Intra-Industry Trade, Revealed Comparative Advantage, and Trade Specialization: the Case of Korea-Japan Trade[1]

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Since the diplomatic normalization in 1965, Korea and Japan have maintained an intensive relationship in the field of trade, direct foreign investment, and technology transfer. However, there has been increasing friction between the two economies due mainly to Korea's huge and chronic trade deficits with Japan. In this regard, the purpose of this study is to test a widely-cited hypothesis that Korea's chronic trade deficits with Japan are attributable to Korea's industrial structure which is characterized by its excessive dependence on Japan for heavy and chemical industry goods.

In carrying out this enterprise, we made use of an array of well-known indices, *i. e.* indices of intra-industry trade, revealed comparative advantage, and trade specialization index.

The computed results of the Grubel-Lloyd indices of intra-industry trade between Korea and Japan supported the proposition that Korea's chronic trade deficits with Japan are attributable to its unfavourable bilateral trade in heavy and chemical industry sectors. In order to test whether Korean heavy and chemical industries really have a comparative *disadvantage* in trade with Japan, Korea's indices of revealed comparative advantage (*RCA*) were computed. A distinguishing feature from the computation was that Korean heavy and chemical industrial sectors, especially general machinery, showed comparative disadvantage.

We reinforced the above findings by utilizing trade specialization index of Grubel-Lloyd for each category of products (non-durable consumer goods, durable consumer goods, capital goods, labor-intensive intermediate goods, and capital intensive intermediate goods). The statistical results strongly supported the proposition that Korean economy has maintained a pattern of trade which is characterized by import specialization in capital goods from Japan and export specialization in consumer goods to the world market.

1. INTRODUCTION: SIGNIFICANCE AND OBJECTIVE OF THE STUDY

Since the diplomatic normalisation in 1965, Korea and Japan has maintained an intensive economic relationship. Not only have Korea and Japan been engaged in consistently increasing bilateral trade, but Japan has also been Koreas vital source of foreign loans and investment as well as technology transfer. More specifically, Koreas trade with Japan jumped tremendously from a mere 211 million (US) dollars in 1965 to 47215 million dollars in 1996, showing an increase of 224 times. However, although Korea and Japan have become more and more interdependent, and economic cooperation in trade, capital movement, and technology transfer has steadily strengthened, there has been increasing friction between the two economies due mainly to Koreas huge and chronic trade deficits with Japan. Deficits accumulated during the period 1965-1996 amounted to 125538 million dollars, which exceeds twice the Koreas deficits in overall trade balance with the world during the same period. When the trade balance between the two countries is observed from a perspective of trade structure, the outstanding feature is that the Korean economy has consistently registered trade surpluses in foodstuffs and light manufacturing products while recording huge trade deficits in heavy and chemical industry products. Due to this structural feature, Koreas trade deficits with Japan in the heavy and chemical industrial sectors has become a significant issue.[2]

In view of the significance of the problem of Koreas chronic trade deficits with Japan, it is important to offer a comprehensive investigation of the overall causes of trade imbalance between the two countries. However, investigation of overall factors requires examination of all the explanatory variables related to the bilateral trade, which is really a hard task. Thus, I am going to concentrate on one substantial explanatory variable of the overall determinants of the bilateral trade imbalance, namely the validity of the widely-cited

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(2) The shares of heavy and chemical industry products in Koreas total trade deficits with Japan are 154.8%, 137.8%, 154.1%, 174.6% and 122.5% in 1975, 1980, 1985, 1990, and 1995 respectively, the implication of which is that Koreas trade deficits with Japan are attributable solely to the bilateral trade in heavy and chemical industry products. The above data are computed by the author from Japan External Trade Organization(JETRO)(1976, 1981, 1986, 1992), Ministry of International Trade and Industry(MITI)(1996).

hypothesis that Koreas chronic trade deficits with Japan are attributable to Koreas industrial structure which is characterised by its excessive dependence on Japan for heavy and chemical industry goods.

2. TRADE IMBALANCE AND INDUSTRIAL INTERDEPENDENCE BETWEEN KOREA AND JAPAN: AN ANALYSIS USING INTRAINDUSTRY TRADE, REVEALED COMPARATIVE ADVANTAGE, AND TRADE SPECIALISATION INDEX

2.1. Introduction

The central focus of this study is to test the validity of the hypothesis that Korea's chronic trade deficits with Japan is attributable to the dependent industrial structure of the former on the latter. In carrying out this enterprise, we made use of an array of well-known indices to establish the proposition that the Korean economy is characterised by Koreas import specialisation in capital goods from Japan and export specialisation in consumer goods to the rest of the world. This is attempted to find out a fundamental factor of the bilateral trade imbalance from the perspective of Koreas trade management pattern.

We begin by estimating Grubel-Lloyd indices of intra-industry trade. The purpose is to establish whether Korea has maintained a low degree of specialisation in heavy and chemical industries. This is followed by estimates of indices of Korea's revealed comparative advantage in order to ascertain whether Korea has a comparative 'disadvantage' vis-a-vis Japan in heavy and chemical industries. This approach is based on the presumed causal connection that Korean heavy and chemical industries will have comparative disadvantage if the Grubel-Lloyd indices of intra-industry trade show Japan's favour. Finally, through the application of the trade specialisation index, we will test the hypothesis that the Korean economy has maintained a production and trade pattern which is characterised by import specialisation in capital and intermediate goods from Japan and export specialisation in consumer goods to the world market.

2.2. Intra-Industry Trade

There are several methods for measuring the intra-industry trade index.[3] Among them,

the most commonly used standard one is the Grubel-Lloyd method. The Grubel-Lloyd
index of intra-industry trade[Grubel and Lloyd(1975)] is defined as

$$(2.1) \qquad B_i = (1 - \frac{|X_i - M_i|}{X_i + M_i}) \cdot 100$$

where B_i is the intra-industry trade index in the i industry, and X_i and M_i are exports and
imports of a product category i respectively.

As can be noted from the equation (2.1), the value of B_i falls between '0' and '100'.
If the value of exports of an industry is exactly matched by the imports of the same
industry($X_i = M_i$), then that industry will reveal perfect intra-industry trade, i.e. the value
of B_i equals 100. On the other hand, if one of the values of exports or imports of a
product category i equals zero($X_i = 0$ or $M_i = 0$), then there will be the situation where
intra-industry trade does not exist, and the value of B_i becomes '0'. Normally, however,
the value of B_i will lie within the range between '0' and '100'.

⟨Table 1⟩ shows the computed results of the Grubel-Lloyd indices of intra-industry
trade for Korea-Japan. From ⟨Table 1⟩, it is found that bilateral trade between Korea and
Japan is characterised by low level of intra-industry specialisation in heavy and chemical
industrial sectors with relatively active intra-industry trade in light manufacturing sectors.
In particular, it is significant that Korea-Japan trade has negligible intra-industry trade in
the general machinery sector which is the backbone of capital goods industries.

One of the demerits of the Grubel-Lloyd index of intra-industry trade is that it is
impossible to judge directly from the value of B_i whether the extent of relative imbalance
in intra-industry trade operates in a favourable manner or not from the perspective of a
particular country. In this context, a slightly modified intra-industry trade index of
Grubel-Lloyd may be proposed as equation (2.2).

$$(2.2) \qquad B_i = (1.0 - \frac{X_i - M_i}{X_i + M_i}) \cdot 100$$

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(3) Grubel-Lloyd index of intra-industry is the most common method of measuring intra-industry
    trade. For more information in terms of intra-industry trade index, see Havrylynshyn and
    Civan(1983), Lee(1987), Balassa(1986), Caves(1981), Falvey(1981), Greenway and Milner
    (1986), Gunasekera(1987), Lancaster(1987), and Yoko(1986).

⟨Table 1⟩ Intra-Industry Trade Indices of Korea-Japan (I)

	1975	1985	1992	1996
Foodstuffs	2	3	12	18
Raw Materials and Fuels	85	48	83	64
petroleum products	97	29	75	46
Light Industry Products	86	80	59	64
textiles	73	57	45	52
non-metallic mineral products	68	91	89	45
miscellaneous	82	85	73	60
Heavy and Chemical Industry Products	24	33	46	48
chemicals	13	34	38	40
iron and steel	9	68	92	77
general machinery	7	6	15	21
electrical machinery	64	39	52	66
precision instrument	55	51	42	34
Total	74	73	79	70

Note: Intra-industry trade indices were computed by the author from the raw data: Japan External Trade Organization(JETRO)(1976, 1986, 1993), Ministry of International Trade and Industry(MITI)(1996).

Where B_i is the modified index of the intra-industry trade in i industry, X_i and M_i stand for Korea's exports of product i to Japan, and Korea's imports of product i from Japan respectively.

The advantage of this modified index is that the value of B_i can cover a wider range than the original Grubel-Lloyd index. That is, if exports and imports are equal, the intra-industry division of labor is perfect, and $B_i = 100$; if Korea only exports i goods and does not import at all, the intra-industry trade is non-existent, and $B_i = 0$; and if Korea only imports i goods and does not export it, then the value of B_i becomes '200'. Thus, the value of B_i falls between '0' and '200', in which range one can judge directly from B_i whether each industrial sector provides a favourable contribution to Korea's trade account balance or not. In other words, the use of this modified index of intra-industry trade makes it easier to examine the hypothesis that Korea-Japan trade is characterised by, not an intra-industry, an inter-industry trade in heavy and chemical industries in the form of vertical division of labor.

By using the same data as the ⟨Table 1⟩, modified intra-industry trade indices were computed based on the equation (2.2) and the results are shown in the ⟨Table 2⟩.

⟨Table 2⟩ Intra-Industry Trade Indices of Korea-Japan (II)

	1975	1985	1992	1996
Foodstuffs	2	3	12	18
Raw Materials and Fuels	85	48	83	64
petroleum products	103	29	75	46
Light Industry Products	86	80	59	64
textiles	73	57	45	52
non-metallic mineral products	132	109	111	155
miscellaneous	118	115	127	60
Heavy and Chemical Industry Products	176	167	154	152
chemicals	187	166	162	160
iron and steel	191	132	92	123
general machinery	193	194	185	179
electrical machinery	136	161	148	134
precision instrument	145	149	158	166
Total	126	127	121	130

Note: Intra-industry trade indices were computed by the author from the raw data: Japan External
　　　Trade Organization(JETRO)(1976, 1986, 1993), Ministry of International Trade and
　　　Industry(MITI)(1997).

According to the ⟨Table 2⟩, the intra-industry trade indices with respect to light industry

goods and primary industry products show that exports and imports of these product

categories have been maintained in favour of Korea($0 < B_i < 100$). However, the

intra-industry trade indices of heavy industry goods indicate that Korea's exports to Japan

represent a negligible proportion of the imports from Japan. Though the ratio of exports

to imports has risen somewhat, the general picture of the trade in heavy and chemical

industry products is still predominantly in Japan's favour in view of the size of

intra-industry trade indices, i.e. ($100 < B_i < 200$). Thus, this analysis suggests a vital

issue that the Korean economy has to attain a horizontal international division of labor or

cooperative intra-industry trade between the two countries in heavy and chemical industrial

sectors.

2.3. Revealed Comparative Advantage

As was investigated in the previous section, Korea's chronic trade deficits with Japan

were reflected in the intra-industry trade indices especially in heavy and chemical industry

products. If these indices are interpreted from the perspective of comparative advantage

theory, it is reasonable to hypothesise that Korea's heavy and chemical industries have comparative 'disadvantage' in international trade with Japan. We will reinforce this conclusion by applying the 'revealed comparative advantage' method.

The concept of comparative advantage in international trade is elaborated by the Heckscher-Ohlin theorem,[4] which is an extension of Ricardo's comparative advantage theory, and states that countries have comparative advantage in the production of commodities that use intensively the factors of production which are relatively abundant. However, for the measurement of a countrys comparative advantage based on the Heckscher-Ohlin theorem, one must examine the production cost of individual commodities by different countries simultaneously, which involves a time-consuming data-intensive technique. Thus, as another approach to the detection of the comparative advantage entails an index of revealed comparative advantage.

According to Balassa[Balassa(1965, pp. 99-123; 1979, pp. 259-266; 1983, pp. 149-167)], revealed comparative advantage(RCA) is measured by the relative trade performance of individual countries in manufacturing products. The relative trade performance is stressed on the rationale that it reflects the competitiveness of exporting countries as well as the changes in the demands of the importing countries. In addition, as a comprehensive approach, the trade pattern of industrial products reflects not only the relative costs but also the differences in non-price factors. In other words, the advantage of this approach is that it is a simplified analysis which takes account of a diverse range of factors, and provides us with important information about relative trade performance.[5]

Balassa prefers to use the export performance index to evaluate comparative advantage,

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(4) The Heckscher-Ohlin theorem was first advanced by Heckscher, E. in 1919 and systematically elaborated by Ohlin, B. in 1933. The original version of the theorem was based on an attempt to explain the effect of the relative factor endowments on the determination of trade flows between countries. In this context, this theorem is often called the factor endowment theory of comparative advantage: see Heckscher(1919, Chapter 13), Ohlin(1933). For a more advanced version, see Lancaster(1957), Jones(1956/57).

(5) Ramasamy and Viana(1994, p. 179). It should also be noted that there are also qualifications for using the indices of revealed comparative advantage (RCA) . Firstly, the degree of product aggregation may effect the numerical values of the RCA indices. Secondly, the importing country may apply discriminatory trade policies to different exporters.

rather than the import data which may be distorted by government subsidies, tariffs and other protection measures. The export performance ratio(EP_{ij}) is measured as a ratio of the share of country i's export of commodity j in the total world exports of commodity j, to the share of country i's total exports of manufactured goods to the worlds total exports of manufactures, which is simply written as follows:

$$(2.3) \qquad EP_{ij} = \frac{X_{ij} \ / \ X_{wj}}{X_{im} \ / \ X_{wm}}$$

where X_{ij} is country i's exports of product j; X_{wj} is the world's exports of product j; X_{im} is country i's total exports of manufactured products; X_{wm} is the world's total exports of manufactured products.

From the above equation (2.3), it follows that the value of EP_{ij} can range from '0' to infinity. A country is said to have a comparative 'advantage' if EP_{ij} is greater than 1 (unity). On the other hand, if EP_{ij} is less than unity, country i has a comparative 'disadvantage' in the product j.

In practice, however, for the measurement of Korea's revealed comparative advantage in terms of the bilateral trade of manufactured goods between Korea and Japan, the index of Korea's revealed comparative advantage in each product category (RCA_{kj}) is formulated in a modified way, which is shown in equation (2.4).[6]

$$(2.4) \qquad RCA_{kj} = \frac{M_{kj} \ / \ M_{wj}}{M_{km} \ / \ M_{wm}}$$

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[6] This is, in essence, the same methodology as Chow and Kellman adopted in their estimations of the comparative advantage of the Newly Industrializing Countries in OECD countries. Chow and Kellman estimated the comparative advantage of the Asian Newly Industrializing Countries (Hong Kong, Korea, Taiwan, and Singapore) in OECD countries to describe their relative trade performances and competitive abilities as follows:

$$RCA_{ij} = \frac{X_{ij} \ / \ C_j}{X_i \ / \ W}$$

where X_{ij} = OECD imports of the jth product from the ith country
C_j = total OECD imports of jth product
X_i = total OECD imports of manufactured products from the ith country
W = total OECD imports of manufactured products.

For detailed information, see Chow and Kellman(1993, pp. 13-23).

where M_{kj} is Japan's imports of manufactured product j from Korea; M_{wj} is Japan's total imports of manufactured product j from the world; M_{km} is Japan's imports of total manufactured products from Korea; M_{wm} is Japan's imports of total manufactured products from the world.

As is seen from the formula (2.4), import data of Japan are used for the estimation of the indices of Korea's revealed comparative advantage.[7] The numerator in the equation (2.4) is the Korean share of the Japan's total imports in 'jth' product while the denominator shows the share of Korea out of the Japan's total imports of manufactured goods. When the index of Korea's revealed comparative advantage is greater than unity in a specific industrial sector, it is said that Korea revealed its comparative advantage in that manufacturing sector in terms of its bilateral trade with Japan. Such an index suggests that the exports of Korea are more highly concentrated in the Japanese market for that product owing to its overall efficiency including price and non-price factors. On the other hand, a Korean manufacturing sector is said to have revealed comparative disadvantage (*RCD*) in that industry when the index of Korea's revealed comparative advantage is less than unity.

⟨Table 3⟩ shows the indices of Korea's revealed comparative advantage in the Japanese market for selected years from 1975 to 1996, which are results computed on the basis of the equation (2.4). As expected, the Korean economy shows its comparative advantage in the light manufacturing sectors such as textile products, leather products, footwear, and miscellaneous goods, whose indices of revealed comparative advantage are greater than unity. However, a distinguishing feature is that Korean heavy and chemical industrial sectors show comparative disadvantage in terms of the bilateral trade with Japan, whose indices of revealed comparative advantage were 0.4327, 0.6365, 0.7708, and 0.7865 in 1975, 1985, 1992 and 1996 respectively. Admittedly, *RCA* is rising but by no means sufficiently to overcome the comparative disadvantage in the industries under review.

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(7) The reasons for using Japanese import data come from the fact that Japanese import data of manufactured goods are, to a considerable extent, free from the market distortions. The basic statistical data for the analyses are obtained from the three publications: Japan External Trade Organization(1976, 1986, 1993), and Ministry of International Trade and Industry(1997).

〈Table 3〉 Indices of Korea's Revealed Comparative Advantage in Japan

product group	1975	1985	9192	1996
Heavy and chemical industrial products	0.4327	0.6365	0.7708	0.7865
chemicals	0.2138	0.3549	0.4226	0.6744
general machinery	0.1006	0.1695	0.3269	0.5188
precision instrument	0.4693	0.9012	0.5397	0.5552
Light industrial products	2.2929	1.9685	1.4313	1.4833
textile products	4.6584	3.4192	2.2120	1.2843
leather, leather products and furs	1.1593	0.7202	1.3425	7.4237
footwear	-	4.4306	3.1897	1.7587
miscellaneous goods	1.2267	1.3925	1.3055	1.0717

Notes: 1) Miscellaneous goods include such products as furniture, traveling goods, handbags, records and tapes, albums, musical instruments, books and magazines, stationery, toys, sporting goods, etc.
     2) " - " indicates non-available figure.

Among the heavy and chemical industrial sectors, it is worth noting that the indices of Korea's revealed comparative advantage in the general machinery sector, the most important single sector contributing to Korea's chronic trade deficits with Japan,[8] show a significant level of comparative 'disadvantage' right through the years under investigation, i.e. 0.1006, 0.1695, 0.3269, and 0.5188 in the years 1975, 1985, 1992, and 1996 respectively.

In sum, the results obtained through the revealed comparative advantage approach support the hypothesis that Korea's chronic trade deficits with Japan are attributable to significant Korea's comparative 'disadvantage' in heavy and chemical industrial sectors.

2.4. Trade Specialisation Index and Its Application to the Korean Economy

2.4.1 The context

In the previous sections, it was found that the intra-industry trade indices of heavy and chemical industries showed low level of intra-industry specialisation and exhibited comparative 'disadvantage' in terms of trade with Japan. Now, it is necessary to

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(8) The contribution rates of general machinery sector to Koreas total trade deficits with Japan are 42.2%, 42.9%, 57.2%, 78.1%, and 54.9% in 1975, 1980, 1985, 1990, and 1996 respectively.

investigate the nature of Korea's chronic trade deficits with Japan using the trade specialisation index. The purpose is to explore more fully the proposition that Korea has engaged in import specialisation in capital goods from Japan and export specialisation in consumer goods to the world market.[9]

2.4.2 Examination of Korea's trade pattern

The application of the trade specialisation index requires a prior classification of manufactured goods into four categories, i.e. non-durable consumer goods(I), durable consumer goods(II), capital goods(III), and intermediate goods(IV). The intermediate goods are again classified into two types, i.e. labour-intensive intermediate goods(IV-1) and capital-intensive intermediate goods(IV-2). This is based on the classification made by the Ministry of International Trade and Industry(MITI) of the Japanese government[(1986, pp. 405-406)]. utilising the Standard International Trade Classification(SITC). The commodity groups classified on this basis are presented in the ⟨Table 4⟩.

Korea's extent of trade specialisation for each category of products is computed through the trade specialisation index of Grubel and Lloyd(1975). According to Grubel and Lloyd, trade specialisation index is defined as

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(9) In terms of Korea's trade pattern, it is generally recognized in Korea that the Korean economy has maintained a pattern of processing trade since it has pursued an export-oriented growth strategy in the early 1960s and that this processing trade policy resulted in Korea's chronic trade deficits against Japan. For instance, at the Fifteenth Economic Ministers' Conference, President Kim, Young-Sam of Korea pointed out some problems in connection with Korea's processing trade pattern and emphasized the importance of developing capital goods industry for the substantial correction of Korea's chronic trade deficits with Japan(Dong-A Daily News, 12 May, 1995).

Processing trade is a pattern of trade management in which a national economy imports capital and intermediate goods for the production of manufactured products and exports finished goods to foreign countries. In terms of this pattern, Professor Kang, Seoul Municipal University, suggests conditions for the creation of processing trade as follows: (1) Availability of capital goods and high technology from the domestic economy is highly limited. (2) Imports of capital goods and technology of advanced countries have to be implemented through a systemised transmission mechanism. (3) Sufficient number of high quality labor force engaged in processing and assembling should be provided within the domestic economy. (4) Conditions for the exports of processed goods should be fulfilled in order to secure foreign exchange revenue for the imports of capital and intermediate goods[Kang(1989, pp. 161-162)].

⟨Table 4⟩ Classification of Trading Manufactured Goods by Use

commodity group		SITC No.
non-durable consumer goods(I) (18 items)		553,572,656,658,659,831,842,843,844,845,846,8 47,848,851,883,892,895,899
durable consumer goods(II) (21 items)		666,696,697,761,762,763,764,775,781,782,783,7 84,785,812,821,885,893,894,896,897,898
capital goods (III) (41 items)		695,711,712,713,714,716,721,722,723,724,725,7 26,727,728,736,737,741,742,743,744,745,749,75 1,752,759,771,772,773,774,776,778,786,791,792 ,793,871,872,873,874,881,884
intermediate goods(IV) (71 items)	labour-intensive(IV-1) (22 items)	611,612,613,633,634,635,651,652,653,654,655,6 57,662,663,664,665,667,691,692,693,694,699
	capital-intensive(IV-2) (49 items)	335,511,512,513,514,515,516,522,523,524,531,5 32,533,541,551,554,562,582,583,584,585,591,59 2,598,621,625,628,641,642,661,671,672,673,674 ,675,676,677,678,679,681,682,683,684,685,686, 687,688,689,882

Notes: 1) Initially, the Ministry of International Trade and Industry of Japan classified according
to the SITC Revision 1. This was reclassified by the author according to the SITC
Revision 2, utilising United Nations, Statistics Office of the Department of International
Economic and Social Affairs(1987, pp. 1172-1176).

2) For the headings of each SITC No., see Appendix.

(2.5)
$$E_{ij} = \frac{X_{ij} - M_{ij}}{X_{ij} + M_{ij}}$$

where E_{ij} stands for trade specialisation index, X_{ij} and M_{ij} are exports and imports of a
product category i against the jth country respectively.

Equation (2.5) shows that the value of E_{ij} falls between '1' and '-1'. If the value of
E_{ij} equals '+1' , then the Korean economy enjoys complete export specialisation in i
industry in terms of trade with jth country. On the other hand, if the value of E_{ij} equals
'-1', the situation is complete import specialisation. If the value of E_{ij} lies in the range
-1 < E_{ij} < 0, or 0 < E_{ij} < 1, then the economy is situated on import specialisation
or export specialisation in industry i respectively.

Utilising the exports and imports data, the trade specialisation indices by product

categories are computed on the basis of the equation (2.5). From the ⟨Table 5⟩ of the estimated results of Korea's overall trade specialisation indices by product categories, one can easily detect a conspicuous feature that the Korean economy has maintained import specialisation in capital goods and export specialisation in durable and non-durable consumer goods. A more outstanding characteristic is that Korea's exports of non-durable consumer goods (I) reveals nearly complete export specialisation while trade specialisation indices of capital goods (III) has shown consistent import specialisation. These statistical results strongly support the generally proposed hypothesis that the Korean economy, during the development path of export-oriented growth, has maintained a pattern of processing trade.

⟨Table 6⟩ clearly suggests a characteristic feature in terms of Koreas trade with Japan. It is very evident that the Korean economy shows a pattern of export specialisation in non-durable consumer goods such as textile, fabrics, footwear, clothing accessories, travel goods, bags, etc. On the other hand, Korea's specialisation indices of capital goods against Japan show an import specialization, intensifying Korea's dependence for capital goods on Japan in such areas as electrical machinery and apparatus, textile and leather machiery, electronic microcircuits, electric power machinery, agricultural machinery, engine and motors. Clearly, what emerges is a trade regime in which capital goods are imported to produce consumer goods. One could regard this as a pattern of development which is import dependent and factor-driven.

Moreover, the Korean economy has not yet escaped from its dependent structure on Japanese intermediate goods. More specifically, Korea recorded negative trade specialisation indices in labour-intensive intermediate goods such as textile yarn, woven fabrics, glass and glassware, etc. Korea's import specialisation of capital-intensive intermediate goods appears to have been intensified in such sectors as construction materials, rubber tires, tire cases, interchangeable tire treads, inner tubes and tire flops for wheels of all kinds, plastic materials, organic chemicals, primary forms of iron or steel, most of which are used for the production of durable and non-durable consumer goods.

In conclusion, Koreas substantial success with export-driven development has come at an apparent cost. It has entrenched a pattern of trade in which capital goods have been imported mainly from Japan in order to feed the drive to export consumer goods to the

⟨Table 5⟩ Korea's Trade Specialisation Indices by Product Categories

product group	1980	1985	1988	1992	1996
I	0.9380	0.9569	0.9497	0.9267	0.9051
II	0.4652	0.5579	0.6914	0.6499	0.6370
III	-0.3076	-0.0876	-0.1358	-0.1809	-0.1491
IV	0.2024	0.0701	-0.0436	-0.0268	-0.0436
(IV-1)	0.5213	0.4000	0.2986	0.4000	0.5000
(IV-2)	0.0193	-0.1326	-0.2201	-0.1326	0.0326

Notes: 1) product group I = non-durable consumer goods; II = durable consumer goods; III = capital goods; IV = intermediate goods; IV-1 = labour-intensive intermediate goods; IV-2 = capital-intensive intermediate goods

2) Data on Korea's exports and imports for the calculation of trade specialisation indices were obtained from, Ministry of Trade, Industry & Energy(1981, 1986, 1989, 1993, 1997), Korea Customs Service & Korea Customs Research Institute, *Statistical Yearbook of Foreign Trade*, various years.

⟨Table 6⟩ Korea's Trade Specialisation Indices against Japan by Product Categories

product group	1980	1985	1988	1992	1996
I	0.7452	0.8138	0.9203	0.9396	0.9275
II	-0.4785	-0.4235	-0.1328	-0.1024	-0.0189
III	-0.7542	-0.6485	-0.6754	-0.7736	-0.6766
IV	-0.3975	-0.4341	-0.2623	-0.4453	-0.4260
(IV-1)	-0.0758	-0.2927	-0.1566	-0.2831	-0.1431
(IV-2)	-0.5384	-0.4913	-0.2934	-0.5004	-0.4455

world (primarily United States). Given that the Korean economy has not been able to disengage from such a pattern of trade, it has not been able to reduce its import dependence on Japan.

3. SUMMARY AND CONCLUDING REMARKS

3.1. Summary

Since the diplomatic normalization between Korea and Japan in 1965, there has been increasing friction between the two economies due mainly to Korea's huge and chronic trade deficits with Japan. In terms of this, the purpose of this study is to test the validity

of the widely-cited hypothesis that Koreas chronic trade deficits with Japan are attributable to Koreas industrial structure which is characterised by its excessive dependence of heavy and chemical industry goods on Japan.

In order to examine the causal relationship between industrial interdependency and trade imbalance between Korea and Japan, we applied a series of well-known techniques, i.e. indices of intra-industry trade, indices of revealed comparative advantage, and the trade specialisation indices. The computed results of the Grubel-Lloyd indices of intra-industry trade between Korea and Japan suggested that intra-industry trade indices in heavy and chemical industrial sectors was negligible. We also attempted to measure the Grubel-Lloyd indices in a modified form, and found that the intra-industry trade indices with respect to light industry goods and primary industry products were in favour of Korea whereas those of heavy and chemical goods were in favour of Japan. Thus, analyses of the intra-industry trade indices supported the proposition that Koreas chronic trade deficits with Japan is reflected in the form of low level of Grubel-Lloyd indices in an unfavourable manner in the heavy and chemical industry sectors. Koreas revealed comparative advantage indices were computed to test whether Korean heavy and chemical industries have a comparative 'disadvantage' in trade with Japan. A distinguishing feature from the computation was that Korean heavy and chemical industrial sectors showed comparative 'disadvantage' in terms of bilateral trade with Japan. In particular, the indices in general machinery, the most important single sector responsible for Koreas chronic trade deficits with Japan, showed a significant level of comparative 'disadvantage' throughout the years under investigation.

We reinforced the above findings by utilising trade specialisation indices. The extent of Koreas trade specialisation for each category of products (non-durable consumer goods, durable consumer goods, capital goods, labour-intensive intermediate goods and capital-intensive intermediate goods) was computed through the trade specialisation index of Grubel-Lloyd. The statistical results strongly supported the proposition that the Korean economy has maintained a pattern of trade which is characterised by import specialisation in capital goods from Japan and export specialisation in consumer goods to the world market. In other words, a characteristic feature of Korea-Japan trade was that the Korean economy showed a pattern of export specialisation in non-durable consumer goods while

Koreas specialisation indices of capital goods showed an import specialization, intensifying Koreas dependence for capital goods, especially machinery, on Japan. Thus, these statistical context provided evidence regarding a substantial factor of Koreas trade imbalance with Japan from the perspective of Koreas trade pattern.

3.2. Concluding Remarks: Policy Implications of the Study

Based on this study, some policy directions can be suggested in terms of Koreas long term industrial structure and trade pattern. The discussion will be split into an enunciation of basic guidelines in approaching the resolution of the trade imbalance between Korea and Japan, and an elaboration of policy suggestions.

3.2.1. Basic guidelines in approaching the problem of trade imbalance between Korea and Japan

'First, the issue of trade imbalance between Korea and Japan should be considered in a positive rather than negative manner'. In discussing the issue of trade imbalance between Korea and Japan, Korean policies should put emphasis on a more positive or active dimension of industrial cooperation between the two countries rather than an attitude of clinging to the trade deficits. This line of thinking is based on the recognition that the basic nature of the economic relationship between the two countries during the past three decades can be defined as a positive one that reflects harmony of interests in the process of economic cooperation and development.

'Second, countermeasures for the structural trade deficits should not be short-term approaches such as import restrictions, but should involve a fundamental approach that can change the underlying causes of the trade imbalance mechanism, based on long-term perspectives'. Pressing Korean industries to deviate from its market-oriented behaviour such as import restrictions as a means of narrowing the trade gap would be counterpro-ductive, resulting not only in trade contraction, but also in engendering an unfavourable environment for Koreas long-term economic growth potential.

3.2.2. Policy implications of the study

'Firstly, the Korean economy must extricate itself from the current pattern of trade and should be transformed into an economy with a solid industrial foundation'. If the Korean economy maintains its traditional pattern of trade and production structure, in the

long-term, it will face the following problems under the current pattern of trade-led growth. (1) The Korean economy is liable to technological subordination to Japan. As the Korean economy has been considerably dependent on foreign advanced technology in such areas as production design and core industrial manufacturing technology, not only has the international competitiveness been limited by the supply conditions of Japan, but also the Korean economy itself is likely to face control and restrictions from Japan. (2) Export specialisation in consumer goods to the world other than Japan under the pattern of Koreas processing trade has brought about undesirable trade conflicts with the United States and European countries. As long as the Korean economy maintains this pattern of trade management, trade friction against these countries is expected to continue. (3) In the near future, the Korean economy will be caught up with such late comers as ASEAN and China in the export of labour-intensive manufactured products under this pattern of processing trade. As the primary foundation supporting the current pattern of trade-led growth is substantially cheap and abundant labour force rather than high technology and capital, it is expected that the Korean economy will lose its comparative advantage in the world markets to these late comers. The implications is that Korea should find a way to substitute traditionally imported intermediate and capital goods with domestic supply through technological innovation.

'Secondly, the Korean economy should intensify intra-industry trade with Japan, especially in heavy and chemical industrial products, on the basis of horizontal division of labor'. Since the diplomatic normalisation in 1965, Japan has been the linchpin for Koreas economic growth by providing Korea with capital and technology. However, this has resulted in a structure of Koreas excessive dependence on Japan and a pattern of vertical division of labour. In order to correct the chronic trade imbalance between the two economies with a more fundamental solution, the industrial and trade structure of the Korean economy should be transformed into a more sophisticated one, the implication of which is that the Korean economy should make efforts to develop heavy and chemical industries for the establishment of solid domestic industrial foundation, based on the notion of dynamic comparative advantage. This proposition can be supported on the ground that the existing comparative cost relations are not so significant if, after a certain time, initial

production difficulties will have been overcome and the industry will then be able to produce at lower costs through the full exploitation of the economies of scale. The industry will thereby eventually acquire a comparative advantage in a dynamic context. This was well verified by the success story of the Korean steel industry, which is a fruition achieved by intensive economic cooperation between Korea and Japan.[10] In order to develop intraindustry trade based on horizontal division of labour between Korea and Japan, the Korean economy must expand research and development (R&D) investment in the fields of heavy and chemical industries in a planned resolute way and further intensify technology cooperation with advanced countries. By establishing capital and intermediate goods industries and developing them into export industries for the exploitation of scale economies, the Korean economy would be able to enhance intra-industry trade with Japan based on horizontal division of labour.

'Thirdly, it would be desirable for the Korean economy to diversify its import sources of capital and technology'. As excessive dependence of capital goods and technology on Japan has formed a rigid import structure and trade imbalance between Korea and Japan, diversification of source of imports is suggested as an alternative policy direction. Through the diversification of economic cooperation with the United States and European countries in terms of capital and technology, the Korean economy would be able to combine each comparative advantageous factor efficiently and form yet another type of comparative advantage in manufacturing sectors. In addition, not only will it provide a momentum for the Korean economy to intensify economic relationship with advanced countries other than Japan, but it will also alleviate trade conflicts with major trading partners.

Appendix: The Headings of SITC No.

1. Non-Durable Consumer Goods (18 items)

perfumery, cosmetics and toilet preparations(553), explosives and pyrotechnic products

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(10) One distinctive successful intra-industry trade between Korea and Japan was the Korean steel industry. Through the intensive technological cooperation between the two countries, Pohang Iron and Steel Company Limited(POSCO) was constructed and became one of the most efficient steel producers in the world, contributing a dramatic increase in intra-industry trade between Korea and Japan: For details, see Islam and Kim(1994).

(572), tulles, laces, embroideries, ribbons, trimmings and other small wares(656), made-up articles, wholly or chiefly of textile(658), floor coverings, etc.(659), travel goods, shopping bags, handbags, satchels, briefcases, wallets; purses, toilet-cases, tool-cases, tobacco pouches, etc.(831), other garments, men's and boys' of textile fabrics(842), outer garments, women's, girls' and infants' of textile fabrics(843), under garments of textile fabrics(844), outer garments and other articles, knitted or crocheted, not elastic nor rubberised(845), under garments, knitted or crocheted(846), clothing accessories of textile fabrics(847), articles of apparel and clothing accessories of other than textile fabrics; headgear(848), footwear(851), cinematography film, exposed and developed, whether or not incorporating sound track or consisting only of sound track, negative or positive(883), printed matter (892), office and stationery supplies(895), other miscellaneous manufactured articles(899)

2. Durable Consumer Goods (21 items)

pottery(666), cutlery(696), household equipment of base metals(697), television receivers (761), radio-broadcast receivers(762), gramophones(phonographs), dictating machines and other sound recorders and reproducers; television image and sound recorders and reproducers, magnetic(763), telecommunications equipment and parts, and accessories for the apparatus and equipment(764), household typewriter, electrical and non-electrical equipment(775), passenger motor cars, including vehicles designed for the transport of both passengers and goods(781), motor vehicles for the transport of goods or materials and special purposes motor vehicles(782), road motor vehicles(783), parts and accessories for the motor vehicles(784), motor cycles, motor scooters and other cycles, motorised and non-motorised; invalid carriages(785), sanitary, plumbing, heating and lighting fixtures and fittings(812), furniture and parts thereof(821), watches and clocks(885), articles of materials(893), baby carriages, toys, games and sporting goods(894), works of art, collectors' pieces and antiques(896), jewelry, goldsmiths' and silversmiths' wares and other articles of precious or semi-precious materials(897), musical instruments and parts and accessories thereof(898)

3. Capital Goods (41 items)

tools for use in the hands or in machines(695), steam and other vapour generating boilers, super-heated water boilers, and auxiliary plant for use therewith, and parts thereof

(711), steam and other vapour power units, not incorporating boilers; steam engines with self contained boilers, and parts thereof(712), internal combustion engines, and parts thereof(713), engine and motors, non-electric; parts of the engines and motors(714), rotating electric plant and parts thereof(716), agricultural machinery(excluding tractors) and parts thereof(721), tractors whether or not fitted with power take-offs, winches or pulleys(722), civil engineering and contractors' plant and equipment and parts thereof (723), textile and leather machinery, and parts thereof(724), paper mill and pulp mill machinery, paper cutting machines and other machinery for the manufacture of paper articles; and parts thereof(725), printing and bookbinding machinery, and parts thereof (726), food-processing machines(excluding domestic) and parts thereof(727), other machinery and equipment specialised for particular industries, and parts thereof(728), machine-tools for working metal or metal carbides, and parts and accessories thereof(736), metal working machinery(other than machine tools), and parts thereof(737), heating and cooling equipment and parts thereof(741), pump(including motor and turbo pumps) for liquids, whether or not fitted with measuring devices; liquid elevators of buckets, chain, screw, band and similar kinds; parts of such pumps and liquid elevators(742), pump(other than pumps for liquids), and compressors; and fans and blowers; centrifuges; filtering and purifying apparatus, and parts thereof(743), mechanical handling equipment, and parts thereof(744), other non-electrical machinery, tools and mechanical apparatus, and parts thereof(745), non-electric parts and accessories of machinery(749), office machines(751), automatic data processing machines and units thereof; magnetic or optical readers, machines for transcribing data onto data media in coded form and machines for processing such data(752), parts of and accessories suitable for use solely or principally with machines(759), electric power machinery and parts thereof(771), electric apparatus for making and breaking electrical circuits, for the protection of electrical circuits, or for making connection to or in electrical circuits; resistors, fixed or variable, other than heating resistors; printed circuits; switchboards, and control panels; parts of the foregoing apparatus (772), equipment for distributing electricity(773), electric apparatus for medical purposes and radio-logical apparatus(774), thermionic cold cathode and photo-cathode valves and tubes; photocells; mounted piezo-electric crystals; diodes, transistors and similar

semi-conductor devices; electronic microcircuits; and parts thereof(776), electrical machinery and apparatus(778), trailers and other vehicles, not motorised and specially designed and equipped transport containers(786), railway vehicles and associated equipment(791), aircraft and associated equipment, and parts thereof(792), ship, boats and floating structures(793), optical instruments and apparatus(871), medical instruments and appliances(872), meters and counters(873), measuring, checking, analysing and controlling instruments and apparatus; parts and accessories of the instruments and apparatus (874), photographic apparatus and equipment(881), optical goods(884)

4.1. Labour-Intensive Intermediate Goods (22 items)

leather(611), manufactures of leather or of composition leather; saddlery and harness; parts of footwear(612), furskins, tanned or dressed(613), cork manufactures(633), veneers, plywood, improved or reconstituted wood, and other wood(634), wood manufactures(635), textile yarn(651), cotton fabrics, woven(652), fabrics, woven of man-made fibres(653), textile fabrics, woven, other than of cotton or man-made fibres(654), knitted or crocheted fabrics(655), special textile fabrics and related products(657), clay construction materials and refractory construction materials(662), mineral manufactures(663), glass(664), glass-ware(665), pearls, precious and semi-precious stones(667), structures and parts of structures of iron, steel or aluminium(691), metal containers for storage and transport(692), wire products and fencing grills(693), nails, screws, nuts, bolts, rivets, and the like of iron, steel or copper(694), manufactures of base metals(699)

4.2. Capital-Intensive Intermediate Goods (49 items)

residual petroleum products and related materials(335), hydrocarbons and their halogenated, sulphonated, nitrated or nitrosated derivatives(511), alcohols, phenols, phenol-alcohols, and their halogenated, sulphonated, nitrated or nitrosated derivatives(512), carboxylic acids, and their anhydrides, halides, peroxides and peracids, and their halogenated, sulphonated, nitrated or nitrosated derivatives(513), nitrogen-function compounds (514), organo-inorganic and heterocyclic compounds(515), other organic chemicals(516), inorganic chemical elements, oxides and halogen salts(522), other inorganic chemicals; organic and inorganic compounds of precious metals(523), radio-active and associated materials(524), synthetic organic dyestuffs, etc., natural indigo and colour lakes(531),

dyeing and tanning extracts and synthetic tanning materials(532), pigments, paints, varnishes and related materials(533), medicinal and pharmaceutical products(541), essential oils, perfume and flavour materials(551), soap, cleansing and polishing preparations(554), fertilisers, manufactured(562), condensation , polycondensation and polyaddition products, whether or not modified or polymerised, and whether or not linear(582), polymerisation and copolymerisation products(583), regenerated cellulose; cellulose nitrate, cellulose acetate and other cellulose esters, cellulose ethers and other chemical derivatives of cellulose, plasticised or not; vulcanised fibre(584), other artificial resins and plastic materials (585), disinfectants, insecticides, fungicides, weed killers, anti-sprouting products, rat poisons and similar products, put up in forms or packings for sale by retail or as preparations or as articles(591), starches, inulin and wheat gluten; albuminoidal substances; glues(592), miscellaneous chemical products(598), materials of rubber(621), rubber tires, tire cases, interchangeable tire treads, inner tubes and tire flaps, for wheels of all kinds(625), articles of rubbers(628), paper and paperboard(641), paper and paperboard, cut to size or shape, and articles of paper and paperboard(642), lime, cement, and fabricated construction materials(661), pig iron, spiegeleisen, sponge iron, iron or steel powders and shot, and perro-alloys(671), ingots and other primary forms of iron or steel(672), iron and steel bars, rods, angles, shapes and sections(673), universals, plates and sheets of iron or steel(674), hoop and strips of iron or steel, hot-rolled or cold-rolled(675), rails and railway track construction materials of iron or steel(676), iron or steel wire, whether or not coated, but not insulated(677), tubes, pipes and fittings of iron or steel(678), iron and steel castings, forgings and stampings in the rough state(679), silver, platinum and other metals of the platinum group(681), copper(682), nickel(683), aluminium(684), lead(685), zinc(686), tin (687), uranium depleted in U 235 and thorium and their alloys, unwrought or wrought, and articles thereof; waste and scrap of uranium depleted in U 235 and of thorium(688), miscellaneous non-ferrous base metals employed in metallurgy, and cermets(689), photographic and cinematographic supplies(882)

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