The Transition of Postwar Asia-Pacific Trade: A Simple Application of the Gravity Model*

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Abstract

This paper introduces a new series of dummy variables to the Gravity Model and examines the transition of postwar Asia-Pacific trade using temporal cross-section analyses of every five year interval from 1960 to 1990. This paper also investigates whether or not the member countries of APEC actually constitute what would be the ideal membership for this forum. The main conclusion of this paper is summarized in two findings. Firstly, that the volume of trade in Asia has been at a high level since 1970, while the amount of trade among APEC economies has been growing throughout the postwar period. Secondly, that the constituent countries of APEC at the time of its inauguration are indeed not what may be termed the "preferred" membership for this economic and political forum, in view of already existing intimate extent of trade relations.

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1. Introduction

In the Southeast Asia and Pacific region, the rate of economic growth is still high, while trade and direct investment also continue growing. One of the most important features of this region until recently, was its lack of regional economic institution which discriminates against non-Asia-Pacific countries in trade.[1)] Even then, the Asia-Pacific Economic Cooperation Conference (APEC), initiated in 1989, has the outstanding feature of "non-discrimination", and its members seek "to apply the principle of non-discrimination between and among them in the process of liberalization and facilitation of trade and investment" (The APEC Osaka Action Agenda, Part 1: Liberalization and Facilitation, 1995). This principle is the basis of APEC's "Open Regionalism". One of the reasons why APEC adopts such a non-discrimination principle is that the flow of trade and investment among APEC economies is increasing spontaneously, and therefore APEC may as well have a role in maintaining and strengthening this spontaneous trend, instead of impeding upon it by making some kind of discriminatory arrangement.

The purpose of this paper is to examine the nature of and transition in postwar Asia-Pacific trade, in a comparison with what has occurred in the case of general world trade. This paper also investigates whether or not the constituent countries of APEC form a preferable membership. The method of analysis applied in this paper is based on the "Gravity Model". A modified

1) In Asia, the ASEAN (Association of South East Asian Nations) Free Trade Area (AFTA), founded in 1993, is the first institution whose trade liberalization measures are not applied to non-member economies. While in North-America, U.S.-Canada Free Trade Agreement, which came into effect in 1989 and was reorganized into the North America Free Trade Agreement (NAFTA) in 1994, discriminates to liberalize only intra-region trade.

approach to the gravity model is used to estimate the flow of trade between two countries through temporal cross-section data analyses, for every five years from 1960 to 1990.

In order to see the relation between the volume and direction of international trade and the formation of trading blocs, 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, though some critics disapprove of its weak theoretical foundations.[2)3)] 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 of the gravity model, for example, estimated trade flows among 42 countries for the year 1959. Tinbergen proved that the coefficient of preference group variable is positive and highly significant statistically. Similar results were obtained by several other works, despite the different stages of development and characteristics of the economic systems of the countries examined. Examples include Linnemann (1966), Ait-

2) 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.

3) Attempts to explain foundations of the gravity model include Linnemann (1966), Anderson (1979) and Bergstrand (1985) using an assumption that goods are differentiated according to country of origin. Bergstrand (1989) extends 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.

ken (1973), Hewett (1976), Geraci and Prewo (1977), Pelzman (1977), Brada and Méndez (1985), and Bergstrand (1985). Hamilton and Winters (1992), however, showed that some trade preference groups constituted by developing countries had less significant coefficients for the intra-union trade.

Concerning Asia, Frankel, Stein and Wei (1993) made clear that the East Asia Economic Caucus (EAEC) dummy was highly statistically significant throughout the analyzed period of 1965 - 1990. Frankel (1993) examined the boundary of the Asian bloc, using the back-of-the-envelope calculation for 1980, 1985 and 1990. Frankel and Wei (1995) showed that the EAEC dummy and APEC dummy were both highly statistically significant for 1980, 1985 and 1990.

This paper introduces two new kinds of dummy variables into the Gravity Model, which is considered appropriate in answering the questions posed herein. One such dummy variable is used to seize the nature of trade flows in each region, and consists of four sets of regional dummy variables: ASEAN (the Association of South East Asian Nations), the APEC forum in 1989, Asia, and APEC in 1994. Another dummy variable is used to ascertain the effect of each region's economic integration: trade creation effect, import trade diversion effect, and export trade diversion effect.

Chapter 2 explains the equation of estimation used in this paper. The back-of-the-envelope calculation is performed, along with estimations of any trade creation and trade diversion effects occurring in each region from 1960 to 1990. The calculations and estimations are performed for each five year period therein. Chapter 3 discusses the empirical results, and describes the nature and transition of Asia-Pacific trade during the post-World War Ⅱ period. Chapter 3 also considers the "idealness" of the initial membership of the APEC forum. Chapter 4 presents the main implications of this paper.

2. The Gravity Model of Bilateral Trade

In the context of international trade, the basic formulation of the gravity equation is as follows:[4)]

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

or, using common iogarithms,

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

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

Y_i, Y_j = incomes of countries i and j

N_i, N_j = populations of countries i and j

D_{ij} = the distance between countries i and j[5)]

e_{ij} = the lognormally distributed error term, while E (log e_{ij}) = 0.

The income and population variables represent the trading countries' endowments, while the distance variable represents resistance to trade.

Next three kinds of dummy variables are introduced to (2), so as to create a version of the Gravity Model which will provide data on trade patterns

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4) 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.

5) 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.

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 regional dummy variables. ASEAN (Indonesia, Brunei, Malaysia, Philippines, Singapore, Thailand and Viet Nam) 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 Viet Nam are omitted from the analyses since Brunei was not independent on a member until 1983, and Viet Nam 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 APEC89 in this paper. 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 countries of APEC in 1994 are represented as APEC94. However, since APEC94 countries are geographically dispersed, ASIA dummies are used to seize the character of the Asian trade component among ASEAN, China, Hong Kong, Japan, Korea and Taiwan. Therefore ASEAN is taken to consist of five countries, APEC89, eleven countries, ASIA, ten economies and APEC94, sixteen economies. Such definitions for these regional dummies are appropriate for the back-of-the-envelope calculation.

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

$$(3)\quad \log X_{ij} = \log a_0 + a_1 \log Y_i + a_2 \log Y_j + a_3 \log N_i + a_4 \log N_j + a_5 \log D_i + a_6 \log A_{ij} + a_7 \log L_{ij}$$

$$+a_8\log ASEAN_{ij}^1+a_9\log ASEAN_{ij}^2+a_{10}\log ASEAN_{ij}^3$$
$$+a_{11}\log APEC89_{ij}^1+a_{12}\log APEC89_{ij}^2+a_{13}\log APEC89_{ij}^3$$
$$+a_{14}\log ASIA_{ij}^1+a_{15}\log ASIA_{ij}^2+a_{16}\log ASIA_{ij}^3$$
$$+a_{11}\log APEC94_{ij}^1+a_{12}\log APEC94_{ij}^2+a_{13}\log APEC94_{ij}^3+\log e_{ij}$$

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

Y_i, Y_j = the nominal GDP of countries i and j in U.S. dollars[6)]

N_i, N_j = fthe populations of countries i and j

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

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

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

$ASEAN_{ij}^1$, $APEC89_{ij}^1$, $ASIA_{ij}^1$, $APEC94_{ij}^1$ = dummy variables reflecting exports from a non-member country of APEC94 to a member country of ASEAN, APEC89, ASIA and APEC94, respectively

$ASEAN_{ij}^2$, $APEC89_{ij}^2$, $ASIA_{ij}^2$, $APEC94_{ij}^2$ = dummy variables reflecting intra-ASEAN, intra-APEC89, intra-ASIA and intra-APEC94 trade, respectively

$ASEAN_{ij}^3$, $APEC89_{ij}^3$, $ASIA_{ij}^3$, $APEC94_{ij}^3$ = dummy variables reflecting exports from a member country of the ASEAN, APEC89, ASIA and APEC94, respectively, to a non-member country of the APEC94

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

'log' refers to common logarithms.

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6) 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.

Equation (3) is in full form. When performing the back-of-the-envelope calculations reported in the following section, estimates of nine different equations are made par 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), $ASEAN_{ij}^{1}$, $APEC89_{ij}^{1}$, $ASIA_{ij}^{1}$ and $APEC94_{ij}^{1}$ reflect trade diversion in terms of each region's imports from non-APEC94 countries. If the signs of these coefficients are negative and statistically significant, then these areas are switching their import purchases from non-APEC94 members to member countries of ASEAN, APEC89, ASIA and APEC94, respectively. This effect is termed "import trade diversion".[7) 8)] $ASEAN_{ij}^{2}$, $APEC89_{ij}^{2}$, $ASIA_{ij}^{2}$ and $APEC94_{ij}^{2}$ reflect net intra-region "trade creation". While $ASEAN_{ij}^{3}$, $APEC89_{ij}^{3}$, $ASIA_{ij}^{3}$ and $APEC94_{ij}^{3}$ reflect trade diversion with respect to each region's exports to non-APEC94 countries. If the signs of these coefficients are negative and statistically significant, then these areas are switching their exports from non-APEC94 members to member countries of ASEAN, APEC89, ASIA and APEC94, respectively. This is called "export trade diversion".[9) 10)]

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7) Note that these dummy variables are not those which show the effect of trade diversion from non-member countries of particular economic integration to member countries of the same economic integration. Such a definition would weaken the substance of the back-of-the-envelope calculations of this paper, since, based on this definition, the set of trade flows coming under $ASEAN_{ij}^{1}$ is not a subset of that for $APEC89_{ij}^{1}$, and the set of trade flows coming under $APEC89_{ij}^{1}$ is not the subset of that for $APEC94_{ij}^{1}$. Therefore, the above-mentioned definition of "import trade diversion" is used to avoid this problem concerning subjects.

8) 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.

What has to be noted here is that, among these dummy variables, the set for APEC89 and that of ASIA cannot be introduced into equation (3) simultaneously. Since APEC89 area is not a subset of ASIA and vice versa, there need to be two back-of-the-envelope dummy variable lines: (1) ASEAN-APEC89-APEC94 and (2) ASEAN-ASIA-APEC94.

In the regression equation (3), signs of the following explanatory variables are expected thus. Firstly, Y_i and Y_j should have positive coefficients because GDP has a positive correlation with export supply and import demand. Secondly, N_i and N_i ought to have negative coefficients since a large population means a larger domestic market, more diversified production and less dependence on international specialization.[11] Thirdly, D_{ij} is expected to have a negative coefficient because greater distance increases transport costs, transport time and the likelihood of communication failures. Finally, A_{ij} and L_{ij} are both expected to have positive coefficients because these factors reduce trade costs, increase opportunities to have contacts with foreigners and facilitate communication with other countries.

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9) These dummies are so defined in this paper so as to avoid the subset problem. See the footnote 7.

10) Bikker (1992) suggests that trade liberalization among EEC economies has effects on trade flows among non-EEC countries as well as intra-EEC trade flows (trade creation) and inter-EEC trade flows (trade diversion), using the "Extended Gravity Model". His attempt to show the extent of these effects is, however, not so successful. Thus it is assumed here that trade liberalization within an economic region has no or slight effect on trade flows among non-member countries.

11) In almost all the papers concerning the gravity model, N_i and N_j are assumed to have negative coefficients. Brada and Médez (1985), however, expected N_j to have a positive coefficient for the reason that a larger population in the importing country enables imports to better compete 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.

3. Empirical Results

The regression equation (3) is estimated using a cross-section of aggregate bilateral trade flows among 80 economies and regions in principle (see Appendix 1) for every five years from 1960 to 1990. The model covers 88% of total world trade in 1960 and 94% in 1990. All dummy variables are given a value of 1 in logarithms (or 10 in anti-logarithms) for the trade flows which correspond to each condition, and a value of 0 in logarithms (or 1 in anti-logarithms) for other trade flows. This means that if the coefficient of a dummy variable for a particular year is 0.2, then this factor has the effect of pushing up the volume of trade by 58.5% ($10^{0.2} \approx 1.585$).

The OLS (ordinary least squares) regression is 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 1990. Among nine equations, equations 1-5 comprise the ASEAN-APEC89-APEC94 back-of-the-envelope dummy variables line and equations 1, 4, and 6 - 9 comprise the ASEAN-ASIA-APEC94 back-of-the-envelope line. Comparing these two back-of-the-envelope lines, it is evident that the ASEAN-ASIA-APEC94 line has a higher adjusted coefficient of determination and has many statistically significant dummy variables. Equation 8 has the highest adjusted coefficient of determination in this case, and this results is the same for the entire period analyzed. The ASEAN-APEC89-APEC94 back-of-the-envelope dummy variables line is, on the other hand, statistically inferior to the ASEAN-ASIA-APEC94 line, and some dummy variables for APEC89 are less statistically significant compared with those for ASIA in the ASEAN-ASIA-APEC94 line. This result is also the same for the entire period analyzed. From this it is inferred that APEC89 countries are actually not suitable as the ideal membership for such an organization

Table 1 Empirical Results of Regression Equations : 1990

Equation No.		1	2	3	4	5	6	7	8	9
Constant		-4.195**	-3.718**	-4.092**	-3.185**	-3.539**	-4.036**	-4.066**	-3.638**	-3.610**
		(0.148)	(0.159)	(0.167)	(0.161)	(0.169)	(0.147)	(0.148)	(0.167)	(0.165)
Coefficients of Independent Variables	Yi	0.990**	0.944**	0.978**	0.925**	0.960**	0.980**	0.977**	0.960**	0.963**
		(0.016)	(0.016)	(0.017)	(0.016)	(0.017)	(0.016)	(0.016)	(0.016)	(0.016)
	Y_j	0.817**	0.775**	0.809**	0.760**	0.789**	0.810**	0.819**	0.796**	0.788**
		(0.016)	(0.016)	(0.017)	(0.015)	(0.016)	(0.015)	(0.015)	(0.016)	(0.015)
	N_i	-0.243**	-0.224**	-0.244**	-0.244**	-0.266**	-0.275**	-0.275**	-0.276**	-0.276**
		(0.018)	(0.018)	(0.018)	(0.017)	(0.018)	(0.018)	(0.018)	(0.017)	(0.017)
	N_j	-0.128**	-0.110**	-0.129**	-0.121**	-0.135**	-0.141**	-0.142**	-0.141**	-0.140**
		(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
	D_{ij}	-0.702**	-0.727**	-0.704**	-0.834**	-0.810**	-0.720**	-0.719**	-0.787**	-0.789**
		(0.027)	(0.028)	(0.028)	(0.029)	(0.030)	(0.027)	(0.027)	(0.030)	(0.030)
	A_{ij}	0.249**	0.253**	0.256**	0.232**	0.234**	0.273**	0.274**	0.245**	0.243**
		(0.050)	(0.050)	(0.050)	(0.049)	(0.048)	(0.049)	(0.049)	(0.048)	(0.048)
	L_{ij}	0.297**	0.239**	0.267**	0.198**	0.222**	0.295**	0.295**	0.261**	0.261**
		(0.028)	(0.028)	(0.028)	(0.027)	(0.028)	(0.027)	(0.027)	(0.028)	(0.028)
	$ASEAN_{ij}^1$	0.217**		0.291**		0.270**		0.195**	0.180**	
		(0.042)		(0.054)		(0.052)		(0.053)	(0.053)	
	$ASEAN_{ij}^2$	0.986**		0.278#		0.174		0.033	0.001	
		(0.133)		(0.146)		(0.142)		(0.146)	(0.143)	
	$ASEAN_{ij}^3$	0.227**		0.276**		0.252**		-0.065	-0.075	
		(0.040)		(0.051)		(0.050)		(0.050)	(0.050)	
	$APEC89_{ij}^1$		0.067*	-0.071#		-0.072				
			(0.030)	(0.038)		(0.051)				
	$APEC89_{ij}^2$		0.788**	0.711**		0.110				
			(0.058)	(0.064)		(0.079)				
	$APEC89_{ij}^3$		0.086**	-0.047		-0.232**				
			(0.029)	(0.037)		(0.048)				
	$ASIA_{ij}^1$						0.169**	0.076#	0.126**	0.207**
							(0.030)	(0.039)	(0.049)	(0.043)
	$ASIA_{ij}^2$						1.002**	0.994**	0.374**	0.372**
							(0.063)	(0.071)	(0.084)	(0.079)
	$ASIA_{ij}^3$						0.315**	0.347**	0.432**	0.399**
							(0.028)	(0.037)	(0.046)	(0.041)
	$APEC94_{ij}^1$				0.161**	0.116**			0.004	0.010
					(0.027)	(0.041)			(0.038)	(0.038)
	$APEC94_{ij}^2$				0.811**	0.724**			0.643**	0.646**
					(0.040)	(0.053)			(0.051)	(0.051)
	$APEC94_{ij}^3$				0.233**	0.305**			0.037	0.040
					(0.026)	(0.039)			(0.037)	(0.037)
adj.R^2		0.660	0.666	0.670	0.682	0.686	0.679	0.680	0.692	0.691
S.E.		0.587	0.582	0.578	0.568	0.564	0.570	0.570	0.559	0.559

Notes : (1) Number of observations : 4421
(2) Standard errors are in parentheses
(3) ** denotes significant at 1% level (2-tailed test : $|t| \geqq 2.576$)
* denotes significant at 5% level (2-tailed test : $|t| \geqq 1.96$)
\# denotes significant at 10% level (2-tailed test : $|t| \geqq 1.645$)
(4) All variables are in common logarithms

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, in order to have a greater effect on more substantial trade flows.

Now begins a more careful look into the coefficients of variables in the ASEAN-ASIA-APEC94 back-of-the-envelope, statistically preferable variables line. Table 2 presents the summary of regression results of equation 8 from 1960 to 1990. Adjusted coefficients of determination are becoming higher as time goes by. 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 expands annually.

It is obvious that coefficients for Y_i, Y_j, N_i, N_j, D_{ij}, A_{ij} and L_{ij} all have the same signs as expected, and all are highly statistically significant. What should be noted is the trend in the figures reading as coefficients for Y_i, Y_j, N_i, and N_j. Before 1970, the coefficients for Y_i and Y_j are increasing and those for N_i and N_j are decreasing. This phenomenon seems to be the result of expanding volumes of trade caused by world-wide trade liberalization, especially through activity due to the General Agreement on Tariffs and Trade (GATT). After 1970, however, the changes in the value for these coefficients becomes the reverse. The reason for this trend may be the two oil crises of the 1970s and the subsequent international recession. During this period, world trade was sluggish, given the stagnation of the world economy. Coefficient readings for D_{ij}, on the other hand, exhibit a downward trend throughout the analyzed period. While the reason for this phenomenon is not clear, such statistics are surely indicative of the trend towards recent economic "regionalism".

Concerning the dummy variables $ASEAN_{ij}^{n}$, $ASIA_{ij}^{n}$ and $APEC94_{ij}^{n}$ (n = 1, 2, 3), the significance of the estimates of their coefficients turns out to

Table 2 Empirical Results of Regression Equation 8 : 1960 - 1990

Year		1960	1965	1970	1975	1980	1985	1990
Constant		-4.092**	-4.278**	-6.145**	-4.871**	-5.000**	-4.821	-3.638**
		(0.215)	(0.199)	(0.227)	(0.201)	(0.202)	(0.202)	(0.167)
Coefficients of Independent Variables	Y_i	0.979**	0.974**	1.327**	1.188**	1.196**	1.167**	0.960**
		(0.030)	(0.026)	(0.028)	(0.022)	(0.022)	(0.022)	(0.016)
	Y_j	0.775**	0.858**	1.122**	0.867**	0.871**	0.876**	0.796**
		(0.030)	(0.026)	(0.028)	(0.023)	(0.022)	(0.021)	(0.016)
	N_i	-0.380**	-0.341**	-0.505**	-0.429**	-0.400**	-0.394**	-0.276**
		(0.031)	(0.028)	(0.030)	(0.024)	(0.023)	(0.022)	(0.017)
	N_j	-0.224**	-0.259**	-0.389**	-0.155**	-0.123**	-0.130**	-0.141**
		(0.032)	(0.028)	(0.030)	(0.024)	(0.023)	(0.023)	(0.018)
	D_{ij}	-0.347**	-0.428**	-0.614**	-0.678**	-0.738**	-0.753**	-0.787**
		(0.037)	(0.034)	(0.040)	(0.035)	(0.034)	(0.034)	(0.030)
	A_{ij}	0.257**	0.271**	0.188**	0.204**	0.168**	0.265**	0.245**
		(0.056)	(0.053)	(0.065)	(0.057)	(0.056)	(0.056)	(0.048)
	L_{ij}	0.246**	0.313**	0.376**	0.335**	0.235**	0.179**	0.261**
		(0.036)	(0.034)	(0.038)	(0.033)	(0.032)	(0.032)	(0.028)
	$ASEAN_{ij}^1$	-0.114	0.042	0.002	0.041	0.095	-0.035	0.180**
		(0.082)	(0.078)	(0.077)	(0.066)	(0.066)	(0.064)	(0.053)
	$ASEAN_{ij}^2$	0.176	-0.428*	-0.095	-0.032	0.141	0.042	0.001
		(0.169)	(0.208)	(0.206)	(0.174)	(0.174)	(0.172)	(0.143)
	$ASEAN_{ij}^3$	0.160*	0.011	0.113	-0.104	-0.078	-0.172**	-0.075
		(0.079)	(0.077)	(0.082)	(0.064)	(0.062)	(0.058)	(0.050)
	$ASIA_{ij}^1$	0.321**	0.152*	0.341**	0.187**	0.119#	0.194**	0.126**
		(0.072)	(0.063)	(0.070)	(0.060)	(0.061)	(0.059)	(0.049)
	$ASIA_{ij}^2$	0.683**	0.753**	0.863**	0.720**	0.475**	0.488**	0.374**
		(0.110)	(0.110)	(0.128)	(0.103)	(0.104)	(0.101)	(0.084)
	$ASIA_{ij}^3$	0.357**	0.365**	0.459**	0.480**	0.431**	0.419**	0.432**
		(0.071)	(0.063)	(0.068)	(0.059)	(0.057)	(0.055)	(0.046)
	$APEC94_{ij}^1$	-0.235**	-0.203**	-0.278**	-0.136**	-0.135**	-0.160**	0.004
		(0.050)	(0.046)	(0.052)	(0.045)	(0.045)	(0.045)	(0.038)
	$APEC94_{ij}^2$	0.065	0.075	0.235**	0.316**	0.455**	0.448**	0.643**
		(0.067)	(0.063)	(0.076)	(0.060)	(0.062)	(0.061)	(0.051)
	$APEC94_{ij}^3$	-0.239**	-0.199**	-0.222**	-0.104*	-0.071	-0.082#	-0.037
		(0.050)	(0.046)	(0.054)	(0.044)	(0.044)	(0.044)	(0.037)
# observations		0.480	0.533	0.596	0.615	0.630	0.641	0.692
adj.R^2		0.617	0.597	0.756	0.666	0.664	0.656	0.559
S.E.		2999	3383	4313	4488	4508	4497	4421

Notes : (1) Standard errors are in parentheses
(2) ** denotes significant at 1% level (2-tailed test : $|t| \geqq 2.576$)
* denotes significant at 5% level (2-tailed test : $|t| \geqq 1.96$)
# denotes significant at 10% level (2-tailed test : $|t| \geqq 1.645$)
(3) All variables are in common logarithms

vary with the year analyzed. The coefficients for these dummy variables may be interpreted as reflecting the extent of trade creation and trade di-

version occurring in each regional institution. Note, however, that increases and decreases in values for coefficients reflecting trade creation and trade diversion differ from increases and decreases of total amount of trade creation and trade diversion, since the degree of trade creation and trade diversion occurring depends on the volume of trade in the region.

Equation 8 has three dummy variables concerning ASEAN which are not particularly highly statistically significant, while dummy variables for ASIA and APEC94 are highly statistically significant. This shows that the volume of trade among ASEAN countries occurs at a similar level to that of intra-ASIA trade. In other words, intra-ASEAN trade has not been outstanding compared with intra-ASIA trade. It could be said that ASEAN has had no effect of its own in boosting trade among its member countries. This nature reflects the fact that the intra-ASEAN ratio of trade in each ASEAN countries is low.

Observing the change in values for each coefficient for $ASIA_{ij}^{n}$ and $APEC94_{ij}^{n}$ dummy variables from 1960 to 1990, the following points are of interest. Firstly, the coefficients for $ASIA_{ij}^{2}$ and $APEC94_{ij}^{2}$ are all positive throughout the analyzing period and the value of the coefficient for $ASIA_{ij}^{2}$ decreases after 1970, while that of $APEC94_{ij}^{2}$ continues to increase and becomes statistically significant. This means that the volume of trade occurring among ASIA countries had been at a very high level during the 1960s, compared with the general level of world trade. This "Asian trade expanding area" has been expanding its network to include other APEC94 countries, becoming stronger year after year.

Secondly, regarding ASIA, almost all coefficients for $ASIA_{ij}^{1}$ and $ASIA_{ij}^{3}$ are positive and statistically significant. This reflects the fact that the volume of trade between ASIA countries and non-member countries of APEC94 has been more than the average volume of trade between any two

countries in the world. Thirdly, as for APEC94, almost all coefficients for $APEC94_{ij}^{1}$ and $APEC94_{ij}^{3}$ are negative and highly statistically significant. This means that the APEC94 countries do not trade with non-member countries as briskly as indicated by the world trade standard. The values of coefficients for $APEC94_{ij}^{1}$ and $APEC94_{ij}^{3}$, however, increased throughout the analyzing period and became positive, although not statistically significant, in 1990. This indicates that APEC94's trade diversion effect has been weakening each year. These three observations show that APEC promotes inter- as well as intra-APEC trade, and also substantial "open regionalism", one objective of APEC. In other words, APEC can maintain such a policy of "open regionalism", thanks to these characteristics of and the transition occurring in Asia-Pacific trade.

4. Concluding Remarks

This short paper has examined the nature of the transition of postwar Asia-Pacific trade using the Gravity Model. The resulting analysis leads to the following conclusions about this nature of Asia-Pacific trade. Firstly, the volume of trade among Asian countries existed at a higher level than that occurring among countries in the general network of international trade during the 1960s, and this "Asian trade expanding area" has been expanding from merely Asian countries to include other countries belonging to APEC in 1994, thus strengthening each year. Secondly, the volume of trade between Asian countries and non-member countries of APEC(1994) has been more than the average volume of trade between any two countries in the world, while that between APEC(1994) and non-member countries has been increasing. These results prove that APEC promotes inter- as well as intra-APEC trade, and also substantial "open regionalism", a major objective of

APEC. Thirdly, ASEAN has had no effect of its own on promoting trade among its member countries. And fourthly, APEC has had an endogenous incentive to expand its membership to include more Asian economies, since its inauguration in 1989, in order to have a greater effect on a greater quantity of trade flows. This is because the original APEC(1989) membership is in fact not the ideal group of economies to benefit from establishing such a forum, given already existing intimate extent of their trade relations.

Appendix 1. List of countries used in the gravity equation

Europe (25) : Austria, Belgium-Luxembourg, Bulgaria, Czechoslovakia, Denmark, Finland, France, Germany (1990-), East Germany (-1989), West Germany (-1989), Greece, Hungary, Iceland, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, Switzerland, the United Kingdom, the U.S.S.R. (-1990), Yugoslavia, SFR

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 (-1963, 1966-), Malaysia - Singapore (1964, 1965), Mongolia, Pakistan, Philippines, Saudi Arabia, Singapore (-1963, 1966-), 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 (1987), *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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