Korea's Marginal Intra-industry Trade and the Choice of Preferential Partners*

by

Hyun-Hoon Lee**
Kangwon National University

and

Chan-Hyun Sohn***
Korea Institute for International Economic Policy

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** Hyun-Hoon Lee, Professor, Division of Economics and International Trade, Kangwon National University, Chuncheon 200-701, South Korea. Email: hhlee@kangwon.ac.kr

*** Chan-Hyun Sohn, Senior Fellow, Korea Institute for International Economic Policy, Seoul 137-747, South Korea. Email: chsohn@kiep.go.kr

Abstract

In recent years a new regionalism has begun to emerge in East Asia. In accordance with this new trend of regionalism in East Asia, Korea signed a free trade agreement (FTA) with Chile in October 2002, for the first time in its history, and is studying bilateral FTAs with Singapore, New Zealand, Mexico, Thailand as well as Japan. Korea has also actively studied the possibilities of plurilateral FTAs in East Asia. Inside Korea, however, there are many arguments against opening its domestic market for the foreign competition resulting from both multilateral and preferential agreements. The main reason is because trade liberalization would result in costly factor adjustment. It has been argued by many researchers that intra-industry trade generates smaller inter-industry factor adjustment than inter-industry trade, and hence intra-industry trade involves lower costs than inter-industry trade. The purpose of this paper is to understand the extents and the nature of intra-industry trade (IIT) and marginal intra-industry trade (MIIT) in the case of Korea, and help predict the relative degree of adjustment costs which Korea would face as it opens its markets to different trading partners. For this purpose, this paper first calculates the weighted average of the unadjusted Grubel-Lloyd indices for different trading partners, using the data at three-digit SITC for 1991 and 2001, and the weighted average of Brülhart (1994)'s A indices between 1991 and 2001. This paper then evaluates the country characteristics that have effects on the extent of IIT and MIIT. Finally, the paper assesses the desirability of regional trade arrangement with different trading partners from the perspective of trade-induced adjustment costs.

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1. Introduction

In recent years a new regionalism has begun to emerge in East Asia. In accordance with this new trend of regionalism in East Asia, Korea signed a free trade agreement (FTA) with Chile in October 2002 for the first time in its history, and is studying bilateral FTAs with Singapore, New Zealand, Mexico, Thailand as well as Japan. Korea has also actively studied the possibilities of plurilateral FTAs in East Asia. Inside Korea, however, there are many arguments against opening its domestic market for the foreign competition resulting from both multilateral and preferential agreements. The main arguments is that trade liberalization would result in costly factor adjustment. In the context of trade expansion, adjustment costs are normally referred to those trade-induced welfare losses that arise in labor markets from temporary unemployment or from costs incurred through job search, relocation and retraining.

Verdoorn (1960) discovered that the formation of a customs union among the Benelux countries had stimulated a phenomenon of two-way trade flows of similar products, and Drèze (1960) found the same phenomenon among the six-nation EEC. One of the distinct features of intra-industry trade (IIT) is that IIT expansion generally results in smaller inter-industry factor adjustment inter-industry trade. This is why Verdoorn (1960), Drèze (1960) and Balassa (1966) all emphasized the empirical importance of IIT in their analyses of the trade effects of early European economic integration.

Since these early studies on IIT, the so-called "smooth adjustment hypothesis" (SAH) has become firmly rooted in economic thinking, according to which IIT generates smaller inter-industry factor adjustment than inter-industry trade, and hence IIT involves lower costs than inter-industry trade. The SAH has intuitive appeal and is firmly established in the field of international economics.[1] For example, Krugman (1981) found in a general equilibrium model that "intra-industry trade poses fewer adjustment problems than inter-industry trade" (p.970).

However, Hamilton and Knies (1991), Greenaway, Hine, Milner and Elliot (1994), Brülhar (1994) and Dixon and Menon (1997) have argued that IIT measured normally using the Grubel-Lloyd (GL) index is 'static' in the sense that it reveals the structure of trade at a certain point in time, and intertemporal comparison of of GL indices is 'comparative static', in the sence that it compares the structure of trade at different

points in time. But the costs of adjustment depend on the structure of the change in trading patterens. They also revealed that differencing GL index (i.e., $\Delta GL = GL_t - GL_{t-n}$) was flawed, pointing out that an increase in inter-industry flows will show an increase in the GL index of IIT when the increase in inter-industry trade acts to reduce the trade imbalance in the sector being measured. Accordingly, they have proposed some alternative indices of 'marginal IIT' (MIIT) to be used in studies of the SAH.

The purpose of this paper is to understand the extents and the nature of Korea's IIT and MIIT, and help predict the relative degree of adjustment costs which Korea would face as it opens to different trading partners. There have been many empirical studies on MIIT using data from different countries.[2] To our best knowledge, however, there have been no attempts to measure the dynamic changes in IIT using the Korean trade data.[3] Another unique feature of this paper is that while most (if not all) studies of MIIT estimate the industry-specific determinants, this paper investigates the country-specific determinants of MIIT. Empirical testing of country-specific hypotheses about MIIT is important because this will help understand how different characteristics of trading partners have effects on MIIT and hence the trade-induced adjustment costs. More specifically, estimating the MIIT is especially fruitful because this helps predict the degree of adjustment costs which Korea would face as it opens its markets to different trade partners due to FTAs.

A brief summary of recent developments of regional trade arrangements (RTA) and Korea's response are offered in Section 2. Section 2 also discusses the importance of IIT with regard to the trade-induced adjustments costs and its implication for Korea's selection of FTA partners. Section 3 then presents the extents of Korea's IIT with 59 trading partners for the years 1991 and 2001, and MIIT for the period 1991-2001. IIT will be measured using the most widely used Grubel-Lloyd index and MIIT using the "A" index of Brülhart (1994). With the estimated indices, this paper will then estimate the country-specific determinants of IIT and MIIT. Hypotheses and test results are discussed in Sections 4 and 5 for IIT and MIIT, respectively. Finally Section 6 will discuss the policy implication of the results.

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[1] For a list of references to the SAH, see Brülhart (1994).
[2] See Brülhart and Hine (1999) for example.
[3] Kimura and Ando (2003) have estimated the extents of vertical IIT and horizontal IIT among Japan, China and Korea, using the Grubel Lloyd indices to discuss the possible implication of free trade under an FTA among these countries. While distinction between vertical IIT and horizontal IIT is also an important issue, we refrain ourselves from discussing this issue in this paper.

2. Recent Developments of RTAs in East Asia and Korea's Response

2.1. Recent Developments of RTAs in East Asia

Until the Asian crisis erupted in 1997, East Asian economies had pursued a multilateral approach to trade. In particular, Japan, China and South Korea were the world's only major economies that had yet to conclude an FTA. The sole exception was ASEAN, which had been planning an FTA for several years with the target date of 2002. However, a new tide of regionalism is emerging in East Asia. A number of bilateral FTAs have been concluded and are being negotiated or studied.

Singapore, the most trade-reliant ASEAN member, started the ball rolling by signing FTAs with New Zealand (2000), Japan (2002), Australia (2003) and the United States (2003). Singapore is currently negotiating/laying the groundwork for similar bilateral FTAs with Canada, Mexico and India.

Thailand is also one of the leading proponents of the creation of bilateral FTAs. Thailand is expected to sign a Closer Economic Relations (CER) Framework Agreement with India and a Closer Economic Relations and free-trade agreement (CER-FTA) with Australia in the near future. At the APEC summit in October 2003, the beginning of formal FTA negotiations between Thailand and the United States was announced. Thailand has also discussed an expanded FTA with China, and proposed an FTA deal with Korea. It also aims to reach bilateral FTAs with 10 countries: India, Bangladesh, Bahrain, Qatar, Oman, Kuwait, the United Arab Emirates, Saudi Arabia, Malaysia and Singapore (Bangkok Post, December 20, 2002).

The Philippines is also exploring the possibility of signing FTAs with countries outside of ASEAN. China and Australia have agreed to hold talks on an FTA (ABC Online News, August 18, 2003). Taiwan also signed its first FTA with Panama in August 2003.

Japan signed an FTA in January 2002 with Singapore. Japan has also negotiated, studied or considered bilateral FTAs with Thailand, Indonesia, the Philippines, Korea, Chile, Mexico, Canada, Australia, New Zealand, Switzerland and Taiwan.

Multi-country agreements are also being negotiated, proposed or studied in East Asia. ASEAN and CER countries discussed a link between the two free trade areas in November 2000. During the recent summit of the ASEAN+3 countries in November 2001, China and ASEAN announced that they had decided to create an FTA within 10 years. The Philippines has also proposed the East Asian Free Trade Area (EAFTA), an area covering the whole of East Asia.

Table 1 summarizes RTAs involving East Asian countries. Thus, in the East Asian region, each one of the major economies is involved in negotiations with more than one other country or a group of countries on the formation of bilateral/plurilateral agreements. This trend towards regionalism is likely to spread to other East Asian countries.

<Table 1>

East Asia's recent regionalism is, in large part, due to the enlargements of the EU and growing Pan-American moves to increase free trade arrangements, such as expanding the North American Free Trade Agreement (NAFTA) into the proposed Free Trade Areas of the Americas (FTAA) which includes the entire American continent except Cuba.[4] In particular, the United States, the major export market for most East Asian countries and long-time proponent of multilateralism under the framework of the GATT/WTO, has recently pursued bilateral and regional free trade arrangements as a new reality of the global multilateral trading system.[5]

2.2. Korea's Response

There is no doubt that international trade has been, and will remain, an engine of economic growth for Korea (Harvie and Lee, 2003a,b). Therefore, Korea (and other East Asian countries) should promote further trade liberalization through a number of

[4] See Lloyd and Lee (2001) for a more detailed discussion on the reasons for East Asian regionalism.
[5] The United States signed FTAs with Singapore in May 2003 and with Chile in June 2003. It has also begun negotiating FTAs with Australia; Morocco; Bahrain; the five Central American Common Market nations of Guatemala, Honduras, El Salvador, Nicaragua, and Costa Rica; and the five South African Customs Union nations of South Africa, Botswana, Namibia, Lesotho, and Swaziland (Griswold, 2003). United States has recently shown its willingness of forging an FTA with the Middle East - an area Washington has tended to neglect economically. Other potential FTA partners proposed by members of Congress include Taiwan, New Zealand, the United Kingdom and South Korea.

means. Above all, Korea (and other East Asian countries) should regard the multilateral approach as its basic policy option for fostering trade and investment liberalization and therefore commits itself to faithfully abide by the rule-based terms and conditions of GATT/WTO, and take an active role to accelerate the multilateral trade talks of DDA negotiations under the WTO (Harvie and Lee, 2002).

However, in this era of the coexistence of multilateralism and regionalism, it is also believed that RTAs, in many cases, have served as stepping stones to integration into the global free trading system, helping industries, sectors and countries adjust to the competitive winds of liberalization. Therefore, acknowledging that regional and multilateral agreements are complementary rather than contradictory in the pursuit of more liberal and open trade, Korea also needs to pursue a parallel approach of multilateral and regional trade initiatives in order to protect and maximize economic benefits of the continued liberalization process.

In accordance with this new trend of regionalism in East Asia and elsewhere, Korea concluded an FTA with Chile in October 2002, for the first time in its history, and has been studying bilateral FTAs with Singapore, Mexico, Thailand, New Zealand and the United States as well as Japan and China. Korea has also been keen on concluding a Northeast Asian Free Trade Area (NEAFTA) consisting of China, Japan and Korea.[6] At the ASEAN+3 summit in November 2001, Korea also called for the formation of an East Asian economic community equivalent to the EAFTA.[7]

This new trend towards regionalism represents a clear break from Korea's strong history of multilateralism. And this trend is likely to continue in the coming years. However, finding good FTA partners that could maximize the gains of trade liberalization is not a simple proposition. Korea's FTA initiatives, still in its initial stages, lack clear and

[6] At the "ASEAN Plus Three" summit in November 1999, Japan, Korea and China agreed to launch a joint research project involving institutes from the three countries to discuss the possibility of forming an FTA among themselves in Northeast Asia. Since then, the three countries have held a summit every year at the ASEAN+3 meetings and have held regular meetings between their finance ministers. Among the three, each country is one of the largest trading partners of the other two. For China, Japan is its largest trading partner and Korea the third. For Japan, China (including Taiwan) ranks the second and Korea the third. For Korea, Japan and China are the second and the third trading partners, respectively.

[7] During the ASEAN+3 summit in 1999, Korea proposed establishing an expert panel, the East Asia Vision Group, as the first step in exploring the possibility of forging a regional cooperation mechanism. This group discussed ways to develop the ASEAN+3 grouping into a regional cooperation forum. A joint surveillance of short-term capital movements and an early warning system in East Asia have also been studied. The group later proposed the establishment of an East Asian Monetary Fund and a regional exchange rate coordination mechanism, with the long-term goal of creating a common currency area. Other recommendations included upgrading the annual ASEAN+3 meetings to an East Asian summit.

consistent direction. In order to define and project the future course of Korea's FTA policy, however, some clear selection criteria for choosing desirable FTA partners will be needed.

Although many FTAs currently exist in the world, there is little literature that suggest clear criteria for the selection of desirable FTA partners. Multiple factors, not only from economic, but also historical and political dimensions, may intervene in the formation of FTAs. Sohn and Lee (2003) suggest six important criteria taking into account economic factors. These are: the structure of comparative advantage, income level, geographical proximity, market size, the level of outstanding trade barriers and trade-induced adjustment costs.

Among those six criteria, this paper intends to investigate more specifically the implications of trade-induced adjustment costs on Korea's choice of FTA partners. This is a very important issue in Korea, as there has been a strong opposition to opening its domestic market for the foreign competition resulting from both multilateral and preferential agreements, based on the argument that trade liberalization would result in costly factor adjustment.

As noted in Introduction of this paper, Verdoorn (1960), Drèze (1960) and Balassa (1966) all emphasized the empirical importance of IIT in their analyses of the trade effects of early European economic integration because IIT expansion generally entails lower adjustment costs than inter-industry trade.

Therefore in the following sections, this paper will investigate the extent and the nature of Korea's IIT and MIIT, and help predict the relative degree of adjustment costs which Korea would face as it opens its markets due to the FTA agreements with different trading partners. This will then help assess the desirability of regional trade arrangement with Chile and others from the perspective of trade-induced adjustment costs.

3. Trends and Extents of IIT and MIIT

3.1. The IIT Indices

By far the most widely used measure of IIT is due to Grubel and Lloyd (1975), who suggested the following formula:

$$GL_i = 1 - \frac{|X_i - M_i|}{(X_i + M_i)}, \qquad (1)$$

where X_i and M_i refer to a country's exports and imports of goods contained in industry i in one particular year. This measure takes values between zero and one and increases in IIT. The summary GL index over several industries is calculated as a trade-weighted average of the industry indices:

$$GL = \sum_{i=1}^{n} w_i GL_i = \sum_{i=1}^{n} \left(\frac{X_i + M_i}{\sum_{i=1}^{n}(X_i + M_i)}\right) GL_i = 1 - \frac{\sum_{i=1}^{n}|X_i - M_i|}{\sum_{i=1}^{n}(X_i + M_i)}. \qquad (2)$$

Using the GL index, many researchers uncovered a secular increase in the share of IIT among developing as well as developed economies, and cited this fact as a powerful force for attenuating trade-induced economic frictions within and between countries during the past half-century.

However, Hamilton and Kniest (1991) and Brülhart (1994; 2002) pointed out that the traditional GL index is a static measure, in the sense that it describes IIT patterns for one point in time, and hence argued that in the context of adjustment, dynamic measures of IIT may be more informative than static measures. They also revealed that differencing GL index (i.e., $\Delta GL = GL_t - GL_{t-n}$) was flawed, pointing out that an increase in inter-industry flows will show an increase in the GL index of IIT when the increase in inter-industry trade acts to reduce the trade imbalance in the sector being measured. They also argued that GL index is 'static' in the sense that it reveals the structure of trade at a certain point in time, and hence intertemporal comparison of GL indices is 'comparative static', in the sense that it compares the structure of trade at different points in time.

Hamilton and Kniest (1991), Greenaway, Hine, Milner and Elliot (1994), Brülhart (1994) and Dixon and Menon (1997) proposed some alternative indices of "marginal IIT" (MIIT) to be used in studies of the SAH. Among those the so-called 'A' index

proposed by Brülhart (1994) is now commonly used by many researchers as a measure of changes in IIT or marginal IIT in studies of the SAH.

Specifically,

$$B_i^A = 1 - \frac{|\Delta Xi - \Delta Mi|}{|\Delta Xi| + |\Delta Mi|}, \tag{3}$$

where Δ is the difference operator. This index, like the GL index, varies between 0 and 1, where 0 indicates marginal trade in the particular industry to be completely of the *inter*-industry type, and 1 represents marginal trade to be entirely of the *intra*-industry type. The main appeal of the B^A index lies in the fact that it reveals the structure of the *change* in import and export flows.

$B^A{}_i$ can be summed, like the GL index, across industries of the same level of statistical disaggregation by applying the following formula for a weighted average:

$$B^A = \sum_{i=1}^{k} w_i B^A{}_i, \qquad \text{where} \quad w_i = \frac{|\Delta X|_i + |\Delta M|_i}{\sum_{i=1}^{k} (|\Delta X|_i + |\Delta M|_i)} \tag{4}$$

where B^A is the weighted average of MIIT over several industries, denoted by *i*...*k*.

3.2. Extents of IIT and MIIT

Before we present the estimated share of IIT and MIIT, shares of major trading partners in Korea's trade (%) are presented in Table 2, for the years 1991 and 2001. These countries/groups of countries are those with which Korea has concluded/studied FTAs. In 1991 the U.S., Japan, the E.U. (not shown in the table), ASEAN and China were the major trading partners of Korea. These remain Korea's major trading partners in 2001. It should be noted that China's share has increased more than three times from 2.9 percent in 1991 to 10.8 percent in 2001.

<Table 2>

Using the 3-digit SITC data sets (available at Korea International Trade Association), we first calculated the extent of IIT for the years 1991 and 2001, and MIIT for the period of 1991-2001. IIT is measured using the most widely used Grubel-Lloyd index and MIIT using the "A" index of Brülhart (1994). In order to obtain a more reliable and consistent estimates, extents of IIT and MIIT are calculated only for the trading partners with which Korea traded more than US$ 1 billion in 1991. There were 63 such countries. Among these countries, four countries (Andorra, Brunei, Liberia, and the former Soviet Union) were excluded because GL indices or 'A' indices were incalculable for all years over the different groups of industries. Estimated IIT and MIIT shares of Korea's 59 trading partners are presented in Appendix Tables 1 and 2.

IIT and MIIT shares of Korea's FTA candidates are presented in Tables 3 and 4, respectively. See Table 3 first. (See also Appendix Table 1 for a whole sample with 59 countries.) When measured for all industries (SITC 0-9) in 2001, Singapore, the Philippines, Malaysia, Japan, China, the U.S., Thailand and Australia are the countries with relatively large values of GL indices. Among these countries, Singapore is the only country with the large value of GL indices even when measured only for non-manufactures (SITC 0-4). Interestingly, Japan and China have very similar values of IIT for non-manufactures in 2001, unlike the common perceptions. It is also interesting to note that the GL values of most large-size economies are greater than the simple average of the GL values for a whole sample with 59 countries.

<Table 3>

<Table 4>

Let us now turn to Table 4, which presents the values of 'A' index for the period 1991-2001 for Korea's FTA candidates. (See also Appendix Table 2 for a whole sample with 59 countries.) It is interesting to note that countries with high values of GL indices tend to have high values of MIIT. For example, Singapore, the Philippines, and Malaysia, which are the countries with the largest GL indices (0.579, 0.526 and 0.525, respectively, for all industries in 2001), also have the largest values of MIIT (0.544, 0.461 and 0.401, respectively, for all industries between 1991 and 2001). The eight countries with large values of GL indices also rank similarly even when MIIT is measured for all industries

between 1991 and 2001.[8] Nevertheless, there are some differences. China has greater value of MIIT than Japan between 1991 and 2001, regardless of industry groups. This is at odds with a common perception that Korea would face greater adjustment costs with China than with Japan. Interestingly, Malaysia, China, the Philippines and Indonesia which are considered to have complementary structures of comparative advantage with Korea, have relatively large values of MIIT.

A question then arises: what are the characteristics of those economies with which Korea has greater extents of IIT and MIIT than with others? Therefore the next two sections attempt to investigate the country characteristics that may affect the extents of IIT and MIIT, respectively.

4. The Determinants of GL Index of Intra-industry Trade

4.1. Hypotheses of Intra-industry Trade Analysis

Krugman (1979), Lancaster (1980) and Brander (1981) have suggested some formal theoretical explanations for IIT. Krugman (1979) and Lancaster (1980) modeled IIT of differentiated products under monopolistic competition, while Brander (1981) explained two-way trade in identical products under oligopolistic competition. Helpman (1987), utilizing the theory under monopolistic competition, has shown that the share of IIT in trade flows increases, as countries become more similar in their factor endowments. On the other hand, Bernhofen (1999) extended Brander (1981)'s model to develop a general reciprocal-markets model of trade that accounts for IIT in homogeneous and differentiated products under oligopolistic competition. The model predicts that the share of IIT between a country-pair increases, when countries become more similar in their industry productivity and demand size. In their reciprocal dumping model, Feenstra, Makusen and Rose (2001) also showed that two-way trade only occurs when countries are of similar size.

Thus, a very useful caveat derived from the models of IIT is that the share of IIT

[8] This finding is also evident in the whole sample (Appendix Tables 1 and 2). When calculated for all industries in 2001, the order of the sizes of IIT is Ireland, Taiwan, Singapore, the Philippines, Malaysia, China, Japan, and the U.S. In the case of MIIT for all industries between 1991 and 2001, it is Ireland, the Philippines, Taiwan, Singapore, Malaysia, China, Thailand, and Indonesia. Thus seven out of the eight countries remain in both cases.

increases as two countries become similar. This caveat holds regardless of the types of goods: differentiated products or identical products under either monopolistic competition or oligopolistic competition. In the following, we define the two variables which will capture the (di)similarities between Korea and its trading partners: country size and per capita income. Country size difference will capture the differences in demand size, while per capita income difference will capture the differences in relative factor endowments, productivity, etc.

(i) Country size difference: The extent of IIT will be negatively correlated with differences in country size. Following Balassa and Bauwens (1987), the relative difference of GDP between Korea and a particular trading partner j (*GDPDIF*), is defined as:

$$GDPDIF_j = 1 + [w \cdot lnw + (1 - w) \cdot ln(1 - w)] / ln2 \quad (5)$$

where *w* is the ratio of Korean GDP to the sum of Korean GDP and a trading partner j's GDP. Obviously, as the difference becomes large, *w* approaches zero or one, and *GDPDIF* approaches to one. If GDPs of two countries are the same, *w* is 1/2, and *GDPDIF* will be zero.

(ii) Per capita income difference: The extent of IIT will be negatively correlated with differences in per capita incomes. The relative difference between Korea and a particular trading partner j ($PCGDPDIF_j$) is calculated using the formula for $GDPDIF_j$, with GDP being replaced with per capita GDP.

(iii) Scale economies and the domestic market: The extent of IIT will be positively correlated with the country size. Lancaster (1980), for example, illustrated that the extent of IIT is higher in industries with scale economies. The larger a country is the greater the opportunities for domestic economies of scale and the higher the extent of IIT, although national scale is distinct from scale in a specific industry. Here, we measure the scale as the log of the gross domestic product (*GDPj*) in millions of U.S. dollars.

(iv) Per capita income: The extent of IIT will be positively correlated with the country's per capita income, due to the more diversified pattern of demand suggested by Linder (1961). This variable is measure as the log of the per capita gross domestic product

(*PCGDP*).

(v) Trade orientation: The share of IIT will be positively correlated with the country's trade orientation. Falvey (1981) has demonstrated that countries with lower trade barriers have higher levels of IIT. Following Balassa (1986) and Balassa and Bauwens (1987), we define a proxy for trade orientation (*TO*) as the log of the residuals from a regression of the log of per capita trade (*PCT*) on the log of per capita income (*PCGDP*) and the log of population (*POP*). Per capita trade is the total trade divided by population. The results for 1991 and 2001 are reported in Equation (6) and (7), respectively, with t-values in parentheses.

Year 1991: $PCT = -10.294 + 0.964PCGDP - 0.239POP$; Adjusted $R^2 = 0.905$ (6)
(8.960) (17.460) (4.659)

Year 2001: $PCT = -10.179 + 0.942PCGDP - 0.217POP$; Adjusted $R^2 = 0.884$ (7)
(7.898) (15.121) (3.934)

(vi) *Trade Imbalance*: As Grubel and Lloyd (1975) pointed out, the share of GL index is affected by the size of the overall trade imbalance with a trading partner. The greater the imbalance, the greater will be the share of net trade and the smaller the share of IIT. Lee and Lee (1993) suggested that, when regressing the unadjusted GL index on explanatory variables, a measure of the relative trade imbalance should be included in the set of explanatory variables in order to control for any possible bias. Therefore, the sizes of the trade imbalance with trading partners (*TIMB*) will be included. This variable is computed as

$$TIMB_j = \frac{\left|X_j - M_j\right|}{\left(X_j + M_j\right)}, \quad (8)$$

Where X_j is Korea's exports to country j and M_j Korea's imports from country j. So $TIMB_j$ becomes zero if trade with a country is balanced (i.e., $X_j = M_j$), and one if there are only either exports to or imports from a country (i.e., $X_j = 0$ or $M_j = 0$).

(vii) Distance: The theoretical models of IIT do not explicitly tell us how the geographical distance between trading partners affect the nature of IIT between them.

But it can be easily inferred that the share of IIT is negatively correlated with the degree of difficulties in getting information from the trading partners (Balassa and Bauwens, 1987). This is due to the fact that there is more need for information on the characteristics of differentiated products than on the characteristics of standardized products. Geographical distance is commonly used as a proxy for information and transportation costs. More recently Venables, Rice and Stewart (2003) have used bilateral trade data for OECD countries at the 3-digit industry level to investigate the geography of intra-industry trade (IIT) and showed that IIT diminishes with distance because of the spatial structure of countries' supply and demand characteristics; close countries do a lot of IIT because they have similar economic structures. The log of the distance (*DISTANCE*) between Seoul and the capital cities of other countries is included to investigate the effects of distance on IIT.

In sum, the testable determinants of IIT (with predicted signs) are summarized as:

$$\underset{-}{GDPDIF}, \underset{-}{PCGDPDIF}, \underset{+}{GDP}, \underset{+}{PCGDP}, \underset{+}{TO}, \underset{-}{TIMB}, \underset{-}{DISTANCE}) \qquad (9)$$

where G*L* is the unadjusted GL index defined as Equation (2).

In estimating the determinants of IIT, some authors use a linear or loglinear function by ordinary least squares. However, because the GL index of IIT takes values from 0 to 1, the regression equation estimated by using a linear or loglinear function may have predicted values of IIT that lie outside the theoretically feasible range, i.e., smaller than or greater than 1. To overcome this problem, we apply a nonlinear least-squares estimation of a logistic function as follows.

$$GL = 1 / [1 + EXP (- \beta Z)] \qquad (10)$$

where Z is the vector of explanatory variables including a constant and β is the corresponding vector of coefficients.

4.2. Results of Analysis

Among the 59 countries (See Appendix Tables 1 and 2), eight countries (Arab Emirates, Ecuador, Iran, Libya, Oman, Qatar, Taiwan and Yugoslavia) are excluded from the

sample set because some of the explanatory variables are not available for these countries. Thus we have 51 observations for regression analysis. The dependent variable is the GL indices calculated for all industries in 1991 and 2001, respectively.

Nonlinear least-squares estimates of the determinants of GL index of IIT are presented in Table 5. First, consider columns (1) and (2) whose dependent variables are GL indices calculated for 1991. Explanatory variables are also obtained for 1991. Size variables (*GDP*, *PCGDP*) and size difference variables (*GDPDIF*, *PCGDPDIF*) are included alternatively because these variables are highly correlated. The estimated coefficients of trade openness (*TO*) and transportation costs (*DISTANCE*) have expected positive and negative signs, respectively, and are significant at the 1 percent level in both equations. The estimated coefficients for *TIMB* also have expected negative signs in both equations and are significant in equation (2). However, the coefficients of relative difference in GDP between Korea and its trading partners (*GDPDIF*) has positive sign, unlike our previous prediction, but they are not significant at any plausible level. The coefficients of the relative difference in per capita GDP (*PCGDP*) have expected sign, but insignificant even at the 10 percent level in both equations. The coefficients of country sizes (*GDP*) and incomes (*PCGDP*) have predicted signs but are not significant. A similar pattern is also observed in columns (3) and (4) whose dependent variables are GL indices calculated for 2001.

<Table 5>

Because our empirical study is not solely based on a single theoretical model of intra-industry trade but is rather eclectic, we also estimated simple correlation coefficients between the calculated GL indices and the various variables included in this study. The results are presented in Appendix Table 3. As can be seen in the table, the correlation results are consistent with the regression results.

5. The Determinants of Marginal Intra-industry Trade

5.1. Hypotheses of MIIT Analysis

While the GL index has been systematically incorporated in theoretical frameworks that

generate IIT, there has been no similar development with respect to MIIT.[9] Therefore, we are forced to infer hypotheses from the hypotheses introduced for the static GL indices. For this, we employ a partial adjustment model, drawing upon Stone and Lee (1995).

First, note that Equation (10) can be transformed to a linear log-odds specification:

$$Ln[GL / (1\text{-}GL)] = \beta Z \tag{11}$$

For convenience, we denote the dependent variable in Equation (11) as *TGL*. Note that the range of *TGL* is from minus infinity to plus infinity, so that the dependent variable is no longer limited in range. Next, we turn to the dynamics. Suppose the desired level of *TGL* at time t is TGL_t^*, then the relationship between the actual and the desired level of TGL may be specified as follows.

$$(TGL_t - TGL_{t-1}) = \delta (TGL_t^* - TGL_{t-1}) \tag{12}$$

where δ is rate of adjustment and is bounded by zero and one. Because TGL_t^* is not observed, several formulations are possible. One formulation assumes that TGL_t^* is determined by the levels of the determinants of *TGL* in period t-1, as well as the first differences (which incorporate changes in the long-run extent of *TGL* between period t-1 and t). Thus, the equation for changes in *TGL* is

$$(TGL_t - TGL_{t-1}) = - \delta TGL_{t-1} + \alpha_1 Z_{t-1} + \alpha_2 (Z_t - Z_{t-1}) \tag{13}$$

If the coefficients in Equation (13) are invariant to the choice of time period (which obtains at equilibrium with constant coefficients) and if the errors between t and t-1 are not correlated, then the α coefficient on each level variable divided by the rate of adjustment parameter, δ, equals the corresponding long-run coefficient β. The α coefficients on the first-difference variables represent the short-run adjustments to contemporaneous changes in the determinants of *TGL*.

Thus, we can evaluate the dynamic structure IIT by first estimating (13). The dependent

[9] One exception is Lovely and Nelson (2000, 2002), who have developed theoretical models which show how changes in IIT are related with adjustment. These models are, however, not relevant here because they can render only industry-specific predictions, but not country-specific ones.

variable could be the first-difference of the linear log-odds transformation of the GL indices. However, as discussed previously, the first-differenced GL indices have limitations in that increasing GL indices do not necessarily imply smoother adjustment to trade liberalization. If the aim of the analysis is 'dynamic' in nature, meaning that the structure of the change in trading patterns is to be scrutinized, that the comparison of GL indices is inadequate and alternative measure such as 'A' index of Brülhart (1994) is more appropriate.

Therefore we use 'A' index of Brülhart as a dependent variable.

$$'A' Index = - \delta TGL_{t-1} + \alpha_1 Z_{t-1} + \alpha_2 (Z_t - Z_{t-1}) \quad (14)$$

In other words, we hypothesize that the extent of marginal intra-industry trade ('A' index) between period t-1 and t depends on the extent of static intra-industry trade (GL index) in period t-1, size of the explanatory variables (suggested by the theories of intra-industry trade) in period t-1, and the first difference of the size of these variables between t-1 and t. This seems plausible and intuitively appealing.

Lastly, it should be noted that 'A' index is bounded between 0 and 1, and therefore we apply again a nonlinear least squares estimation as follows.

$$'A' Index = 1 / [1 + EXP (- \gamma W)] \quad (15)$$

where W is the vector of explanatory variables shown in Equation (13) and γ is the corresponding vector of coefficients.

5.2. Results of Analysis

Estimated results are summarized in Table 6. The dependent variable is 'A' index calculated for all industries between 1991 and 2001. The number '91' attached to the explanatory variables indicates that these variables are calculated using the 1991 data. And letter 'C' attached to the explanatory variables indicates that these variables are first-differenced for the period 1991-2001.

<Table 6>

First, see columns (1) and (2). Again, size variables (*GDP*, *PCGDP*) and size difference variables (*GDPDIF*, *PCGDPDIF*) are included alternatively because these variables are highly correlated. The estimated coefficients for the values of GL index in1991 (*TGL91*) have positive signs in both columns and are significant at the 1 percent level in Column (2). This reconfirms our previous finding that the countries with higher values of GL index tend to have higher values of 'A' index. The individual coefficients for other explanatory variables tend to be roughly consistent with those estimated for the GL indices presented in Table 5. That is, the coefficients for trade openness, trade imbalance and distance have predicted signs and are statistically significant, while the coefficients for the size variables and size difference variables are statistically insignificant. This finding is quite interesting because Hamilton and Kniest (1991) and Brülhart (2000) have asserted that the observation of a high proportion of intra-industry trade does not justify a priori any prediction of the likely pattern of 'change' in trade flows. It should also be noted that the coefficients for the trade-imbalance variable are negative and significant at the 1 percent level. This indicates that similarly to GL index, 'A' index becomes smaller as the size of overall trade imbalance increases.

It is also very interesting to note that the first-difference variables for trade opening (*CTO*) and trade imbalance (*CTIMB*) also have coefficients whose signs are consistent with our prediction and are significant at the 1 or 5 percent level.

Presented in columns (3) and (4) are the estimates without the values of GL index (*TGL91*) in the regression equation. This is to check if the multicolinearities between TGL and other 'state' variables alter our findings. As seen in the table, the results do not appear to differ from the ones with GL index. Taken as a whole, the dynamic estimates in Table 6 reveal the continuing importance of trade orientation, trade imbalances and geographical distance with respect to MIIT in the case of Korea.

We also estimated simple correlation coefficients between the calculated 'A' indices and the various variables included in this study. The results are presented in Appendix Table 3. As can be seen in the table, the correlation coefficients results are consistent with the regression results.

6. Summary and Concluding Remarks

One of the distinct features of intra-industry trade (IIT) is that IIT expansion generally entails lower adjustment costs than inter-industry trade. This is why Verdoorn (1960), Drèze (1960) and Balassa (1966) all emphasized the empirical importance of intra-industry trade in their analyses of the trade effects of early European economic integration. However, it has been pointed out that the traditional GL index is a static measure, in the sense that it describes intra-industry trade patterns for one point in time, and hence in the context of adjustment, measures of marginal intra-industry trade (MIIT) such as 'A' index of Brülhart (1994) may be more appropriate.

We estimated GL indices for 1991 and 2001; and 'A' indices for the period 1991-2001. When measured for all industries (SITC 0-9) in 2001, Singapore, the Philippines, Malaysia, Japan, China, the U.S., Thailand and Australia are the countries with relatively large values of GL indices. Among these countries, Singapore is the only country with the large value of GL indices even when measured only for non-manufactures (SITC 0-4). It was also found that countries with high values of GL indices tend to have high values of MIIT: the eight countries with large values of GL indices also rank similarly even when MIIT is measured for all industries between 1991 and 2001.

A question then arises: what are the characteristics of those economies with which Korea has greater extents of IIT and MIIT than with others? Therefore, with the estimated IIT and MIIT indices, we then attempted to investigate the country characteristics that may affect the extents of IIT and MIIT, respectively. The GL index has been systematically incorporated in theoretical frameworks that generate IIT, and hence we utilized the predictions of different theoretical models of IIT. But, there still does not exist a formal theoretical model that can generate MIIT and thus serve as a base for the specification of empirical models. Therefore, relying on a partial adjustment model, we inferred hypotheses for MIIT from the hypotheses introduced for the static GL indices.

The effect on the extent of IIT (measured with GL index) is significantly positive for the constructed measure of trade orientation; and significantly negative for distance to market and trade imbalances. But GDP or per capita GDP does not seem to affect the extent of IIT in the case of Korea. The effect of the extent of MIIT (measured with 'A' index of Brűlhart) reveals a similar pattern. The size of 'A' indices measured for the

period 1991-2001 is positively dependent upon the size of GL indices and trade orientation of the beginning year; and negatively dependent upon the geographical distance and the size of trade imbalances of the beginning year. The size of 'A' indices is also dependent upon the changes in trade orientation and the size of trade imbalances between 1991 and 2001. Again GDP or per capita GDP does not have significant effects on MIIT. The insignificant effects of GDP and per capita GDP (both absolute level and relative difference) suggest that effects of scale economies and tastes on Korea's IIT and MIIT are insubstantial.

From the perspective of trade-induced adjustment costs, we have attempted to assess the desirability of regional trade arrangement with different trading partners. As mentioned earlier, many different factors, not only from economic, but also historical and political dimensions, may intervene in the formation of FTAs. Among different factors, studying the implications of trade-induced adjustment costs on Korea's choice of FTA partners is of particular importance because in Korea, there has been strong opposition to opening its domestic market for the foreign competition based on the argument that trade liberalization would result in costly factor adjustment.

We do believe that this paper has presented at least some information needed to understand the implications of trade-induced adjustment costs on FTAs. But we acknowledge that a measure of MIIT does not explicitly estimate the factor-market adjustment costs, and instead is assumed to relate to the adjustment costs. Therefore further studies remain to be done to explore more explicit measures of adjustment costs and their implications on FTAs.

<Table 1> Regional Trade Agreements Involving East Asian Countries

Actual	- ASEAN FTA (1997) - Singapore-New Zealand CEP (2000) - Singapore-Japan (2002) - Singapore-U.S (2003) - Singapore-Australia (2003) - Korea-Chile (2002) - Taiwan-Panama (2003)
Under Negotiation	- Singapore-Canada - Singapore-Mexico - Singapore-India - Thailand-Australia - Thailand-India - Thailand-China - Japan-Mexico - Japan-Thailand - Japan-Malaysia - ASEAN-China Free Trade Area - ASEAN-Japan Free Trade Area
Proposals	- Singapore-Thailand - Thailand-U.S. - Thailand-Bangladesh - Thailand-Bahrain - Thailand-Qatar - Thailand-Oman - Thailand-Kuwait - Thailand-the United Arab Emirates - Thailand-Saudi Arabia - Thailand-Malaysia - Japan-Philippines - Japan-Indonesia - Japan-Australia - Japan-New Zealand - Japan-Taiwan - Japan-Brazil - Japan-Canada - Japan-Chile - Korea-Japan - Korea-China - Korea-Singapore - Korea-Australia - Korea-New Zealand - Korea-Mexico - Korea-Thailand - Korea-U.S. - China-Australia - Northeast Asia FTA (China, Japan, Korea) - ASEAN-Korea FTA - ASEAN+India FTA - ASEAN+3 (ASEAN10, China, Japan, Korea) - ASEAN+5 (ASEAN10, China, Japan, Korea, Australia, New Zealand) - ASEAN+6 (ASEAN10, China, Japan, Korea, Australia, New Zealand, India) - ASEAN+5 (ASEAN10, China, Japan, Korea, Hong Kong, Taiwan) - APEC FTA

Source: Various internet on-line newspapers.

Table 2. Value and Share of Major Trading Partners in Korea's Trade (1991 and 2001)

	Value (US $ million)						Share (%)	
	1991			2001			1991	2001
	Exports	Imports	**Trade**	Exports	Imports	**Trade**		
Japan	12,355.8	21,120.2	**33,476.1**	16,505.8	26,633.4	**43,139.1**	21.82	14.79
China	1,002.5	3,440.5	**4,443.1**	18,190.2	13,302.7	**31,492.9**	2.90	10.80
ASEAN							8.80	11.11
Singapore	2,701.9	1,029.8	**3,731.7**	4,079.6	3,011.5	**7,091.1**	2.43	2.43
Thailand	1,336.8	561.7	**1,898.5**	1,848.2	1,589.2	**3,437.4**	1.24	1.18
Malaysia	1,037.2	1,869.0	**2,906.2**	2,628.0	4,126.0	**6,754.0**	1.89	2.32
Indonesia	1,349.1	2,051.8	**3,400.9**	3,279.8	4,473.5	**7,753.3**	2.22	2.66
Philippines	674.8	322.7	**997.5**	2,535.4	1,819.0	**4,354.4**	0.65	1.49
Vietnam	198.9	41.2	**240.1**	1,731.7	385.8	**2,117.4**	0.16	0.73
Cambodia	0.0	0.0	**0.0**	101.5	7.1	**108.6**	-	0.04
Myanmar	28.9	4.9	**33.7**	232.1	50.7	**282.7**	0.02	0.10
Laos	0.0	0.0	**0.0**	6.3	0.5	**6.7**	-	0.002
Brunei	3.1	281.8	**284.9**	16.5	452.4	**468.9**	0.19	0.16
Australia	990.0	3,009.4	**3,999.3**	2,173.2	5,534.1	**7,707.3**	2.61	2.64
New Zealand	120.2	500.7	**620.9**	272.2	743.4	**1,015.6**	0.40	0.35
U.S.	18,559.3	18,894.4	**37,453.6**	31,210.8	22,376.2	**53,587.0**	24.42	18.38
Chile	269.9	370.6	**640.5**	572.6	696.1	**1,268.7**	0.42	0.44
Mexico	774.6	224.1	**998.6**	2,148.9	266.6	**2,415.5**	0.65	0.83
World	71,870.1	81,524.9	**153,395.0**	150,439.1	141,097.8	**291,537.0**	100	100

Notes: 1. Trade value and share for all industries (SITC 0-9).

Table 3. IIT in Korea's Trade with Major Trading Partners (1991 and 2001)

	Non-manufactures (SITC 0-4)		All industries (SITC 0-9)		Manufactures (SITC 5-8)	
	1991	2001	1991	2001	1991	2001
Japan	0.323	0.225	0.336	0.431	0.338	0.466
China	0.036	0.193	0.208	0.429	0.271	0.475
ASEAN						
Singapore	0.822	0.788	0.367	0.579	0.273	0.560
Thailand	0.019	0.125	0.163	0.396	0.228	0.457
Malaysia	0.013	0.156	0.227	0.525	0.289	0.547
Indonesia	0.062	0.266	0.123	0.243	0.156	0.226
Philippines	0.305	0.259	0.178	0.526	0.135	0.559
Vietnam	0.000	0.045	0.075	0.124	0.089	0.132
Cambodia	-	0.001	-	0.032	-	0.039
Myanmar	0.000	0.017	0.001	0.039	0.001	0.039
Laos	-	0.000	-	0.004	-	0.006
Brunei	-	-	0.000	0.021	0.000	0.021
Australia	0.039	0.085	0.109	0.242	0.148	0.147
New Zealand	0.008	0.187	0.035	0.154	0.061	0.137
U.S.	0.078	0.137	0.359	0.396	0.402	0.424
Chile	0.035	0.055	0.004	0.008	0.003	0.007
Mexico	0.013	0.109	0.046	0.149	0.049	0.150
Canada	0.058	0.156	0.132	0.229	0.139	0.236
Mean (59)	0.085	0.128	0.131	0.179	0.122	0.179

Notes: 1. Intra-industry trade indices are the weighted average of unadjusted GL indices calculated from three-digit SITC over all (or subset of) industries. 2. Mean (59) is a simple mean calculated for 59 countries with which Korea traded more than US$ 1 billion in 1991.

Table 4. MIIT in Korea's Trade with Major Trading Partners (1991-2001)

	Non-manufactures (SITC 0-4)	Manufactures (SITC 5-8)	All industries (SITC 0-9)
	1991-2001	1991-2001	1991-2001
Japan	0.039	0.283	0.244
China	0.178	0.440	0.399
ASEAN			
Singapore	0.042	0.480	0.461
Thailand	0.033	0.345	0.266
Malaysia	0.092	0.433	0.401
Indonesia	0.372	0.192	0.260
Philippines	0.157	0.577	0.544
Vietnam	0.042	0.131	0.122
Cambodia	0.001	0.039	0.032
Myanmar	0.008	0.038	0.037
Laos	0.000	0.006	0.004
Brunei	–	0.021	0.021
Australia	0.103	0.103	0.260
New Zealand	0.225	0.127	0.151
U.S.	0.085	0.203	0.192
Chile	0.054	0.007	0.009
Mexico	0.049	0.136	0.132
Canada	0.053	0.146	0.137
Mean (59)	0.071	0.137	0.135

Notes: 1. 'MIIT' is the weighted average of Brülhart (1994)'s A indices over all industries calculated from three-digit SITC. 2. Mean (59) is a simple mean calculated for 59 countries with which Korea traded more than US$ 1 billion in 1991.

Table 5. Determinants of IIT - GL index

	GL91		GL01	
	(1)	(2)	(3)	(4)
CONSTANT	6.290***	-1.599	4.698***	-0.047**
	(3.085)	(0.479)	(2.874)	(0.017)
GDPDIF	0.898		0.475	
	(1.606)		(0.835)	
PCGDPDIF	-1.066		-1.199*	
	(1.402)		(1.688)	
GDP		0.124		0.094
		(1.291)		(1.127)
PCGDP		0.115		0.115
		(1.371)		(1.515)
TO	0.827***	0.598***	0.694***	0.794***
	(3.689)	(3.003)	(3.827)	(4.263)
TIMB	-2.483***	-1.007	-2.351***	-1.884***
	(3.941)	(1.620)	(4.728)	(3.944)
DISTANCE	-0.787***	-0.476**	-0.588***	-0.490***
	(3.863)	(2.646)	(3.647)	(3.184)
# of Observations	51	51	51	51
Adjusted R^2	0.495	0.392	0.614	0.637

Notes: 1. Nonlinear least-squares estimates of a logistic function, with asymptotic t-values in parentheses. 2. ***, **, and * indicates the signifincance level at 1%, 5% and 10%, respectively. 3. Dependent variable is the GL index computed from 3-digit SITC over all industries for 1991 (GL91) and 2001 (GL01). 4. GDP, PCGDP and DISTANCE are in natural logs. 5. See the main text for a detailed explanation of the variables.

Table 6. Determinants of MIIT – 'A' index

	A index (1991-2001)			
	(1)	(2)	(3)	(4)
CONSTANT	3.862*	3.995	5.371	1.375
	(1.805)	(0.972)	(2.478)	(0.310)
TGL91	0.261	0.629***		
	(1.539)	(2.834)		
GDPDIF91	0.476		0.313	
	(0.637)		(0.392)	
PCGDPDIF91	-0.273		-0.317	
	(0.347)		(0.418)	
GDP91		-0.091		-0.001
		(0.771)		(0.007)
PCGDP91		0.098		0.162
		(0.977)		(1.536)
TO91	0.597**	0.395	0.703***	0.784***
	(2.620)	(1.661)	(3.000)	(3.108)
TIMB91	-1.972***	-2.082***	-2.543***	-2.847***
	(2.888)	(2.777)	(3.770)	(3.335)
DISTANCE	-0.547**	-0.353	-0.750***	-0.508*
	(-2.463)	(1.562)	(3.436)	(2.014)
CGDPDIF	-1.994		-3.056	
	(0.996)		(1.400)	
CPCGDPDIF	2.209		3.242*	
	(1.304)		(1.907)	
CGDP		1.038		1.946
		(0.646)		(1.227)
CPCGDP		-0.035		-0.818
		(0.022)		(0.523)
CTO	1.791**	2.360**	1.707**	2.251***
	(2.607)	(2.695)	(2.670)	(2.803)
CTIMB	-2.673***	-2.551***	-2.816***	-2.935***
	(3.623)	(3.339)	(3.768)	(3.477)
# of Observations	51	51	51	51
Adjusted R^2	0.582	0.613	0.560	0.533

Notes: 1. 1. Nonlinear least-squares estimates of a logistic function, with asymptotic t-values in parentheses. 2. ***, **, and * indicates the signifincance level at 1%, 5% and 10%, respectively 3. Dependent variable the weighted average of Brülhart (1994)'s A indices between 1991 and 2001 over all industries computed from 3-digit SITC. 4. TGL91 is a logit transformation of GL91. 5. GDP91, PCGDP91 and DISTANCE are in natural logs. 6. See the main text for a detailed explanation of the variables.

Appendix - Table 1. IIT in Korea's Trend with All Countries (1991, 2001)

(This is a full version of Table 3.)

	Non-manufactures (SITC 0-4)		Manufactures (SITC 5-8)		All industries (SITC 0-9)	
	1991	2001	1991	2001	1991	2001
Arab Emirates	0.003417	0.003727	0.025209	0.009978	0.026518	0.013858
Argentina	0.024791	0.104900	0.057963	0.039216	0.062362	0.038429
Austria	0.069567	0.042512	0.129690	0.295020	0.130060	0.300033
Australia	0.038531	0.084641	0.109444	0.241860	0.147936	0.147222
Bangladeshi	0.000590	0.663885	0.025816	0.062404	0.026277	0.055578
Belgium	0.050470	0.114216	0.272910	0.259320	0.280401	0.268172
Bahrain	0.000153	0.000847	0.005217	0.010264	0.008692	0.021299
Brazil	0.001799	0.014746	0.048430	0.050629	0.060109	0.059292
Canada	0.058085	0.155582	0.131519	0.229341	0.138798	0.236137
Switzerland	0.236918	0.027429	0.189793	0.236836	0.196576	0.127863
Chile	0.034630	0.055070	0.003514	0.008380	0.003043	0.007221
China	0.035508	0.192668	0.207672	0.429245	0.271186	0.475174
Costa Rica	0.434819	0.015003	0.187740	0.016820	0.172171	0.016834
Cyprus	0.000000	0.000000	0.002233	0.001470	0.002233	0.001470
Germany	0.154117	0.229444	0.177359	0.297287	0.178025	0.298382
Denmark	0.048649	0.113935	0.109075	0.219528	0.111466	0.232278
Ecuador	0.004008	0.146535	0.006685	0.013817	0.027056	0.013054
Egypt	0.000000	0.005869	0.060651	0.051797	0.060738	0.068047
Spain	0.142922	0.300542	0.134001	0.140866	0.133342	0.131432
Finland	0.000979	0.000327	0.107090	0.089601	0.111255	0.097088
France	0.117698	0.223087	0.182555	0.333054	0.184964	0.336539
England	0.034609	0.063979	0.224567	0.204923	0.235423	0.235539
Greece	0.198402	0.217685	0.014287	0.016243	0.006473	0.012221
Hong Kong	0.030057	0.040876	0.254399	0.217514	0.278128	0.207612
Hungary	0.064513	0.024995	0.023716	0.281229	0.023396	0.281438
Indonesia	0.061906	0.266115	0.122844	0.242906	0.156178	0.226191
Ireland	0.000390	0.071084	0.239849	0.641290	0.363780	0.661412
India	0.307103	0.176335	0.183614	0.191616	0.127278	0.196544
Iran	0.002527	0.227088	0.037755	0.047242	0.040684	0.033227
Italy	0.263336	0.072134	0.246266	0.270110	0.246229	0.274468
Japan	0.322899	0.225171	0.336413	0.430688	0.338227	0.466162
Kuwait	0.000290	0.000006	0.024667	0.001243	0.027938	0.007903
Sri Lank	0.020950	0.034224	0.146279	0.160991	0.160798	0.169723
Libya	0.000000	0.051289	0.006701	0.023084	0.007672	0.015542
Mexico	0.012519	0.108812	0.046182	0.149002	0.048900	0.150046
Malaysia	0.013454	0.155942	0.227500	0.524718	0.289162	0.547142
Nigeria	0.000000	0.000342	0.000444	0.034487	0.000444	0.060125
Netherlands	0.060639	0.237273	0.130234	0.196288	0.138603	0.194480
Norway	0.006517	0.023108	0.116845	0.083951	0.119222	0.087064
New Zealand	0.007624	0.187319	0.034577	0.154093	0.061137	0.137232
Oman	0.000000	0.068372	0.009235	0.015268	0.019885	0.014345
Panama	0.563586	0.006854	0.049644	0.139949	0.047400	0.140166
Peru	0.000600	0.399150	0.001773	0.114672	0.001896	0.033903
Papua New Guinea	0.000000	0.000000	0.413390	0.012098	0.458831	0.015790

Philippines	0.304570	0.258882	0.177525	0.526389	0.134556	0.559286
Pakistan	0.000644	0.099848	0.159022	0.087046	0.190507	0.085388
Poland	0.009359	0.019569	0.004528	0.097627	0.004517	0.097907
Portugal	0.000000	0.066729	0.043322	0.088714	0.045265	0.088931
Qatar	0.000000	0.000006	0.000180	0.002581	0.000263	0.003852
Saudi Arabia	0.000452	0.012749	0.010067	0.029328	0.012103	0.035289
Sweden	0.038247	0.028098	0.124269	0.274360	0.125201	0.279623
Singapore	0.822252	0.787684	0.366794	0.579467	0.273159	0.560455
Thailand	0.019147	0.125113	0.163147	0.396083	0.228464	0.457123
Turkey	0.011420	0.222330	0.023485	0.102177	0.023982	0.084603
Taiwan	0.269731	0.493186	0.510144	0.637739	0.550427	0.645970
U.S.	0.078045	0.136842	0.358563	0.396083	0.401578	0.423967
Venezuela	0.000000	0.117952	0.037857	0.001573	0.037924	0.001369
Vietnam	0.000395	0.045371	0.074951	0.123504	0.088560	0.131733
Yugoslavia	0.000000	0.000000	0.069477	0.007565	0.069502	0.007638
Mean	0.0844718	0.1282623	0.1218488	0.1786538	0.130795	0.179268

Note: Intra-industry trade indices are the weighted average of unadjusted GL indices calculated from three-digit SITC over all (or subset of) industries..

Appendix - Table 2. MIIT in Korea's Trend with All Countries (1991-2001)

(This is a full version of Table 4.)

	Non-manufactures (0-4)	Manufactures (5-8)	All industries (0-9)
Arab Emirates	0.003464	0.016337	0.010587
Argentina	0.010578	0.039252	0.036465
Austria	0.013048	0.168490	0.165603
Australia	0.103093	0.102759	0.259636
Bangladeshi	0.004137	0.070360	0.068987
Belgium	0.088530	0.175596	0.170079
Bahrain	0.001757	0.042667	0.026159
Brazil	0.011912	0.028784	0.025912
Canada	0.052525	0.145607	0.137396
Switzerland	0.008502	0.095402	0.172014
Chile	0.053964	0.007429	0.008591
China	0.178034	0.439886	0.399349
Costa Rica	0.453063	0.087321	0.100730
Cyprus	0.000000	0.002026	0.002025
Germany	0.112332	0.215393	0.212833
Denmark	0.086888	0.057718	0.060079
Ecuador	0.004876	0.011258	0.008414
Egypt	0.005785	0.054526	0.039908
Spain	0.220418	0.076232	0.083705
Finland	0.000146	0.075229	0.068510
France	0.094048	0.176592	0.173092
England	0.039179	0.104983	0.089929
Greece	0.209751	0.009517	0.012843
Hong Kong	0.032673	0.125449	0.136775
Hungary	0.033567	0.216099	0.215451
Indonesia	0.372187	0.191986	0.260050
Ireland	0.000370	0.653847	0.630371
India	0.037452	0.148782	0.128319
Iran	0.005096	0.047036	0.042788
Italy	0.032812	0.114654	0.113211
Japan	0.038874	0.283345	0.243580
Kuwait	0.000006	0.009963	0.001273
Sri Lank	0.034977	0.196882	0.182159
Libya	0.000000	0.011565	0.009524
Mexico	0.049191	0.135897	0.131526
Malaysia	0.091796	0.432576	0.400525
Nigeria	0.000342	0.058848	0.034101
Netherlands	0.026866	0.124292	0.119017
Norway	0.017677	0.046344	0.044739
New Zealand	0.224843	0.127156	0.150807
Oman	0.004587	0.001485	0.002206
Panama	0.008515	0.122484	0.122237
Peru	0.412833	0.023927	0.085215
Papua New Guinea	0.000000	0.150395	0.115751
Philippines	0.156790	0.577055	0.543972

Pakistan	0.047416	0.015946	0.024962
Poland	0.029088	0.045690	0.045649
Portugal	0.011962	0.025399	0.025083
Qatar	0.000007	0.003733	0.002655
Saudi Arabia	0.018256	0.047280	0.040020
Sweden	0.008045	0.118584	0.116199
Singapore	0.042127	0.479879	0.460899
Thailand	0.033233	0.345071	0.266233
Turkey	0.010215	0.047182	0.044409
Taiwan	0.378665	0.545967	0.530425
U.S.	0.085282	0.203484	0.192191
Venezuela	0.143198	0.001223	0.001411
Vietnam	0.041844	0.130642	0.121848
Yugoslavia	0.000000	0.069528	0.069468
Mean	0.070963	0.1370006	0.1353881

Note: MIIT is the weighted average of Brülhart (1994)'s A indices over all industries calculated from three-digit SITC for the period 1991-2001.

Appendix - Table 3. Simple Correlations with IIT and MIIT

	GL91	GL01	'A' index
GL91	1.000	0.629	0.550
GL01	0.629	1.000	0.914
'A' index	0.550	0.914	1.000
TRADE91	0.553	0.544	0.356
GDPDIF91	0.046	-0.161	-0.048
PCGDPDIF91	0.160	0.073	0.123
GDP91	0.350	0.396	0.130
PCGDP91	0.230	0.211	0.004
TO91	0.419	0.500	0.488
TIMB91	-0.353	-0.395	-0.182
TRADE01	0.543	0.542	0.356
GDPDIF01	0.071	-0.163	-0.045
PCGDPDIF01	0.233	0.074	0.156
GDP01	0.324	0.411	0.157
PCGDP01	0.194	0.225	0.245
TO01	0.411	0.531	0.539
TIMB01	-0.410	-0.549	-0.405
DISTANCE	-0.418	-0.447	-0.451
EASIA	0.348	0.471	0.506
CGDP	-0.230	-0.050	0.083
CPCGDP	-0.229	0.008	0.097
CTO	0.020	0.111	0.152
CGDPDIF	0.072	0.040	0.024
CPCGDPDIF	0.213	0.002	0.095
CTIMB	-0.108	-0.244	-0.322

Notes: 1. GL91 and GL01 are the GL indices computed over all industries from 3-digit SITC industries for 1991 and 2001, 2. 'A' index is the weighted average of Brülhart (1994)'s A indices between 1991 and 2001 over all industries computed from 3-digit SITC. 3. The numbers '91' and '01' attached to the variables indicate that these variables are calculated using the data for the years 1991 and 2001, respectively. 4. The letter 'C' attached to the variables indicates that these variables are first-differenced for the period 1991-2001. 5. TGL91 is a logit transformation of GL91. 6. TRADE91, TRADE01, GDP91, GDP01, PCGDP91, PCGDP01 and DISTANCE are in natural logs. 7. See the main text for a detailed explanation of the variables.

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