0.517 in 2012 to 0.509 in 2019 due to bigger economic distances, and mutually more unfavorable trade agreements between the two countries.

South Korea's trade intensity with Italy in 2019 is higher than her trade intensity with Germany and France (GF in short hereafter). This is due to the fact that South Korea's special country bias with Italy is much higher than her equivalent value with GF, even if South Korea's trade complementarity with Italy is lower than her equivalent value with GF. This means that lower transportation costs, discriminatory tariffs and other import restrictions,

higher capital movements and economic cooperation which are prevalent in the economic relations between South Korea and Italy do increase South Korea's special country bias with Italy and accordingly raise her trade intensity with Italy, even if South Korea's trade complementarity with this country is lower than her equivalent value with GF.

South Korea's trade intensity with France in 2019 is lower than her trade intensity with Italy and the Netherlands (IN in short hereafter). This is due to the fact that South Korea's special country bias with France is much lower than her equivalent value with IN, even if South Korea's trade complementarity with France is higher than her equivalent value with IN. This means that higher transportation costs, discriminatory tariffs and other import restrictions, lower economic cooperation which used to be prevalent in the economic relations between South Korea and France did reduce South Korea's special country bias with France and accordingly lessen her trade intensity with France, even if South Korea's trade complementarity with France is higher than her equivalent value with IN.

South Korea's trade intensity with Germany in 2019 is lower than her trade intensity with Italy and the Netherlands (IN in short hereafter). This is due to the fact that South Korea's special country bias with Germany is lower than her equivalent value with IN, even if South Korea's trade complementarity with Germany is higher than her equivalent value with IN. This means that higher transportation costs, discriminatory tariffs and other import restrictions, lower economic cooperation which used to be prevalent in the economic relations between South Korea and Germany did reduce South Korea's special country bias with Germany and accordingly lessen her trade intensity with Germany, even if South Korea's trade complementarity with Germany is higher than her equivalent value with IN.

4.2 Determinants of South Korea's trade complementarity with Major EU trading countries

4.2.1 Determinants of South Korea's trade complementarity with Germany

As shown in Table 3, in 2012 South Korea has a comparative advantage in the production of (a) **intermediate goods**, such as *parts and accessories of capital goods (BEC 42)*, and *parts and accessories of transport equipment (BEC 53)*, (b) **capital goods**, such as *capital goods (except transport equipment) (BEC 41)* and *other industrial transport equipment except*

passenger motor vehicles (BEC 521), and (c) **not classified goods,** such as *motor spirit (gasoline or petrol) (BEC 321)* and *passenger motor vehicles (BEC 51).* (please note that in order to save space in this paper only the *BEC* code will be listed from now on; look at Table 1 for the classification of manufactured products by *BEC* and their name and code).[1 4]

In 2019 South Korea continues to have a comparative advantage in the production of (a) **intermediate goods**, such as *BEC 42* and *BEC 53*, (b) **capital goods**, such as *BEC 41,* and (c) **not classified goods** such as *BEC 321 and BEC 51.*

On the other hand, in 2012 Germany has a comparative disadvantage in the production of (a) **consumption goods**, such as *BEC 62*, (b) **intermediate goods**, such as *BEC 111, BEC 22, BEC 322, BEC 42,* and *BEC 53,* (c) **capital goods**, such as *BEC 521,* and (d) **not classified goods** such as *BEC 7.*

In 2019 Germany has a comparative disadvantage in the production of (a) **consumption goods**, such as *BEC 61* and *BEC 62*, (b) **intermediate goods**, such as *BEC 111, BEC 22, BEC 42,* and *BEC 53,* and (c) **not classified goods** such as *BEC 51.*

Consequently, South Korea's promising and potentially exportable products to Germany (i.e. the products which have a high value of $S_K^h \cdot R_G^h$ in Table 3) in 2012 turn out to be (a) **intermediate goods**, such as *BEC 42* and *BEC 53,* (b) **capital goods**, such as *BEC 41* and *BEC 521,* and (c) **not classified goods** such as *BEC 321 and BEC 51.* In 2019, South Korea's promising and potentially exportable products to Germany changed to (a) **intermediate goods**, such as *BEC 22, BEC 42* and *BEC 53* and (b) **not classified goods** such as *BEC 321* and *BEC 51.*

As shown in Table 3, the standard deviation of S_K^h decreases from 0.627 in 2012 to 0.588 in 2019, which means that South Korea's export specialization becomes **more diversified** over time. The standard deviation of R_G^h also decreases from 0.162 in 2012 to 0.132 in 2019, which means that Germany's import specialization becomes **more diversified** over time during the period 2012-2019.

Since South Korea's pattern of export specialization and Germany's pattern of import specialization were negatively correlated in 2012 ($\text{Cov}(S_K, R_G)$ = -0.013), C_{KG} (South Korea's trade complementarity with Germany) reached 0.987, which means that South Korea's export structure and Germany's import structure were **competitive** with each other in

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[1 4] As shown in Tables 3 to 6, the numbers with a value higher than one are italicized.

2012. As this negative correlation coefficient between South Korea's pattern of export specialization and Germany's pattern of import specialization switched to a positive value in 2019 ($Cov(S_K, R_G) = 0.026$), C_{KG} reached 1.026, which means that South Korea's export structure and Germany's import structure became **complementary** with each other in 2019.

Table 3: Analysis of South Korea's trade complementarity with Germany in the manufacturing sector: 2012, 2019

Basic classes in SNA	BEC code	2012					2019				
		S_K^h	R_G^h	$S_K^h \cdot R_G^h$	$\frac{X_{..}^h}{X_{..}}$	$\frac{X_{..}^h}{X_{..}} S_K^h \cdot R_G^h$	S_K^h	R_G^h	$S_K^h \cdot R_G^h$	$\frac{X_{..}^h}{X_{..}}$	$\frac{X_{..}^h}{X_{..}} S_K^h \cdot R_G^h$
Consumption	112	0.006	0.866	0.005	0.000	0.000	0.008	0.763	0.006	0.000	0.000
	122	0.127	0.917	0.117	0.004	0.001	0.124	0.926	0.115	0.004	0.000
	522	0.055	0.765	0.042	0.003	0.000	0.010	0.997	0.010	0.004	0.000
	61	0.556	0.989	0.551	0.034	0.019	0.553	*1.002*	0.555	0.034	0.019
	62	0.375	*1.106*	0.414	0.040	0.017	0.570	*1.196*	0.682	0.049	0.034
	63	0.180	0.905	0.163	0.062	0.010	0.271	0.986	0.267	0.064	0.017
Intermediate	111	0.097	*1.284*	0.125	0.001	0.000	0.040	*1.430*	0.057	0.001	0.000
	121	0.084	0.598	0.050	0.002	0.000	0.180	0.593	0.106	0.002	0.000
	21	0.109	0.876	0.096	0.031	0.003	0.142	0.929	0.132	0.024	0.003
	22	0.821	*1.062*	0.872	0.291	0.253	0.971	*1.077*	*1.046*	0.278	0.290
	31	0.000	0.695	0.000	0.050	0.000	0.000	0.627	0.000	0.032	0.000
	322	0.075	*1.668*	0.126	0.009	0.001	0.076	0.615	0.047	0.008	0.000
	42	*1.419*	*1.042*	*1.479*	0.087	0.128	*1.676*	*1.039*	*1.741*	0.083	0.145
	53	*1.382*	*1.243*	*1.718*	0.079	0.136	*1.531*	*1.152*	*1.763*	0.089	0.156
Capital	41	*1.676*	0.904	*1.515*	0.127	0.192	*1.022*	0.932	0.952	0.138	0.132
	521	*1.759*	*1.148*	*2.018*	0.028	0.056	0.595	0.727	0.433	0.032	0.014
Not Classified	321	*1.908*	0.694	*1.325*	0.048	0.063	*1.886*	0.765	*1.442*	0.032	0.046
	51	*1.901*	0.850	*1.616*	0.066	0.106	*2.078*	*1.025*	*2.129*	0.079	0.168
	7	0.041	*1.217*	0.050	0.039	0.002	0.020	0.888	0.018	0.046	0.001
Summation($\sum$)		-	-	-	1	0.987	-	-	-	1	1.026
Standard Deviation		0.627	0.162	-	-	-	0.588	0.132	-	-	-
Covariance & Corr. Coefficient		$Cov(S_K, R_G) = -0.013$ $\rho_{S_K R_G} = -0.125$					$Cov(S_K, R_G) = 0.026$ $\rho_{S_K R_G} = 0.336$				

Accordingly, the correlation coefficient between South Korea's export specialization structure and Germany's import specialization structure (ρ_{KG}), which is the measure of the degree of match of the two patterns neutral from the degree of concentration or diversification, increased from -0.125 in 2012 to 0.336 in 2019, which implies that South Korea's export structure and Germany's import structure neutral from the degree of concentration or diversification of two structures switched from being **competitive** to **complementary** with each other during the period 2012-2019.

4.2.2 Determinants of South Korea's trade complementarity with the Netherlands

As shown in Table 4, in 2012 the Netherlands had a comparative disadvantage in the production of (a) **consumption goods**, such as *BEC 112, BEC 122,* and *BEC 61*, (b)

intermediate goods, such as *BEC 111, BEC 121, BEC 21, BEC 31,* and *BEC 322,* and (c) **not classified goods** such as *BEC 321*.

In 2019 the Netherlands has a comparative disadvantage in the production of (a) **consumption goods**, such as *BEC 112, BEC 122, BEC 522, BEC 61,* and *BEC 63*, (b) **intermediate goods**, such as *BEC 111, BEC 121, BEC 21, BEC 22, BEC 31, BEC 322, BEC 42,* and (c) **not classified goods** such as *BEC 321*.

Table 4: Analysis of South Korea's trade complementarity with the Netherlands in the manufacturing sector: 2012, 2019

Basic classes in SNA	BEC code	2012					2019				
		S_K^h	R_N^h	$S_K^h \cdot R_N^h$	$\frac{X_{..}^h}{X_{..}}$	$\frac{X_{..}^h}{X_{..}} S_K^h \cdot R_N^h$	S_K^h	R_N^h	$S_K^h \cdot R_N^h$	$\frac{X_{..}^h}{X_{..}}$	$\frac{X_{..}^h}{X_{..}} S_K^h \cdot R_N^h$
Consumption	112	0.006	2.644	0.017	0.000	0.000	0.008	2.226	0.017	0.000	0.000
	122	0.127	1.116	0.142	0.004	0.001	0.124	1.433	0.178	0.004	0.001
	522	0.055	0.884	0.048	0.003	0.000	0.010	1.213	0.012	0.004	0.000
	61	0.556	1.099	0.612	0.034	0.021	0.553	1.142	0.632	0.034	0.021
	62	0.375	0.940	0.352	0.040	0.014	0.570	0.963	0.549	0.049	0.027
	63	0.180	0.920	0.165	0.062	0.010	0.271	1.011	0.274	0.064	0.018
Intermediate	111	0.097	2.954	0.288	0.001	0.000	0.040	2.263	0.091	0.001	0.000
	121	0.084	2.550	0.214	0.002	0.000	0.180	2.770	0.497	0.002	0.001
	21	0.109	1.075	0.117	0.031	0.004	0.142	1.084	0.154	0.024	0.004
	22	0.821	0.985	0.809	0.291	0.235	0.971	1.044	1.014	0.278	0.282
	31	0.000	1.928	0.001	0.050	0.000	0.000	2.196	0.000	0.032	0.000
	322	0.075	1.523	0.115	0.009	0.001	0.076	1.315	0.100	0.008	0.001
	42	1.419	0.890	1.262	0.087	0.110	1.676	1.003	1.681	0.083	0.140
	53	1.382	0.456	0.630	0.079	0.050	1.531	0.546	0.836	0.089	0.074
Capital	41	1.676	0.820	1.374	0.127	0.174	1.022	0.997	1.018	0.138	0.141
	521	1.759	0.605	1.063	0.028	0.030	0.595	0.613	0.365	0.032	0.012
Not classified	321	1.908	2.614	4.988	0.048	0.239	1.886	2.055	3.876	0.032	0.125
	51	1.901	0.541	1.029	0.066	0.067	2.078	0.501	1.041	0.079	0.082
	7	0.041	0.737	0.030	0.039	0.001	0.020	0.842	0.017	0.046	0.001
Summation($\sum$)		-	-	-	1	0.957	-	-	-	1	0.928
Standard Deviation		0.627	0.478	-	-	-	0.588	0.588	-	-	-
Covariance & Corr. Coefficient		Cov(S_K, R_N) = -0.043 $\rho_{S_K R_N}$ = -0.144					Cov(S_K, R_N) = -0.072 $\rho_{S_K R_N}$ = -0.332				

Consequently, South Korea's promising and potentially exportable products to the Netherlands (the products which have a high value of $S_K^h \cdot R_N^h$ in Table 4) in 2012 turn out to be (a) intermediate goods such as *BEC 42*, (b) capital goods, such as *BEC 41* and *BEC 521*, and (c) not classified goods such as *BEC 321* and *BEC 51*.

In 2019, South Korea's promising and potentially exportable products to the Netherlands changed to (a) intermediate goods, such as *BEC 22* and *BEC 42*, (b) capital goods such as BEC 41, and (c) not classified goods, such as *BEC 321* and *BEC 51*.

As shown in Table 4, the standard deviation of R_N^h increased from 0.478 in 2012 to 0.588 in 2019, which means that the Netherlands' (or Dutch) import specialization has become more concentrated over time during the period of 2012-2019.

Since South Korea's pattern of export specialization and the Dutch pattern of import specialization were negatively correlated in 2012 ($\text{Cov}(S_K, R_N)$ = -0.043), C_{KN} (South Korea's trade complementarity with the Netherlands) reached 0.957, which means that South Korea's export structure and the Dutch import structure were competitive with each other in 2012. As this negative correlation coefficient between South Korea's pattern of export specialization and the Dutch pattern of import specialization increased in 2019 ($\text{Cov}(S_K, R_N)$ = -0.072), C_{KN} reached 0.928, which means that South Korea's export structure and the Dutch import structure became more competitive with each other in 2019.

Accordingly, the correlation coefficient between South Korea's export specialization structure and the Dutch import specialization structure (i.e., $\rho_{S_K R_N}$), which is the measure of the degree of match of the two patterns neutral from the degree of concentration or diversification decreased from -0.144 in 2012 to -0.332 in 2019, which implies that South Korea's export structure and the Dutch import structure neutral from the degree of concentration or diversification of two structures became **more competitive** with each other during the period of 2012-2019.

4.2.3 Determinants of South Korea's trade complementarity with Italy

As shown in Table 5, in 2012 Italy has comparative disadvantage in the production of (a) **consumption goods**, such as *BEC 112, BEC 122, BEC 522, BEC 62* and *BEC 63*, (b) **intermediate goods**, such as *BEC 121, BEC 21, BEC 22,* and *BEC 322,* and (c) **not classified goods,** such as *BEC 51 and BEC 7.*

In 2019 Italy has comparative disadvantage in the production of (a) **consumption goods**, such as *BEC 112, BEC 122, BEC 522, BEC 62,* and *BEC 63*, (b) **intermediate goods**, such as *BEC 121, BEC 21, BEC 22, BEC 322,* and (c) **not classified goods** such as *BEC 51.*

Consequently, South Korea's promising and potentially exportable products to Italy (the products which have a high value of $S_K^h \cdot R_I^h$ in Table 5) in 2012 turn out to be (a) **intermediate goods,** such as *BEC 22* and *BEC 42*, (b) **capital goods**, such as *BEC 41* and *BEC 521,* and (c) **not classified goods** such as *BEC 51.*

In 2019, South Korea's promising and potentially exportable products to Italy changed to (a) **intermediate goods**, such as *BEC 22* and *BEC 42,* and (b) **not classified goods** such as *BEC 51.*

As shown in Table 5, the standard deviation of R_I^h decreases from 0.321 in 2012 to 0.240 in 2019, which means that Italy's import specialization becomes **more diversified** over time during the period 2012-2019. Since South Korea's pattern of export specialization and Italy's pattern of import specialization were negatively correlated in 2012 ($\text{Cov}(S_K, R_I)$ = -0.090), C_{KI} (South Korea's trade complementarity with Italy) reached 0.910, which means that South Korea's export structure and Italy's import structure were **competitive** with each other in 2012. As this negative correlation coefficient between South Korea's pattern of export specialization and Italy's pattern of import specialization increased in 2019 ($\text{Cov}(S_K, R_I)$ = -0.038), C_{KI} reached 0.962, which means that South Korea's export structure and Italy's import structure became **less competitive** with each other in 2019.

Table 5: Analysis of South Korea's trade complementarity with Italy in the manufacturing sector: 2012, 2019

Basic classes in SNA	BEC code	2012					2019				
		S_K^h	R_I^h	$S_K^h \cdot R_I^h$	$\frac{X_{..}^h}{X_{..}}$	$\frac{X_{..}^h}{X_{..}} S_K^h \cdot R_I^h$	S_K^h	R_I^h	$S_K^h \cdot R_I^h$	$\frac{X_{..}^h}{X_{..}}$	$\frac{X_{..}^h}{X_{..}} S_K^h \cdot R_I^h$
Consumption	112	0.006	2.518	0.016	0.000	0.000	0.008	1.924	0.014	0.000	0.000
	122	0.127	2.114	0.269	0.004	0.001	0.124	1.656	0.206	0.004	0.001
	522	0.055	1.155	0.063	0.003	0.000	0.010	1.248	0.012	0.004	0.000
	61	0.556	0.984	0.547	0.034	0.018	0.553	0.970	0.537	0.034	0.018
	62	0.375	1.178	0.441	0.040	0.018	0.570	1.210	0.690	0.049	0.034
	63	0.180	1.350	0.243	0.062	0.015	0.271	1.342	0.364	0.064	0.023
Intermediate	111	0.097	0.819	0.080	0.001	0.000	0.040	0.786	0.031	0.001	0.000
	121	0.084	2.052	0.172	0.002	0.000	0.180	1.641	0.295	0.002	0.000
	21	0.109	1.157	0.126	0.031	0.004	0.142	1.276	0.181	0.024	0.004
	22	0.821	1.252	1.027	0.291	0.298	0.971	1.171	1.138	0.278	0.316
	31	0.000	0.419	0.000	0.050	0.000	0.000	0.594	0.000	0.032	0.000
	322	0.075	1.602	0.121	0.009	0.001	0.076	1.276	0.097	0.008	0.001
	42	1.419	0.940	1.333	0.087	0.116	1.676	0.839	1.406	0.083	0.117
	53	1.382	0.605	0.837	0.079	0.066	1.531	0.650	0.996	0.089	0.088
Capital	41	1.676	0.822	1.377	0.127	0.174	1.022	0.854	0.873	0.138	0.121
	521	1.759	0.692	1.218	0.028	0.034	0.595	0.726	0.432	0.032	0.014
Not Classified	321	1.908	0.264	0.505	0.048	0.024	1.886	0.510	0.961	0.032	0.031
	51	1.901	1.099	2.089	0.066	0.137	2.078	1.174	2.440	0.079	0.192
	7	0.041	1.153	0.047	0.039	0.002	0.020	0.908	0.018	0.046	0.001
Summation($\sum$)		-	-	-	1	0.910	-	-	-	1	0.962
Standard Deviation		0.627	0.321	-	-	-	0.588	0.240	-	-	-
Covariance & Corr. Coefficient		$\text{Cov}(S_K, R_I)$ = -0.090 $\rho_{S_K R_I}$ = -0.447					$\text{Cov}(S_K, R_I)$ = -0.038 $\rho_{S_K R_I}$ = -0.269				

Accordingly, the correlation coefficient between South Korea's export specialization structure and Italy's import specialization structure ($\rho_{S_K R_I}$), which is the measure of the degree of match of the two patterns neutral from the degree of concentration or diversification increased from -0.447 in 2012 to -0.269 in 2019, which implies that South

Korea's export structure and Italy's import structure neutral from the degree of concentration or diversification of two structures became **less competitive** with each other during the period 2012-2019.

4.2.4 Determinants of South Korea's trade complementarity with France

As shown in Table 6, in 2012 France has comparative disadvantage in the production of (a) consumption goods, such as *BEC 122*, *BEC 522*, *BEC 61*, *BEC 62*, and *BEC 63*, (b) intermediate goods, such as *BEC 111*, *BEC 121* and *BEC 22*, (c) capital goods, such as *BEC 521*, and (d) not classified goods, such as *BEC 7*.

In 2019 France has a comparative disadvantage in the production of (a) consumption goods, such as *BEC 122*, *BEC 522*, *BEC 61*, and *BEC 62*, (b) intermediate goods, such as *BEC 111*, *BEC 121*, *BEC 22*, and *BEC 53*, (c) capital goods such as *BEC 521*, and (d) not classified goods such as *BEC 7*.

Consequently, South Korea's promising and potentially exportable products to France (the products which have a high value of $S_K^h \cdot R_F^h$ in Table 6) in 2012 turn out to be (a) intermediate goods, such as *BEC 42* and *BEC 53*, (b) capital goods, such as *BEC 41* and *BEC 521*, and (c) not classified goods, such as *BEC 321* and *BEC 51*.

In 2019, South Korea's promising and potentially exportable products to France changed to (a) **intermediate goods**, such as *BEC 42* and *BEC 53,* and (b) **not classified goods,** such as *BEC 321* and *BEC 51*.

As shown in Table 6, the standard deviation of R_F^h decreases from 0.232 in 2012 to 0.179 in 2019, which means that France's import specialization becomes more diversified over time during the period 2012-2019.

Since South Korea's pattern of export specialization and France's pattern of import specialization were negatively correlated in 2012 ($\text{Cov}(S_K, R_F)$ = -0.004), C_{KF} (South Korea's trade complementarity with France) reached 0.996, which means that South Korea's export structure and Italy's import structure were competitive with each other in 2012. As this negative correlation coefficient between South Korea's pattern of export specialization and France's pattern of import specialization decreased in 2019 ($\text{Cov}(S_K, R_F)$ = -0.025), C_{KF} reached 0.975, which means that South Korea's export structure and Italy's import structure became more competitive with each other in 2019.

Table 6: Analysis of South Korea's trade complementarity with France in the manufacturing sector: 2012, 2019

Basic classes in SNA	BEC code	2012					2019				
		S_K^h	R_F^h	$S_K^h \cdot R_F^h$	$\frac{X^h}{X_{..}}$	$\frac{X^h}{X_{..}} S_K^h \cdot R_F^h$	S_K^h	R_F^h	$S_K^h \cdot R_F^h$	$\frac{X^h}{X_{..}}$	$\frac{X^h}{X_{..}} S_K^h \cdot R_F^h$
Consumption	112	0.006	0.842	0.005	0.000	0.000	0.008	0.770	0.006	0.000	0.000
	122	0.127	1.316	0.168	0.004	0.001	0.124	1.462	0.182	0.004	0.001
	522	0.055	1.463	0.080	0.003	0.000	0.010	1.599	0.016	0.004	0.000
	61	0.556	1.221	0.680	0.034	0.023	0.553	1.346	0.745	0.034	0.025
	62	0.375	1.422	0.533	0.040	0.021	0.570	1.370	0.782	0.049	0.038
	63	0.180	1.129	0.203	0.062	0.013	0.271	0.994	0.270	0.064	0.017
Intermediate	111	0.097	1.180	0.115	0.001	0.000	0.040	1.562	0.063	0.001	0.000
	121	0.084	1.022	0.086	0.002	0.000	0.180	1.079	0.194	0.002	0.000
	21	0.109	0.466	0.051	0.031	0.002	0.142	0.550	0.078	0.024	0.002
	22	0.821	1.018	0.835	0.291	0.243	0.971	1.021	0.992	0.278	0.276
	31	0.000	0.677	0.000	0.050	0.000	0.000	0.642	0.000	0.032	0.000
	322	0.075	0.679	0.051	0.009	0.000	0.076	0.771	0.059	0.008	0.000
	42	1.419	0.806	1.144	0.087	0.099	1.676	0.819	1.373	0.083	0.114
	53	1.382	0.976	1.349	0.079	0.107	1.531	1.062	1.626	0.089	0.144
Capital	41	1.676	0.905	1.516	0.127	0.192	1.022	0.923	0.943	0.138	0.131
	521	1.759	1.865	3.279	0.028	0.091	0.595	1.190	0.708	0.032	0.023
Not Classified	321	1.908	0.893	1.705	0.048	0.082	1.886	0.753	1.420	0.032	0.046
	51	1.901	0.962	1.829	0.066	0.120	2.078	0.952	1.979	0.079	0.156
	7	0.041	1.227	0.050	0.039	0.002	0.020	1.211	0.024	0.046	0.001
Summation(∑)		-	-	-	1	0.996	-	-	-	1	0.975
Standard Deviation		0.627	0.232	-	-	-	0.588	0.179	-	-	-
Covariance & Corr. Coefficient		Cov(S_K, R_F) = -0.004 $\rho_{S_K R_F}$ = -0.027					Cov(S_K, R_F) = -0.025 $\rho_{S_K R_F}$ = -0.242				

Accordingly, the correlation coefficient between South Korea's export specialization structure and Italy's import specialization structure (ρ_{S_K, R_F}), which is the measure of the degree of match of the two patterns neutral from the degree of concentration or diversification decreased from -0.027 in 2012 to -0.242 in 2019, which implies that South Korea's export structure and France's import structure neutral from the degree of concentration or diversification of two structures became more competitive with each other during the period 2012-2019.

5. Concluding Remarks

From the above analysis on South Korea's trade intensity with GNIF, the following policy recommendation can be suggested.

Firstly, South Korea's trade intensity with Germany increased during the period 2012-2019. This is due to (a) the fact that South Korea's special country bias with Germany increased thanks to the EU-South Korea FTA (Free Trade Agreement) which was formally ratified in December 2015 and (b) the fact that South Korea's trade complementarity with

Germany increased during the period 2012-2019. Therefore, both South Korea and Germany should do their utmost in enhancing South Korea's special country bias with Germany by (a) increasing capital movements and economic cooperation and (b) lifting discriminatory tariffs and other import restrictions between the two countries.

Secondly, South Korea's trade intensity with the Netherlands decreased for the period 2012-2019. This is due to (a) the fact that South Korea's special country bias with the Netherlands decreased for the period 2012-2019 along with (b) the fact that South Korea's trade complementarity with the Netherlands decreased during the same period. Therefore, both South Korea and the Netherlands should do their utmost in enhancing South Korea's special country bias with the Netherlands by (a) increasing capital movements and economic cooperation and (b) lifting discriminatory tariffs and other import restrictions between the two countries.

Thirdly, South Korea's trade intensity with Italy increased during the period 2012-2019. This is due to (a) South Korea's increasing trade complementarity with Italy despite of (b) the fact that South Korea's special country bias with Italy decreased for the period due to bigger economic distances, and mutually more unfavorable trade agreements between the two countries. Therefore, both South Korea and Italy should do their utmost in enhancing South Korea's special country bias with Italy by (a) increasing capital movements and economic cooperation and (b) lifting discriminatory tariffs and other import restrictions between the two countries.

Fourthly, South Korea's trade intensity with France increased during the period 2012-2019. This is due to (a) South Korea's increasing special country bias with France due to smaller economic distances, and mutually more favorable trade agreements between the two countries despite of (b) the fact that South Korea's trade complementarity with France decreased for the period. Therefore, both South Korea and France should do their utmost in enhancing South Korea's special country bias with France by (a) increasing capital movements and economic cooperation and (b) lifting discriminatory tariffs and other import restrictions between the two countries.

Fifthly, South Korea's trade intensity with Italy in 2019 is higher than her trade intensity with Germany and France (GF). This is due to the fact that South Korea's special country bias with Italy is much higher than her equivalent value with GF, even if South Korea's trade complementarity with Italy is lower than her equivalent value with GF. This

means that lower transport costs, discriminatory tariffs and other import restrictions, higher capital movements and economic cooperation which are prevalent in the economic relations between South Korea and Italy do increase South Korea's special country bias with Italy and accordingly raise her trade intensity with this country, even if South Korea's trade complementarity with Italy is lower than her equivalent value with GF. Therefore, both South Korea and Italy should do their utmost in enhancing South Korea's special country bias with Italy by (a) increasing capital movements and economic cooperation and (b) lifting discriminatory tariffs and other import restrictions between the two countries.

Sixthly, South Korea's promising and potentially exportable products to Germany in 2019 changed to (a) **intermediate goods**, such as *BEC 22, BEC 42* and *BEC 53* and (b) **not classified goods** such as *BEC 321* and *BEC 51*. Therefore, South Korea should try to export more of these products to Germany from now on.

Seventhly, South Korea's promising and potentially exportable products to the Netherlands in 2019 changed to (a) **intermediate goods**, such as *BEC 22* and *BEC 42,* (b) **capital goods** such as *BEC 41,* and (c) **not classified goods**, such as *BEC 321 and BEC 51.* Therefore, South Korea should try to export more of these products to the Netherlands from now on.

Eighthly, South Korea's promising and potentially exportable products to Italy in 2019 changed to (a) **intermediate goods**, such as *BEC 22* and *BEC 42,* and (b) **not classified goods** such as *BEC 51.* Therefore, South Korea should try to export more of these products to Italy from now on.

Ninthly, South Korea's promising and potentially exportable products to France in 2019 changed to (a) **intermediate goods**, such as *BEC 42* and *BEC 53,* and (b) **not classified goods,** such as *BEC 321* and *BEC 51.* Therefore, South Korea should try to export more of these products to France from now on.

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