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The Transition of Postwar Asia-Pacific Trade Relations

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Abstract

The purpose of this paper is to examine the feature and the transition of trade in the Asia-Pacific region during the post-World War II period. The paper employs the gravity model with some regional dummy variables to estimate trade flows among 80 economies through temporal cross-section data analysis, for approximately every five-year-term from 1960 to 1994. Its main findings are the following: First, ASEAN has had no effect of its own on promoting trade among its member countries. Second, the volume of trade among EAEC has been at a high level compared with the hypothetical trade level since 1960. Third, the amount of trade between EAEC economies and other APEC countries has been growing throughout the postwar period. Fourth, there has been close trade relations among APEC economies plus some other Asian countries.

1. Introduction

The purpose of this paper is to examine the nature and the transition of trade in the Asia-Pacific region during the post-World War II period, in a comparison with what has occurred in the case of general world trade. The method of analysis applied in this paper is based on the "Gravity Model" with some regional dummy variables. This is used to estimate the flow of trade among 80 economies through temporal cross-section data analysis, for approximately every five years from 1960 to 1994.

In order to see the relation between the volume and direction of international trade and the formation of trading areas, regardless of whether these are formed intentionally or unintentionally, many econometric researchers have used a variety of methods. The gravity model is, among these methods, of a simple nature, with a high statistical explanatory power. Using this model, the effects of membership in a common grouping, such as the European Economic Community (EEC), the European Free Trade Association (EFTA), or the Council of Mutual Economic Assistance (CMEA), can be evaluated by using dummy variables to characterize whether or not trading partners are members of the same preferential trading group.

Tinbergen's (1962) seminal work with the gravity model is one example of how it may be used to examine the effects of economic integration. Tinbergen performed estimations for trade flows among 42 countries during 1959, and found that the coefficient of the preference group variable was positive and highly significant statistically. Similar results were obtained in other research, irrespective of the stage of development or other characteristics of the economic systems of the nations examined.

(See, for example, Linnemann (1966), Hewett (1976), Geraci and Prewo (1977), Pelzman (1977), Brada and Méndez (1985), Bergstrand (1985), among others.) However, Hamilton and Winters (1992) showed that the coefficients of some trade preference group variables consisting of developing countries were less significant statistically in intra-union trade. Furthermore, Frankel, Stein and Wei (1995) established that the European Community (EC) dummy variable lacked statistical significance during the 1970s, while Aitken (1973) discovered the same characteristic for the 1950s.

Concerning the Asia-Pacific region, Frankel, Stein and Wei's (1995) work made it clear that the East Asia Economic Caucus (EAEC) and the Asia-Pacific Economic Cooperation Conference (APEC) dummies were highly statistically significant throughout the analyzed period of 1965-1990, while the North America Free Trade Agreement (NAFTA) dummy was not significant. Frankel (1993) examined a sequence of nested candidates for trading blocs in the Asia-Pacific, using the data for the years 1980, 1985 and 1990.

However, there are two points that these analyses do not show. First, these analyses do not tell us conclusively whether or not such regional economic groups have trade diversion effects. The reason for this is that the methods used in these studies do not distinguish between trade creation and trade diversion. Even if the coefficient of the regional institution dummy variable was high and statistically significant, these methods will fail to ascertain whether a decrease in trade between non-member economies and the union membership has occurred, or whether there has been an increase in intra-union activity, or indeed that both have taken place. Second, these analyses do not show clearly the transition of trade relations in the circum-pan-Pacific

region. The reason for this is that only a few regional dummy variables are considered in their estimations, together with the fact that the trade diversion effect in each region is ignored.

Accordingly, this paper introduces two new kinds of dummy variables into the gravity model, which is considered appropriate in responding to the issues raised above. One such dummy variable is used to ascertain the effect of each region's economic integration on its trade: trade creation effect, import trade diversion effect, and export trade diversion effect. Another dummy variable is used to capture the nature of trade relations for some economic areas in the Asia-Pacific region, and consists of six sets of regional dummy variables which are suitable for applying to the relevant estimation: the ASEAN (the Association of South East Asian Nations), the APEC forum in 1989, the EAEC, the APEC in 1994, the APEC plus Asia, and the APEC plus America.

The following section explains the equation for estimation used in this paper. The nested-areas calculation is performed, along with estimations of any trade creation and trade diversion effects occurring in each region from 1960 to 1994. The calculations and estimations are performed for mainly each five year period therein. Section 3 discusses the empirical results, and describes the nature and transition of Asia-Pacific trade during the post-World War II period. Section 4 estimates the strength of trade relations of hypothetical enlarged APEC, using a similar approach to that in Section 2. Section 5 presents the main conclusions of this paper.

2. The Gravity Model of bilateral trade

The purpose of this section is to find prominent trading areas in the Asia-Pacific region by applying the gravity equation.[1] Some nested dummy variables are used in this equation. As the basis for the analysis of the regional intensity of trade relations, four sub-regional institutions in Asia-Pacific region are considered in this section: the ASEAN, the APEC forum in 1989, the EAEC, and the APEC forum in 1994.

In the context of international trade, the basic formulation of the gravity equation is as follows:[2]

$$(1) \quad X_{ij} = a_0 Y_i^{a_1} Y_j^{a_2} N_i^{a_3} N_j^{a_4} D_{ij}^{a_5} e_{ij}$$

or, using natural logarithms,

$$(2) \quad \log X_{ij} = \log a_0 + a_1 \log Y_i + a_2 \log Y_j + a_3 \log N_i + a_4 \log N_j + a_5 \log D_{ij} + \log e_{ij}$$

where X_{ij} = the flow of goods from economy i to economy j

Y_i, Y_j = incomes of economies i and j

N_i, N_j = populations of economies i and j

D_{ij} = the distance between economies i and j

e_{ij} = the log normally-distributed error term, where $E(\log e_{ij}) = 0$.

An explanation of the foundations of this basic specification of the gravity model,

using an assumption that goods are differentiated by country of origin, may be found in Anderson (1979) and Bergstrand (1985). Bergstrand (1989) extended his previous work to a two-factor, two-industry, many-firm and many-country model, using an assumption of monopolistic competition to derive the "generalized" gravity equation. Oguledo and MacPhee (1994) also derived the gravity equation from a linear expenditure system. The analysis developed in this paper owes its theoretical foundation to the work of these authors. However, there is some simplification made in its application in this paper. The main simplification is to eliminate domestic price level from explanatory variables, which is done for the purpose of including among the data set the many developing countries whose economic indicator is not often available. In other words, the gravity model used here is a simplified version of the basic model in order to examine trade among as many countries and over as wide a period as possible.

Three types of dummy variables are introduced in (2), so as to create a version of the Gravity Model which will provide data on trade patterns in cases of economic integration. These new variables are the adjacency dummy variable, the common language dummy variable, and respective regional dummy variable, all of which are considered to reflect any effects on the volume of trade. The adjacency dummy and common language dummy comprise one variable each, while there are four sets of regional dummy variables in this section: ASEAN, APEC(89), EAEC, APEC(94).

ASEAN (Brunei, Indonesia Malaysia, Philippines, Singapore, Thailand and Vietnam) is, although not an institution of economic integration, the most united and active cooperative association in Asia, given its high degree of political and economic cooperation. Brunei and Vietnam are omitted from the analyses since Brunei was not

independent on a member until 1983, and Vietnam only joined ASEAN in 1995. The APEC forum was originally founded by the ASEAN countries, Australia, Canada, Japan, Korea, New Zealand and the United States in 1989. We represent these countries as APEC(89) here. By 1994, APEC expanded to include Chili, China, Hong Kong, Papua New Guinea, Taiwan and Mexico. However, Papua New Guinea is excluded from the analyses since it had not become independent until 1975. The other member economies of APEC in 1994 are represented as APEC(94). EAEC is an conception of institution which is proposed by Malaysia. EAEC is expected to be composed of Asian economies: ASEAN, China, Hong Kong, Japan, Korea and Taiwan. The motive of this plan is to counteract the rapid institutionalization and trade liberalization of APEC led by the United States and also the strengthening of regional political power of North America and Europe. EAEC dummies are used to capture the character of the trade relations of EAEC economies. Therefore ASEAN is taken to consist of five countries, APEC(89) eleven countries, EAEC ten economies and APEC(94) sixteen economies. Such definitions for these regional dummies are appropriate for the nested dummies calculation.

Each regional dummy variable mentioned above is further divided into three dummies. These three dummies are introduced to evaluate the effect of membership of each regional grouping on world trade flows. Three types of effect are considered in this paper. First, "import trade diversion" effect means that respective organization's import is diverted from outside countries to inside economies. The dummies for this effect have a superscript 1. Second, "trade creation" effect represents the movement that the members of these respective organizations increase their inside trade. The dummies

that express this effect have a superscript 2. Third, "export trade diversion" effect expresses each member economy 's diversion of its object of export from outside countries to inside economies. These dummies are distinguished by a superscript 3.

Thus, the gravity equation used in this section is as follows:

$$
\begin{aligned}
(3)\quad \log X_{ij} &= \log a_0 + a_1 \log Y_i + a_2 \log Y_j + a_3 \log N_i + a_4 \log N_j \\
&\quad + a_5 \log D_{ij} + a_6 \log A_{ij} + a_7 \log L_{ij} \\
&\quad + a_8 \log ASEAN_{ij}^1 + a_9 \log ASEAN_{ij}^2 + a_{10} \log ASEAN_{ij}^3 \\
&\quad + a_{11} \log APEC(89)_{ij}^1 + a_{12} \log APEC(89)_{ij}^2 + a_{13} \log APEC(89)_{ij}^3 \\
&\quad + a_{14} \log EAEC_{ij}^1 + a_{15} \log EAEC_{ij}^2 + a_{16} \log EAEC_{ij}^3 \\
&\quad + a_{17} \log APEC(94)_{ij}^1 + a_{18} \log APEC(94)_{ij}^2 + a_{19} \log APEC(94)_{ij}^3 \\
&\quad + \log e_{ij}
\end{aligned}
$$

where X_{ij} = the dollar value of economy i's exports to economy j

Y_i, Y_j = the nominal GDP of economies i and j in U.S. dollars[3]

N_i, N_j = the number of populations in economies i and j

D_{ij} = the great circle distance between the capitals of the two economies i and j

A_{ij} = a dummy variable reflecting adjacency of the two economies

L_{ij} = a dummy variable reflecting commonness of the official languages in economies i and j

$ASEAN_{ij}^1, APEC(89)_{ij}^1, EAEC_{ij}^1, APEC(94)_{ij}^1$ = dummy variables reflecting exports from a economy excluded from ASEAN, APEC(89), EAEC, and APEC(94), respectively, to a member economy of the same institution

$ASEAN_{ij}^{2}, APEC(89)_{ij}^{2}, EAEC_{ij}^{2}, APEC(94)_{ij}^{2}$ = dummy variables reflecting intra-institutional trade for ASEAN, APEC(89), EAEC, and APEC(94), respectively

$ASEAN_{ij}^{3}, APEC(89)_{ij}^{3}, ASIA_{ij}^{3}, APEC(94)_{ij}^{3}$ = dummy variables reflecting exports from one economy of ASEAN, APEC(89), EAEC, and APEC(94), respectively, to a economy which does not belong to the same institution

e_{ij} = the log normally-distributed error term, where $E(\log e_{ij}) = 0$

the term 'log' refers to a natural logarithms.

Equation (3) is in full form. What has to be noted here is that, among four sets of regional dummy variables, the set for APEC(89) and that of EAEC cannot be introduced into equation (3) simultaneously. Since APEC(89) area is not a subset of EAEC and *vice versa*, there need to be two dummy variable lines: (1) ASEAN-APEC(89)-APEC(94) and (2) ASEAN-EAEC-APEC(94). When performing the nested dummies calculations reported in the following subsection, estimates of nine different equations are made per year, with different combinations of the regional dummies, in order to find the regression equations with a high adjusted coefficient of determinant, and which regional dummies have high statistical significance.

Among the dummy variables of (3), $ASEAN_{ij}^{1}$, $APEC(89)_{ij}^{1}$, $EAEC_{ij}^{1}$ and $APEC(94)_{ij}^{1}$ reflect trade diversion in terms of each region's imports from outside economies. If the coefficients of these variables are negative and statistically significant, then it can be stated that the members of these respective organizations have switched their importing activities from non-member economies to member economies. This

effect is termed "import trade diversion".[4] $ASEAN_{ij}^2$, $APEC(89)_{ij}^2$, $EAEC_{ij}^2$ and $APEC(94)_{ij}^2$ reflect net intra-region "trade creation". If the coefficients of these variables are positive and statistically significant, then it can be said that the member of these respective organizations have traded with each other more than the hypothetical trade level. $ASEAN_{ij}^3$, $APEC(89)_{ij}^3$, $EAEC_{ij}^3$ and $APEC(94)_{ij}^3$ represent trade diversion with respect to each regional institution's exporting activities. Negative and statistically significant coefficients of these variables indicate that integration has caused members to prefer member economies to non-member economies in their exporting activities. This new preference is termed "export trade diversion".

In the regression equation (3), expected signs for several of the explanatory variables would be as follows. First, Y_i and Y_j would have positive coefficients, given the positive correlation between GDP and both export supply and import demand. N_i and N_j would have negative coefficients since a larger population means a larger domestic market and a more diversified range of output, and less dependence on international specialization would exist.[5] Values for D_{ij} are likely to have negative coefficients, given that greater distances tend to increase transportation costs, the time required for shipments and communication failures.[6] Finally, A_{ij} and L_{ij} would be expected to have positive coefficients as these factors tend to reduce the costs involved in trade, and promote opportunities for contact and allow easier communication with other countries.

3. The effect of the Asia-Pacific regional institutions on trade relations

Regression equation (3) was estimated using cross-sectional data for aggregate trade flows among 80 countries and regions (see Appendix 1) for intervals of approximately five years from 1960 to 1994. Thus, 88% of the world trade occurring in 1960 and 93% of the world's trade in 1994 is covered. All dummy variables are given a value of 1 in natural logarithms (or e in anti-logarithms) where the respective condition in question is satisfied, and 0 (or 1 in anti-logarithms) otherwise. Thus, a value of 0.5 for the coefficient of a dummy variable for any one year pushes up the volume of trade for that same year by 64.9% $\left(e^{0.5} \approx 1.649\right)$.

The OLS (ordinary least squares) regression was performed for several combinations of regional dummies appearing in (3). Nine different equations have been estimated per year. Table 1 presents regression results in the case of the year 1994. All the coefficients of Y_i, Y_j , N_i , N_j , D_{ij} , A_{ij} and L_{ij} possess the expected signs and are highly statistically significant. Among nine equations, equations 1-5 comprise the ASEAN-APEC(89)-APEC(94) nested dummy variables line, while equations 1, 4, and 6-9 comprise the ASEAN-EAEC-APEC(94) line. Comparing these two cases, it is evident that the ASEAN-EAEC-APEC(94) case has a higher adjusted coefficient of determination and has many statistically significant dummy variables. Equation 8 are one of the equations which have the highest adjusted coefficient of determination of all nine equations in this case. These characters are the same for the entire period analyzed, i.e. for 1960-1994. The ASEAN-APEC(89)-APEC(94) dummy variables line is, on the other hand, statistically inferior to the ASEAN-EAEC-APEC(94) line, and some

dummy variables for APEC(89) are less statistically significant compared with those for EAEC in the ASEAN-EAEC-APEC(94) line. This result is also the same for the entire period analyzed. From this it is inferred that APEC(89) countries are actually not suitable as the ideal membership for such an organization given the already existing intimate extent of their trade relations. In other words, APEC has had an endogenous incentive to expand and include other Asian countries in its memberships since its 1989 inception, from a viewpoint of having a greater effect on more substantial trade flows.

Equation 8 has three dummy variables concerning ASEAN which are not particularly highly statistically significant. Eliminating three ASEAN dummies from equation 8 leads to equation 9, which has almost the same adjusted coefficient of determination as equation 8. This is also the same for the entire period analyzed, i.e. for 1960-1994. This result shows that the volume of trade among ASEAN countries occurs at a similar level to that of intra-EAEC trade. It could be said that ASEAN has had no effect of its own in boosting trade among its member economies. This nature reflects the fact that the intra-ASEAN ratio of trade in each ASEAN countries is low.

EAEC and APEC(94) dummy variables are, on the other hand, have some highly statistically significant coefficients. Both $EAEC_{ij}^2$ and $APEC(94)_{ij}^2$ have positive and statistically significant coefficients, which means that there are two-stage trade creation areas in the Asia-Pacific region: one is the APEC in 1994 and the other is EAEC. APEC(94) region has a strong trade relation compared with the whole world, so it could be called the "first-stage prominent trading area" in the Asia-Pacific region. EAEC, which is a sub-region of APEC(94), has a further strong trade relation compared with APEC(94), so it could be called the "second-stage prominent trading area". With

respect to trade diversion, $EAEC_{ij}^{1}$ and $EAEC_{ij}^{3}$ have both positive and statistically significant coefficient. This means that EAEC economies, far from doing trade diversion, trade with non-EAEC countries more than the hypothetical level estimated by gravity analysis. As for APEC(94), the coefficient of $APEC(94)_{ij}^{1}$ is not statistically significant, while the coefficient of $APEC(94)_{ij}^{3}$ is minus and relatively statistically significant. It can be said that APEC(94) has an export trade diversion effect.

4. The transition of trade relation about Asia and America-Oceania

We now examine the transition of trade among Asia-Pacific regions from two prominent trading areas' points of view: EAEC and APEC(94). In the analysis presented in the previous section, it was shown that the APEC(94) economies have traded with each other more than the hypothetical trade level in 1994. Moreover, in the APEC(94) members, the member of the EAEC have traded with each other even more than the APEC(94) level. The question here is that of the relation between prominent trade relation of APEC(94) and even more prominent trade relation of EAEC. Even if the existence of "two-stage prominent trade areas" are found in the Asia-Pacific region, described in the previous section, the question arises as to what trade relationships in APEC(94) and EAEC members have brought about this phenomenon, whether it is due to the strong trade relationship in APEC(94), caused by a brisk trade activity on the whole region, or to the rising trade within some particular economies.

In this section, another gravity analysis is used to answer this question. New regional dummy variables are introduced to capture the intensity of trade relation between some particular economies. From the result in the previous analysis that APEC(94) is the first-stage prominent trading area and EAEC is the second-stage area, it is reasonable to divide the Asia-Pacific region into the EAEC area and the America-Oceania area (non-EAEC area) in order to examine appropriately trade relations among Asia-Pacific region or between Asia-Pacific region and the rest of the world. EAEC consists of ten economies (China, Hong Kong, Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand), while America-Oceania is composed of six (Australia, Canada, Chili, Mexico, New Zealand and the United States). Other countries are all belong to the rest of the world.

The gravity equation employed in this section is different from equation (3) in respect that it has eight new regional trade dummy variables, which are modified version of $EAEC_{ij}^{1}$, $APEC(94)_{ij}^{1}$, $EAEC_{ij}^{2}$, $APEC(94)_{ij}^{2}$, $EAEC_{ij}^{3}$ and $APEC(94)_{ij}^{3}$. These new dummy variables and the trade flows that each dummy reflects are as follows:

(1) $(EAEC \rightarrow EAEC)_{ij}$: exports from EAEC to EAEC

(2) $(AMOC \rightarrow AMOC)_{ij}$: exports from America-Oceania to America-Oceania

(3) $(AMOC \rightarrow EAEC)_{ij}$: exports from America-Oceania to EAEC

(4) $(EAEC \rightarrow AMOC)_{ij}$: exports from EAEC to America-Oceania

(5) $(ROW \rightarrow EAEC)_{ij}$: exports from the rest of the world to EAEC

(6) $(EAEC \rightarrow ROW)_{ij}$: exports from EAEC to the rest of the world

(7) $(ROW \rightarrow AMOC)_{ij}$: exports from the rest of the world to America-Oceania

(8) $(AMOC \rightarrow ROW)_{ij}$: exports from America-Oceania to the rest of the world

Table 2 presents the summary of regression results of gravity equation, using the new eight trade dummy variables, from 1960 to 1994. Adjusted coefficients of determination are seen to be getting higher with time. The reason for this may be, not that world trade is tending to converge upon the theoretically expected value, but that the range covered by each explaining variable are expanding annually.

It is apparent that all the coefficients of Y_i, Y_j, N_i, N_j, D_{ij}, A_{ij} and L_{ij} possess the expected signs and are highly statistically significant. Note the trend in the figures for the coefficients of Y_i, Y_j, N_i and N_j. Before 1970, the coefficients of Y_i and Y_j have increasing value, while those for N_i and N_j have decreasing values. This phenomenon would seem to be the result of expansion in world trade during this period. The growth rate of world trade had greatly exceeded the growth rate of world income until around 1970. This occurred with trade liberalization throughout much of the developed world and especially through the activity promoted by the General Agreement on Tariffs and Trade (GATT). However, after 1970, the trend in the change of the readings for the coefficients of these variables is reversed. This may be explained by the impact of the two oil crises of the 1970s that brought about a global recession. This period also witnessed a sluggish performance for world trade with stagnant growth throughout many of the world economies. In the period from 1980 to 1985, the point at which the growth rate of world trade fell below the growth rate of world income was reached.

Values obtained for the coefficients of D_{ij} exhibit a downward trend. Negative values obtained for the coefficient readings of the distance variable D_{ij} become larger for every period until the 1994 readings. While the reason of this phenomenon is not clear,

the appearance of this trend in Table 2 may be regarded as one of the factors explaining recent economic "regionalism". As for A_{ij} and L_{ij} , the coefficients of these dummy variables do not show a clear trend.

Concerning the regional trade dummy variables, the estimates of these coefficients turn out to vary with the year analyzed. Observing the values for each coefficient from 1960 to 1994, the following points are of interest. First, all of the coefficients of $(EAEC \rightarrow EAEC)_{ij}$ are statistically significant and have high values compared with these of other explanatory variables. This is to be expected from the fact that EAEC area has a strong trade creation effect throughout the analyzing period. The volume of trade occurring among Asian economies had been at a very high level since the 1960s, compared with the general level of world trade. On the other hand, the coefficients of $(AMOC \rightarrow AMOC)_{ij}$ are positive and statistically significant only in 1990 and 1994. This means that America-Oceania area has no trade creation effect until 1990.

Second, the coefficients of $(AMOC \rightarrow EAEC)_{ij}$ and $(EAEC \rightarrow AMOC)_{ij}$ both exhibit upward trend in the entire analyzing period. These two dummies have statistically insignificant coefficient in 1960, while in 1995 the coefficients of both dummies become significant and largely positive value. This result shows the reason why $APEC(94)_{ij}^2$ in Table 1 have positive and statistically significant coefficients. It is not because the value of trade among any economies in the Asia-Pacific region has increased, but because of the increased trade between EAEC and America-Oceania. This result shows that the EAEC economies, not American or Oceanic countries, play pivotal role for increasing volume of trade in the pan-Pacific region.

Third, four dummy variables reflecting the trade between APEC(94) economies and

the rest of the world, $(ROW \rightarrow EAEC)_{ij}$, $(EAEC \rightarrow ROW)_{ij}$, $(ROW \rightarrow AMOC)_{ij}$, and $(AMOC \rightarrow ROW)_{ij}$, all have the upward trend. As for EAEC, the coefficient of $(ROW \rightarrow EAEC)_{ij}$ become positive and statistically significant in 1990's, while all of the coefficients of $(EAEC \rightarrow ROW)_{ij}$ are significantly positive throughout the analyzing period. This reflects the fact that the volume of trade between Asian economies and non-member countries of APEC94 has been more than the average volume of trade between any two countries in the world. As for America-Oceania, on the other hand, almost all coefficients for $(ROW \rightarrow AMOC)_{ij}$ and $(AMOC \rightarrow ROW)_{ij}$ are negative and highly statistically significant. This means that the American-Oceanic countries do not trade with non-APEC94 countries as briskly as indicated by the world trade standard. The values of coefficients for these dummies, however, increased throughout the analyzing period.

These three observations show that the APEC(94) economies promote inter- as well as intra-APEC trade, and also substantial "open regionalism", one objective of APEC, by the pivotal role of EAEC. APEC can maintain such a policy of "open regionalism", thanks to these characteristics of the transition occurring in Asia-Pacific trade.

In order to check the stability of the coefficient estimates with the passage of time, the Chow test is applied. In this paper, a test is carried out to ascertain whether or not the coefficients estimated for two different sets of regression equations, one using data five years older than the other basically, are the same. Seven inclusive sets of data are therefore subjected to the Chow test. Each of these data sets contains data readings from two years, the latter of which becomes the first lot of data in the next two-year data set. Specifically, the seven data sets used comprised data readings for 1960 and

1965, then 1965 and 1970, 1970 and 1975, 1975 and 1980, 1980 and 1985, 1985 and 1990, and finally 1990 and 1994.

After conducting the Chow test procedure for all seven data sets, the hypothesis that the coefficients remain stable can be rejected at the 1% level in all cases except for one instance. This exception is the data set of 1980 and 1985, for which the hypothesis can be rejected at the 5% level. These outcomes shows that the coefficients in a gravity equation are generally not stable in a five-year term, and therefore that the gravity analysis has no ability to make an economic forecast for more than five years.

5. Trade intensity among enlarged APEC

Since its inception in 1989, APEC has been expanding to include other Pacific Rim economies. In 1998, three new members joined in APEC: Peru, Russia, and Vietnam. There are still some other countries which show their readiness to become members of this group. It seems that APEC still has an momentum for expanding to, or even beyond, the circum-pan-Pacific area. It is a matter of interest to which area APEC will expand in the 21th century.

This section attempts to estimate the strength of trade relations of hypothetical enlarged APEC. Two kinds of enlarged APEC are considered. One is the enlarged APEC that includes five Asian countries besides APEC(94) economies: APEC(94), India, Mongolia, Pakistan, Russia, Sri Lanka. This hypothetical enlarged APEC is called here

AsiaAPEC. The other is that includes five American countries in addition to APEC(94) economies: APEC(94), Colombia, Costa Rica, Ecuador, Panama, Peru. This is called AmerAPEC.

The gravity equation used in this section is modified version of equation (3) in section 2. Instead of ASEAN and APEC(89) dummies in (3), other regional dummy variables, AsiaAPEC and AmerAPEC, are introduced here. These two dummies are further divided into three dummies of each, similarly to section 2: $AsiaAPEC_{ij}^{1}$, $AsiaAPEC_{ij}^{2}$, $AsiaAPEC_{ij}^{3}$, $AmerAPEC_{ij}^{1}$, $AmerAPEC_{ij}^{2}$, $AmerAPEC_{ij}^{3}$. Four kinds of regional dummies form two nested dummy variable lines: (1) EAEC-APEC(94)-AsiaAPEC and (2) EAEC-APEC(94)-AmerAPEC.

Table 3 shows the summary of regression results of gravity equation employing these two dummy lines from 1980 to 1994. Compared the coefficient value of $AsiaAPEC_{ij}^{2}$ with that of $AmerAPEC_{ij}^{2}$, three out of four $AsiaAPEC_{ij}^{2}$ have positive and statistically significant coefficient values. Only one out of four coefficients of $AmerAPEC_{ij}^{2}$, on the other hand, is, though negative, statistically significant. This means that AmerAPEC area as a whole has strong trade creation effect. As for $AsiaAPEC_{ij}^{1}$, $AsiaAPEC_{ij}^{3}$, $AmerAPEC_{ij}^{1}$, and $AmerAPEC_{ij}^{3}$, somewhat statistically significant coefficients of $AsiaAPEC_{ij}^{1}$ and $AsiaAPEC_{ij}^{3}$ are all positive, while that of $AmerAPEC_{ij}^{1}$ and $AmerAPEC_{ij}^{3}$ are all negative. From this it is inferred that APEC may expand to the South Asia region given the already existing intimate extent of their trade relations, even though almost all the AmerAPEC economies are located on the Pacific Rim.

6. Summary

This paper has examined the nature of the transition of postwar Asia-Pacific trade using the gravity model. The analysis developed in this paper focused on mainly two aspects of this trade: firstly, to distinguish between trade creation and trade diversion in order to grasp the character of each regional economic group; secondly, to examine clearly the transition of trade relations in the circum-pan-Pacific region.

The analysis leads to the following conclusions. First, ASEAN has had no effect of its own on promoting trade among its member countries further than these of EAEC. Second, the volume of trade among EAEC has been at a higher level than that occurring among countries in the general network of international trade during the 1960s. Third, the value of trade between EAEC and non-EAEC countries in APEC(94) has been increasing through the analyzing period. These phenomena lead to the formation of two-stage trade creation areas in the Asia-Pacific region: EAEC and APEC(94). Fourth, the volume of trade from EAEC economies to non-member countries of APEC(94) has been more than the average volume of trade between any two countries in the world, while that between non-EAEC countries in APEC(94) and non-member countries of APEC(94) has been increasing. These results show that APEC promotes inter- as well as intra-APEC trade, and also substantial "open regionalism." Finally, the results in this paper make it clear that APEC(94) has close trade relations with some Asian countries rather than American countires. It can be said from this that APEC may expand to the South Asia region given the already existing close trade relations among them.

Appendix 1. List of countries and regions used in the gravity analyses

Europe (25): Austria, Belgium-Luxembourg, Bulgaria, Czechoslovakia, Denmark, Finland, France, Germany (1990-), East Germany (-1985), West Germany (-1985), Greece, Hungary, Iceland, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Romania, Russia (1994), Spain, Sweden, Switzerland, the United Kingdom, the U.S.S.R. (-1990), Yugoslavia, SFR (-1990)

Americas (19): Argentina, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Jamaica, Mexico, Panama, Paraguay, Peru, Trinidad and Tobago, the United States, Uruguay, Venezuela

Asia (20): People's Republic of China, China Taiwan, Hong Kong, India, Indonesia, Iran, Iraq (-1990), Israel, Japan, Republic of Korea, Kuwait, Malaysia (1960, 1970-), Malaysia - Singapore (1965), Mongolia, Pakistan, Philippines, Saudi Arabia, Singapore (1960,1970-), Sri Lanka, Thailand, Turkey

Africa (14): Algeria, Cameroon, Cote d'Ivoire, Egypt, Ethiopia, Ghana, Kenya, Liberia, South Africa, Sudan, Tunisia, Libya, Morocco, Nigeria

Oceania (2): Australia, New Zealand

Note: (-19**),(19**-), etc. show the period where trade flows of that country are considered in our estimation. Countries without this mark are considered throughout our analyzing period.

Appendix 2. Data sources and adjustments

Volume of trade: International Monetary Fund, *Direction of Trade Statistics*; Council for Economic Planning and Development, Republic of China (Taiwan), *Statistical Data Book*; Institute of Developing Economies, Japan, *Trade Statistics of China 1970-1985 - Utilization and Appraisal-* (in Japanese).

GDP: United Nations, *Statistical Yearbook*. The method of estimation for the GDP of CMEA countries is as follows. 1) Find the value of Net Material Product (NMP) in national currency units from the UN Statistical Yearbook. 2) Calculate GDP in national currency units based on the formula: GDP = NMP × (Total employment)/(Total employment - Persons employed by service industries). 3) Multiply the outcome of 2) by the non-commercial exchange rate reported in the UN Statistical Yearbook. In cases where the non-commercial exchange rate is not reported, use the basic exchange rate. It should be noted that the exchange rates of CMEA countries are relatively over-estimated, so GDP figures for CMEA countries estimated by this method are also likely to be over-estimated. 4) For GDP or NMP figures of particular countries which are not available for certain years in the UN Statistical Yearbook, estimates are calculated using the trend of GDP or NMP growth for the same region or a similar country.

Population: United Nations, *Demographic Yearbook*.

Great circle distance: G. L. Fitzpatrick and M. J. Modlin (1986), *Direct-Line Distances, International Edition*, The Scarecrow Press.

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[1] The name "gravity model" originates from Newton's theory of gravity, which states the fact that gravitation between two objects is in inversely proportional to the square of the distance between them. The "gravity model" also has a distance term to help explain the volume of trade between two countries.

[2] The basic formulation of the gravity equation is a loglinear function as shown in the text. Though Sanso, Cuairan and Sanz (1993) show that the loglinear form is not statistically acceptable to explain trade flows among Organization for Economic Cooperation and Development (OECD) countries, they also mention that an acceptable form depends on the countries, years and estimation methods involved. Therefore, it is considered acceptable in this paper to pursue the analysis of Asia-Pacific trade using a loglinear function, as has been done by many other researches.

[3] Linnemann(1966) shows that the use of real GDP figures instead of nominal GDP makes only little difference in readings for the coefficients of determination.

[4] Frankel (1993) and Frankel and Wei (1995) use similar dummy variables to those of

this paper to see any trade diversion effects occurring in East Asian countries and Europe. Neither paper divided the trade diversion effects measured into "import trade diversion" and "export trade diversion", and the years analyzed are 1980, 1985 and 1990 only.

[5] In almost all the papers concerning the gravity model, N_i and N_j are assumed to have negative coefficients. Brada and Méndez (1985), however, expected N_j to have a positive coefficient for the reason that a larger population in the importing country enables imports to compete better with domestic goods and compensates exporters for the cost of foreign sales activities. Their econometric analysis indeed shows that N_j has a positive and statistically significant coefficient.

[6] The ordinary gravity model uses distance as one of independent variables. Geraci and Prewo (1977), however, considered distance as a determinant of the transport cost, and used this transport cost, instead of distance, as one of independent variable in their model with data of trade flows among OECD countries for 1970.

Table 1 Empirical Results of Regression Equation (3) : 1994

	Year	1	2	3	4	5	6
	constant	-8.657**	-7.545**	-8.464**	-6.716**	-7.630**	-7.525**
		(0.296)	(0.326)	(0.336)	(0.336)	(0.349)	(0.303)
Coefficients of Independent Variables	Yi	0.999**	0.947**	0.990**	0.926**	0.968**	0.960**
		(0.014)	(0.014)	(0.015)	(0.014)	(0.015)	(0.013)
	Yj	0.824**	0.777**	0.811**	0.765**	0.796**	0.797**
		(0.013)	(0.014)	(0.014)	(0.014)	(0.014)	(0.013)
	Ni	-0.172**	-0.147**	-0.169**	-0.158**	-0.180**	-0.186**
		(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.015)
	Nj	-0.055**	-0.037*	-0.052**	-0.043**	-0.054**	-0.058**
		(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
	Dij	-0.888**	-0.902**	-0.883**	-0.959**	-0.937**	-0.939**
		(0.025)	(0.026)	(0.026)	(0.027)	(0.027)	(0.026)
	Aij	0.667**	0.660**	0.674**	0.627**	0.640**	0.646**
		(0.109)	(0.110)	(0.109)	(0.108)	(0.107)	(0.107)
	Lij	0.619**	0.505**	0.577**	0.441**	0.507**	0.625**
		(0.058)	(0.059)	(0.059)	(0.058)	(0.058)	(0.057)
	ASEAN1ij	0.778**		0.687**		0.641**	
		(0.078)		(0.101)		(0.099)	
	ASEAN2ij	1.826**		0.918**		0.747*	
		(0.296)		(0.330)		(0.325)	
	ASEAN3ij	0.887**		0.849**		0.794**	
		(0.075)		(0.099)		(0.097)	
	APEC(89)1ij		0.330**	-0.010		-0.221*	
			(0.062)	(0.078)		(0.097)	
	APEC(89)2ij		1.588**	0.913**		-0.361*	
			(0.126)	(0.150)		(0.184)	
	APEC(89)3ij		0.371**	-0.064		-0.560**	
			(0.060)	(0.078)		(0.096)	
	EAEC1ij						0.580**
							(0.060)
	EAEC2ij						1.886**
							(0.134)
	EAEC3ij						0.984**
							(0.059)
	APEC(94)1ij				0.343**	0.261**	
					(0.058)	(0.082)	
	APEC(94)2ij				1.626**	1.497**	
					(0.089)	(0.125)	
	APEC(94)3ij				0.513**	0.598**	
					(0.057)	(0.080)	
	adj. R2	0.732	0.727	0.734	0.737	0.743	0.745
	S.E.	1.244	1.253	1.238	1.231	1.217	1.214

Number of observations : 4380
Standard errors are in parentheses.
** The coefficient is significant at the 1% level.
* The coefficient is significant at the 5% level.
# The coefficient is significant at the 10% level.
All variables are in natural logarithms.

7	8	9
-7.627**	-7.460**	-7.341**
(0.305)	(0.342)	(0.339)
0.960**	0.956**	0.956**
(0.013)	(0.014)	(0.014)
0.806**	0.794**	0.784**
(0.013)	(0.014)	(0.014)
-0.187**	-0.186**	-0.185**
(0.015)	(0.015)	(0.015)
-0.059**	-0.057**	-0.055**
(0.016)	(0.016)	(0.016)
-0.939**	-0.935**	-0.937**
(0.025)	(0.028)	(0.028)
0.653**	0.645**	0.637**
(0.107)	(0.106)	(0.106)
0.621**	0.589**	0.590**
(0.057)	(0.058)	(0.058)
0.444**	0.416**	
(0.100)	(0.099)	
0.164	0.139	
(0.326)	(0.324)	
-0.020	-0.029	
(0.097)	(0.097)	
0.362**	0.301**	0.490**
(0.077)	(0.094)	(0.083)
1.724**	1.012**	1.136**
(0.159)	(0.192)	(0.175)
0.997**	1.077**	1.060**
(0.077)	(0.093)	(0.081)
	-0.013	0.004
	(0.078)	(0.078)
	0.734**	0.756**
	(0.122)	(0.122)
	-0.188*	-0.188*
	(0.077)	(0.077)
0.746	0.749	0.749
1.211	1.202	1.204

Table 2. Empirical Results of Asia-Pacific Trade : 1960-1994

	Year	1960	1965	1970	1975	1980	1985
	constant	-9.436**	-9.900**	-14.311**	-11.311**	-11.567**	-11.292**
		(0.495)	(0.457)	(0.521)	(0.460)	(0.460)	(0.461)
(Coefficients of Independent Variables)	Yi	0.978**	0.974**	1.335**	1.198**	1.207**	1.182**
		(0.030)	(0.026)	(0.028)	(0.022)	(0.022)	(0.022)
	Yj	0.782**	0.866**	1.133**	0.868**	0.869**	0.879**
		(0.030)	(0.026)	(0.028)	(0.022)	(0.021)	(0.021)
	Ni	-0.385**	-0.340**	-0.514**	-0.434**	-0.408**	-0.401**
		(0.032)	(0.028)	(0.030)	(0.024)	(0.023)	(0.022)
	Nj	-0.227**	-0.268**	-0.395**	-0.157**	-0.125**	-0.132**
		(0.032)	(0.028)	(0.030)	(0.024)	(0.023)	(0.023)
	Dij	-0.349**	-0.428**	-0.611**	-0.677**	-0.740**	-0.750**
		(0.037)	(0.034)	(0.040)	(0.035)	(0.034)	(0.034)
	Aij	0.605**	0.622**	0.442**	0.483**	0.402**	0.633**
		(0.128)	(0.123)	(0.149)	(0.130)	(0.129)	(0.129)
	Lij	0.576**	0.730**	0.891**	0.789**	0.561**	0.431**
		(0.083)	(0.078)	(0.088)	(0.076)	(0.074)	(0.074)
	(EAEC-EAEC)ij	1.829**	1.737**	2.614**	2.372**	2.302**	2.175**
		(0.177)	(0.191)	(0.208)	(0.173)	(0.173)	(0.168)
	(AMOC-AMOC)ij	-0.306	-0.221	-0.392	-0.074	0.167	0.245
		(0.291)	(0.275)	(0.346)	(0.287)	(0.296)	(0.294)
	(AMOC-EAEC)ij	0.285	0.522*	0.765**	0.833**	1.120**	1.069**
		(0.248)	(0.227)	(0.275)	(0.209)	(0.220)	(0.214)
	(EAEC-AMOC)ij	0.319	0.556*	0.837**	1.032**	1.418**	1.332**
		(0.233)	(0.236)	(0.266)	(0.213)	(0.212)	(0.207)
	(ROW-EAEC)ij	0.084	-0.074	0.149	0.164#	0.078	0.039
		(0.108)	(0.099)	(0.101)	(0.088)	(0.087)	(0.085)
	(EAEC-ROW)ij	0.449**	0.391**	0.673**	0.760**	0.759**	0.586**
		(0.103)	(0.098)	(0.103)	(0.085)	(0.083)	(0.080)
	(ROW-AMOC)ij	-0.551**	-0.475**	-0.661**	-0.314**	-0.306**	-0.375**
		(0.115)	(0.106)	(0.120)	(0.103)	(0.102)	(0.103)
	(AMOC-ROW)ij	-0.542**	-0.460**	-0.563**	-0.250**	-0.198*	-0.211*
		(0.116)	(0.106)	(0.126)	(0.101)	(0.101)	(0.101)
	adj. R2	0.479	0.533	0.598	0.616	0.631	0.641
	S.E.	1.422	1.374	1.738	1.532	1.527	1.510
	# observations	2999	3383	4313	4488	4508	4497

Standard errors are in parentheses.
** The coefficient is significant at the 1% level.
* The coefficient is significant at the 5% level.
# The coefficient is significant at the 10% level.
All variables are in natural logarithms.

1990	1994
-8.344**	-7.334**
(0.379)	(0.339)
0.966**	0.956**
(0.016)	(0.014)
0.789**	0.784**
(0.015)	(0.014)
-0.278**	-0.185**
(0.017)	(0.015)
-0.141**	-0.055**
(0.018)	(0.016)
-0.791**	-0.938**
(0.030)	(0.028)
0.573**	0.641**
(0.111)	(0.106)
0.616**	0.591**
(0.064)	(0.058)
2.342**	1.892**
(0.141)	(0.133)
0.627*	0.518*
(0.245)	(0.226)
1.601**	1.349**
(0.176)	(0.163)
1.792**	1.835**
(0.175)	(0.163)
0.503**	0.484**
(0.071)	(0.066)
0.832**	0.871**
(0.068)	(0.064)
0.022	0.026
(0.088)	(0.081)
-0.094	-0.184*
(0.085)	(0.080)
0.692	0.749
1.286	1.204
4421	4380

Table 3. Enlarged APEC : 1980-1994

	Year	1980(1)	1980(2)	1985(1)	1985(2)	1990(1)	1990(2)
	constant	-11.766**	-11.652**	-11.385**	-11.387**	-8.427**	-8.353**
		(0.463)	(0.463)	(0.464)	(0.464)	(0.382)	(0.383)
(coefficients of Independent Variables)	Yi	1.225**	1.198**	1.188**	1.169**	0.975**	0.965**
		(0.023)	(0.022)	(0.023)	(0.022)	(0.016)	(0.016)
	Yj	0.881**	0.878**	0.890**	0.882**	0.789**	0.794**
		(0.022)	(0.022)	(0.022)	(0.021)	(0.016)	(0.016)
	Ni	-0.441**	-0.403**	-0.413**	-0.397**	-0.296**	-0.277**
		(0.026)	(0.023)	(0.025)	(0.022)	(0.019)	(0.018)
	Nj	-0.146**	-0.130**	-0.155**	-0.137**	-0.140**	-0.142**
		(0.025)	(0.023)	(0.025)	(0.023)	(0.019)	(0.018)
	Dij	-0.741**	-0.728**	-0.752**	-0.721**	-0.788**	-0.796**
		(0.034)	(0.035)	(0.034)	(0.035)	(0.030)	(0.031)
	Aij	0.388**	0.403**	0.621**	0.673**	0.570**	0.555**
		(0.128)	(0.129)	(0.129)	(0.129)	(0.111)	(0.111)
	Lij	0.556**	0.576**	0.425**	0.462**	0.613**	0.608**
		(0.074)	(0.074)	(0.074)	(0.074)	(0.064)	(0.064)
	EAEC1ij	0.458**	0.453**	0.464**	0.450**	0.532**	0.537**
		(0.112)	(0.112)	(0.109)	(0.109)	(0.091)	(0.091)
	EAEC2ij	1.859**	1.840**	1.690**	1.702**	1.457**	1.435**
		(0.234)	(0.234)	(0.228)	(0.228)	(0.190)	(0.190)
	EAEC3ij	0.975**	0.950**	0.809**	0.793**	0.928**	0.917**
		(0.109)	(0.108)	(0.105)	(0.105)	(0.088)	(0.087)
	APEC(94)1ij	-0.502**	-0.446**	-0.619**	-0.316*	0.038	-0.159
		(0.148)	(0.142)	(0.145)	(0.141)	(0.122)	(0.124)
	APEC(94)2ij	-0.076	0.474*	0.103	0.891**	0.674**	0.754**
		(0.232)	(0.225)	(0.227)	(0.218)	(0.189)	(0.185)
	APEC(94)3ij	-0.443**	0.099	-0.305*	0.209	-0.247*	-0.061
		(0.143)	(0.143)	(0.142)	(0.141)	(0.119)	(0.125)
	APECAS1ij	0.157		0.232#		-0.069	
		(0.125)		(0.120)		(0.102)	
	APECAS2ij	0.590**		0.429*		0.232	
		(0.175)		(0.169)		(0.143)	
	APECAS3ij	0.252*		0.093		0.157	
		(0.119)		(0.116)		(0.100)	
	APECAM1ij		0.076		-0.121		0.154
			(0.118)		(0.116)		(0.104)
	APECAM2ij		-0.023		-0.443**		0.156
			(0.161)		(0.156)		(0.135)
	APECAM3ij		-0.341**		-0.478**		-0.029
			(0.119)		(0.117)		(0.108)
	adj. R2	0.632	0.632	0.641	0.642	0.693	0.692
	S.E.	1.526	1.526	1.510	1.508	1.286	1.286
	# observations	4508	4508	4497	4497	4421	4421

Standard errors are in parentheses.
** The coefficient is significant at the 1% level.
* The coefficient is significant at the 5% level.
# The coefficient is significant at the 10% level.
All variables are in natural logarithms.

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