Working Paper 02-12

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– Evidence from a Gravity Analysis

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Executive Summary

This study examines the observable phenomenon of growing trade intensity among the ASEAN+3 countries over the last twenty years by using a standard gravity approach. While there is a conventional belief that trade intensities within CJK (China, Japan and Korea) and between CJK and ASEAN have increased, we cannot find proper evidence that the relations have intensified over time beyond the gravity factors, considering the change of pattern in the gravity residuals. Moreover, with the exclusion of Hong Kong, the fitted trade flows projected by the gravity equation can explain most of the actual flows within CJK. With respect to the trade relations between CJK and ASEAN, substantial time-serial fluctuations in trade intensity disappear if the two entrepots of Hong Kong and Singapore are excluded.

A test for any special trade relations between each CJK country and ASEAN reveals that the widely known close trade relations between Japan and ASEAN are mostly explained by the gravity factors even in the heyday of the Japanese yen bloc, but that the Chinese connection which the gravity regression cannot explain, may exist in trade with ASEAN. It is also revealed that recent developments in trade between Korea and ASEAN are growing increasingly distant from the realm of the gravity explanation.

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Has Trade Intensity in ASEAN+3 Really Increased? - Evidence from a Gravity Analysis

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I. Introduction

This study examines the observable phenomenon of growing trade intensity among ASEAN+3 over the last twenty years by using a standard gravity approach. Over the past 20 years, an explosive growth in trade volume has been reported in ASEAN+3. The average export and import growth rates for ASEAN+3 in 1970~1995 are 16.08% and 15.42% respectively, higher than the world average growth rates of 12.15% and 12.06%.[1] As a result, the export and import shares of ASEAN+3 in world trade soared from 14.83% and 15.07% in 1980 to 26.72% and 24.73% in 1995. Despite the financial crisis in 1997, ASEAN+3 accounted for more than 23% of the world trade volume in 2001. With the rapid growth of the total trade volume, intra-regional trade has increased too. The share of intra-regional trade in ASEAN+3 developed from 31% in 1978, to 36% in 1988 and further to 49% in 1996.[2]

1) IMF, International Financial Statistics, each year.

2) Bark (1999), p. 893, Table 2. After the financial crisis, the share decreased to 43% in 1998.

The observable phenomenon of rapidly growing total and intra-regional trade volumes in ASEAN+3 may invite the following question: Does the trade in ASEAN+3 have its own characteristics, unique from the trade in other regions, or does it simply reflect the growing economic size of East Asian countries? If over-trade or under-trade in relation to the economic size of trading partners is observed, then intra-regional trade in ASEAN+3 may have a variety of aspects that cannot be explained simply by economic size. On the other hand, considering the fact that ASEAN+3 has grown more rapidly than any other region in the world over more than thirty years, it seems reasonable to suppose that growing intra-regional trade in ASEAN+3 is simply a mirror of the region's rapid economic growth. It is important to highlight such characteristics of trade in ASEAN+3 when we think of the recent discussions on trade structure in ASEAN+3 in the context of prospects of the formation of 'natural' trading blocs in Asia.

So far, a great deal of research has been conducted on trade structure within ASEAN, between Japan and ASEAN, and China and ASEAN.[3)] It is well known that Japan has been engaging in more intra- industry trade with ASEAN, while its dominant status in overall trade with ASEAN has shrunk. On the other hand, China is reported to have emerged as an alternative production base for ASEAN. It has also been observed that China's trade relations with ASEAN have tremendously restored since its earlier era of openness in 1978. Trade relations between Korea and ASEAN have been the focus of growing interest among members of the public as well as academics.

3) Kwan (1996), Abe (1997), and Tamamura (2002) are a few examples of such studies.

Recently, there has been another proliferation of research on the trade structure in East Asia or ASEAN+3 with regards to the possibility of trading blocs in Asia. Some of the most prominent studies have been conducted by Petri (1993) who traced changes in East Asian trade patterns to consider the possibility of a trading bloc led by Japan and to illuminate the role of the U.S. in the Asia-Pacific region. Bark (1999) analyzed inter- and intra-regional trade patterns of East Asian economies and examined the effects of the Asian crisis on East Asian trade patterns. He showed East Asia had been more integrated than North America or the EU in terms of regional gravity coefficient, although North America began to surpass East Asia in the early 1990s when NAFTA came into effect. Frankel (1997) conducted an extensive analysis of the effects of trading blocs on world trade using the gravity equation approach, finding that East Asia or ASEAN played a role in promoting intra-regional trade. He argues that this kind of pattern was observed even in the 1960s. Lee and Park (2002) presented interesting research on the prospects of trading blocs in East Asia, analyzing trade structure by the gravity approach. They argue that ASEAN+3 is emerging as a promising regional trading bloc more than any of the other categories such as CJK (China, Japan and Korea) or East Asia+2 (ASEAN+3 plus Australia and New Zealand).

This paper tries to test the above-mentioned question on the peculiarity of trade within ASEAN+3. To do this, a degree of trade intensity is formulated to grasp the trend in the trade intensity of ASEAN+3. This measure can serve as the starting point for a rigorous analysis to determine the characteristics of the ASEAN+3 trade structure. The next step is to test whether trade in ASEAN+3 has aspects unique from that of other regions. To do this, the gravity method is used, as it can capture the effect of economic size and other factors on trade. A main focus of this study is on finding the characteristics of the trade relationship within CJK and between CJK and ASEAN over a twenty-year period starting in 1980.

The rest of the paper is organized as follows. Chapter II proposes a trade intensity measure and examines patterns of trade intensity among ASEAN+3 countries since 1980. Chapter III analyzes trade relations within the ASEAN+3 region by using a gravity equation approach and examines whether the simple findings of trade intensity patterns shown in Chapter II do hold in the context of the gravity approach. To do this, trade flows within the region are regressed on the basic gravity factors and dummy variables representing the trade relationship of the subgroup in ASEAN+3. Chapter IV discusses remaining issues and concludes the paper.

II. Growing Bilateral Trade Intensity of ASEAN+3[4)]

1. Bilateral Trade Intensity

To evaluate the degree of trade intensity among ASEAN+3 countries over the past twenty years, a measure of bilateral trade intensity is introduced. Several methods have been developed to evaluate the degree of trade intensity between two countries.[5)] Among others, Frankel and Rose (1998) proposed the following simple proxy for the bilateral trade intensity of two countries, in evaluating the suitability of the optimum currency areas.[6)]

$$w_{ijt} = (X_{ijt} + M_{ijt})/(X_{i.t} + X_{j.t} + M_{i.t} + M_{j.t}) \qquad (1)$$

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4) This chapter originates from "A measurement of degree of trade integration in East Asia (1980 -1999)" in *A Study on Medium- to Long-term Strategy for Currency Cooperation and Integration in East Asia*, KIEP Report, 2001. The original version was substantially revised and condensed.

5) To name a few examples representing trade intensity, $X_{ij}/X_i(orM_{ij}/M_i)$ are commonly used as proxies for trade intensity. To standardize the measure to be immune from any size effect, $(X_{ij}/X_i)/(M_j/M_w)$ is also widely used.

6) The other measure for optimality of common currency area suggested by Frankel and Rose is the bilateral correlation of real economic activity, that is, bilateral trade volume divided by the nominal GDP of the two countries.

Where w_{ijt} is the degree of trade intensity between two countries i and j during period t, X_{ijt} denotes country i's total nominal exports to country j, M_{ijt} denotes country i's total nominal imports from country j, $X_{i.t}$ denotes country i's total global exports to the world and $M_{i.t}$ denotes country i's total global imports from the world. This measure expresses the bilateral trade intimacy normalized by the total trade of two countries. Higher values of w_{ijt} indicates greater trade intensity between countries i and j.

While this measure is intuitive and simple to calculate, it contains some problems. Firstly, as Frankel and Rose have recognised, not a few cases are observed in the dataset where country i's exports to country j do not coincide with country j's imports from country i. From the asymmetry of the data, controversies on data accuracy may arise.[7] Secondly, four terms appear in the denominator in the meas-

7) Why $X_{ijt} \neq M_{jit}$? There are some reasons for the statistical discrepancy. First, the importing and exporting countries use different prices for the traded goods. Exporting countries collect export data based on FOB prices, while importing countries more often use CIF criteria. The trade data reflects any discrepancy between those two types of prices. The second reason stems from a calendar discrepancy. If an item is exported on the last day of a month and arrives at the destination port in the following month, the exporting country includes the item in the previous month's trade record, while the importing country may consider it as part of the following month's performances. Thirdly, there are some other reasons which are hard to explain. This unexplainable statistical discrepancy may arise from calculation errors including double counting, application of different criteria to the same items, and so on. We would like to thank Dr. Sohn, Chan-Hyun for helpful comments on this matter.

ure, but there are only two terms in the numerator. So, any effects of trade flows from country j to i are ignored in the numerator, while they are considered in the second and the fourth terms of the denominator. To recognize any misunderstanding which might happen in the measure, think of an extreme case when two countries trade exclusively with each other and there is no trade with third parties. The value of the measure makes 1/2. It would be more natural for trade intensity to be 1 in this case.

To avoid these problems, we made a minor revision from Frankel and Rose's measure by simply adding two other terms of X_{jit} and M_{jit} in the numerator;

$$w_{ijt}(\%) = (X_{ijt} + X_{jit} + M_{ijt} + M_{jit}) * 100 \,/\, (X_{i.t} + X_{j.t} + M_{i.t} + M_{j.t}) \qquad (2)$$

w_{ijt} implies the degree of intensity in the trade of two countries, compared to their global trade volume. Higher values of the measure indicate greater trade intensity between the countries i and j. By definition, this measure is symmetric, that is, $w_{ijt} = w_{jit}$ which hardly hold in the measure of Frankel and Rose.[8)]

8) This measure as well as Frankel and Rose's makes a weighted average of trade dependency for any one country on another. The value of the measure is closer to the larger partner's trade ratio towards the smaller one, than the smaller partner's trade ratio towards the bigger one. For example, the value of the measure between Japan and other ASEAN countries is much closer to Japan's ratio of bilateral trade volume divided by its global trade volume.

2. The Data

The data used in this paper include annual nominal export/import performances of the ten ASEAN+3 countries, that is, Korea, Japan, China, Hong Kong, Brunei, Indonesia, Malaysia, the Philippines, Singapore, Thailand and Vietnam from 1980 to 1999, and the data source is the Direction of Trade Statistics Yearbook, published by the IMF each year.[9]

The data set contains bilateral export and import record of the ten ASEAN+3 countries and their share in the world trade volume. Some trade data are missing, such as those of Vietnam in the early 1980s and of Korea-China trade before the establishment of official diplomatic relations in 1992.

3. Results

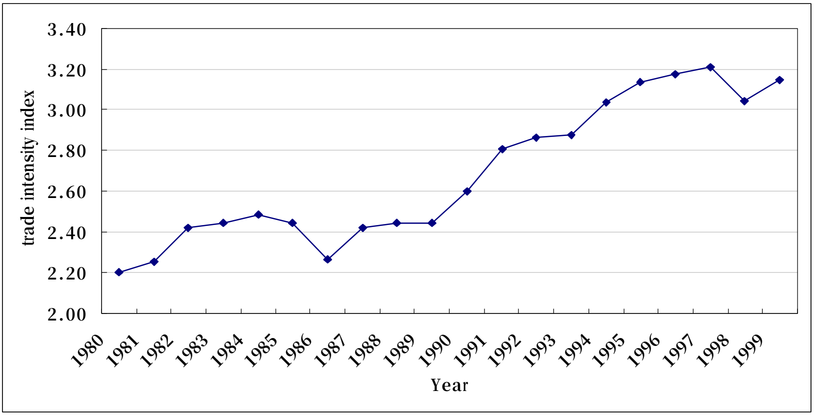
Over the twenty years from 1980 to 1999, the averaged trade intensity defined in Section 1 increased from 2.2 (1980) to 3.14 (1999), except in two periods of economic recession in 1984-1986 and 1997-1998.[10] This reveals that the ASEAN+3 countries have been get-

9) Among 10 ASEAN+3 countries, Laos, Cambodia and Myanmar are excluded, as their economic sizes and trade volumes are relatively small compared to the other countries'.

10) Although two troughs of 1984-1986 and 1997-1998 can be observed in <Figure 1>, the patterns of contraction of trade intensity differ. In the former case when the Japanese yen appreciated by more than a fourth, the trade intensity of Japan-ASEAN and within ASEAN conspicuously shrank, while Korea was not affected so much. This may have been

ting more integrated in trade over the whole period (Figure 1 and Table 1).

Figure 1. Trade intensity trend of the ten ASEAN+3 countries since 1980



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caused by Japan's big increase in *nominal* export performances toward the Western countries with the yen's appreciation in 1986. ASEAN, a major subcontractor of Japan, has been affected by the decrease in its exports to Japan, in *real* terms and US dollar terms, caused by yen's appreciation. Korea experienced a 47.6% increase in imports from and 29.3% increase of export to Japan in 1986. In the latter case, the trade intensity of Korea and Japan with respect to the other ASEAN+3 countries drastically decreased. This may be explained by the fact that the import market in East Asian countries collapsed but that their exports *outside* East Asia exploded. The collapse of East Asia's imports had rather a symmetric effect on the whole world, including those regions outside ASEAN+3; but the explosion of East Asia's exports outside the region, as financial or economic crisis did not happen outside of the East Asia, led to the collapse of the trade intensity of Korea and Japan with ASEAN.

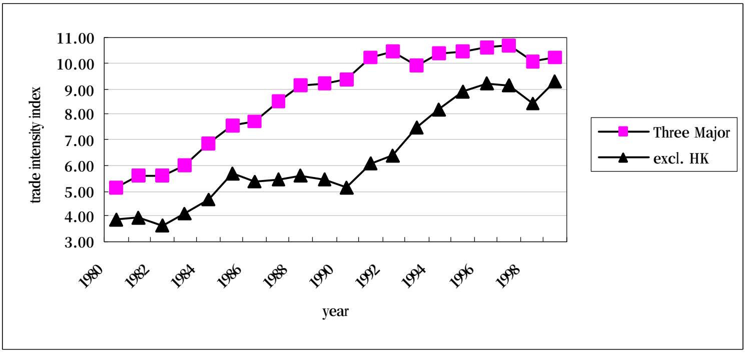
Over the same period, trade intensity within CJK has also substantially increased from 5.14 (1980) to 10.24 (1999). The values of trade intensity in CJK are much higher than the average value of ASEAN+3, which implies that CJK depend on each other in trade more than the other ASEAN countries (Table 1).[11)]

Table 1. Trade intensity in the major ASEAN+3 countries

	1980	1985	1990	1995	1999
ASEAN+3	2.20	2.44	2.60	3.13	3.14
CJK	5.14	7.55	9.17	10.45	10.24
CJK(excl. H.K.)	3.87	5.68	5.14	8.87	9.26
ASEAN	1.96	2.13	1.82	2.20	2.46

* CJK indicates the three Northeast Asian countries of China, Japan and Korea.

Figure 2. Trade intensity trend within Korea, Japan and China



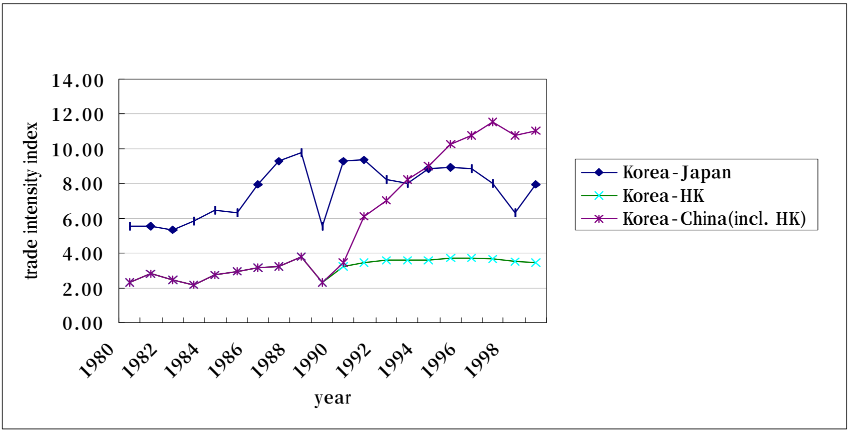
It is interesting to note that the weight of Hong Kong in trade among the three countries expanded throughout the 1980s, but

11) ASEAN is revealed not to be so integrated, since values ranges around 2, which is much less than those of CJK.

shrank very rapidly in the 1990s (Figure 2).[12)]

While trade intensity between Korea and Japan over the same period has not changed much, rising from 5.57 (1980) to 7.98 (1999), trade between Korea and China, especially mainland China, has substantially intensified from 2.36 to 11.05 (Figure 3). The growing trade intensity between Korea and China after 1991 can be mainly attributed to the explosive growth of trade between Korea and mainland China.

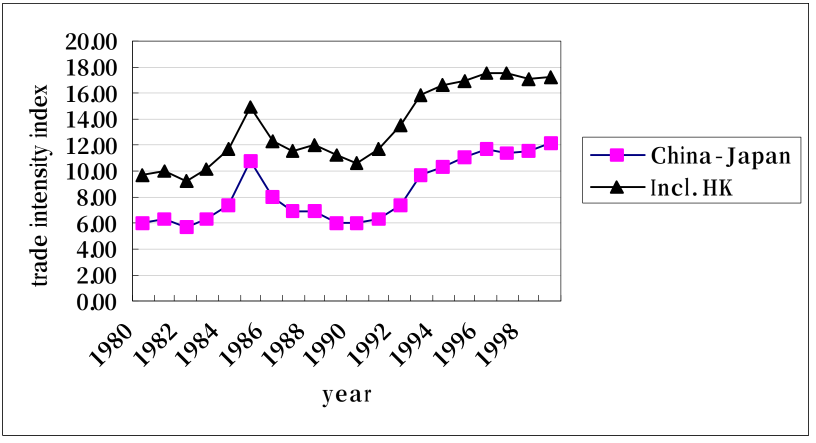
Figure 3. The trade intensity trend in Korea-Japan and Korea-China



12) A possible explanation for this change is that growing trade flows with Hong Kong in the 1980s reflects an increasing volume of detour trade to mainland China. Note that it is not until the early 1990s that the trade performances between Korea and mainland China has been recorded, so it can be interpreted that substantial parts of trade flows between Korea and Hong Kong in the 1980s may have been trade on its way to mainland China via Hong Kong. Furthermore, mainland China's trade with Hong Kong increased very rapidly in the second half of the 1980s.

China's trade with Japan has substantially increased too, jumping from 9.67 to 17.18 in terms of trade intensity (Figure 4). It is notable that trade between Japan and Hong Kong has been quite stable over the period, while trade between Japan and mainland China has undergone drastic change. Recall that Korea, as well as Japan, has kept stable trade relations with Hong Kong (Figure 3).

Figure 4. The trade intensity between China and Japan



Although trade intensity among the ASEAN+3 countries has increased over the whole period, the contribution of the trade within each of the three subregional groups - CJK, ASEAN, and CJK and ASEAN - to the increment of trade intensity varies. The increase of trade intensity among the CJK countries, Korea, Japan and China is 30.6, which accounts for 59.1% of the total increase of 51.7. Meanwhile 20.5% of the total increase can be attributed to the trade within ASEAN, and the increase of trade intensity between CJK and ASEAN accounts for 20.4% of the total increase.

Of the increased trade intensity within CJK, China's explosive trade performance accounts for most of the increase; among the total 30.6, 11.97 is for the increased trade between China and Hong Kong, 7.43 is for trade with Korea, and 6.14 is for trade with Japan. Therefore, the 'China factor' accounts for more than 83% of the total increment of trade intensity within CJK.

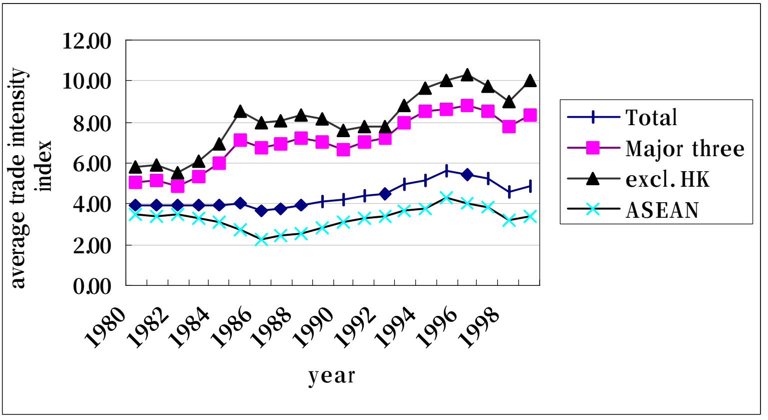
If we focus on CJK's trade intensity with ASEAN, Korea has been the biggest contributor in the growth of trade. The net increment of Korea's trade intensity towards ASEAN over the twenty-year period is 8.01, which is far ahead of 3.92 for China, while the trade intensity of Japan and Hong Kong towards ASEAN decreased over the same period. Korea, together with Malaysia, is one of only two ASEAN+3 countries that have shown growing trade intensity with all trading partners.

While all three CJK countries have undergone increased trade intensity within ASEAN+3, within CJK, and with ASEAN, Korea has shown very rapid growth in intensity, in contrast to Japan's slow increase. The following explains the trends of CJK trade intensity in more detail.

1) Japan-ASEAN+3

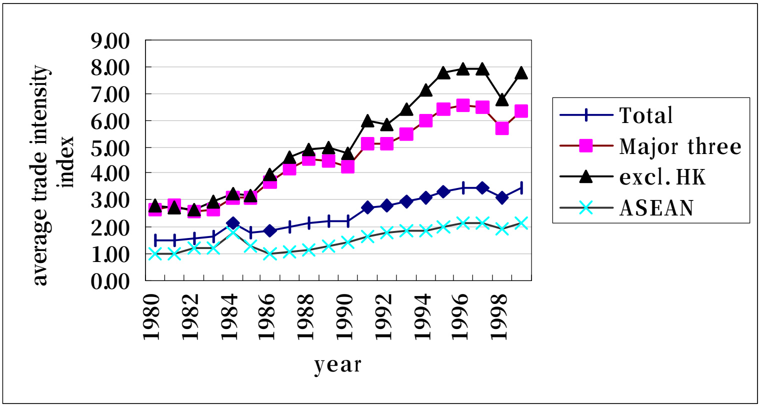
Japan's trade intensity with ASEAN+3 stagnated in the 1980s, before slowly increasing to peak in 1995, and decreased again thereafter (Figure 5). In terms of averages, the values of trade intensity are higher in the 1990s than in the 1980s. Japan's average trade intensity with Korea and China has increased from 5.08 to 8.39. However, Japan's trade intensity with ASEAN has severely stagnated (Figure 5).[13)]

Figure 5. Japan's trade intensity with ASEAN+3



2) Korea-ASEAN+3

Figure 6. Korea's trade intensity with ASEAN+3



Over the same period, Korea's trade intensity with ASEAN+3 un-

13) Abe (1997) reports similar findings for the period of 1980 and 1991. See Abe (1997), pp. 15-16.

derwent a large increase from 1.52 to 3.43 (Figure 6). Korea's trade intensity with China and Japan has shown a steady increase from 2.64 to 6.34, while its trade intensity with ASEAN has doubled from 1.03 to 2.18. Korea's trade intensity underwent the most severe fluctuation around 1997-1998 in terms of trade with CJK.

3) China-ASEAN+3

During the same twenty-year period, China's trade intensity with ASEAN+3 grew from 2.60 to 5.56. Its average trade intensity with Korea and Japan increased from 6.43 to 15.01, and with ASEAN from 0.96 to 1.52. China's trade intensity with Hong Kong also grew from 13.26 in 1980, peaking at 34.11 in 1991, but showed a decrease to 25.22 in 1999 (Figure 8). Nevertheless, Hong Kong remains the biggest trading partner of mainland China. It is interesting to note that China's trade intensity with ASEAN+3 did not show any fluctuations around 1997-1998, which contrasts with the severe ups and downs in the corresponding figures for Korea and Japan.

Figure 7. China's trade intensity with ASEAN+3

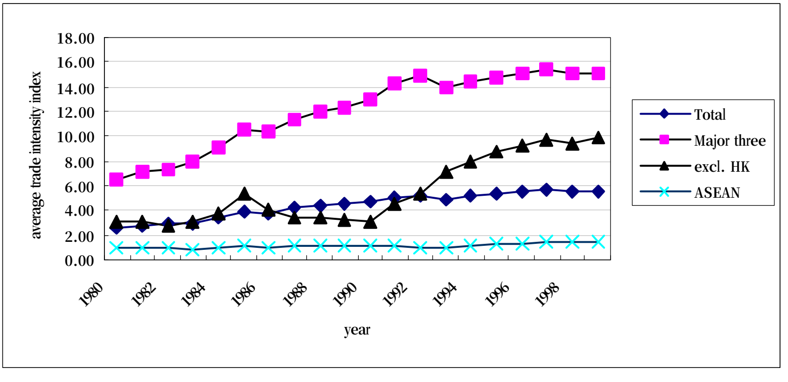
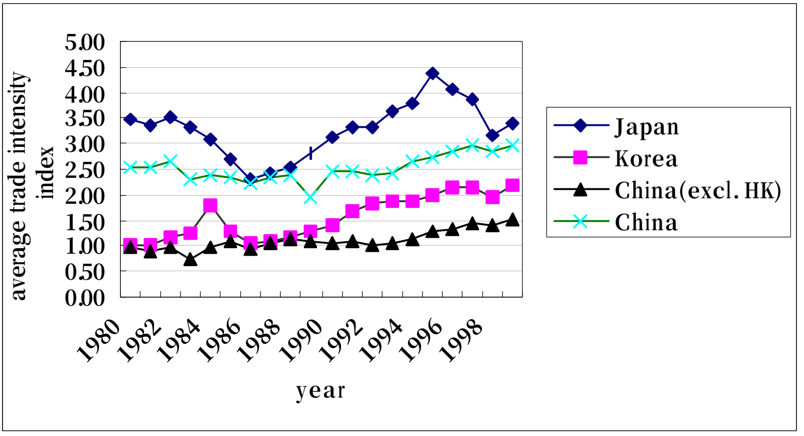


Figure 8. CJK's trade intensity with ASEAN



When we compare the intensities in the trade of each of the CJK countries with ASEAN, we find that Japan has built the most concrete and steady ties with ASEAN countries, to show higher values of trade intensity over the whole period (Figure 8), while China has the second most intense ties and Korea, the third. One conspicuous trend between Japan and ASEAN is the increasing pattern of trade intensity for the period of 1986 to 1995. This period coincides with the era of the appreciating Japanese yen and subsequent large wave of Japanese FDI into ASEAN countries to construct the network of international division of labour.

In terms of speed of growth rate, however, Korea is the top among the three Northeast Asian countries in the growth rate of its trade intensity with ASEAN. This contrasts with Japan's stagnating values of trade intensity with ASEAN over the years. Korea's trade intensity has grown faster than China's (including Hong Kong), as well. In 1980, Korea's trade intensity with ASEAN was only 1.03, while that of Japan was 3.48. Korea's performance was just 29.7% of Japan's. By 1999, Korea's trade intensity had jumped to 2.18, which is equivalent to 63.8% of Japan's trade intensity with ASEAN. Over the same period, the degree of trade intensity of China (including Hong Kong) with respect to ASEAN increased from 2.52 in 1980 to 2.96 in 1999, which are equivalent to 72.4% and 86.8%, respectively of Japan's.

III. A Gravity Interpretation of the Trade Intensity in ASEAN+3

1. The Gravity Model

The stylized facts on the trade pattern in ASEAN + 3 revealed in the previous chapter are summarized as follows:

1. The average bilateral trade intensity for the ten ASEAN+3 countries increased from 2.2 to 3.14 over the twenty-year period of 1980-1999.

2. Trade within CJK has intensified from 5.14 to 10.24 within the same twenty-year period, mainly due to big increases in trade with China.

3. The growing trade intensity between Korea and ASEAN has been especially conspicuous. While the degrees of trade intensity of Korea and China with respect to ASEAN are respectively 29.7% and 72.4% of Japan's in 1980, those figures jump to 63.8% and 86.8% of Japan's in 1999.

In this chapter, we will examine the stylized facts on the trade structure of ASEAN+3 by using the gravity model approach. The gravity model was introduced in this paper for several reasons; first, we want to test whether the so-called "success of empirical fitness" of the gravity model applies to the trade relations in ASEAN+3. The question is whether trade in ASEAN+3 is positively affected by the economic size (GDP) and income level (per capita GDP) of trading partners and negatively affected by the geographical distance between trading partners. Second, with regard to the observable growing trade intensity within ASEAN+3, it will be significant to note to what degree the growth can be explained by the basic gravity factors of economic size, income and distance. That is, if the basic gravity is revealed to explain most of the increase in trade intensity, then we can conclude that the growing trade intensity in ASEAN+3 is not a phenomenon unique to East Asia. The growing trade intensity can be a result of the region's higher growth rate compared to other parts of the world. Third, the gravity model can help to identify the effects of bilateral trade relations of any subregional group, simply by introducing regional dummy variables. For instance, Korea's growing trade with ASEAN may be grasped by introducing a dummy of Korea-ASEAN trade. Fourth, with the gravity approach, we can estimate the existence of trade barriers, which can be reflected in gravity residuals. Cross-sectional analyses can give us information on which countries perform better in trade than their baseline trade volume as explained by economic size, income and distance.

The basic gravity equation for the regression analysis takes the following form:

$$\ln T_{ijt} = \alpha + \beta_1 \ln(Y_{it} \cdot Y_{jt}) + \beta_2 \ln D_{ij} + \varepsilon_{ijt} \qquad (3)$$

where T_{ijt} denotes bilateral trade volume between two countries i and j, α is a constant term, $Y_{it} \cdot Y_{jt}$ denotes a product of the GDPs of two countries i and j, and D_{ij} denotes distance between two countries i and j.

In equation (3), all variables take a natural logarithm form. Among the explanatory variables on the right-hand side of the equation, $Y_{it} \cdot Y_{jt}$ can serve as a proxy for economic size. The gravity model predicts a positive sign of β_1, as bigger economic size may cause bigger trade volumes. The distance variable D_{ij} reflects trade resistance factors such as transport costs and geographical and cultural dissimilarity. The sign of the coefficient β_2 is expected to be negative, as trade resistance factors must be harmful for enlarging trade. Equation (3) is called the first form of basic gravity equation.

To the basic equation form, we add an additional term of product of per capita GDP of the two countries, so that we can consider any influence of a country's income level on trade. If it is observed that bigger $Y_{it}/P_{it} \cdot Y_{jt}/P_{jt}$ leads to more volumes of trade, it means richer countries trade more than poor ones. The Krugman and Helpman theory predicts that the coefficient of this term will have a positive effect on the trade term.[14] It is important to know, however, that the positive sign of the coefficient does not refute the Heckscher-Ohlin theory, because the theory is described as predicting that the absolute value of the difference of the two variables will have a positive effect. Rather, popular use of per capita GDP in the gravity equation is from

14) Some possible explanations for the effect of income per capita may exist in the gravity equations. First, the advanced economies can produce exotic varieties better than the backward ones and the variety leads to consumption. Second, the more developed economies have more advanced transportation infrastructures which facilitate trade. Third, the more advanced economies keep more open economic system, so that trade are encouraged. To see the role of per capita GDP in the gravity equation, refer to Frankel (1997), pp. 57-61.

the empirical clarity of independency of effects between GDP and per capita GDP.

So, the second form of the basic gravity equation is

$$\ln T_{ijt} = \alpha + \beta_1 \ln(Y_{it} \cdot Y_{jt}) + \beta_2 \ln(Y_{it}/P_{it} \cdot Y_{jt}/P_{jt}) + \beta_3 \ln D_{ij} + \varepsilon_{ijt} \qquad (4)$$

where P_{it} denotes population of country i at time t and $Y_{it}/P_{it} \cdot Y_{jt}/P_{jt}$ is a product of the per capita GDPs of two countries i and j. The expected signs for the coefficients on the right-hand side of equation (4) are respectively positive, positive and negative.

Now, the basic gravity equation is expanded to test the role of specific regional trade relations which cannot be explained by the basic gravity factors. Dummies for ASEAN and CJK-ASEAN relations are introduced. Thus, the resulting expanded gravity equation takes the form of

$$\begin{aligned}\ln T_{ijt} = {} & \alpha + \beta_1 \ln(Y_{it} \cdot Y_{jt}) + \beta_2 \ln(Y_{it}/P_{it} \cdot Y_{jt}/P_{jt}) + \beta_3 \ln D_{ij} \\ & + \beta_4 ASEAN + \beta_5 CHINA + \beta_6 KORASEAN + \beta_7 JAPASEAN \qquad (5) \\ & + \beta_8 XNASEAN + \varepsilon_{ijt}\end{aligned}$$

where *ASEAN* is a dummy for ASEAN countries, *CHINA* is for China and Hong Kong, *KORASEAN* is for Korea and ASEAN, *JAPASEAN* is for Japan and ASEAN and *XNASEAN* is for China and ASEAN. The magnitude and statistical significance as well as signs of the coefficients are of key note. For instance, if Japan continues firm ties with ASEAN in trade beyond factors of economic size or geographical distance, then β_7 must take a positive value with statistical significance, and so on.

2. The Data

Countries of analysis include the 10 ASEAN+3 countries - Korea, Japan, China, Hong Kong, Malaysia, Indonesia, Thailand, the Philippines, Singapore and Vietnam. 45 cross-sectional cases are considered in each year as a result of ${}_{10}C_2$. Time variant trend is of much interest, so the cases of the five years of 1980, 1985, 1990, 1995 and 1999 are analyzed. Any change of trade structure over the twenty years can be grasped.

Some data on the trade and GDP of Vietnam and China in the 1980s are missing. Trade data are based on the Direction of Trade Statistics of the IMF, while GDP and per capita GDP are from the World Development Indicators 2001 of the World Bank. Two types of GDP and per capita GDP are used: current and PPP base, as there are sizable differences in the two types of data for some countries such as China.

Distance between two countries is the great circle distance between their commercial centers.[15] Most of the bases for the calculation of distance are the capital cities of the countries except for China. Shanghai is chosen for the economic capital of China as it has been the most prosperous and economically active region in China over the years.

3. Empirical Analysis

1) The basic gravity equation

The cross-sectional OLS regression results for five selected years

15) For the distance data, refer to http://www.indo.com/distance.

for the first basic gravity equation (3) are reported in Table 2.[16] Data for GDP are in current terms.

Table 2 reveals that the GDP term has a positive sign of coefficients, which means bigger economic size leads to more volume of trade. The values of coefficients in GDP terms range between 0.56 ~ 0.70. Distance term shows negative signs, implying that distance plays a role of restraining trade. But coefficients in 1985 and 1990 are statistically insignificant at 5%, showing low t-statistics of 1.72 and 1.38. Another weak point in the first basic gravity model is that the R^2 values are lower than predicted by other gravity research results. Other studies of gravity R^2 report high values of 0.7~0.8.

Table 2. OLS regression results for the first basic gravity model

Explanatory Variable	1980	1985	1990	1995	1999
Constant	7.53***	5.89**	4.67*	6.95***	6.65***
Product of GDPs	0.56***	0.70***	0.69***	0.69***	0.58***
Distance	-0.67**	-0.67*	-0.49	-0.77***	-0.56***
No. of Observations	34	41	45	45	45
R^2	0.40	0.39	0.48	0.60	0.62
Adjusted R^2	0.36	0.36	0.46	0.69	0.61

Note: ***, ** and * mean statistical significance at the 1%, 5% and 10% levels respectively.

Table 3 and 5 report the regression results with GDP per capita term of the second basic gravity model (4). The regression was done twice, so that the PPP and the current base of GDP per capita terms are applied respectively.[17] Table 3 reports the results with the PPP

16) For the complete results, refer to the appendix.

bases per capita GDP, and Table 4 shows the case with the current per capita GDP.

Table 3 shows the regression results with the PPP measured GDP per capita. The log of product of GDP variables is statistically significant at the 1% level in all 5 years. However, the most striking results are negative signs of the coefficient in GDP per capita until 1990, although they are not significant at the 5% level and the coefficients in 1985 and 1990 are insignificant even at the 10% level. The degree of fitness is also poor. R^2 in 1980, 1985 and 1990 shows low values, ranging between 0.34 to 0.46.[18)]

17) In all selected years, actually four times of regressions in the basic gravity equation have been done by two types of GDP data and two types of per capita GDP data. There have been many controversies whether or not the PPP bases are better to use in the gravity model. The PPP bases may have an advantage, as it is said to correctly reflect the purchasing power. Another supporter for using the PPP bases is that it may immune from the multicollinearity problem in using two current base income data in the same equation. However, there also exist disadvantages of using the PPP bases. They are subject to large measurement errors (Srinivasan, T.N. (1995), p. 58 and pp. 61-62). In many cases, the derivation of the PPP bases income crucially depends on what kind of goods the basket contains, how much differentiated qualities of goods are reflected, and others. If the PPP data have severe defects of accuracy, it may lead to misleading results. The other questioning in using PPP bases is rather fundamental: Does it really make sense to use the PPP bases in the gravity equation? The PPP base reflects any usage of non-tradable goods in domestic economy. It can be less related to trade than the current base.

18) The regression result in 1990 are the worst case, where only constant

Table 3. OLS regression results for the basic gravity model (in case of per capita GDP in PPP base)

Explanatory Variable	1980	1985	1990	1995	1999
Constant	11.50***	10.18***	9.34**	3.35	-1.14
Product of GDPs	0.52***	0.56***	0.45***	0.66***	0.43***
Product of per capita GDPs	-0.27*	-0.14	-0.19	0.22*	0.50***
Distance	-0.61*	-0.72**	-0.34	-0.78***	-0.48***
No. of Observations	34	35	36	45	45
R^2	0.46	0.43	0.34	0.63	0.80
Adjusted R^2	0.40	0.38	0.28	0.60	0.79

Note: ***, ** and * mean statistical significance at the 1%, 5% and 10% levels respectively.

The second basic gravity model with the current per capita GDP shows a much better fit in general. In Table 4, the coefficients of GDP and per capita GDP strongly support a positive impact on trade, while the distance factor shows a negative effect on trade. R^2 is in the high range of 0.68 ~ 0.79 and the trend shows a consistent ascending order. Compared with the results presented in Table 2, R^2 figures are much improved.

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and coefficient of log of GDP product are statistically significant, but per capita GDP and distance coefficients fail to be statistically significant at 10% level. The adjusted R^2 is only 0.28. Another interesting observation is that in 1995 and especially in 1999, the regression results drastically improved. In 1999, all three coefficients are statistically significant and R^2s are 0.80, which shows very good fitness. The results in 1999 strongly support the Krugman and Helpman theory.

Table 4. OLS regression results for the basic gravity model (in case of current per capita GDP)

Explanatory Variable	1980	1985	1990	1995	1999
Constant	0.42	-2.87	-1.42	2.67*	3.26**
Product of GDPs	0.52***	0.58***	0.38***	0.48***	0.44***
Product of per capita GDPs	0.46***	0.61***	0.51***	0.35***	0.27***
Distance	-0.60**	-0.57**	-0.34	-0.68***	-0.49***
No. of Observations	34	41	45	45	45
R^2	0.68	0.69	0.76	0.78	0.79
Adjusted R^2	0.65	0.67	0.74	0.77	0.77

Note: ***, ** and * mean statistical significance at the 1%, 5% and 10% levels respectively.

The log of product of GDP variables are statistically significant at the 1% level in all 5 years. The estimated values of the coefficient are 0.52, 0.58, 0.38, 0.48 and 0.44 respectively. The magnitude of co-efficients in GDP variables are lower than those of other studies, which may be due to another GDP related factor of the per capita GDP.

In contrast to the results in Table 3, per capita GDP variables in Table 4 are revealed to be highly significant in all five years.[19] The estimated coefficient on the per capita GDP variables are 0.46, 0.61, 0.51, 0.35 and 0.27. The magnitude of the estimated coefficient in per capita GDP variables is rather higher than in other analyses such as Frankel (1998) and Sohn (2001). This may be due to the fact that very

19) However, our results are along the same lines as Linnemann (1966), in that they may have little impact on the results except for the coefficient on income itself.

small countries with high income levels and high volume of trade flow such as Hong Kong and Singapore are included in our data. In our study, the coefficients of per capita GDP are not smaller than those of GDP, so that income factor (per capita GDP) has as much effect on trade as the economic size factor (GDP). Recent data shows that the effect of income factor has lessened.

The distance variables are significant in three years, but fluctuate greatly in magnitude and statistical significance over the years. The estimated values of the coefficient range from -0.34 to -0.68, and significance levels of the coefficients are within 1% in 1995 and 1999; within 5% in 1980; and within 10% in 1985; but more than 17% in 1990. The coefficient of the distant term in 1990 appears to be insignificant in this case. The estimated values of the coefficients of the log of distances in this study turned out to be rather smaller in absolute terms than those estimated by previous studies, which ranged around -0.75 ~ -0.95.[20)]

As the fitted trade flows estimated by the gravity model can be interpreted to be a 'natural' level of trade flows between trading partners, a comparison with actual trade flows can reveal information on whether the actual trade flows are over-trade or under-trade in terms of the gravity.

Table 5 reports the ratio of actual trade flows between countries i and j (T_{ijt}) to the estimated trade flows (t_{ijt}) in equation (4).[21)] Figures larger than 1 in Table 5 imply that actual trade flows between two

20) See p. 23 in Sohn and Yoon (2001) for reference.

21) The basic gravity model with the current base GDP per capita is used for the comparison, as the regression results in the case of current base are better performed than those in case of the PPP base.

countries are larger than those expected by the gravity factors of economic size, income level, and transport and geographical costs. For instance, Table 5 reports 2.96 in 1999 in the item, Korea - Indonesia, which indicates that trade volume between Korea and Indonesia in 1999 is 2.96 times as large as that explained by the gravity factors.

Table 5 shows Hong Kong and (mainland) China have over-traded long before 1997 when the two economies officially pronounced China's annexation of Hong Kong. Trade volume between the two regions has been 4.05 ~18.07 times as large as that explained by the gravity. Another adjacent pair, Malaysia and Singapore, have traded so much that their trade volumes are 2.5 ~ 3.56 times as large as expected by the gravity.[22)]

It is significant that bilateral trade relations between Korea and Indonesia have been deep, showing 2.96 in 1999, ranking second on the table, even though the two countries are not adjacent to each other, nor serve as an entrepot for goods in transit.[23)]

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22) Hong Kong and Singapore have played the role of representative entrepots in the world. As many of their imports are re-exported, trade volumes are, in general, much higher than GDP volume (for instance, Hong Kong re-exported 84.6% of its imports in 2001, and its total trade volumes are 2.38 times as large as its GDP volume). In many cases, this peculiarity creates disturbances in the gravity regression, as the GDP performance corresponds less with the trade records. The resulting phenomenon is very big ratios of actual trade flows to the fitted flows by the gravity in the data of entrepot. This must be considered when we think of the cases of Hong Kong and Singapore.

23) Adjacency can be a trade promoting effect if we consider the four cases of adjacency. That is, Hong Kong-China, Malaysia-Singapore, Malaysia

Trade between Korea and China has expanded very rapidly, so that trade volume between the two countries exceeded that of the gravity level from the low level of 0.08 in 1990 to 1.26 in 1999. On the other hand, Korea's trade performance with Japan is one of the lowest records among the ASEAN+3. The ratio reported in Table 5 ranges from 0.32 to 0.57, which is the third lowest level among the 45 cases of ASEAN+3 in 1999. The ratio between Indonesia and Singapore shows another descending trend, decreasing from 3.86 through 2.93, 1.75, and 1.06, to 0.82. Only two countries, Japan and Vietnam are excluded in the top 10 country pairs in 1999, which shows the two countries are among the most under-performing trading partners in ASEAN+3 from the view of the gravity. On the other hand, China and Indonesia are not included in the bottom 10 list for 1999, implying that these two countries are the most active trading partners in the region.

The firm tie in trade between Japan and Indonesia undergoes consistent loosening, from 3.84 through 2.54, 2.37 and 1.26 to 1.17. Japan and Singapore have followed a similar trend, dropping from 1.26 in 1980 to only 0.61 in 1999. The arithmetic mean values of Japan's trade ratio with ASEAN (except Vietnam) have decreased from 1.62 in 1980, through 1.08 in 1985, 1.22 in 1990 and 0.87 in 1995 to 0.86 in 1999. This indicates that Japan's dominant status in trading with ASEAN has been eroded.

-Thailand, and Indonesia-Malaysia show figures bigger than 1 for the ratio of actual to fitted trade flows in Table 5.

Table 5. The Ratio of Actual to Fitted Trade Flows in ASEAN+3 (T_{ijt} / t_{ijt})

	1980	1985	1990	1995	1999
Hong Kong - China	4.05	10.14	18.07	10.10	6.53
Indonesia - Korea	1.57	2.13	1.76	1.88	2.96
Malaysia - Singapore	2.92	3.13	3.56	2.50	2.93
Singapore - Thailand		2.81	2.13	2.34	1.95
Phillipines - Singapore	0.26	1.48	0.89	1.44	1.90
China - Phillipines	0.73	1.72	0.71	0.64	1.80
Malaysia - Phillipines	0.87	3.38	1.06	0.10	1.78
China - Indonesia	0.34	1.60	3.57	2.22	1.76
Malaysia - Thailand	0.95	2.62	1.57	1.39	1.58
Korea - Malaysia	1.19	2.67	1.07	1.43	1.55
China - Singapore	1.97	4.79	2.46	2.12	1.53
Hong Kong - Singapore	2.55	1.76	1.10	2.15	1.49
China - Malaysia	1.22	1.18	2.15	1.87	1.39
China - Korea			0.08	1.18	1.26
Indonesia - Thailand	0.88	0.59	5.77	0.72	1.22
China - Japan	1.09	1.58	1.60	1.25	1.22
Japan - Indonesia	3.84	2.54	2.37	1.26	1.17
Indonesia - Malaysia	0.15	0.36	0.77	1.06	1.16
Hong Kong - Malaysia	0.49	0.51	0.64	1.38	1.12
Singapore - Vietnam		1.57	3.11	2.10	1.10
Japan - Malaysia	1.31	1.09	1.10	1.17	1.09
Korea - Vietnam		0.29	0.38	1.80	1.09
Korea - Singapore	0.99	0.89	0.65	1.35	1.08
Indonesia - Vietnam		0.14	0.75	0.92	1.06
China - Thailand	1.59	1.82	2.13	1.36	1.05
Korea - Phillipines	0.81	1.02	0.56	0.64	1.05
Phillipines - Thailand	4.84	1.12	0.61	0.85	1.04

Table 5. Continued

	1980	1985	1990	1995	1999
China - Vietnam			0.14	2.01	0.94
Japan - Thailand	0.89	0.80	1.26	0.81	0.88
Indonesia - Singapore	3.86	2.93	1.75	1.06	0.82
Hong Kong - Thailand	0.65	0.75	0.65	0.68	0.73
Indonesia - Phillipines	0.93	1.66	0.75	0.82	0.70
Thailand - Vietnam			0.76	0.59	0.66
Hong Kong - Indonesia	0.74	0.79	0.69	0.76	0.64
Hong Kong - Phillipines	0.46	0.76	0.59	0.62	0.61
Japan - Singapore	1.26	0.65	0.71	0.67	0.61
Korea - Thailand	0.65	0.82	0.64	0.65	0.60
Hong Kong - Korea	0.49	0.72	0.50	0.57	0.57
Hong Kong - Japan	0.52	0.42	0.29	0.60	0.56
Japan - Phillipines	0.80	0.31	0.65	0.42	0.54
Malaysia - Vietnam		0.10	0.24	0.46	0.48
Japan - Vietnam		0.13	0.64	0.39	0.46
Japan - Korea	0.54	0.40	0.57	0.32	0.46
Phillipines - Vietnam			1.86	0.46	0.42
Hong Kong - Vietnam		0.52	1.36	0.71	0.31

Note : Country pairs are arranged in the order of ranks in 1999

In contrast to the case of Japan, Korea's trade ratio with Indonesia has an increasing trend, 1.57 in 1980, 1.76 in 1990 and 2.96 in 1999, and this ratio exceeds Japan's in the years of 1995 and 1999. The average trade ratio between Korea and ASEAN has fluctuated from 1.04 in 1980, 1.3 in 1985, 0.84 in 1990, 1.29 in 1995, but in 1999, the ratio marked 1.39. The averaged trade ratio between China and ASEAN is 1.17 in 1980, 2.22 in 1985, 2.20 in 1990, 1.64 in 1995 and 1.51 in 1999. Although the values reveal a decreasing trend, the level is still the highest among the three countries.

Figure 9 depicts CJK's trade ratio with ASEAN over selected years. China shows the highest average values among the three CJK countries except in 1980. The Japan-ASEAN ratio, once the highest value in the 1980s shows less than 1 in the years of 1995 and 1999, which implies that Japan's actual trade volume with ASEAN fell short of the natural level explained by the gravity factors. Korea's ratios with ASEAN were higher than those of Japan and have been approaching the values of China in recent years.

Figure 9. CJK's trade flows with ASEAN beyond the gravity factors

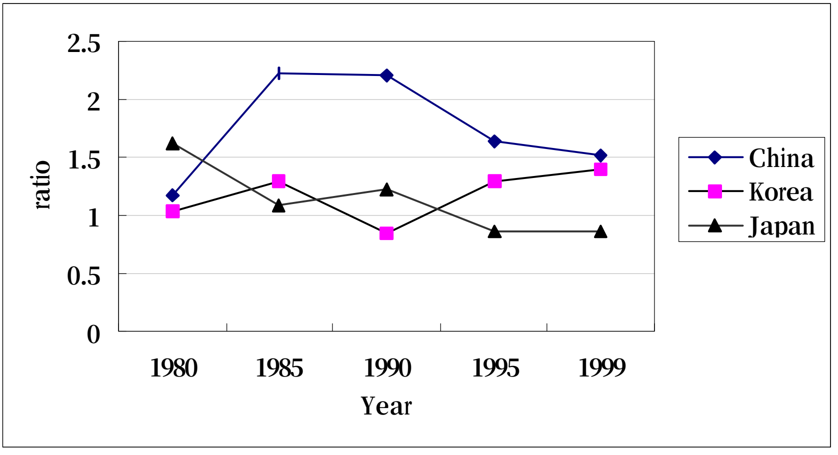

Table 6 shows average values of the ratio in Table 5 in each subgroup of CJK, CJK and ASEAN and ASEAN. We can induce very interesting points from Table 6. First, actual trade flows between Korea, China and Japan have been higher than the fitted trade flows by 1.34 ~ 3.52 times, or by 0.75 ~ 0.99 times, if Hong Kong is excluded. The

1990 result shows the sharpest contrast between the two cases of including and excluding Hong Kong. Second, in both cases, the values of the ratio do not increase over time. Thus, on the observable growing trade intensity over time which was revealed in the degree of trade intensity in Chapter 2, we cannot support an argument that the intensification of trade among the three countries simply implies leveling up to the formation of special trading partners of the three countries. On the contrary, recent results show that the three countries' trade intensity is becoming more related to their economic mass. Moreover, the actual trade flows mostly do reflect the gravity factors with the exception of Hong Kong.

Table 6. The averaged ratios of gravity residuals*

	1980	1985	1990	1995	1999
CJK (excl. H.K.)	1.34	2.65	3.52	2.34	1.77
	0.82	0.99	0.75	0.92	0.98
CJK-ASEAN	1.20	1.24	1.03	1.12	1.02
(excl. H.K.)	1.28	1.44	1.28	1.26	1.20
(excl. H.K. and Singapore)	1.25	1.29	1.28	1.24	1.22
intra ASEAN	1.74	1.24	1.31	0.84	0.98
(excl. Singapore)	1.44	1.25	1.57	0.82	1.12

Note: The gravity residual implies actual to fitted trade flows estimated by the basic gravity equation.

Third, values of the ratios for flows between CJK and ASEAN do not show an increasing trend, which means that we cannot induce a conclusion that the observable growing trade intensity in Chapter 2 goes hand in hand with making special trade relations between the two subregions. Fourth, if the two entrepots are excluded, the trade relations between CJK and ASEAN show a remarkably stable trend of 1.22 ~ 1.29 over the twenty years. Trade with Hong Kong and Singapore has simply contributed to severer fluctuations to ASEAN. Fifth, if Hong Kong is excluded, values of the ratio for CJK level down, but those for CJK - ASEAN go up, which implies that the trade of Hong Kong is re-directed to Korea, China and Japan rather than ASEAN.

2) The expanded gravity

The expanded gravity includes subregional dummies to find out whether any regional peculiarity emerges in trade flows within ASEAN+3 beyond the gravity explanation. There have been conventional arguments that Japan has kept a special and firm relationship with Southeast Asia in the form of subcontracting relations, and/or Japan has dominated the Southeast Asian market. Another common belief is that many ethnic Chinese live in Southeast Asia and trade exclusively with each other, so the strong Chinese connection must influence trade flows in ASEAN+3. If these arguments are uttered in the gravity terminology, these are almost much the same as whether there are any special trade relations between ASEAN and Japan/China beyond the explanation by the basic gravity relations.

To test these arguments, dummies for trade between Japan and ASEAN, China and ASEAN and Korea and ASEAN are introduced in the regression equation. To determine whether there is any trade integrity within ASEAN, we add a dummy for ASEAN, too. The absorption of Hong Kong by mainland China is considered by introducing a dummy for bilateral relations between China and Hong Kong.

The regression was carried out with the following procedure: First, trade flows are regressed on the three basic gravity factors and five dummy variables including ASEAN, CHINA, KORASEAN, JAPASEAN and XNASEAN, following the notation of equation (5). Second, on the basis of the outcomes of the regression, a test on insignificant explanatory variables is adopted to sort out redundancy variables in the expanded gravity model.

Table 7 reports the results of OLS regression for the expanded gravity equation.[24)] Fist of all, over the selected years, the economic size and income level represented by the logs of products of GDPs and per capita GDPs continue to be strong explanatory variables for trade in ASEAN+3. The fitness of the regression consistently increases with the growing value of R^2 as time passes. The adjusted R^2s as well as R^2s reported in Table 7 are higher than those reported in Table 4, which proves the effectiveness of the dummy variables.

The dummy variables all keep positive signs, which means additional trade volumes may exist beyond what the gravity factors could explain. The CHINA dummy, representing the special relationship between mainland China and Hong Kong, proved to be the most influential factor among the dummies in terms of significance level as well as the magnitude. From the table, we can see that mainland China and Hong Kong maintained close trade relations even before the return of Hong Kong to mainland China. CHINA in 1999 has a highly reliable coefficient of 2.32, which implies that trade flows between mainland China and Hong Kong are more than ten times as large as those explained by the gravity, keeping other conditions controlled. Recalling that the distance factor between Hong Kong and

24) Data for GDP and GDP per capita are all in current base.

China is calculated by the geographical distance between Hong Kong and Shanghai, the high values of the coefficients in CHINA prove the existence of a firm Chinese connection.[25)]

Table 7. OLS regression results for the expanded gravity model

Explanatory Variable	1980	1985	1990	1995	1999
Constant	-0.30	-11.09***	-6.55***	1.00	-0.73
Product of GDPs	0.48***	0.63***	0.38***	0.44***	0.50***
Product of per capita GDPs	0.54***	0.93***	0.65***	0.46***	0.37***
Distance	-0.67**	-0.26	-0.06	-0.69***	-0.33*
ASEAN	0.47	1.13**	1.25***	0.29	0.88***
CHINA	1.88*	3.25***	3.76***	2.71***	2.32***
KORASEAN	0.48	0.59	0.16	0.48	0.57*
JAPASEAN	0.78	-0.59	0.20	-0.08	-0.24
XNASEAN	0.66	1.82***	1.18**	1.11**	0.70**
No. of Observations	34	41	45	45	45
R^2	0.74	0.82	0.86	0.87	0.89
Adjusted R^2	0.66	0.77	0.83	0.84	0.87

Note: ***, ** and * mean statistically significant at the 1%, 5% and 10% levels respectively.

Trade relations within ASEAN and between China and ASEAN are also revealed to have peculiarities in trade other than the explanatory forces imposed by the gravity. The ASEAN dummy proved to be significant in 1985, 1990 and 1999. In 1999, the ASEAN variable

25) On the other hand, we need to consider the close trade relationship between Hong Kong and adjacent area of Gwangdong province and prosperity of the province, which could account for high values of the coefficients.

reports an estimated coefficient of 0.88, which implies that the trade volume would be 2.4 times as large as that of non-member countries of the same gravity condition.

The XNASEAN variable has statistically significant coefficients. The coefficients of the variable are highly significant except in 1980. The coefficients of XNASEAN in 1999 is 0.70, which implies that the trade volume between China and ASEAN will be more than 2 times as large as that of other relationships, even if there is no difference in the gravity factors like economic size, income level, distance, and other dummies.[26)]

On the other hand, the trade relations between Japan/Korea and ASEAN take a different shape from the other dummies above. It is interesting to note that the JAPASEAN variables take negative signs in several years and are insignificant in all cases. This implies that there are no factors at play in Japan's trade with ASEAN but the ordinary explanatory forces of the gravity. Note that the JAPASEAN dummy was insignificant even at the 10% level in the 1980s when Japan and ASEAN are reported to have established firm economic ties.

From the KORASEAN dummy, Korea's trade relationship with ASEAN seems to be not so different from that of Japan, as most of the KORASEAN variables prove to be insignificant. One point of note

26) For patterns of the trade and investment between China and ASEAN, see Zhang and Hock (1996). Close trade relations between the two economies are believed to be related to ASEAN's investment into mainland China, but their industrial structures are growing more competitive than complementary, which may be a possible explanation for the weakened impact of the dummy for XNASEAN in recent years.

is the case of 1999 when the coefficient is proved to be significant at the 10% level, which requires further analysis of the redundancy test.

Table 8 reports the final results of the OLS regression for the expanded gravity equation after the redundancy test.[27] The results show a similar pattern with that of the OLS regression in Table 7. The variables which proved to be highly significant survived the redundancy test, but less significant variables proved to be redundant.

Table 8 shows some interesting findings that are worthy of note. First, the Chinese connection such as mainland China - Hong Kong and - ASEAN are revealed to be significant in most of the five years, although the magnitude of the coefficients has decreased. Second, the JAPASEAN variable is reported to be redundant *in all cases*. Note, again, that the JAPASEAN dummy was redundant even in the 1980s in the so-called heyday of the Japanese yen bloc. Third, KORASEAN emerged as a highly significant variable at the 5% level with a value of 0.67 in 1999. This implies the bilateral trade flows between Korea and ASEAN will be 1.95 times as much as those among other trading partners, after controlling for the gravity impacts.[28]

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27) Testing redundant variable is done by Likelihood Ratio test for each variable. 5% criterion is applied so that p value of test statistic of LR more than 0.05 implies *no* rejection of the null Hypothesis that the exclusion of the variable would make no difference in the regression results, in other words, the variable of the test cannot make further contribution to explain the trade relations. We test any existence of redundant variable in all cases, and then derive the final regression results composed of non-redundant variables.

28) It would be interesting to compare these results with Figure 9 in the previous section. The ratios of the actual to fitted trade flows in Figure

Table 8. Final regression results after the variable redundancy test

Explanatory Variable	1980	1985	1990	1995	1999
Constant	-0.41	-11.10***	-6.89***	1.57	-0.14
Product of GDPs	0.50***	0.50***	0.39***	0.40***	0.49***
Product of per capita GDPs	0.48***	0.84***	0.65***	0.44***	0.37***
Distance	-0.51**	×	×	-0.64***	-0.40***
ASEAN	×	0.98**	1.20***	×	0.89***
CHINA	1.53*	3.43***	3.70***	2.59***	2.36***
KORASEAN	×	×	×	×	0.67**
JAPASEAN	×	×	×	×	×
XNASEAN	×	1.67***	1.07**	0.88**	0.81***
No. of Observations	34	41	45	45	45
R^2	0.71	0.79	0.86	0.86	0.89
Adjusted R^2	0.68	0.76	0.84	0.84	0.86

Note: 1) ***, ** and * mean statistically significant at the 1%, 5% and 10% levels respectively.

2) × implies redundant variable under the 5% of significant level.

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9 suggest that the China subgroup maintains the highest values except in 1980. On the contrary, the Japan subgroup ranks third three times during the five years. One of the main differences between the two analyses is the case of 1980. Japan's actual trade flows with ASEAN was 1.62 times bigger than that expected by the gravity, but the expanded gravity test reported the redundancy of the JAPASEAN dummy even in 1980. The Korea subgroup kept pace with the China one in 1999, which may be related to the statistical significance of the KORASEAN dummy in 1999 in Table 7.

IV. Concluding Remarks

In this paper, we examine the characteristics of growing trade intensity in ASEAN+3 over the 20 years since 1980 by using a gravity model. To do this, a degree of trade intensity is formulated and the growing trend of trade intensity among ASEAN+3 is drawn over the 20-year period. Next, the changing patterns of gravity residuals are traced to test whether or not the growing trade intensity is a unique phenomenon of ASEAN+3. The regression results show that there is a lack of proper evidence that the trade relations within CJK and between CJK and ASEAN have intensified over time beyond the gravity factors. Moreover, with the exclusion of Hong Kong, the fitted trade flows projected by the gravity equation can explain most of the actual trade flows within CJK. With respect to the trade relations between CJK and ASEAN, a very stable pattern of trade intensity emerges over time with the exclusion of Hong Kong and Singapore.

Tests to determine the existence of any special trade relations between each CJK country and ASEAN reveals that the widely known close trade relations between Japan and ASEAN are mostly explained by the gravity factors even in the heyday of Japanese yen bloc. However, more factors exist in China's trade with ASEAN that the gravity regression cannot explain.

It is interesting to note that recent developments in the trade between Korea and ASEAN are growing distant from the realm of the gravity explanation, as the Korea-ASEAN dummy is reported to be significant in 1999. Thus, we cannot say that the big increase in trade intensity in 1999 between the two economies, reported in Chapter 2, is due to gravity factors of economic size or income. One remaining issue would be to explore whether any structural change has happened recently in the trade between Korea and ASEAN.

One of the issues that we need to examine further in the gravity analysis is why recent trade data have a tendency of better fitting the basic gravity regression, while more regional dummies are revealed to be significant in the recent data. On the other hand, in the process of sorting out the relevant variables that may influence bilateral trade flows in ASEAN+3, the technique of the variable redundancy test has been introduced, and this method proved to be useful in refining the ordinary regression equations.

The gravity analysis of the trend in trade intensity changes has manifold meanings. First, growing trade intensity may arise from a higher degree of economic correlation between trading partners. This study shows that there is no proper evidence supporting this argument in ASEAN+3 or among CJK. On the contrary, considering the fact that ASEAN+3 has experienced a higher rate of growth than any other region in the world, we can draw another inference of intensification of bilateral trade via economic size or income effects. In this study, these effects proved to increase over time, and grew substantially stronger when entrepots were excluded. Second, the emergence of statistically significant sub-regional dummy variables indicates that a special trade relationship among a subgroup in ASEAN+3 contributes to the growth of trade intensity in ASEAN+3. This study, however, uses bilateral trade data without splitting down to the industry level, which may ignore the difference between inter- and intra-industry trade. To understand the peculiarity of trade patterns in the subgroups, we need to explore further the bilateral trade structure, which requires industry level analyses, including an intra-industry analysis. If the international division of labor has prevailed and become dominant in ASEAN+3, the strong intensification of trade without a big increase in total trade volume would occur, thus pushing up trade intensity. In this sense, an intra-industry analysis would be of particular interest as a topic for further research.

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<Appendix>

Trade intensity of ASEAN+3 countries in selected years

1980

1980	JAPAN	H.K.	KOREA	CHINA	BUR	INDONESI	MAL	PHI	SINGAPOF	THAILAND	VIETNAM
JAP	#VALUE!	3.63	5.57	6.03	2.43	10.15	3.72	2.40	3.59	2.08	#VALUE!
HON	3.63	#VALUE!	2.36	13.26	0.05	1.40	1.19	1.62	5.07	1.64	#VALUE!
KOR	5.57	2.36	#VALUE!	#VALUE!	0.00	1.91	1.77	1.44	1.20	0.91	#VALUE!
CHI	6.03	13.26	#VALUE!	#VALUE!	#VALUE!	0.33	1.46	1.15	1.91	1.86	#VALUE!
BUR	2.43	0.05	0.00	#VALUE!	#VALUE!	#VALUE!	0.31	0.59	1.82	2.05	#VALUE!
IND	10.15	1.40	1.91	0.33	#VALUE!	#VALUE!	0.37	1.21	8.98	1.25	#VALUE!
MAL	3.72	1.19	1.77	1.46	0.31	0.37	#VALUE!	1.48	14.85	2.45	#VALUE!
PHI	2.40	1.62	1.44	1.15	0.59	1.21	1.48	#VALUE!	1.03	0.62	#VALUE!
SIN	3.59	5.07	1.20	1.91	1.82	8.98	14.85	1.03	#VALUE!	4.10	#VALUE!
THA	2.08	1.64	0.91	1.86	2.05	1.25	2.45	0.62	4.10	#VALUE!	#VALUE!
VIET	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!

1990

1990	JAPAN	H.K.	KOREA	CHINA	BUR	INDONESI	MAL	PHI	SINGAPOF	THAILAND	VIETNAM
JAP	#VALUE!	4.73	9.30	5.93	0.53	5.99	3.87	1.59	4.90	4.73	0.25
HON	4.73	#VALUE!	3.27	32.64	0.02	1.05	1.40	1.13	4.05	1.62	0.43
KOR	9.30	3.27	#VALUE!	0.20	0.38	2.65	2.19	0.92	2.21	1.45	0.05
CHI	5.93	32.64	0.20	#VALUE!	0.02	1.67	1.37	0.39	2.50	1.51	0.01
BUR	0.53	0.02	0.38	0.02	#VALUE!	0.04	0.35	0.91	0.93	0.70	0.00
IND	5.99	1.05	2.65	1.67	0.04	#VALUE!	1.13	0.69	3.95	0.70	0.18
MAL	3.87	1.40	2.19	1.37	0.35	1.13	#VALUE!	1.21	15.20	2.99	0.09
PHI	1.59	1.13	0.92	0.39	0.91	0.69	1.21	#VALUE!	1.28	0.75	0.69
SIN	4.90	4.05	2.21	2.50	0.93	3.95	15.20	1.28	#VALUE!	5.49	0.58
THA	4.73	1.62	1.45	1.51	0.70	0.70	2.99	0.75	5.49	#VALUE!	0.29
VIET	0.25	0.43	0.05	0.01	0.00	0.18	0.09	0.69	0.58	0.29	#VALUE!

1999

1999	JAPAN	H.K.	KOREA	CHINA	BUR	INDONESI	MAL	PHI	SINGAPOF	THAILAND	VIETNAM
JAP	#VALUE!	5.02	7.98	12.17	0.31	4.21	5.18	3.12	5.11	5.01	0.96
HON	5.02	#VALUE!	3.42	25.22	0.03	0.01	2.13	1.55	4.13	1.87	0.35
KOR	7.98	3.42	#VALUE!	7.63	0.22	3.70	3.07	2.44	3.06	1.52	1.23
CHI	12.17	25.22	7.63	#VALUE!	0.01	2.14	1.91	0.91	3.10	1.86	0.70
BUR	0.31	0.03	0.22	0.01	#VALUE!	0.28	0.38	0.02	0.51	0.51	0.01
IND	4.21	0.01	3.70	2.14	0.28	#VALUE!	2.51	1.09	5.22	2.32	1.37
MAL	5.18	2.13	3.07	1.91	0.38	2.51	#VALUE!	2.49	15.81	3.83	0.74
PHI	3.12	1.55	2.44	0.91	0.02	1.09	2.49	#VALUE!	3.41	1.91	0.61
SIN	5.11	4.13	3.06	3.10	0.51	5.22	15.81	3.41	#VALUE!	5.72	1.66
THA	5.01	1.87	1.52	1.86	0.51	2.32	3.83	1.91	5.72	#VALUE!	1.33
VIET	0.96	0.35	1.23	0.70	0.01	1.37	0.74	0.61	1.66	1.33	#VALUE!

Regression Results of the Basic Gravity Equations

1980

Dependent Variable: TRADE
Method: Least Squares
Date: 04/23/02 Time: 15:12
Sample(adjusted): 1 41
Included observations: 34
Excluded observations: 7 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.417989	2.224042	0.187941	0.8522
CGDP2	0.520072	0.091898	5.659252	0.0000
PGDP2	0.467719	0.090602	5.162369	0.0000
DISTANCE	-0.599700	0.239177	-2.507352	0.0178

R-squared	0.682056	Mean dependent var	6.870588
Adjusted R-squared	0.650261	S.D. dependent var	1.411369
S.E. of regression	0.834665	Akaike info criterion	2.586559
Sum squared resid	20.89999	Schwarz criterion	2.766131
Log likelihood	-39.97151	F-statistic	21.45207
Durbin-Watson stat	2.520907	Prob(F-statistic)	0.000000

1985

Dependent Variable: TRADE
Method: Least Squares
Date: 08/16/02 Time: 14:57
Sample(adjusted): 1 44
Included observations: 41
Excluded observations: 3 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.865209	2.413120	-1.187346	0.2427
CGDP2	0.579968	0.104445	5.552862	0.0000
PGDP2	0.608817	0.100175	6.077518	0.0000
DISTANCE	-0.573157	0.279108	-2.053529	0.0471

R-squared	0.693366	Mean dependent var	6.583902
Adjusted R-squared	0.668504	S.D. dependent var	1.779102
S.E. of regression	1.024331	Akaike info criterion	2.978424
Sum squared resid	38.82239	Schwarz criterion	3.145602
Log likelihood	-57.05769	F-statistic	27.88832
Durbin-Watson stat	2.249036	Prob(F-statistic)	0.000000

1990

Dependent Variable: TRADE
Method: Least Squares
Date: 04/23/02 Time: 14:38
Sample: 1 45
Included observations: 45

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.423467	1.938730	-0.734227	0.4670
CGDP2	0.377396	0.089693	4.207646	0.0001
PGDP2	0.511166	0.074512	6.860137	0.0000
DISTANCE	-0.341447	0.246995	-1.382407	0.1743

R-squared	0.758507	Mean dependent var	7.206000
Adjusted R-squared	0.740837	S.D. dependent var	1.914638
S.E. of regression	0.974705	Akaike info criterion	2.871325
Sum squared resid	38.95208	Schwarz criterion	3.031917
Log likelihood	-60.60480	F-statistic	42.92571
Durbin-Watson stat	2.237095	Prob(F-statistic)	0.000000

1995

Dependent Variable: TRADE
Method: Least Squares
Date: 04/23/02 Time: 13:57
Sample: 1 45
Included observations: 45

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.673301	1.521896	1.756559	0.0865
CGDP2	0.484512	0.073101	6.627942	0.0000
PGDP2	0.345413	0.058492	5.905311	0.0000
DISTANCE	-0.678423	0.191549	-3.541777	0.0010

R-squared	0.782603	Mean dependent var	8.266222
Adjusted R-squared	0.766696	S.D. dependent var	1.566930
S.E. of regression	0.756852	Akaike info criterion	2.365388
Sum squared resid	23.48579	Schwarz criterion	2.525980
Log likelihood	-49.22123	F-statistic	49.19838
Durbin-Watson stat	2.330019	Prob(F-statistic)	0.000000

1999

Dependent Variable: TRADE
Method: Least Squares
Date: 04/23/02 Time: 11:38
Sample: 1 45
Included observations: 45

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.262429	1.236812	2.637773	0.0117
CGDP2	0.438057	0.059383	7.376817	0.0000
PGDP2	0.270226	0.048356	5.588289	0.0000
DISTANCE	-0.491015	0.152324	-3.223490	0.0025

R-squared	0.786138	Mean dependent var	8.502444
Adjusted R-squared	0.770489	S.D. dependent var	1.269209
S.E. of regression	0.608043	Akaike info criterion	1.927547
Sum squared resid	15.15839	Schwarz criterion	2.088139
Log likelihood	-39.36980	F-statistic	50.23740
Durbin-Watson stat	1.980345	Prob(F-statistic)	0.000000

Regression Results of the Expanded Gravity Equations

1980

Dependent Variable: TRADE
Method: Least Squares
Date: 08/14/02 Time: 15:55
Sample(adjusted): 1 41
Included observations: 34
Excluded observations: 7 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.295940	4.242895	-0.069749	0.9449
CGDP2	0.484159	0.121854	3.973284	0.0005
PGDP2	0.541066	0.165182	3.275580	0.0031
DISTANCE	-0.667632	0.324081	-2.060080	0.0499
ASEAN	0.469427	0.574319	0.817362	0.4214
CHINA	1.884205	0.940629	2.003132	0.0561
KORASEAN	0.484331	0.581726	0.832576	0.4130
JAPASEAN	0.776407	0.612426	1.267758	0.2166
CHINASEAN	0.655544	0.729167	0.899031	0.3772

R-squared	0.741949	Mean dependent var	6.870588
Adjusted R-squared	0.659373	S.D. dependent var	1.411369
S.E. of regression	0.823721	Akaike info criterion	2.671957
Sum squared resid	16.96291	Schwarz criterion	3.075994
Log likelihood	-36.42328	F-statistic	8.985024
Durbin-Watson stat	2.579607	Prob(F-statistic)	0.000010

1985

Dependent Variable: TRADE
Method: Least Squares
Date: 08/16/02 Time: 15:59
Sample(adjusted): 1 44
Included observations: 41
Excluded observations: 3 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-11.08537	3.378994	-3.280673	0.0025
CGDP2	0.627186	0.109153	5.745930	0.0000
PGDP2	0.928465	0.118689	7.822663	0.0000
DISTANCE	-0.258399	0.320607	-0.805968	0.4262
ASEAN	1.134711	0.479526	2.366317	0.0242
CHINA	3.251992	0.929834	3.497391	0.0014
KORASEAN	0.588845	0.531438	1.108022	0.2761
JAPASEAN	-0.588901	0.569475	-1.034113	0.3088
CHINASEAN	1.819341	0.616402	2.951549	0.0059

R-squared	0.816442	Mean dependent var	6.583902
Adjusted R-squared	0.770553	S.D. dependent var	1.779102
S.E. of regression	0.852202	Akaike info criterion	2.709201
Sum squared resid	23.23993	Schwarz criterion	3.085351
Log likelihood	-46.53863	F-statistic	17.79149
Durbin-Watson stat	2.497351	Prob(F-statistic)	0.000000

1990

Dependent Variable: TRADE
Method: Least Squares
Date: 08/14/02 Time: 16:53
Sample: 1 45
Included observations: 45

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-6.546653	2.371401	-2.760669	0.0090
CGDP2	0.382600	0.086101	4.443625	0.0001
PGDP2	0.654681	0.076668	8.539114	0.0000
DISTANCE	-0.056871	0.277337	-0.205061	0.8387
ASEAN	1.248044	0.399216	3.126240	0.0035
CHINA	3.755183	0.841709	4.461381	0.0001
KORASEAN	0.158551	0.476345	0.332849	0.7412
JAPASEAN	0.200623	0.502283	0.399422	0.6919
CHINASEAN	1.180687	0.532660	2.216587	0.0331

R-squared	0.860686	Mean dependent var	7.206000
Adjusted R-squared	0.829727	S.D. dependent var	1.914638
S.E. of regression	0.790059	Akaike info criterion	2.543439
Sum squared resid	22.47098	Schwarz criterion	2.904772
Log likelihood	-48.22738	F-statistic	27.80104
Durbin-Watson stat	2.118463	Prob(F-statistic)	0.000000

1995

Dependent Variable: TRADE
Method: Least Squares
Date: 08/14/02 Time: 16:11
Sample: 1 45
Included observations: 45

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.996762	1.990946	0.500648	0.6197
CGDP2	0.442663	0.072841	6.077112	0.0000
PGDP2	0.458482	0.061943	7.401738	0.0000
DISTANCE	-0.691211	0.218862	-3.158197	0.0032
ASEAN	0.288467	0.321854	0.896269	0.3761
CHINA	2.708521	0.666109	4.066183	0.0002
KORASEAN	0.480032	0.375118	1.279681	0.2088
JAPASEAN	-0.076200	0.400994	-0.190027	0.8504
CHINASEAN	1.113112	0.421139	2.643097	0.0121

R-squared	0.869847	Mean dependent var	8.266222
Adjusted R-squared	0.840924	S.D. dependent var	1.566930
S.E. of regression	0.624960	Akaike info criterion	2.074598
Sum squared resid	14.06069	Schwarz criterion	2.435930
Log likelihood	-37.67845	F-statistic	30.07464
Durbin-Watson stat	2.595566	Prob(F-statistic)	0.000000

1999

Dependent Variable: TRADE
Method: Least Squares
Date: 08/14/02 Time: 17:03
Sample: 1 45
Included observations: 45

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.734713	1.592739	-0.461289	0.6474
CGDP2	0.499566	0.059360	8.415908	0.0000
PGDP2	0.369531	0.048280	7.653956	0.0000
DISTANCE	-0.328307	0.164557	-1.995091	0.0536
ASEAN	0.884979	0.263180	3.362645	0.0018
CHINA	2.316507	0.500592	4.627540	0.0000
KORASEAN	0.565370	0.285760	1.978479	0.0556
JAPASEAN	-0.240837	0.302107	-0.797191	0.4306
CHINASEAN	0.704982	0.313333	2.249947	0.0307

R-squared	0.887750	Mean dependent var	8.502444
Adjusted R-squared	0.862805	S.D. dependent var	1.269209
S.E. of regression	0.470113	Akaike info criterion	1.505168
Sum squared resid	7.956218	Schwarz criterion	1.866501
Log likelihood	-24.86629	F-statistic	35.58896
Durbin-Watson stat	1.954977	Prob(F-statistic)	0.000000

Final Results after the Variable Redundancy Test

1980

Redundant Variables: ASEAN KORASEAN JAPASEAN CHINASEAN

F-statistic	0.664879	Probability	0.622286
Log likelihood ratio	3.437198	Probability	0.487492

Test Equation:
Dependent Variable: TRADE
Method: Least Squares
Date: 08/17/02 Time: 10:39
Sample: 1 41
Included observations: 34
Excluded observations: 7

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.405031	2.190975	-0.184863	0.8546
CGDP2	0.499006	0.089329	5.586170	0.0000
PGDP2	0.483254	0.087741	5.507731	0.0000
DISTANCE	-0.506784	0.236135	-2.146161	0.0404
CHINA	1.525380	0.840294	1.815293	0.0798

R-squared	0.714498	Mean dependent var	6.870588
Adjusted R-squared	0.675118	S.D. dependent var	1.411369
S.E. of regression	0.804458	Akaike info criterion	2.537757
Sum squared resid	18.76743	Schwarz criterion	2.762222
Log likelihood	-38.14187	F-statistic	18.14384
Durbin-Watson stat	2.447662	Prob(F-statistic)	0.000000

1985

Redundant Variables: DISTANCE KORASEAN JAPASEAN

F-statistic	1.613539	Probability	0.205577
Log likelihood ratio	5.775467	Probability	0.123060

Test Equation:
Dependent Variable: TRADE
Method: Least Squares
Date: 08/17/02 Time: 10:47
Sample: 1 44
Included observations: 41
Excluded observations: 3

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-11.10205	1.892335	-5.866851	0.0000
CGDP2	0.500127	0.094159	5.311490	0.0000
PGDP2	0.871033	0.110763	7.863959	0.0000
ASEAN	0.978246	0.397107	2.463431	0.0188
CHINA	3.434285	0.906245	3.789576	0.0006
CHINASEAN	1.667386	0.542273	3.074810	0.0041

R-squared	0.788675	Mean dependent var	6.583902
Adjusted R-squared	0.758486	S.D. dependent var	1.779102
S.E. of regression	0.874323	Akaike info criterion	2.703725
Sum squared resid	26.75542	Schwarz criterion	2.954492
Log likelihood	-49.42636	F-statistic	26.12440
Durbin-Watson stat	2.311573	Prob(F-statistic)	0.000000

1990

Redundant Variables: DISTANCE KORASEAN JAPASEAN

F-statistic	0.063050	Probability	0.978990
Log likelihood ratio	0.235819	Probability	0.971610

Test Equation:
Dependent Variable: TRADE
Method: Least Squares
Date: 08/17/02 Time: 10:52
Sample: 1 45
Included observations: 45

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-6.894133	1.158878	-5.948973	0.0000
CGDP2	0.388587	0.076305	5.092565	0.0000
PGDP2	0.650457	0.072729	8.943593	0.0000
ASEAN	1.200893	0.335561	3.578765	0.0009
CHINA	3.700984	0.784283	4.718939	0.0000
CHINASEAN	1.067272	0.439385	2.429015	0.0198

R-squared	0.859954	Mean dependent var	7.206000
Adjusted R-squared	0.841999	S.D. dependent var	1.914638
S.E. of regression	0.761056	Akaike info criterion	2.415346
Sum squared resid	22.58904	Schwarz criterion	2.656234
Log likelihood	-48.34529	F-statistic	47.89584
Durbin-Watson stat	2.167082	Prob(F-statistic)	0.000000

1995

Redundant Variables: ASEAN KORASEAN JAPASEAN

F-statistic	0.877123	Probability	0.462012
Log likelihood ratio	3.174554	Probability	0.365487

Test Equation:
Dependent Variable: TRADE
Method: Least Squares
Date: 08/17/02 Time: 10:56
Sample: 1 45
Included observations: 45

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.572529	1.272942	1.235350	0.2241
CGDP2	0.401185	0.063441	6.323754	0.0000
PGDP2	0.438274	0.057255	7.654796	0.0000
DISTANCE	-0.641867	0.162489	-3.950214	0.0003
CHINA	2.589015	0.643589	4.022778	0.0003
CHINASEAN	0.879555	0.332593	2.644537	0.0117

R-squared	0.860333	Mean dependent var	8.266222
Adjusted R-squared	0.842427	S.D. dependent var	1.566930
S.E. of regression	0.621999	Akaike info criterion	2.011810
Sum squared resid	15.08844	Schwarz criterion	2.252698
Log likelihood	-39.26573	F-statistic	48.04729
Durbin-Watson stat	2.612592	Prob(F-statistic)	0.000000

1999

Redundant Variables: JAPASEAN

F-statistic	0.635514	Probability	0.430567
Log likelihood ratio	0.787462	Probability	0.374869

Test Equation:
Dependent Variable: TRADE
Method: Least Squares
Date: 08/17/02 Time: 10:57
Sample: 1 45
Included observations: 45

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.136637	1.398045	-0.097734	0.9227
CGDP2	0.486307	0.056701	8.576729	0.0000
PGDP2	0.370779	0.048016	7.721981	0.0000
DISTANCE	-0.398828	0.138072	-2.888547	0.0064
ASEAN	0.892254	0.261723	3.409158	0.0016
CHINA	2.358351	0.495374	4.760748	0.0000
KORASEAN	0.668962	0.253248	2.641527	0.0120
CHINASEAN	0.805974	0.285165	2.826343	0.0075

R-squared	0.885768	Mean dependent var	8.502444
Adjusted R-squared	0.864157	S.D. dependent var	1.269209
S.E. of regression	0.467792	Akaike info criterion	1.478223
Sum squared resid	8.096670	Schwarz criterion	1.799407
Log likelihood	-25.26002	F-statistic	40.98607
Durbin-Watson stat	1.944962	Prob(F-statistic)	0.000000

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